Appendix G: Environmental

G1: Existing, Future With- and -Without Habitat Conditions
- Sub-appendix G1a: ECO-PCX Approval MFR
- Sub-appendix G1b: Existing Conditions Raw Data Sheets and Photolog
- Sub-appendix G1c: Calculation Datasheets

G2: Mitigation, Monitoring, and Adaptive Management Plan
- Sub-appendix G2a: Mitigation FACStream Calculation Sheets

G3: Biological Assessment

G4: Greenhouse Gas Analysis
- Attachment 1: Equipment Emissions Factors
- Attachment 2A: Cumulative Construction Emissions
- Attachment 2B: Construction Annualized Emission Rates
- Attachment 3A: OMRR&R Emissions per Activity Unit
- Attachment 3B: OMRR&R Emissions

G5: 404(b)1
- Sub-appendix G5a Desktop Delineation

G6: Lake Kampeska Sediment Load Analysis

US Army Corps of Engineers®

WATERTOWN, SOUTH DAKOTA FLOOD RISK MANAGEMENT GENERAL INVESTIGATIONS STUDY

INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX G1: EXISTING, FUTURE WITH-, AND -WITHOUT HABITAT CONDITIONS

OMAHA DISTRICT
NORTHWESTERN DIVISION



July 2026

TABLE OF CONTENTS

1 Introduction 3
2 Procedure Overview 3
3 Methods 7
4 Existing Conditions and Future Without Project 10
5 Final Array of Alternatives 13
6 Alternative Evaluation 15
7 Conclusion 20
8 Literature Cited 20

FIGURES

Figure 1. FACStream Variable Structure. Derived from Johnson et al., 2016 4
Figure 2. FACStream assessment area comprised of 3 reaches along the Big Sioux River and the 20-year floodplain represented by an 880-foot buffer. 9
Figure 3. Alternative formulation and the final array of alternatives carried forward 14

TABLES

Table 1. Scoring and degree of functional impairment. Derived from Johnson et al., 2016..... 5
Table 2. Variable weights used to calculate functional condition scores. Derived from Johnson et al., 2016. 7
Table 3. Existing (Year 0) and FWOP (Year 10, 25, and 50) FACStream scores across the 3 Reaches. 12
Table 4. Existing and FWOP habitat acreages and corresponding AAHUs calculated with FACStream composite FCI for all 3 Reaches.* 13
Table 7. FCI by Target Year in FWP Alternative 3 across all 3 Reaches and resultant cumulative HUs and AAHUs 17
Table 5. FCI by Target Year in FWP Alternative 7 across all 3 Reaches and resultant cumulative HUs and AAHUs 17
Table 6. FCI by Target Year in FWP Alternative 8 across all 3 Reaches and resultant cumulative HUs and AAHUs 18
Table 8. FCI by Target Year in FWP Alternative 11b across all 3 Reaches and resultant cumulative HUs and AAHUs 19
Table 9. FCI by Target Year in FWP Alternative 11c across all 3 Reaches and resultant cumulative HUs and AAHUs 19
Table 10. Net AAHU loss with and without the incorporation of NNBF 20

APPENDIX

Sub-appendix G1a: ECO-PCX Approval MFR
Sub-appendix G1b: Existing Conditions Raw Data Sheets and Photolog
Sub-appendix G1c: Calculation Datasheets

1 Introduction

The Functional Assessment of Colorado Streams (FACStream) Method (Version 1.0, 2016) was selected to assess the existing habitat conditions within the study area, as well as Future with Project (FWP) and Future without Project (FWOP) conditions. On June 6-8, 2023 site visits were conducted to collect data for the model parameters described in Section 2.

1.1 Project Location

The study area includes a portion of the Upper Big Sioux River subbasin in the vicinity of Watertown, South Dakota. The Big Sioux River (BSR) meanders from north to south through the western side of Watertown. The City of Watertown has two large glacial lakes on the west side which includes Lake Kampeska and Pelican Lake. The BSR partially flows into Lake Kampeska northwest of the city and back out in the same inlet/outlet location.

The area of analysis was divided into three reaches on the BSR and its 20-year floodplain as FACStream recommends utilizing the 20- to 30-year floodplain for an approximate estimate of the valley bottom extent. Reach 1 is the BSR from North Lake Drive at Lake Kampeska downstream to 14th Ave NW, Reach 2 is the BSR from 14th Ave NW downstream to 9th Ave SW. Reach 3 is the BSR from approximately 9th Ave SW to Lake Pelican. Rationale for these study reaches was characterized by adjacent floodplain landuse. See Figure 2 in Section 3.1.

2 Procedure Overview[1]

The FACStream method is a reach-scale functional assessment tool that rates functional condition based on the degree of impairment in comparison to a reference standard condition. FACStream is a weight-of-evidence approach that utilizes the best evidence available through desktop analysis and field verification within a rapid assessment timeframe to develop and support ratings for 10 variables and their associated sub-variables (Johnson et al., 2016) (see Figure 1). FACStream received regional approval use from the ECO-PCX on 28 July 2023 within the Omaha and Kansas City District Civil Works boundaries (see sub-appendix G1a).

[1] All method descriptions and variable descriptions of Section 2 *Procedure Overview* and its sub-headings derived from Johnson et al., 2016 (FACStream Manual).

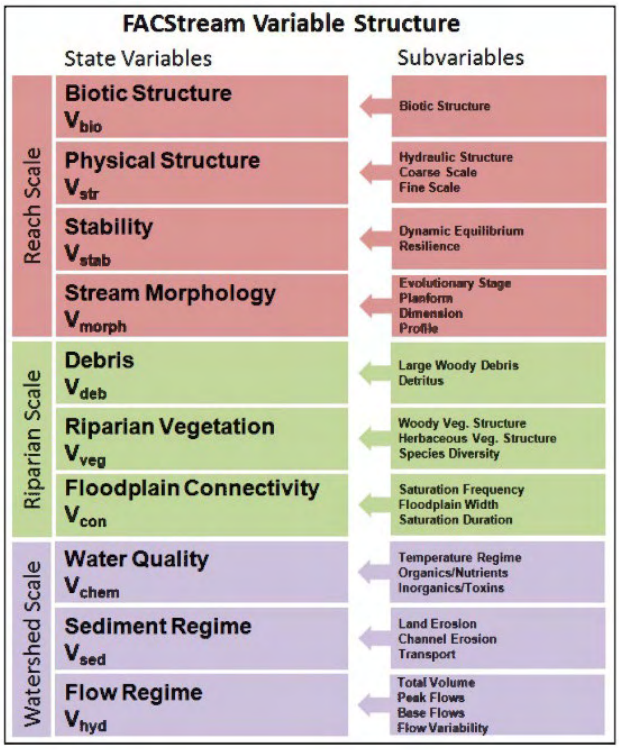


Figure 1. FACStream Variable Structure. Derived from Johnson et al., 2016

A FACStream assessment reads like a report card that represents the functional condition of a reach. The overall condition score, variable and sub-variables are scored using a scale that parallels academic grading where letter grades ("A" through "F") correspond to numerical scores on a 100 to 50 scale. Criteria for scoring is based on overall level of variable alteration which is provided on the FACStream datasheets (raw datasheets for FACStream Existing Conditions may be found in Sub-appendix I). Following the narrative descriptions assigned using the FACStream datasheets, an informal academic letter grade is assigned with a confidence rating to determine an overall accepted academic grade for each individual variable. A decimal value between 0.00 and 1.00[2] will then be assigned to convert the letter grade to numbers to produce a functional capacity index (FCI) so arithmetic operations may be performed (Johnson et al., 2016) (Table 1).

[2] As noted within the FACStream Method on page 16, a score of 50 (F-) indicates the lowest level of functioning for a reach that is profoundly impaired but still recognizable as a feature that conveys water. The overall condition of the reach may also be expressed as a percentage of remaining aquatic function from 0% (non-functional) to 100% (fully functional) in the FCI score (Johnson et al., 2016). FCI scoring procedure for FACStream is discussed in Section 2.2.4.

Table 1. Scoring and degree of functional impairment. Derived from Johnson et al., 2016.

Score	Grade	Impairment
90-100	A	Negligible
80-89	B	Mild
70-79	C	Significant
60-69	D	Severe
50-59	F	Profound (or unsustainable)

2.1 Watershed Scale Variables

Three variables are assessed to determine conditions from a watershed scale, these are Flow Regime (V_{hyd}), Sediment Regime (V_{sed}) and Water Quality (V_{chem}). V_{hyd} is described by four sub-variables- Total Volume ($V_{hyd}1$), Peak Flows ($V_{hyd}2$), Base Flows ($V_{hyd}3$) and Flow Variability ($V_{hyd}4$). These sub-variables combined determine the structure and function of aquatic and riparian ecosystems for streams and rivers. Alterations to the watershed may affect total annual volume of water via depletions or augmentations, alter the pattern of the hydrograph by changing the magnitude and duration of peak flows, low flows, flow variability, timing and rates of change. These four sub-variables are scored and averaged to produce a total score for V_{hyd} (Johnson et al., 2016).

V_{sed} is described by three sub-variables- Land Erosion ($V_{sed}1$), Channel Erosion ($V_{sed}2$) and Transport ($V_{sed}3$). These three sub-variables help the assessor detect impacts to sediment supply by location and process. The V_{sed} variable is scored based on the net impact to the total annual amount and timing of sediment delivery to the reach combined from all sources (Johnson et al., 2016).

V_{chem} is described by three sub-variables- Temperature Regime ($V_{chem}1$), Organics/Nutrients ($V_{chem}2$) and Inorganics/Toxins ($V_{chem}3$). The physiographic properties of a stream reach are largely inherited from the contributing watershed. Biogeochemical processing by stream organisms as well as physical changes within channels and floodplains can alter these properties. Stressors include amount of organic inputs, nutrients, shifts in pH, conductivity, turbidity, metals and other contaminants. The three sub-variables are scored and averaged to produce a total score for V_{chem} (Johnson et al., 2016).

2.2 Riparian Scale Variables

Three variables are assessed to determine conditions from a riparian scale, these are Floodplain Connectivity (V_{con}), Riparian Vegetation (V_{veg}) and Debris (V_{deb}). V_{con} is described by three sub-variables- Saturation Frequency ($V_{con}1$), Floodplain Width ($V_{con}2$) and Saturation Duration ($V_{con}3$). These sub-variables combined describes the degree to which water accesses and hydrates the floodplain. The amount and timing of flow interacts with channel and floodplain morphology to create a pattern of in frequency, lateral extent and duration and saturation of overbank flow and groundwater exchanged. These sub-variables are scored and averaged together to determine the final score for V_{con} (Johnson et al., 2016).

V_{veg} is described by three sub-variables- Woody Vegetation Structure ($V_{veg}1$), Herbaceous Vegetation Structure ($V_{veg}2$) and Species Diversity ($V_{veg}3$). These sub-variables describe the

complexity and assemblage of the vegetative community. Riparian vegetation is critically important to supporting the stream reach. It provides root structure, roughness, natural bank stabilization, provides a buffer to the stream from adjacent stressors, supplies woody debris and detritus that forms the basis of the aquatic food webs and cover and shading for species with terrestrial life stages (Johnson et al., 2016).

V_{deb} is described by two sub-variables- Large Woody Debris ($V_{deb}1$) and Detritus ($V_{deb}2$). Both of these sub-variables assess organic inputs into the stream which impact the structural component of the aquatic habitat as well as secondarily providing nutrient and energy sources. Stressors that impact V_{deb} include adjacent land uses that deplete wood sources (e.g. clearing/thinning, urbanization, agriculture and vegetation conversion), beaver (*Castor canadensis*) loss or extirpation from an area, poor floodplain connectivity or physical barriers between the stream and riparian area (Johnson et al., 2016).

2.3 Reach Scale Variables

Four variables are assessed to determine conditions from a reach scale, these are Stream Morphology (V_{morph}), Stability (V_{stab}), Physical Structure (V_{str}) and Biotic Structure (V_{bio}). V_{morph} is described by four sub-variables- Evolutionary Stage ($V_{morph}1$), Planform ($V_{morph}2$), Dimension ($V_{morp}3$) and Profile ($V_{morph}4$). These sub-variables combined describes the characteristic patterns of geometry and morphology by process domain as a result of geomorphic processes such as dynamic equilibrium between hydrology and sediment, adaptions to natural disturbance and response to biotic agents such as vegetation and beaver. These sub-variables are scored and averaged together to determine the final score for V_{morph} (Johnson et al., 2016).

V_{stab} is described by two sub-variables- Dynamic Equilibrium ($V_{stab}1$) and Resilience ($V_{stab}2$). These sub-variables determine the rate of probability that the stream will maintain its geomorphic structure over time. $V_{stab}1$ is based on stability of the channel bed and banks. On alluvial streams, such as the South Platte River, the bed and banks are mobile and stability is maintained in a complex state of dynamic equilibrium between sediment supply and energy (known as Lane's Balance). $V_{stab}2$ rates the ability of the system to recover after a large disturbance, such as a flood or mass erosion event (Johnson et al., 2016).

V_{str} is described by three sub-variables- Hydraulic Structure ($V_{str}1$), Course Scale ($V_{str}2$) and Fine Scale ($V_{str}3$). These sub-variables describe the heterogeneity in the physical structure of the stream as a result of complex interactions between hydraulics and geomorphology. Biological drivers such as vegetation, wood and beavers may have a profound impact on structure and diversity. Stressors are assessed to determine the degree to which characteristic patterns of structural heterogeneity have been altered (Johnson et al., 2016).

V_{bio} has no sub-variable but describes the biological component of the natural infrastructure of a stream. Biota supported by a stream is not only a category of stream function, but also an essential element of functional condition by carrying out biochemical processing through a characteristic trophic structure. Stressors measured include both direct and indirect impacts on community assemblage and biotic structure (Johnson et al., 2016).

2.4 Functional Condition Scores

Upon assigning each of the ten variables a score, a functional condition score is calculated using weighted averages (see Table 2). FACStream assess four functional categories:

1) Hydraulic Function
2) Geomorphic Function
3) Physiochemical Function
4) Biotic Function

Table 2. Variable weights used to calculate functional condition scores. Derived from Johnson et al., 2016.

State Variable	Hydraulic Functions	Geo-morphic Functions	Physico-chemical Functions	Biotic Functions	Total Functions	
V_{hyd}	30%	15%	15%	20%	**20%**	35%
V_{sed}	0%	15%	5%	0%	**5%**	
V_{chem}	0%	0%	25%	15%	**10%**	
V_{con}	30%	10%	10%	10%	**15%**	30%
V_{veg}	5%	15%	10%	10%	**10%**	
V_{deb}	0%	10%	5%	5%	**5%**	
V_{morph}	10%	10%	0%	0%	**5%**	35%
V_{stab}	10%	15%	5%	10%	**10%**	
V_{str}	15%	10%	5%	10%	**10%**	
V_{bio}	0%	0%	20%	20%	**10%**	

An overall functional score will take the four separate functional category scores and average them together to produce a comprehensive FCI. The FCI is calculated by variables which have the preeminent control over the level of functioning. While additional variables may play a role in creating a given function, if they are not a primary driver, they are not included in the FCI calculation. Furthermore, variables that play a more prominent role in driving a function are subsequently weighted higher. Once total functional points are calculated by adding the relevant variable scores together (and their associated weights) these points are averaged to provide a resultant FCI on a 0.00 to 1.00[3] scale (Johnson et al., 2016).

3 Methods

Riparian assessment areas utilized in FACStream were surveyed for general aquatic habitat conditions, potential isolated wetlands, jurisdictional wetlands and other Waters of the United States by utilizing methods outlined in the 1987 Corps of Engineers Wetland Delineation Manual (Engineering, Research and Development Center- USACE, 1987). Wetlands were classified according to the U.S. Fish and Wildlife Service (USFWS) Cowardin classification system (Cowardin et al., 1979). The National Wetland Inventory (NWI) mapping data was utilized to

[3] As noted within the FACStream Method on page 99, the FCI is a dimensionless index that rates the functional capacity of the reach relative to reference standard on a scale of 0.00 to 1.00 reflecting the degree of aquatic habitat functionality from none to 100%. It is calculated directly from the FACStream overall condition score using the equation $FCI = \left(\frac{condition\ score}{50}\right) - 1$ (Johnson et al., 2016).

depict wetland and riverine habitat. Woody vegetation cover was estimated through desktop analysis.

Initially, 22 representative data points were collected in the field on the BSR, Willow Creek, Mud Creek, Mahoney Creek, Still Lake, Lake Kampeska, and Pelican Lake. Data was collected where access could be gained to the riparian area and within areas where permission was received. When possible, visual observations and aerial photography were used to extrapolate conditions. The width of the ecological floodplain was determined using the 20-year Annual Exceedance Probability (AEP), or more commonly referred to as the 20-year floodplain. Using this inundation area, across all reaches an approximate average total width of 880 feet was estimated using this data to simplify the floodplain into a homogenous linear assessment area of the floodplain. To calculate the area of each reach, the linear feet of the reaches were multiplied by 880 feet, and the resultant square footage was than converted to acres by dividing by 43,560.

Reach 1 represents the most upstream segment of the area of analysis. This reach extends 5.25 miles (27,711 linear feet [lf]) from the outlet of Lake Kampeska near N Lake Dr downstream to 14th Ave NW. The assessment area (AA) for Reach 1 is 560 acres. Reach 2 extends 2.24 miles (11,824 lf) from 14th Ave NW downstream to 9th Ave SW. The AA for Reach 2 is 238 acres. Reach 3 extends from 9th Ave SW downstream 2.75 miles (14,651 lf). The AA for Reach 3 is 296 acres. The total AA is 1,094 acres. See Figure 2 in Section 3.1.

The future without project (FWOP) and future with project (FWP) assess the likely condition of the variables within the five reaches of the study area across a 50-year planning horizon. Four target years were selected; Year 0 (existing conditions), Year 10, Year 25, and Year 50.

3.1 Habitat Unit Calculations

Model outputs, specifically the composite FCI, were utilized to qualitatively assess the existing condition, the FWOP condition and the FWP condition. This qualitative output was then multiplied by the AA, measured in acres. This value is a quantified measure of environmental output, known as a habitat unit (HU), where the difference between future habitat units without management measures (future without project) and future habitat units with management measurements (future with project) equals the habitat units produced by the alternative (USACE, 1995). The HUs are then annualized throughout the 50-year study period to provide an overall average annual HU, or AAHU. This value represents an average environmental functional output that the subject area contributes to in any given year for any FWP condition.

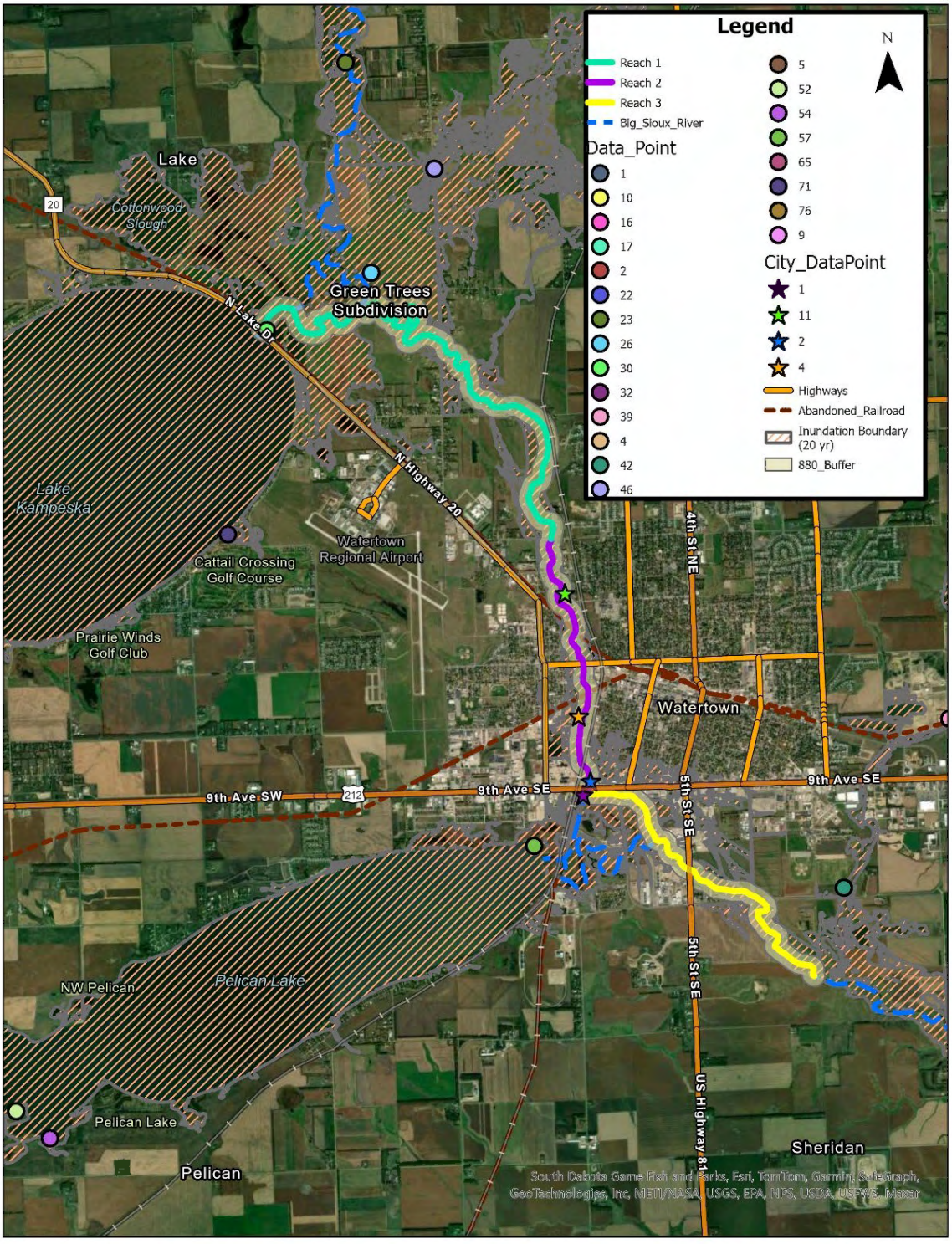


Figure 2. FACStream assessment area comprised of 3 reaches along the Big Sioux River and the 20-year floodplain represented by an 880-foot buffer.

4 Existing Conditions and Future Without Project

The overall characterization of the BSR within the study area represents a perennial, alluvial waterbody that with a moderate width to depth ratio, and of moderate sinuosity within an unconfined valley. The existing stream morphology type on the Rosgen scale (Rosgen, 1996) is "C5" which is indicative of a stream that is slightly entrenched, sand-dominated, riffle-pool channel with a well-developed floodplain. The existing channel material is primarily comprised of sands and silts with some gravel.

A site visit to collect data and verify analysis was conducted June 6-8, 2023. Weather was generally calm and sunny, with day temperatures averaging 74°F and clear skies with 10 miles of visibility. Dominant native vegetation observed along Big Sioux included cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsylvanica*), sandbar willow (*Salix exigua*), false indigo (*Amorpha frucitosa*), prairie cordgrass (*Spartina pectinata*), nettle (*Urtica dioica*), poison ivy (*Toxicodendron radicans*), cattail (*Typha spp.*), and common milkweed (*Asclepias syriaca*). Dominant nonnative vegetation observed included autumn olive (*Elaegnus umbellata*), reed canarygrass (*Phalaris arundinacea*), Kentucky bluegrass (*Poa pratensis*), leafy spurge (*Euphorbia esula*), and Canada thistle (*Cirsium arvense*). Typical native species observed at the representative data points at Lake Kampeska include cottonwood, sandbar willow, swamp rose (*Rosa palustris*), common milkweed, nettle and cattail. Typical nonnative species located at Lake Kampeska included curly dock (*Rumex crispus*), reed canarygrass, Kentucky bluegrass, Canada thistle, and leafy spurge. Typical native species observed at Pelican Lake included cottonwood, sandbar willow, silver maple (*Acer saccharinum*), prairie cordgrass, cattail, and field mint (*Mentha arvensis*). Typical nonnative species at Pelican Lake included autumn olive, reed canarygrass, leafy spurge, curly dock, and field bindweed (*Convolvulus arvensis*). See Sub-appendix G1b for the raw field data sheets.

Existing ecological stressors present throughout the study include the following:

- Unnatural Hydrology
    - Upstream tiling practices are cumulatively causing an increase in draining wetlands and increasing flows to the Big Sioux River and its contributing tributaries
    - Depletions, primarily for irrigation and agricultural practices
    - Local alterations from private entities in upstream contributing tributaries- such as check dams, diversions, or grade control structures can cause areas of aggradation and degradation
- Altered Biotic Communities
    - Low species diversity
    - Nonnative species
    - Extirpated keystone species replaced with habitat generalists
    - Migration and dispersal barriers such as highway and railroad crossings
    - Vegetation removal
    - Sportfish stocking
    - Lack of large woody debris, detritus, riffle-pools, and other dynamic aquatic habitat features

- Disconnected Floodplain and Deleterious Land Use
    - Industrial and residential areas within the ecological floodplain throughout the study area
    - Grazing practices that cause erosion, water quality impacts, soil compaction, and vegetation structure changes
    - Farming practices that necessitate vegetation removal, impact water quality from increased nutrients and inorganic particulates, use of chemical pesticides and fertilizers, erosion, and loss of diverse nutrients in the soil matrix, and draining wetlands
    - Earthen berms line much of the Big Sioux River on both banks throughout the City of Watertown. While these berms are not classified, operated, or maintained as levees, they do cause isolation of the ecological floodplain.

In the FWOP, no federally-funded flood risk reduction measures (FRM) would occur. Economic and residential development in the City of Watertown may suffer as entities would be hesitant to utilize or invest in infrastructure that falls within the regulatory floodplain. Generation of revenue for Watertown could decrease as a result of the loss of businesses. There is also a possibility that an increase in urban development may result from emigration, as indicated during the COVID-19 pandemic where an influx of moving to rural communities in the Midwest occurred (NCA, 2023), and general projected population growth. Future population growth will continue to place demands on watershed resources, and it seems likely that these demands will inevitably impair watershed health. Increases in population and higher-intensity development will increase demand for water supply, likely precipitating the need for additional reservoir storage and new modifications to streamflow for irrigation supply. Each of these hydrologic modifications will continue to shift the watershed hydrology to a more altered state, further impairing watershed condition and having impacts on environmental resources utilized by fish and wildlife.

Across the 50-year planning horizon, it is anticipated that impacts of hydrometeorological trends will continue be a major driver on ecological and social conditions. According to the National Climate Assessment (NCA, 2023), the State of South Dakota falls within the Great Plains region, which also includes the states of Montana, Wyoming, North Dakota, Nebraska, Kansas, Oklahoma and Texas. This region is characterized by a diverse variation of day-to-day temperatures and precipitation. This region experiences multiple weather hazards, such as floods, droughts, severe storms, tornados, hurricanes and winter storms. In much of the Great Plains, little precipitation falls to replace what is utilized by humans, animals and plants. Significant challenges anticipated include increasing rising temperatures which lead to an increased demand for water and energy, increased stress on natural resources and increased competition for water among communities, agriculture, energy production and ecological needs.

For water quality, this increase in development suggests a subsequent increase in nonpoint source pollution throughout the watershed. Nonpoint source pollution, defined as water pollution that comes from many different sources in a watershed, is the leading remaining cause of water quality problems in the United States (EPA, 2005). Increases in the number of septic systems in the non-serviced area of the watershed will likely continue to load nutrients and *E. coli* to downstream waterbodies. Similarly, an increase in stormwater runoff from greater impervious

cover and development-related construction activities will inevitably contribute to continued water quality degradation, unless BMPs and restoration activities that directly address these sources are implemented.

Over-arching assumptions utilized when conducting the FACStream assessment include the following:

- Increase in the frequency and severity of hydrometeorological patterns such as flooding, drought, and increase in temperature and longer growing seasons;
- Increased urban development resulting in a reduction of habitat, impacts to water quality, increases in air emissions, and an increased pressure on resource availability;
- Decrease in species diversity of flora and fauna and an increase of nonnative and undesirable species;
- Increase in stressors such as continued anthropogenic alteration of water flow and volume within the watershed from upstream tiling for agricultural practices, non-federal FRM measures such as armored bank stabilization, dams, levees, diminished floodplain connectivity and widespread wetland losses, and water augmentation/depletions.

4.1 Variable Scores and Functional Condition Indices

In the next 50 years across the planning horizon, Year 0 (existing conditions), Year 10, Year 25, and Year 50 target years are utilized to represent the FWOP. As depicted in Table 3, overall composite scores are the average of all four functional condition scores.

Table 3. Existing (Year 0) and FWOP (Year 10, 25, and 50) FACStream scores across the 3 Reaches.

SCALE	VARIABLES	REACH 1				REACH 2				REACH 3			
		Year 0	Year 10	Year 25	Year 50	Year 0	Year 10	Year 25	Year 50	Year 0	Year 10	Year 25	Year 50
Watershed	(V1) Flow Regime	0.74	0.73	0.71	0.69	0.74	0.73	0.71	0.69	0.74	0.73	0.71	0.69
	(V2) Sediment Regime	0.81	0.79	0.77	0.75	0.84	0.82	0.80	0.77	0.81	0.79	0.77	0.75
	(V3) Water Quality	0.80	0.77	0.74	0.71	0.80	0.77	0.74	0.71	0.80	0.77	0.74	0.71
Riparian	(V4) Floodplain Connectivity	0.82	0.80	0.77	0.75	0.72	0.71	0.71	0.70	0.77	0.74	0.72	0.70
	(V5) Riparian Vegetation	0.73	0.70	0.67	0.63	0.63	0.61	0.58	0.54	0.63	0.62	0.59	0.55
	(V6) Debris Supply	0.85	0.82	0.80	0.77	0.81	0.81	0.76	0.72	0.85	0.82	0.80	0.77
Stream	(V7) Morphology	0.78	0.77	0.76	0.74	0.78	0.77	0.76	0.74	0.78	0.77	0.76	0.74
	(V8) Stability	0.72	0.70	0.68	0.65	0.72	0.70	0.68	0.65	0.72	0.70	0.68	0.65
	(V9) Physical Structure	0.71	0.69	0.68	0.66	0.71	0.69	0.68	0.66	0.71	0.69	0.68	0.66
	(V10) Biotic Structure	0.69	0.65	0.65	0.64	0.69	0.65	0.65	0.64	0.69	0.65	0.65	0.64
FUNCTIONS		**REACH 1**				**REACH 2**				**REACH 3**			
		Year 0	Year 10	Year 25	Year 50	Year 0	Year 10	Year 25	Year 50	Year 0	Year 10	Year 25	Year 50
Hydraulic Functional Condition Score		0.76	0.74	0.72	0.70	0.73	0.71	0.70	0.68	0.76	0.74	0.72	0.70
Geomorphic Functional Condition Score		0.77	0.75	0.72	0.70	0.74	0.73	0.70	0.68	0.77	0.75	0.72	0.70
Physiochemical Functional Condition Score		0.76	0.73	0.71	0.69	0.74	0.71	0.69	0.67	0.76	0.73	0.71	0.69
Biotic Functional Condition Score		0.75	0.72	0.70	0.68	0.72	0.70	0.68	0.66	0.75	0.72	0.70	0.68
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE		**0.76**	**0.74**	**0.71**	**0.69**	**0.73**	**0.71**	**0.69**	**0.67**	**0.76**	**0.74**	**0.71**	**0.69**

4.1.1 Area-driven Habitat Units

The composite FCI may be multiplied by the existing habitat (in this case, area of the existing habitat acreage within the Reach boundaries) to provide a baseline quantifiable HU. It is these baseline HUs with which the Corps will utilize to measure impacts and benefits of with-project conditions. The existing and FWOP area of analysis provides approximately 780 HUs on an

average annual basis. Reference the calculation sheets (Sub-appendix G1c) for a detailed description of assumptions used for scoring.

Table 4. Existing and FWOP habitat acreages and corresponding AAHUs calculated with FACStream composite FCI for all 3 Reaches.*

Reach	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs
1	Existing/FWOP	0	0	0.76	560	424.95		*20,096.31*	**401.93**
		10	10	0.74	560	412.12	4,185.38		
		25	15	0.71	560	399.34	6,085.96		
		50	25	0.69	560	386.66	9,824.97		
2	Existing/FWOP	0	0	0.73	238	174.49		*8,303.35*	**166.07**
		10	10	0.71	238	169.96	1,722.24		
		25	15	0.69	238	165.21	2,513.72		
		50	25	0.67	238	160.18	4,067.40		
3	Existing/FWOP	0	0	0.76	296	224.62		*10,622.33*	**212.45**
		10	10	0.74	296	217.84	2,212.27		
		25	15	0.71	296	211.08	3,216.86		
		50	25	0.69	296	204.38	5,193.20		
Study Area Total:								*39,021.99*	**780.44**

*Note: Minor discrepancies may be present in multiplications due to rounding errors during model analysis

5 Final Array of Alternatives

As described in Section 4 of the main report, 15 separate structural, nonstructural, and nature based/natural measures were formulated to reduce flood risk to the community of Watertown. These measures were individually assessed for plan completeness, effectiveness, efficiency, and acceptability, and determined to be screened from further consideration or carried forward to be combined with other measures to 16 initial create alternative plans (with Alternative 11 having 3 variations). These initial alternatives were further evaluated using screening criteria developed during the Planning Charrette held in January 2023 to refine the alternatives to an interim array of 8 alternatives (with all 3 variations of Alternative 11). These alternatives were then further reviewed to ensure they had a positive benefit to cost ratio to produce a final array of 4 Action Alternatives (with 2 variations of Alternative 11). These alternatives were carried forward in the study for further analysis in addition to the No Action Alternative. Alternative 12 is not discussed in this appendix as no environmental modeling was conducted on the nonstructural plan. The No Action Alternative is synonymous with the FWOP. Refer to the main report for a more detailed discussion on plan formulation.

The final array of alternatives (Figure 3) had similar components of varying type but generally consisted of one of these, or some combination of the following: 1) weir operations for lowering Lake Kampeska to Elev 1718 prior to spring runoff, 2) levee system (on the right and left bank or just the left bank), 3) channel widening and/or 4) floodwall. A description of these primary components is provided below.

Alternative	Measure	Description
1	A	No Action
2	D, E	Channel Widening + Levee Right/Left Banks
3	D, F	Channel Widening + Levee Left Bank
4	D, G	Channel Widening + Levee Right/Left Banks w/ Closure Structures
5	B, D	Forecasted Weir Operations + Channel Widening
6	B, E	Forecasted Weir Operations + Levee Right/Left Banks
7	C, F	Forecasted Weir Operations + Levee Left Bank
8	C, D, F	Forecasted Weir Operations + Channel Widening + Levee Left Bank
9	C, D, E	Forecasted Weir Operations + Channel Widening + Levee Right/Left Banks
10	C, D, G	Forecasted Weir Operations + Channel Widening + Levee Right/Left Banks w/ Closure Structures
11	C, G	Forecasted Weir Operations + Levee Right/Left Banks w/ Closure Structures
12	N	Nonstructural
13	C	Forecasted Weir Operations

Alternative	Description
1	No Action
3	Channel Widening + Levee Left Bank
6	Forecasted Weir Operations + Levee Right/Left Banks
7	Forecasted Weir Operations + Levee Left Bank
8	Forecasted Weir Operations + Channel Widening + Levee Left Bank
9	Forecasted Weir Operations + Channel Widening + Levee Right/Left Banks
10	Forecasted Weir Operations + Channel Widening + Levee Right/Left Banks w/ Closure Structures
11a	Forecasted Weir Operations + Levee Right/Left Banks w/ All 4ft Closure Structures
11b	Forecasted Weir Operations + Levee Right/Left Banks w/ One 3ft Closure Structures
11c	Forecasted Weir Operations + Levee Right/Left Banks w/ Two 3-4ft Closure Structures
12	Nonstructural

Alternative
1
3
7
8
11b
11c
12

Figure 3. Alternative formulation and the final array of alternatives carried forward

Weir Operations for Lowering Lake Kampeska: All of the final structural action alternatives with the exception of Alternative 3 include a measure to lower Lake Kampeska. Full pool elevation at Lake Kampeska is 1718.8 ft and this alternative would lower the lake to 1718 ft fall between September and October to provide storage for spring runoff, as determined necessary, to gain approximately 3,300 acre-feet of additional flood storage. Weir operations are not anticipated to occur annually and would be dictated based on current lake levels and predicted snowmelt and rainfall. This would reduce downstream impacts by not having to conduct higher Fall releases. The existing low flow gates would be utilized to lower Lake Kampeska. The flash boards of the Big Sioux River channel weir would also be altered to draw the elevation down to 1718 ft. To draw the pool down 0.8 ft is estimated to take approximately 80 days with a discharge of 22 cfs.

Levees: On average, a left levee embankment would be 2 to 4 ft tall and a right bank levee would be 5 to 7ft tall. Both right and left bank levees would have a 12 ft wide gravel surfaced crest and 1:3 sideslopes. Both right and left bank levees would extend downstream to U.S. Highway 212 following the alignment of previous floodfighting measures. A right bank levee, approximately 14,208 ft long (2.7 miles) and 70 feet wide, will tie into high ground at 14th Ave; the total estimated footprint of the right bank levee is 22.8 acres. A right bank levee would require a cut of approximately 46,000 cubic yards (cy) to remove the existing discontinuous embankments and require approximately 96,700 cy of fill for construction. The left bank levee, approximately 4,435 ft long (0.84 mile), will tie into high ground south of West Kemp Ave; the total estimated footprint of the left bank levee is 7.1 acres. The left bank levee would require the excavation of approximately 9,800 cy to remove the existing discontinuous existing berm. This material would then be mixed with approximately 4,000 cy of clean, clay loam from a borrow source and then shaped and graded to construct the levee alignment. The existing berm is made of well-graded sand, underlain by Pierre Shale (characterized as fat clay); this material is suitable to reuse for construction of the new levee.

Construction of both, or just the left bank levee, would also include modifications to storm drainage culverts and seepage berms or toe drains depending on available space for underseepage control. Clearing and grubbing existing vegetation would occur within the levee

footprint, additionally woody vegetation would be removed 15 feet on either side of the levee toe. The area encompassed by the levee footprint and the additional 15 feet on either side would perpetually inhibit the growth and establishment of woody vegetation in accordance with ER-1110-2-1913. Natural and Nature-based Features (NNBF) that would be incorporated as part of any levee measure would include native herbaceous plantings within the levee footprint and 15 feet of either side.

Channel Widening: Channel widening would extend just north of the bridge at 14th Ave and continue south to southeast past U.S. Highway 212, where it crosses both 5th St and 20th Ave and ends just south of the 20th Ave bridge. The total length of the BSR that would be widened is approximately 24,366 ft (4.6 miles) and require the excavation of approximately 296,100cy of material. The existing channel of the BSR averages between 30 to 50 ft in width within the study area. This alternative would expand the width of the channel by approximately 25 ft on either side of the existing banks for a total width of approximately 150 ft. Widening of the channel would not occur at any of the bridge crossings which includes 14th Ave, 10th Ave, 3rd Ave, Kemp Ave, 4th Ave, U.S. Highway 212, Broadway St., 5th St., and 20th Ave.

Floodwall: Floodwalls would be cast in place and reinforced concrete T-shape walls. The wall will be designed to resist the hydrostatic and dynamic flood pressure. The foundation of the wall would extend 4.5 ft below grade for protection from frost heave and waterstops would be provided between wall segments.

6 Alternative Evaluation

The following subsections will provide a qualitative summary and quantitative snapshot of environmental impacts for the primary category of lowering Lake Kampeska, levees, and channel widening. Alternative 12 was not included in the FACStream assessment as there would be negligible environmental impacts associated with floodproofing activities of residential and commercial structures. Please see the calculation worksheets in Sub-appendix G1c for more detailed information on scoring for each Alternative.

Weir Operations for Lowering Lake Kampeska: Fall releases at Lake Kampeska would cause a nominal effect on all 3 reaches as a result of minor impacts to the existing hydrograph. Releases would cause a minor and temporary augmentation to total water volume in the BSR at a seasonally unnatural time; contributing to a seasonal increase on peak flows and flow variability. It was also assumed that fall releases may result in minor channel erosion, as minor amounts of sediment and fine material may settle out of the water in Lake Kampeska prior to it being released into the BSR. The existing hydraulic structure may be slightly altered in that the localized depths and velocities of the BSR would nominally increase during releases.

Levees: While 3- to 5-foot tall existing berms traverse segments of the banks along the BSR in Reach 2 that function somewhat as a levee, impacts to floodplain ecology would be exacerbated as compared to existing and FWOP conditions with the construction of a federally-compliant levee system. Adverse impacts to the saturation frequency and duration and floodplain width would result from the continuous levee system isolating the BSR from its floodplain and impacting drainage patterns. Woody vegetation structure would be removed

throughout the levee right-of-way (ROW) and recruitment would be perpetually inhibited a minimum of 15 feet on both sides of the levee toe. Large woody debris (LWD) and detritus inputs into the BSR would be adversely impacted as a result of precluding the growth of riparian woody species. Incorporating NNBF, herbaceous vegetation composition and biodiversity would increase as a result of planting native species on the levee ROW.

Channel Widening: Effects from channel widening include the potential for some channel erosion in the first several years post construction until the BSR adjusts to the new channel configuration. There would also be a reduction in terrestrial floodplain habitat which would be replaced by aquatic habitat. With the incorporation of in-stream features, hydraulic structure is anticipated to improve with constructed boulder clusters. The existing channel would continue to function as a low-flow channel and would be constructed to minimize adverse impacts on aquatic life and water quality- water temperatures would potentially increase throughout the majority of the channel cross section with the exception of the low-flow channel. Incorporating NNBF, herbaceous emergent wetland vegetation composition and biodiversity would increase as a result of planting native species throughout the newly widened channel ROW.

Floodwall: Effects from floodwall construction would include similar adverse impacts as seen with levee construction, with an additional adverse impact of complete vegetation removal and inhibition of future vegetation establishment of any type. However, these effects are highly localized to the specific location of the floodwall and are largely encompassed in the adverse impacts of the levee.

6.1 Alternative 3: Levee on Left Bank Only + Channel Widening

Table 7 below provides the AAHUs by Reach, a total net loss of 1.32 AAHUs would result from the implementation of this Alternative. Without the incorporation of NNBF, Alternative 3 would result in a net loss of 2.79 AAHUs; including NNBF in Alternative 3 minimizes impacts by 52%, or 1.47 AAHUs. Reference the calculation sheets (Sub-appendix G1c) for a detailed description of assumptions used for scoring.

Table 5. FCI by Target Year in FWP Alternative 3 across all 3 Reaches and resultant cumulative HUs and AAHUs

Reach	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs
1	Alt 3	0	0	0.76	560	424.95		*20096.3*	**401.93**
		10	10	0.74	560	412.12	4185.38		
		25	15	0.71	560	399.34	6085.96		
		50	25	0.69	560	386.66	9824.97		
2		0	0	0.73	238	174.49		*8183.4*	**163.67**
		10	10	0.70	238	166.37	1704.31		
		25	15	0.68	238	162.07	2463.28		
		50	25	0.66	238	159.20	4015.80		
3		0	0	0.76	296	224.62		*10676.5*	**213.53**
		10	10	0.74	296	217.84	2212.27		
		25	15	0.71	296	212.51	3227.59		
		50	25	0.69	296	206.42	5236.67		
Exixting/FWOP Study Area Total AAHUs:								*39,021.99*	**780.44**
Alt 3 Study Area Total AAHUs:								*38,956.23*	**779.12**
Net Difference AAHUs								*-65.76*	**-1.32**

6.2 Alternative 7: Forecasted Weir Operations + Levee on Left Bank Only

Table 5 below provides the AAHUs by Reach, a total net loss of 2.16 AAHUs would result from the implementation of this Alternative. Without the incorporation of NNBF, Alternative 7 would result in a net loss of 3.37 AAHUs; including NNBF in Alternative 7 minimizes impacts by 36%, or 1.21 AAHUs. Reference the calculation sheets (Sub-appendix G1c) for a detailed description of assumptions used for scoring.

Table 6. FCI by Target Year in FWP Alternative 7 across all 3 Reaches and resultant cumulative HUs and AAHUs

Reach	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs
1	Alt 7	0	0	0.76	560	424.95		*20,097.36*	**401.95**
		10	10	0.74	560	411.70	4,183.28		
		25	15	0.71	560	399.48	6,083.86		
		50	25	0.69	560	386.94	9,830.22		
2		0	0	0.73	238	174.49		*8,193.69*	**163.87**
		10	10	0.70	238	167.00	1,707.44		
		25	15	0.68	238	162.26	2,469.41		
		50	25	0.67	238	159.09	4,016.85		
3		0	0	0.76	296	224.62		*10,622.89*	**212.46**
		10	10	0.74	296	217.61	2,211.16		
		25	15	0.71	296	211.15	3,215.75		
		50	25	0.69	296	204.52	5,195.97		
Exixting/FWOP Study Area Total AAHUs:								*39,021.99*	**780.44**
Alt 7 Study Area Total AAHUs:								*38,913.94*	**778.28**
Net Difference AAHUs								*-108.05*	**-2.16**

6.3 Alternative 8: Forecasted Weir Operations + Levee on Left Bank Only + Channel Widening

Table 6 below provides the AAHUs by Reach, a total net loss of 1.43 AAHUs would result from the implementation of this Alternative. Without the incorporation of NNBF, Alternative 8 would result in a net loss of 2.92 AAHUs; including NNBF in Alternative 8 minimizes impacts by 51%, or 1.49 AAHUs. Reference the calculation sheets (Sub-appendix G1c) for a detailed description of assumptions used for scoring.

Table 7. FCI by Target Year in FWP Alternative 8 across all 3 Reaches and resultant cumulative HUs and AAHUs

Reach	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs
1	Alt 8	0	0	0.76	560	424.95		*20,097.36*	**401.95**
		10	10	0.74	560	411.70	4,183.28		
		25	15	0.71	560	399.48	6,083.86		
		50	25	0.69	560	386.94	9,830.22		
2		0	0	0.73	238	174.49		*8,187.75*	**163.76**
		10	10	0.70	238	166.45	1,704.70		
		25	15	0.68	238	162.19	2,464.77		
		50	25	0.66	238	159.28	4,018.28		
3		0	0	0.76	296	224.62		*10,665.44*	**213.31**
		10	10	0.73	296	217.39	2,210.05		
		25	15	0.71	296	212.51	3,224.26		
		50	25	0.69	296	205.98	5,231.12		
Alt 8 Study Area Total AAHUs:								*38,950.55*	**779.01**
Existing/FWOP Study Area Total AAHUs:								*39,021.99*	**780.44**
Net Difference AAHUs								*-71.44*	**-1.43**

6.4 Alternative 11b: Forecasted Weir Operations + Levee on Right and Left Bank (One 3ft Closure Structure)

Table 8 below provides the AAHUs by Reach, a total net loss of 3.97 AAHUs would result from the implementation of this Alternative. Without the incorporation of NNBF, Alternative 11b would result in a net loss of 5.50 AAHUs; including NNBF in Alternative 11b minimizes impacts by 28%, or 1.53 AAHUs. Reference the calculation sheets (Sub-appendix G1c) for a detailed description of assumptions used for scoring.

Table 8. FCI by Target Year in FWP Alternative 11b across all 3 Reaches and resultant cumulative HUs and AAHUs

Reach	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs
1	Alt 11b	0	0	0.76	560	424.95		*20,097.36*	**401.95**
		10	10	0.74	560	411.70	4,183.28		
		25	15	0.71	560	399.48	6,083.86		
		50	25	0.69	560	386.94	9,830.22		
2		0	0	0.73	238	174.49		*8,103.12*	**162.06**
		10	10	0.70	238	165.54	1,700.16		
		25	15	0.67	238	160.25	2,443.43		
		50	25	0.66	238	156.51	3,959.53		
3		0	0	0.76	296	224.62		*10,622.89*	**212.46**
		10	10	0.74	296	217.61	2,211.16		
		25	15	0.71	296	211.15	3,215.75		
		50	25	0.69	296	204.52	5,195.97		
Existing/FWOP Study Area Total AAHUs:								*39,021.99*	**780.44**
Alt 11b Study Area Total AAHUs:								*38,823.37*	**776.47**
Net Difference AAHUs								*-198.62*	**-3.97**

6.5 Alternative 11c: Forecasted Weir Operations + Levee on Right and Left Bank (Two 4ft Closure Structures)

Table 9 below provides the AAHUs by Reach, a total net loss of 4.23 AAHUs would result from the implementation of this Alternative. Without the incorporation of NNBF, Alternative 11c would result in a net loss of 5.83 AAHUs; including NNBF in Alternative 11c minimizes impacts by 27%, or 1.6 AAHUs. Reference the calculation sheets (Sub-appendix G1c) for a detailed description of assumptions used for scoring.

Table 9. FCI by Target Year in FWP Alternative 11c across all 3 Reaches and resultant cumulative HUs and AAHUs

Reach	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs
1	Alt 11c	0	0	0.76	560	424.95		*20,097.36*	**401.95**
		10	10	0.74	560	411.70	4,183.28		
		25	15	0.71	560	399.48	6,083.86		
		50	25	0.69	560	386.94	9,830.22		
2		0	0	0.73	238	174.49		*8,090.26*	**161.81**
		10	10	0.69	238	164.97	1,697.29		
		25	15	0.67	238	160.12	2,438.15		
		50	25	0.66	238	156.26	3,954.82		
3		0	0	0.76	296	224.62		*10,622.89*	**212.46**
		10	10	0.74	296	217.61	2,211.16		
		25	15	0.71	296	211.15	3,215.75		
		50	25	0.69	296	204.52	5,195.97		
Existing/FWOP Study Area Total AAHUs:								*39,021.99*	**780.44**
Alt 11c Study Area Total AAHUs:								*38,810.50*	**776.21**
Net Difference AAHUs								*-211.49*	**-4.23**

7 Conclusion

Any of the FWP conditions of the structural alternatives evaluated would require compensatory mitigation, to include Alternative 3, the Recommended Plan. The incorporation of NNBF minimizes the amount of required compensatory mitigation. Please see Appendix G2 for discussion on the Mitigation, Monitoring, and Adaptive Management Plan.

Table 10. Net AAHU loss with and without the incorporation of NNBF

NBS Incorporated?	AAHUs	FWOP	FWP				
		Alt 1	Alt 3	Alt 7	Alt 8	Alt 11b	Alt 11c
No	Area Total	780.45	777.65	777.07	777.52	774.95	774.62
	Net Loss	N/A	-2.79	-3.37	-2.92	-5.49	-5.82
Yes	Area Total	780.45	779.12	778.28	779.01	776.47	776.22
	Net Loss	N/A	-1.32	-2.16	-1.43	-3.97	-4.22
Percent Reduction in Required Mitigation			52%	36%	51%	28%	27%

8 Literature Cited

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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
1400 WALNUT STREET
VICKSBURG MS 39180-3262

CEMVD-PDP 28 July 2023

MEMORANDUM FOR CEMVD-PDP (Keefe)

SUBJECT: Recommend Regional Use Approval of the Functional Assessment of Colorado Streams Method (FACStream) within the Civil Works Boundaries of Omaha and Kansas City Districts

1. References:

   a. Engineer Circular 1105-2-412: Assuring Quality of Planning Models, 31 Mar 2011.

   b. US Army Corps of Engineers. Assuring Quality of Planning Models - Model Certification/Approval Process: Standard Operating Procedures. Feb 2012.

   c. Memorandum to Directors of National Planning Centers of Expertise – Subject: Modification of the Model Certification Process and Delegation of Model Approval for Use, 04 Dec 2017.

   d. Memorandum from the Director of Civil Works to MSC Commanders – Subject: Delegation of Model Certification, 11 May 2018.

   e. Model Approval Plan, FACStream for NWO and NWK, 1 May 2023 (Encl 1).

   f. Peer Review Summary, FACStream, 6 July 2023, (Encl 2).

   g. Model Documentation, FACStream 1.0, 2015 (Encl 3).

   h. Model Documentation, Rationale for Use in NWO and NWK, July 2023 (Encl 4).

   i. FACStream Spreadsheet Calculator, 24 July 2023 (Encl 5).

2. An independent review managed by the Ecosystem Restoration Planning Center of Expertise (ECO-PCX) evaluated the Functional Assessment of Colorado Streams Method (FACStream) following references 1.a. and 1.b. Based on the results, the review team recommends approval of the model for regional use within the civil works boundaries of Omaha and Kansas City Districts. In accordance with reference 1.c., please review this recommendation and provide your concurrence or, if appropriate, additional directions to the team.

3. FACStream was developed by Dr. Brad Johnson, Colorado State University and two scientists at EcoMetrics, LLC, Mark Beardsley and Jessica Doran, with assistance

from the Omaha District (Mike Gilbert). It is a companion model to the approved FACWet Model, created by the same authors and built on the same ecological principles, taking a multi-variable holistic approach to the evaluation process. FACStream is a reach-scale functional assessment tool developed for Colorado streams that rates functional condition according to the degree of impairment of ten ecological forcing factors, or state variables, and 28 subvariables. Variable ratings are based on best-available evidence of the degree of departure from unimpacted reference standard condition. FACStream can be employed at any level of the US Environmental Protection Agency 1-2-3 assessment framework – from reconnaissance (1-2 hours), to routine (8-10 hours), to intensive (longer). There are 28 subvariables scored using criteria that are specific to each. Variable scores are calculated from the more specific subvariables. The overall condition score, state variables, and subvariables are aggregated to produce a numerical functional assessment index between 0 and 1.

4. FACStream was reviewed and approved for single use in 2018 for the Denver Urban Waterways Restoration Feasibility Study. FACStream was also reviewed and approved for single use in 2019 for the Mill Creek General Investigation Study in Walla Walla, Washington. The companion model to FACStream, FACWet 3.0, was reviewed and approved for regional use in 2021 within the civil works boundaries of Omaha and Kansas City Districts.

5. The ECO-PCX managed an intermediate level review of FACStream to evaluate the model's applicability within the Civil Works boundaries of the Omaha and Kansas City Districts. Specifically, an assessment was completed to determine the extent to which the model satisfies the technical quality, system quality, and usability criteria within the larger geographic area. This review was conducted by the ECO-PCX and Dr. Bruce Pruitt, Senior Wetland Scientist, USACE Engineer Research and Development Center.

   The review resulted in 9 comments (3 high significance, 4 medium significance, and 2 low significance). The comments largely dealt with improving model documentation to clarify model application standards and enhance usability of the model for users. The full text comments, evaluations, and resolutions can be found in the Peer Review Summary (Encl 2). Additional comments were provided on the spreadsheet calculator regarding minor inconsistencies and best spreadsheet practices. All comments were addressed and incorporated to the satisfaction of the reviewer and the ECO-PCX.

6. FACStream has sufficient technical quality. FACStream is based on sound hydrological and ecological theory and is well-suited for its intended purposes of

evaluating relative changes in stream function. While FACStream was created to assess stream conditions in the state of Colorado, the variables assessed and the methodology for quantitatively and qualitatively collecting and presenting data are globally applicable as the model is rooted in the hydrogeomorphic approach and rapid bio-assessment concepts. FACStream emphasizes the analysis of common stream habitat form and function variables, which are typically not unique to a given state or region. It provides the ability to assess system stressors that are common to stream habitats across the country and presents methods for determining natural reference conditions.

7. FACStream has sufficient system quality. The model is implemented using a Microsoft Excel® based format (Encl 5) which is an appropriate format to perform model calculations and is readily available. The ECO-PCX tested the spreadsheet calculator to ensure formulas and cell references were correct. The spreadsheets are computationally correct and employ best spreadsheet practices. Error messages display appropriately when erroneous inputs are attempted, and final scoring is displayed and easy to understand.

8. FACStream has sufficient usability. It identifies the data and best professional judgment needed to use the model. Field data requirements are mostly observational and may require local input to be used effectively and efficiently. Users should have field experience conducting stream assessments and evaluating vegetation quality. The model has been evaluated via multiple trial runs and has been found to be reliable. The Agency Technical Review team should evaluate the quality of data and assumptions associated with inputs.

9. The FACStream model and methodologies are consistent with USACE policies and accepted procedures for conducting functional assessments. The model does not incorporate, facilitate, or encourage the use of non-ecosystem parameters or values. The model facilitates established principles of alternative evaluation to produce outputs consistent with Civil Works required functional assessments.

10. Regarding the individuals who apply the model, Districts are entrusted to confirm that the modeler(s) who are using the model have the experience needed to apply the model correctly and interpret the model outputs. In addition, if the modeler(s) have any uncertainties with the application and/or interpretation of the model then he/she should engage the ECO-PCX.

11. The ECO-PCX finds that FACStream has sufficient technical and system quality and

usability and is policy compliant. The ECO-PCX recommends approval for regional use of the model within the civil works boundaries of Omaha and Kansas City Districts. Upon approval, the ECO-PCX will upload the model documentation to the Ecosystem Restoration Model Library (https://ecolibrary.planusace.us/#/home).

Encls (5)

Kathryn McCain, PhD
Operating Director, Ecosystem
Restoration Planning Center
of Expertise

CF
CEMVD-PDP (Lawton, Mallard, Mickal)
CEMVP-PDP (Runyon)
CEERD-EEA (Pruitt)
CENWO-PMA-C (Shelman, Ridenour, Podkowka, Nebel)
CESAJ-PD-P (Foster)
CENWK-PMP-F (Tripe)
CENWO-PMA (Minert)

System: BH 15M SG NW **Data Point:** Still Lake

Date: 7 June Weather: Beach GPA

Stream Characteristics

Metric	Measurement			
Bank Erosion	Y N			
Headcutting	Y N			
Entrenchment	Y N			
Bed Material Type				
Bed Material Size				
Woody Debris Presence	Y N			
Detritus/Organic Presence	Y N	Type	Macrophyte Leaf Litter	
Stability	Aggradation	Degradation		

U/A Drainage Area @ Still Lake

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
Dogwood	30
Cedar	5

Planted PR windrow

Herbaceous (5 ft radius)

Species	Absolute % Cover	
Unk forb (Sample #1 other plots)	10	hoary cress abv
Wormwood	5	whitetop on
Brome	50	pepperwood
Kentucky Bluegrass	20	or ~~hemlock~~
Cattails	50	
Unk Sedge	5	carex
Milkweed	10	
thistle	5	
Cinnabis (unk)	5	water hemlock
Cordgrass	15	
Saw tooth sunflower	5	
Unk Sedge (2)	5	carex /RIG

System: BH 15M SG NW **Data Point:** 16 -2 Possible Reference Point

Date: 8 June Weather:

Euclandia coryleuca
Painted Turtle
Clamshell
Minnows

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	Silt/pea gravel
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N Type: Macrophyte Leaf Litter
Stability	Aggradation Degradation

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
willow sapling	40

Herbaceous (5 ft radius)

Species	Absolute % Cover
Arrowhead	5
Spurge	20
prairie cordgrass	75
sawtooth sunflower	10
horsetail	5
RCG	10
Bulrush	10
Milkweed	15
willow	5
Polygonum	5
3 Square	10
cattail	

System: BH 15M SG NW **Data Point:** 52 Pelican Lake

Date: 7 June Weather:

Stream Characteristics

Metric	Measurement			
Bank Erosion	Y N			
Headcutting	Y N			
Entrenchment	Y N			
Bed Material Type				
Bed Material Size				
Woody Debris Presence	Y N			
Detritus/Organic Presence	Y N	Type	Macrophyte Leaf Litter	
Stability	Aggradation Degradation			

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover
Elm	10
Cottonwood	10
russian olive	5

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
Dogwood	20
green ash	10
Elm	5

Herbaceous (5 ft radius)

Species	Absolute % Cover
Rose	10
milkweed	10
False Indigo	15
Phlox - Dame's Rocket	5
Cordgrass	10
RCG	5
Kentucky bluegrass	10
Sawtooth Sunflower	10
Lily of the valley - solomon's seal	5
Cinquefoil / mayflower (PICID)	5 (more adj.)
grape	5

unk – meadow anemone

System: BH 15M SG NW **Data Point:** 54 Lake Pelican

Date: 7 June Weather:

Stream Characteristics

Metric	Measurement			
Bank Erosion	Y N			
Headcutting	Y N			
Entrenchment	Y N			
Bed Material Type				
Bed Material Size				
Woody Debris Presence	Y N			
Detritus/Organic Presence	Y N	Type	Macrophyte Leaf Litter	
Stability	Aggradation		Degradation	

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover
Green ash	15

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
honeysuckle	15
Scrub/bur willow	20
Dogwood	10
Cherry	10

Herbaceous (5 ft radius)

Species	Absolute % Cover
Cordgrass	15
cattail	25
RCG	10
Virginia Creeper	10
greenbrier	5
Phlox - Dames rocket	5
Kentucky bluegrass	10
Lily of the valley - Solomon's seal	5
curly dock	5
rose	10
milk weed	5

System: BH 15M SG NW **Data Point:** 3 Willow Creek

Date: 8 June Weather: Sunny, breezy, 74° in AM

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	(Y) N
Entrenchment	(Y) N
Bed Material Type	Silty/Sand
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	Y N Type: Macrophyte Leaf Litter
Stability	Aggradation (Degradation)

Scour downstream of culverts

drift/logs damaged culverts

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
False Indigo	35
RCG	70
nettle	25
Leafy Spurge	25
Milkweed	25
Swollen Sunflower	15
hinkweed	5
Cattail	5
Brome	50
cordgrass	30
Sandbar willow ~~Juvenile~~	5
Goose foot → Wild Rose PIC ID	5
polygonum	5
Wormwood	5
thistle	5

gravel mine adjacent to site

- meadow rue

System: BH 15M SG NW **Data Point: 32** Mud Creek Trib / Willow

Date: 9 June Weather:

More wetland than linear

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	Y N
Bed Material Type	Silty sand
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N Type: (Macrophyte) Leaf Litter
Stability	Aggradation Degradation

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
Bulrush	70
3-Square	30
polygonum	20
RCG	45
BIDMK	25
Wormwood	5
Unk polygonum (pic ID)	5 — water plantain

Water plantain

System: BH 15M SG NW **Data Point:** 2300 500

GPIA Eckman

Date: 8 JUNE Weather:

Texas Crossing Flowers

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	Y (N)
Entrenchment	(Y) N
Bed Material Type	silt
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N Type Macrophyte Leaf Litter
Stability	Aggradation Degradation

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
Sandbar willow	25
rose	5

Herbaceous (5 ft radius)

Species	Absolute % Cover
leafy spurge	35
RCG	80
Curly dock	5
Nettle	5
Milkweed	5
Wormwood	5
False Indigo	5

System: BH 15M SG NW **Data Point:** 6.5 mud creek

Date: 8 June Weather:

2 sheep

Exposed culvert @ crossing

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	Y (N) Type: Macrophyte Leaf Litter
Stability	Aggradation Degradation

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
RCG	50
Cordylanthus	20
Cattail	50
leafy spurge	10
Milkweed	5
3 sq rush	15
Brome	15
eleocharis	2
nettle	5

System: BH 15M SG NW **Data Point: 2 Levee**

Date: 6 June 2023 Weather: Sunny - 90°

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	silty sand
Bed Material Size	
Woody Debris Presence	(Y) N small branches etc
Detritus/Organic Presence	(Y) N Type Macrophyte Leaf Litter
Stability	Aggradation Degradation →

maybe farther down so with of datapoint

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover
Box elder	5

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
Autumn olive	5

Herbaceous (5 ft radius)

Species	Absolute % Cover
phlox - dame's rocket	5
RCG	75
nettle	15
Polygonum	10
thistle	10
Grape	15
sawtooth sunflower	25
~~dandelion~~	
Cordgrass	
Mosquitos	

wetland on other bank

System: BH 15M SG NW **Data Point: Level 1**

Date: 6 June Weather:

Weir some flanking

Stream Characteristics

Metric	Measurement			
Bank Erosion	Y (N)			
Headcutting	Y (N)			
Entrenchment	Y (N)			
Bed Material Type				
Bed Material Size				
Woody Debris Presence	Y (N)			
Detritus/Organic Presence	Y (N)	Type	Macrophyte Leaf Litter	
Stability	Aggradation	Degradation		

→ some litter along bankline

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover
Cottonwoods	20

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
Boxelder	5

Herbaceous (5 ft radius)

Species	Absolute % Cover
common milkweed	10
RCG	40
cordgrass	40
Kentucky Bluegrass	50
~~Narrow leaf milkweed~~ leafy spurge	5

minor patch of Eleocharis

pelicans

Red winged blackbirds

Dragonflies

System: BH 15M SG NW **Data Point: Levee 4**

Date: 6 June Weather:

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	
Bed Material Size	
Woody Debris Presence	Y N
Detritus/Organic Presence	(Y) N Type Macrophyte Leaf Litter
Stability	Aggradation Degradation

minor cutbank across BSR

Algal mat wetland

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover
Cottonwood	20
American elm	10

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
cherry/privet (thorns) - PIC ID	40

buckthorn

Herbaceous (5 ft radius)

Species	Absolute % Cover
timothy or ~~foxtail~~	60
leafy spurge	40
thistle	5
PCG	10
cattail	5
common silverweed (PIC yellow flower)	10

Adjacent to cattail wetland

System: BH 15M SG NW **Data Point:** Level II

Date: 6 June Weather:

Pelicans
canada
goose

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	Y (N) → very shallow point bar formation
Bed Material Type	Sand
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N Type: Macrophyte (Leaf Litter)
Stability	Aggradation Degradation

Mowed park setting ↓ small riparian buffer across river

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
Kentucky bluegrass	80
thistle	25
RCG	50
Polygonum	15
leafy spurge	10
poison ivy	5
red clover	5
prairie cord grass	30
nettle	5
grape	5

System: BH 15M SG NW **Data Point:**_____

Date: 6th June Weather: Pelican 57 →

Pelican Lake

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	Sand/gravel
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	Y (N) Type: Macrophyte Leaf Litter
Stability	Aggradation Degradation

cattails to Norway

N/A

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover
Willow sandbar	15
Green Ash	20
cottonwood	5

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
Autumn olive	10
silver maple	5
green ash	10

Herbaceous (5 ft radius)

Species	Absolute % Cover
RCG	75
field bindweed	10
curly dock	5
leafy spurge	10
~~Bad~~ wormwood	5
Ink (purple) flower (pic)	5
~~Yellow~~ prairie cordgrass	60
Jerusalem artichoke	5
grass	10
polygonum	5

— b. Hersweet highbush

System: BH 15M SG NW **Data Point:** Diversion 42

Date: 6 June Weather:

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	(Y) N
Entrenchment	(Y) N
Bed Material Type	Sandy/silty
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N Type: Macrophyte (Leaf Litter)
Stability	Aggradation (Degradation)

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
False indigo	5

Herbaceous (5 ft radius)

Species	Absolute % Cover
RCG	80
leafy spurge	50
Brome	90
field bindweed	15
~~Poison ivy~~	

Oxbow on other side of road

System: BH 15M SG NW **Data Point:** 26 Mullcreek

Date: 7 June Weather:

Snapping turtle

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	Silt
Bed Material Size	
Woody Debris Presence	(Y) N
Detritus/Organic Presence	(Y) N Type: Macrophyte (Leaf Litter)
Stability	Aggradation ~~Degradation~~

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Leafy Spurge adjacent

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
RCG	30
Cattail	90
milkweed	5
curly dock	5
thistle	5

System: BH 15M SG NW **Data Point:** 4 in Mud creek

Date: 7 June Weather:

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	(Y) N
Bed Material Type	Silt
Bed Material Size	
Woody Debris Presence	(Y) N
Detritus/Organic Presence	(Y) N Type: Macrophyte, Leaf Litter
Stability	Aggradation Degradation

Sandpiper (?)

Nothing yet

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
RCG	90
Milkweed	5
cattails	15
grass	5
polygonum	5
eleocharis	5
cordgrass	10

System: BH 15M SG NW **Data Point:** 71 Kumpesky

Date: 7 June Weather:

wetland

Stream Characteristics

Metric	Measurement			
Bank Erosion	Y N			
Headcutting	Y N			
Entrenchment	Y N			
Bed Material Type	NA			
Bed Material Size				
Woody Debris Presence	Y N			
Detritus/Organic Presence	Y N	Type	Macrophyte Leaf Litter	
Stability	Aggradation		Degradation	

red winged yellowheaded

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover
~~USR~~ green ash	5

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
Red osier dogwood	5

Herbaceous (5 ft radius)

Species	Absolute % Cover
~~link~~ purple flowers ← Picture from ~~Dee~~ Data Point 57	15
thistle	15
RCG	35
Nettle	30
Cattail	60
Polygonum	5

bittersweet nightshade

System: BH 15M SG NW **Data Point: 22 SQC**

Date: 7 June Weather:

Cave Swallows

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	silty clay
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N — Type: Macrophyte Leaf Litter
Stability	Aggradation Degradation

backing up f/ Bridge

none but erosion f/ Bridge

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
Brome	~~75~~
Nettle	15
RCG	20
Leafy spurge	15
yak (Timothy)	30
dandelion	20
Cattail	5
wormwood	5
milkweed	5
western wheat grass	10
cordgrass	10

System: BH 15M SG NW **Data Point: 16 SOD**

Date: 7 June Weather:

"Cows swallows Redwinged

scour from bridge

Stream Characteristics

Metric	Measurement			
Bank Erosion	(Y)	N		
Headcutting	Y	(N)		
Entrenchment	Y	(N)		
Bed Material Type	Silty			
Bed Material Size				
Woody Debris Presence	Y	(N)		
Detritus/Organic Presence	Y	(N)	Type	Macrophyte Leaf Litter
Stability	Aggradation		Degradation	

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
wormwood	5
cattail	7
RCG	30
milkweed	5
nettle	5
arrowhead	2
polygonum	5
cordgrass	15
phragmites	5
Brome	~~25~~ 25

System: BH 15M SG NW **Data Point:** 9500

Date: 7 June Weather:

Low water crossing
4 culverts
8 concrete slabs for stabilization

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	(Y) N
Entrenchment	(Y) N
Bed Material Type	Silt
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	Y (N) Type: Macrophyte ~~Leaf Litter~~
Stability	Aggradation (Degradation)

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
~~Cottonwood~~	~~5~~
Sandbar willow	10

Herbaceous (5 ft radius)

Species	Absolute % Cover
eleocharis	5 10
RCG	25
coldgrass	~~50~~ 25
Lnk sedge (Pic ID)	5
~~peppermint~~ mint	2
cottonwood saplings	2
bulrush	2
arrowhead	2
cattail	~~5~~ 10
milkweed	5

- Carex ? PCC

System: BH 15M SG NW **Data Point:** 7 500

Date: 7 June Weather:

cattle crossed ↓ erosion f/ Bridge

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	Silt
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N Type (Macrophyte) Leaf Litter
Stability	Aggradation Degradation

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
red osier	5

Herbaceous (5 ft radius)

Species	Absolute % Cover
Cattail	15
UNK timothy	25
RCG	30
Bromus	20
UNK mint (PIC ID)	5

lambs quarters

System: BH 15M SG NW **Data Point: 5 Mahoney**

Date: 7 June Weather:

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	Silt
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	Y (N) Type: Macrophyte Leaf Litter
Stability	Aggradation Degradation

2 culverts
Cows
Scour around culverts

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
Bulrush	5
Cordgrass	70
leafy spurge	10
Brome	~~50~~ 40
milkweed	5
Unk sedge f/ Data point 9	25 — carex or young PUG?
PCG	15
wormwood	5

System: BH 15M SG NW **Data Point:** 4 Still Lake

Date: 7 June Weather:

Stream Characteristics

Metric	Measurement
Bank Erosion	Y (N)
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	Silt / small gravel in Still Lake
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N Type: Macrophyte, (Leaf Litter)
~~Stability~~	Aggradation Degradation

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
Cattail	75
Brome	40
RCG	20
Milkweed (common)	10
~~Land for BOF Datapoint 2~~	5
Mustard spp.	5
Cordgrass	15
~~Leafy Spurge~~ leafy spurge	~~5~~ 5
Soft stem bulrush	5
Nettle	5
Swamp milkweed	5
Polygonum	5
Wormwood	5

4 culverts inlet tributary to Still Lake

System: BH 15M SG NW **Data Point:** 10 Mahoney

Date: 7 June Weather:

cave swallow

Stream Characteristics

Metric	Measurement
Bank Erosion	Y N
Headcutting	Y N
Entrenchment	Y N
Bed Material Type	Silt
Bed Material Size	
Woody Debris Presence	Y N
Detritus/Organic Presence	Y N Type: Macrophyte Leaf Litter
Stability	Aggradation Degradation

Scour around culvert
Flanking
Weird gravel deposits (possibly manmade)

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
Cattails	40
~~[illegible]~~	
leafy Spurge	25
RCG	30
Brome	30
Cocksfoot	25
Unk (timothy)	5

Unk pic ID @ adjacent to SD2

System: BH 15M SG NW **Data Point:** 30 Kampeska

Date: 7 June Weather: Cloudy 73°

Zebra mussels on outlet structure

redwinged blackbird

Stream Characteristics

Metric	Measurement
Bank Erosion	Y N
Headcutting	Y N
Entrenchment	Y N
Bed Material Type	
Bed Material Size	
Woody Debris Presence	Y N
Detritus/Organic Presence	Y N Type: Macrophyte Leaf Litter
Stability	Aggradation Degradation

N/A

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover
Sandbar willow	5
Cottonwood	5

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover
sandbar willow	60
Swamp rose	15

Herbaceous (5 ft radius)

Species	Absolute % Cover
leafy spurge	40
Prairie cordgrass	25
Thistle	15
Unk Aster	10
Kentucky bluegrass	40
curly dock	10
~~Smartweed~~	~~5~~
common milkweed	5
Flox - dame's rocket	5
Reed	5
wormwood	5
nettle	10
polygonum	5
wild grape	10

Aster sp.?

System: BH 15M SG NW **Data Point:** Big Sioux 2

Date: 7 June Weather:

Stream Characteristics

Metric	Measurement
Bank Erosion	(Y) N
Headcutting	Y (N)
Entrenchment	Y (N)
Bed Material Type	silt/clay/gravel
Bed Material Size	
Woody Debris Presence	Y (N)
Detritus/Organic Presence	(Y) N Type: Macrophyte Leaf Litter
Stability	Aggradation Degradation (minor)

Riparian Vegetation

Trees (30 ft radius)

Species	Absolute % Cover

Saplings/Shrubs (15 ft radius)

Species	Absolute % Cover

Herbaceous (5 ft radius)

Species	Absolute % Cover
Autum olive	5
clover (white flower)	5
milkweed	5
~~Bare~~ Brome	30
cleavers	25
~~Hak Sedge~~ coolgrass	40
dandelion	5
thistle	5
~~Hak mus~~ mustard spp.	5
RCG	20
link for B	10
perennial peppervine	

cattle disturbance / erosion
link scarce from other datapoints = coolgrass
change
adjacent farm field

US Army Corps of Engineers®
Omaha District

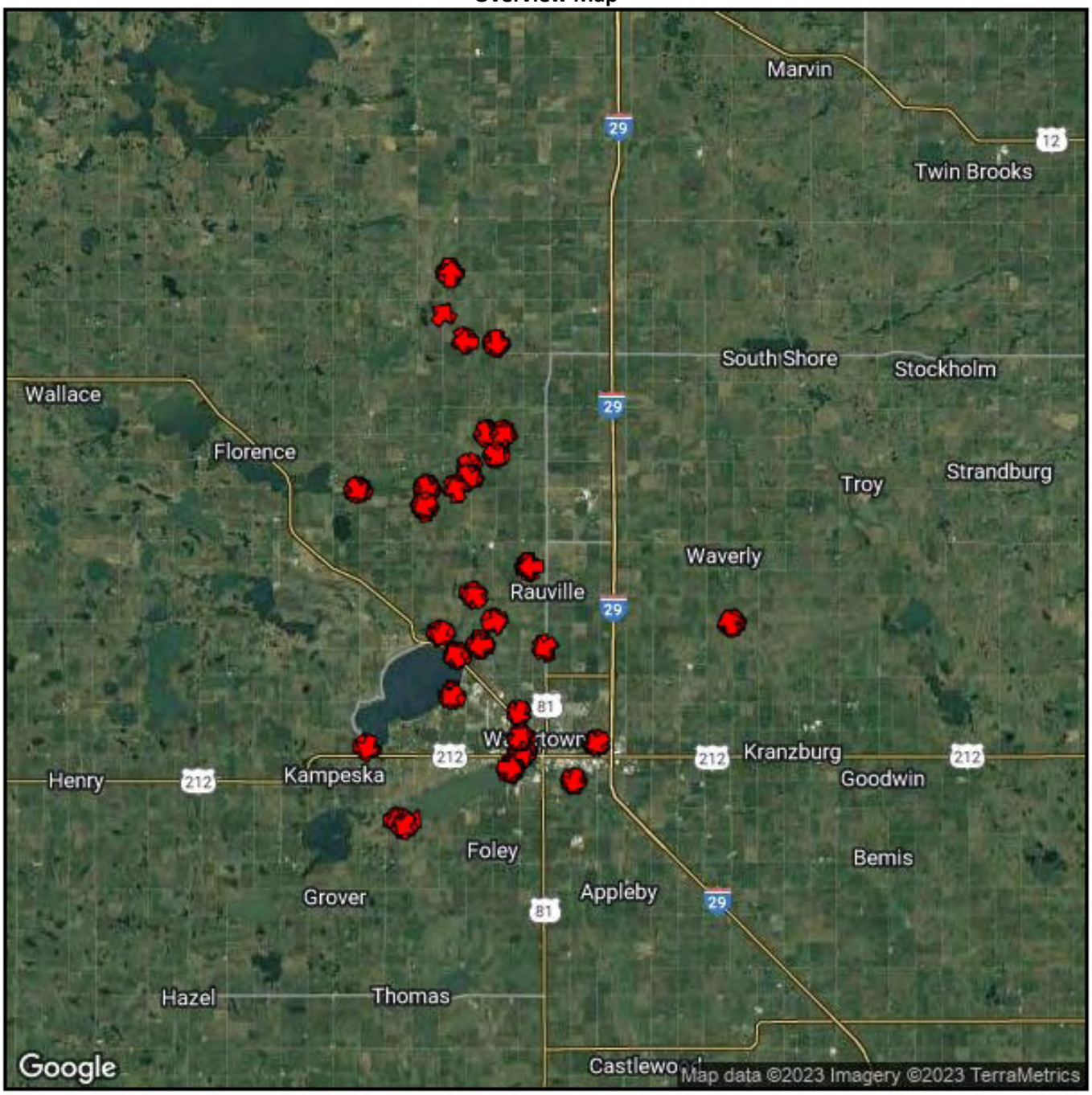
Watertown GI, 2023 June (6-8)

Field Survey Photolog

By: Adam Nebel, Environmental Resources Specialist

Note: Accuracy of coordinates, direction and elevation varies.
Data collected using iPadPro and BadElf GPS unit

Overview Map



IMG_0380.JPG
Photo Direction: 198° SSW



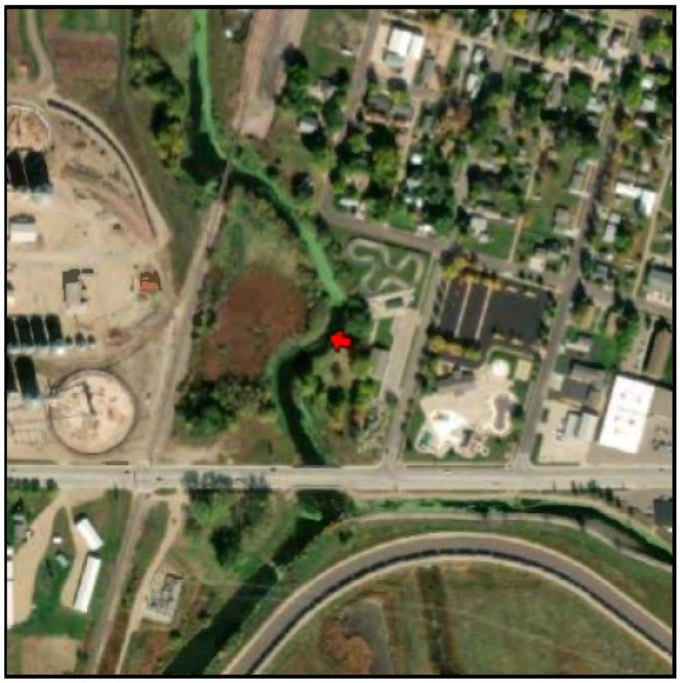




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Photo Direction: 284° WNW







IMG_0382.JPG
Photo Direction: 350° N





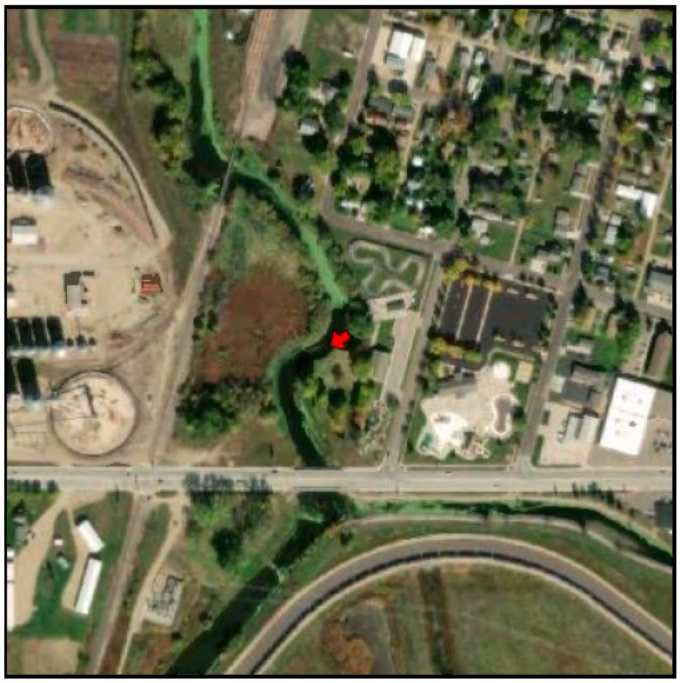


IMG_0386.JPG

Photo Direction: 238° WSW



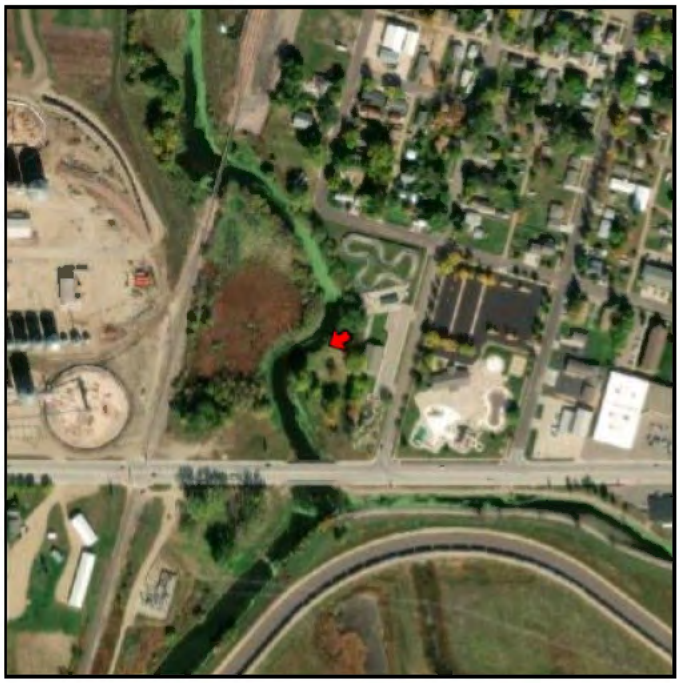




IMG_0387.JPG
Photo Direction: 241° WSW







IMG_0388.JPG

Photo Direction: 243° WSW







IMG_0389.JPG

Photo Direction: 94° E



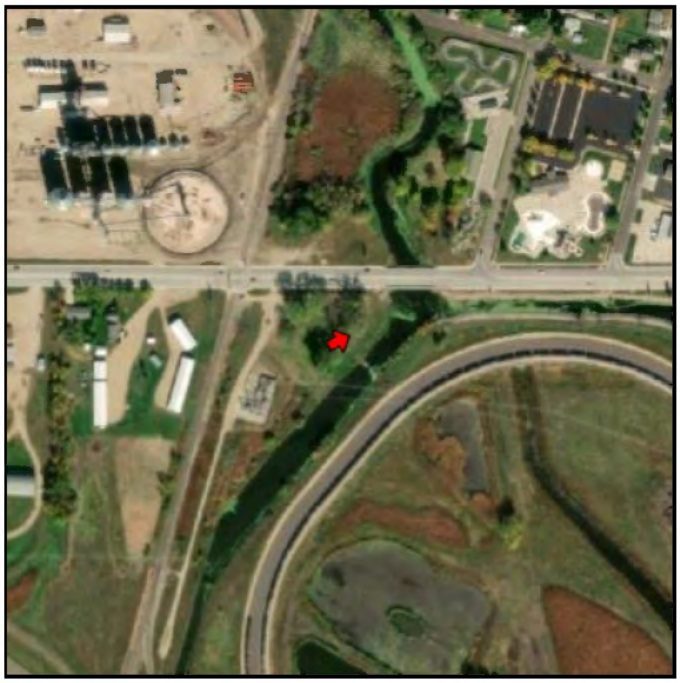




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Photo Direction: 64° ENE







IMG_0391.JPG
Photo Direction: 168° SSE







IMG_0392.JPG
Photo Direction: 143° SE







IMG_0393.JPG
Photo Direction: 91° E







IMG_0394.JPG
Photo Direction: 186° S







IMG_0395.JPG
Photo Direction: 56° NE







IMG_0396.JPG

Photo Direction: 61° ENE







IMG_0399.JPG

Photo Direction: 177° S







IMG_0400.JPG

Photo Direction: 261° W







IMG_0401.JPG

Photo Direction: 221° SW



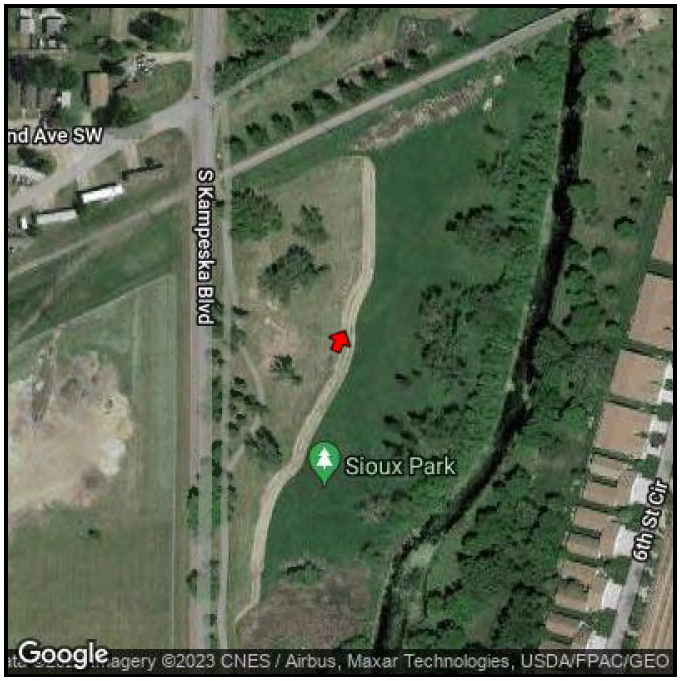




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Photo Direction: 24° NNE







IMG_0403.JPG

Photo Direction: 180° S







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Photo Direction: 73° ENE







IMG_0405.JPG
Photo Direction: 70° ENE







IMG_0406.JPG
Photo Direction: 39° NE







IMG_0407.JPG

Photo Direction: 242° WSW







IMG_0408.JPG

Photo Direction: 314° NW







IMG_0409.JPG
Photo Direction: 311° NW







IMG_0410.JPG

Photo Direction: 240° WSW







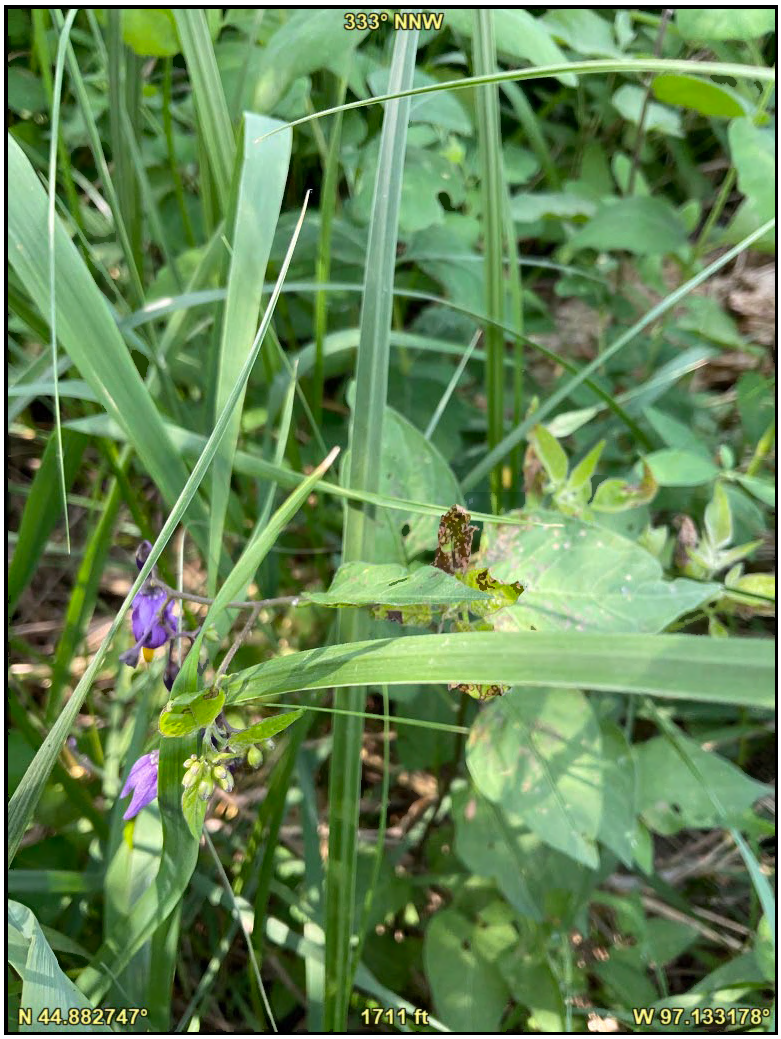
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Photo Direction: 25° NNE







IMG_0417.JPG
Photo Direction: 168° SSE







IMG_0418.JPG
Photo Direction: 333° NNW







IMG_0419.JPG
Photo Direction: 75° ENE







IMG_0420.JPG

Photo Direction: 163° SSE







IMG_0421.JPG
Photo Direction: 159° SSE







IMG_0422.JPG

Photo Direction: 2° N







IMG_0424.JPG
Photo Direction: 101° E







IMG_0426.JPG
Photo Direction: 357° N







IMG_0427.JPG
Photo Direction: 38° NE







IMG_0428.JPG

Photo Direction: 323° NW







IMG_0429.JPG
Photo Direction: 160° SSE







IMG_0430.JPG

Photo Direction: 118° ESE







IMG_0431.JPG

Photo Direction: 199° SSW



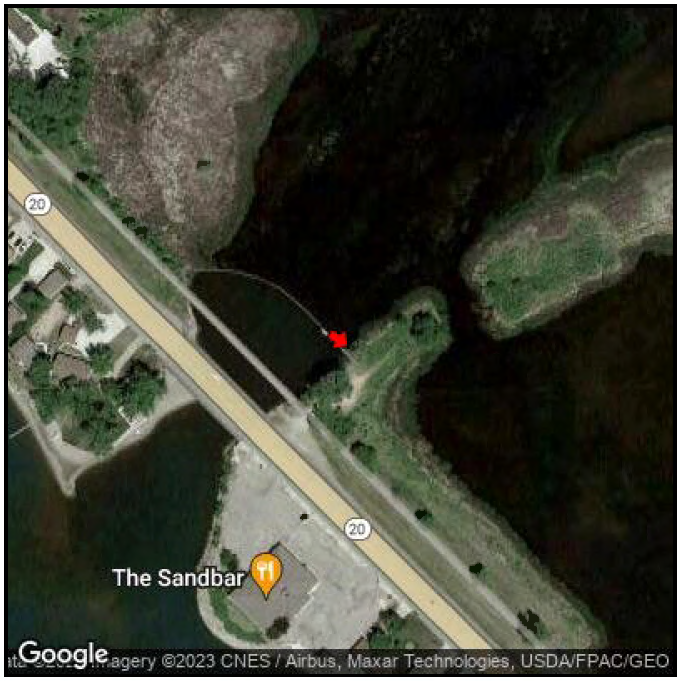




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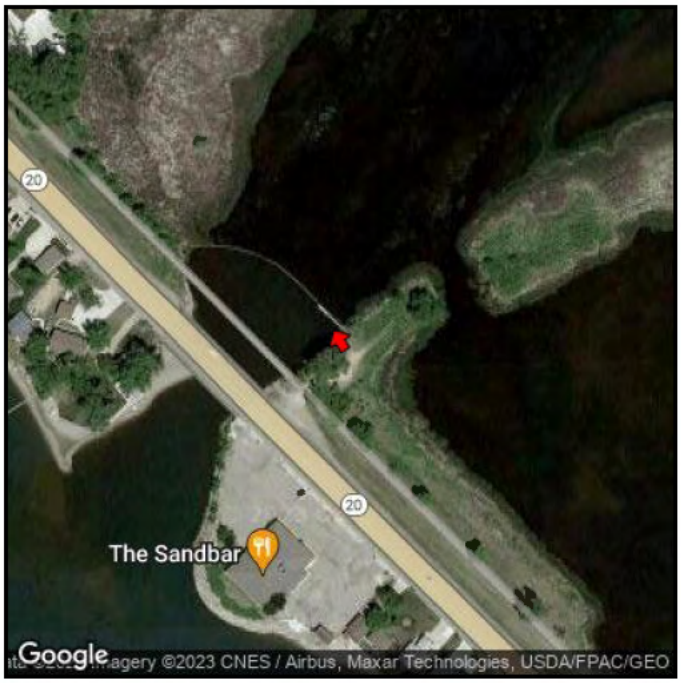






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IMG_0435.JPG
Photo Direction: 257° WSW







IMG_0436.JPG
Photo Direction: 278° W







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Photo Direction: 39° NE







IMG_0438.JPG
Photo Direction: 148° SSE







IMG_0439.JPG
Photo Direction: 222° SW

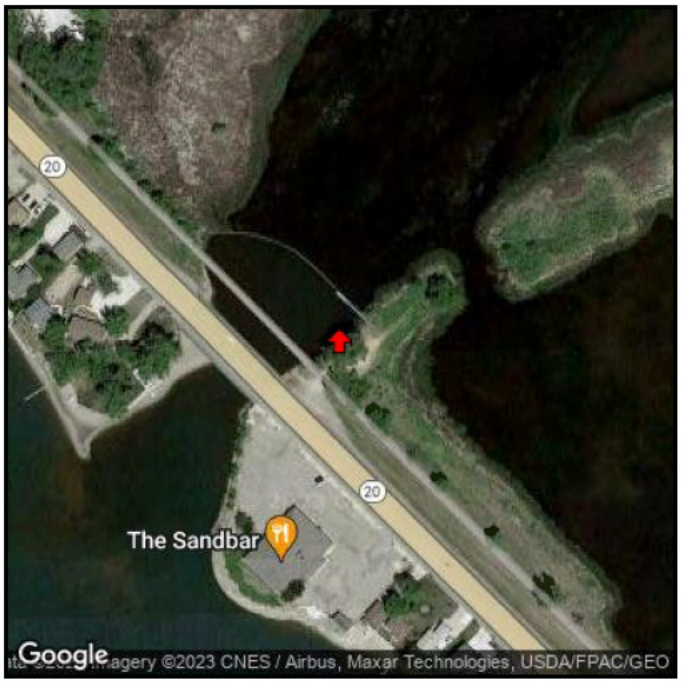






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IMG_0442.JPG
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IMG_0443.JPG
Photo Direction: 329° NNW







IMG_0444.JPG
Photo Direction: 189° S







IMG_0445.JPG

Photo Direction: 184° S







IMG_0446.JPG

Photo Direction: 165° SSE







IMG_0447.JPG
Photo Direction: 65° ENE







IMG_0448.JPG
Photo Direction: 290° WNW







IMG_0449.JPG

Photo Direction: 226° SW







IMG_0451.JPG

Photo Direction: 167° SSE







IMG_0452.JPG
Photo Direction: 68° ENE







IMG_0453.JPG
Photo Direction: 74° ENE







IMG_0454.JPG
Photo Direction: 30° NNE







IMG_0455.JPG
Photo Direction: 286° WNW







IMG_0456.JPG

Photo Direction: 310° NW







IMG_0457.JPG
Photo Direction: 68° ENE







IMG_0458.JPG

Photo Direction: 181° S







IMG_0459.JPG

Photo Direction: 22° NNE







IMG_0460.JPG

Photo Direction: 179° S







IMG_0461.JPG

Photo Direction: 102° ESE







IMG_0462.JPG

Photo Direction: 258° WSW







IMG_0463.JPG
Photo Direction: 251° WSW







IMG_0464.JPG

Photo Direction: 159° SSE







IMG_0467.JPG
Photo Direction: 159° SSE







IMG_0468.JPG

Photo Direction: 119° ESE







IMG_0469.JPG

Photo Direction: 74° ENE







IMG_0470.JPG

Photo Direction: 318° NW







IMG_0471.JPG
Photo Direction: 28° NNE







IMG_0472.JPG
Photo Direction: 344° NNW







IMG_0473.JPG
Photo Direction: 135° SE







IMG_0474.JPG
Photo Direction: 95° E







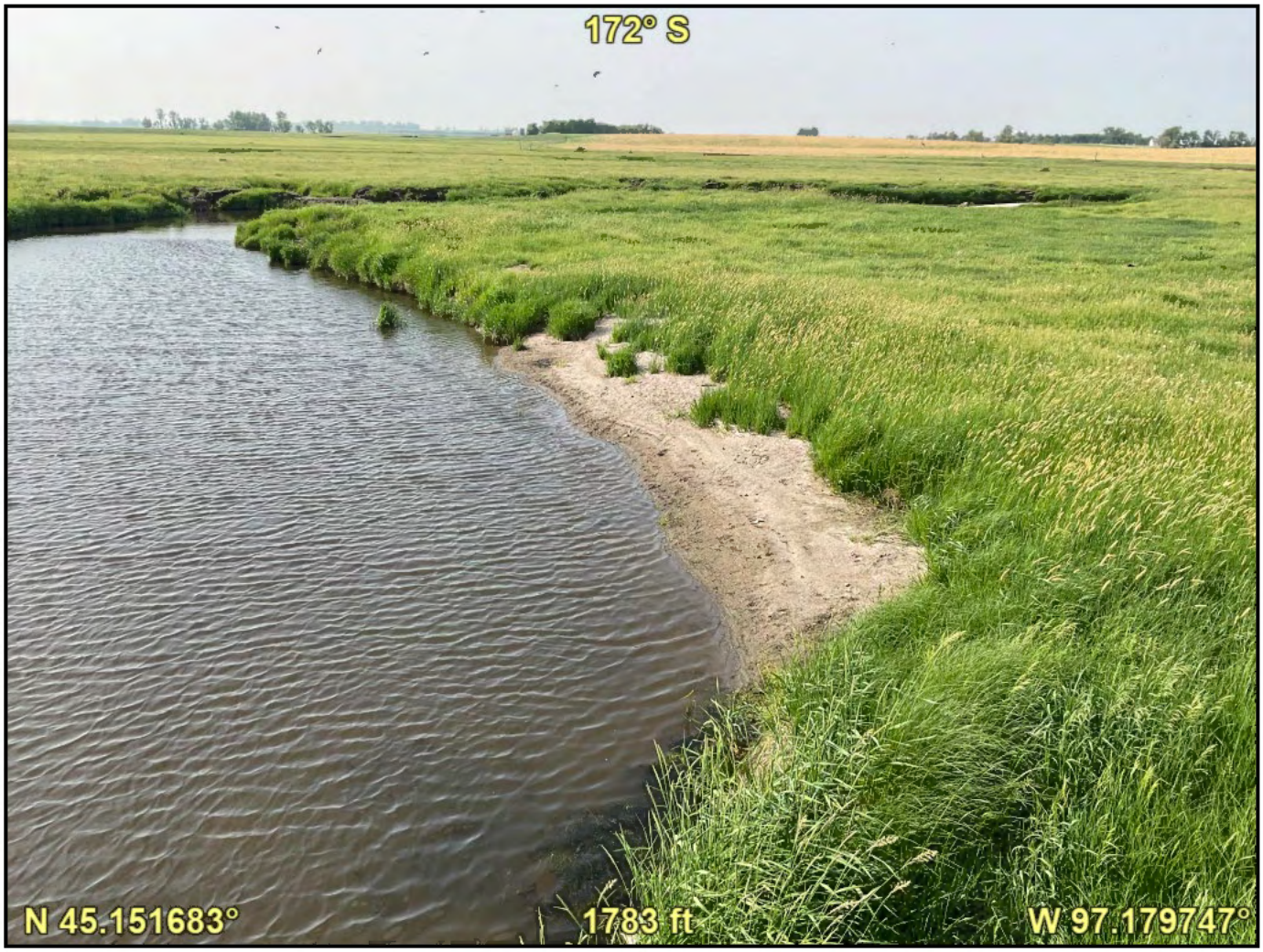
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IMG_0477.JPG
Photo Direction: 172° S







IMG_0478.JPG

Photo Direction: 180° S







IMG_0479.JPG
Photo Direction: 48° NE







IMG_0480.JPG

Photo Direction: 6° N







IMG_0481.JPG
Photo Direction: 294° WNW







IMG_0482.JPG
Photo Direction: 41° NE







IMG_0483.JPG

Photo Direction: 326° NW







IMG_0488.JPG
Photo Direction: 312° NW







IMG_0489.JPG
Photo Direction: 165° SSE







IMG_0490.JPG

Photo Direction: 152° SSE







IMG_0491.JPG
Photo Direction: 278° W







IMG_0493.JPG
Photo Direction: 122° ESE







IMG_0494.JPG
Photo Direction: 70° ENE







IMG_0495.JPG
Photo Direction: 300° WNW







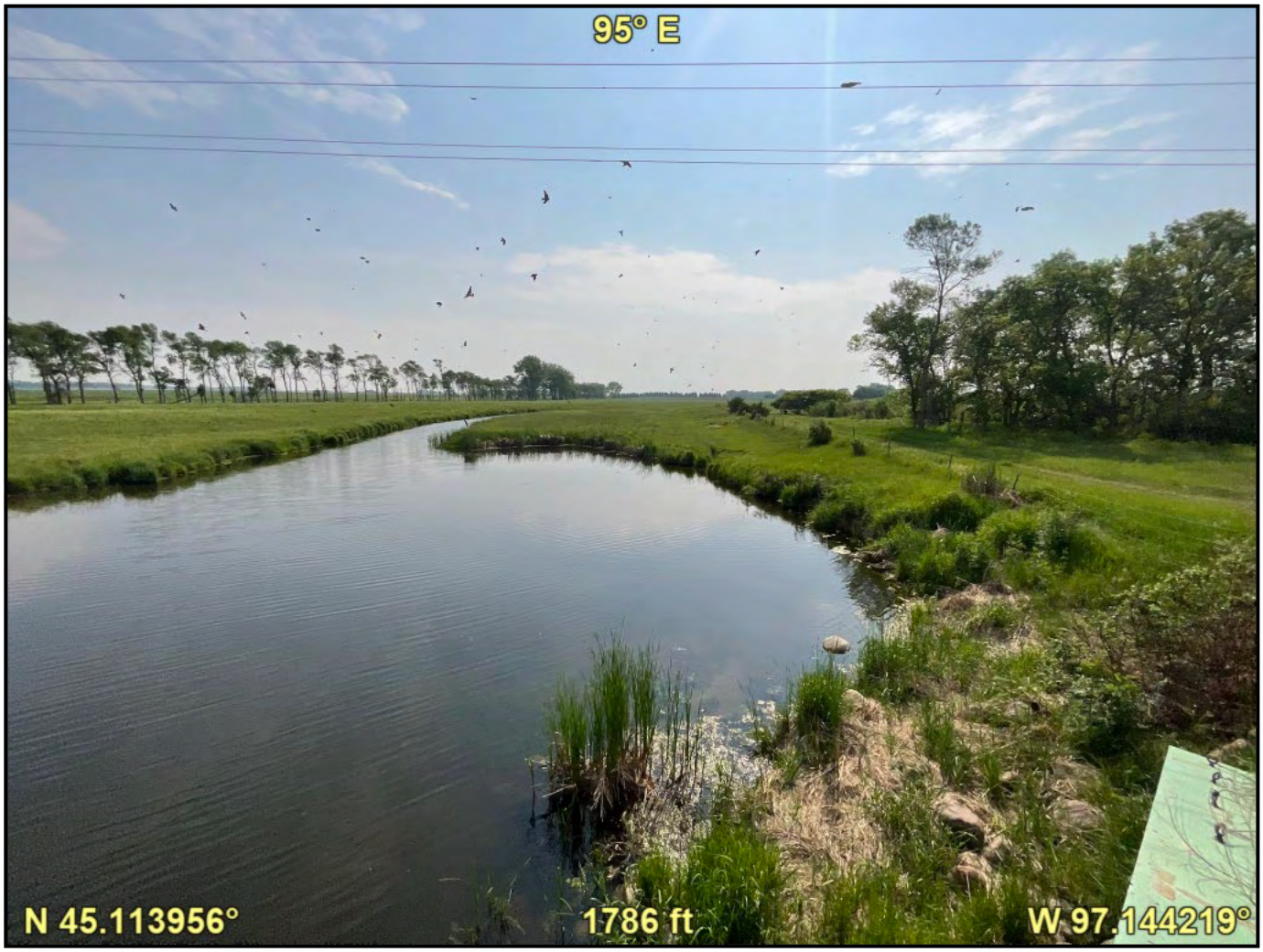
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IMG_0497.JPG
Photo Direction: 95° E







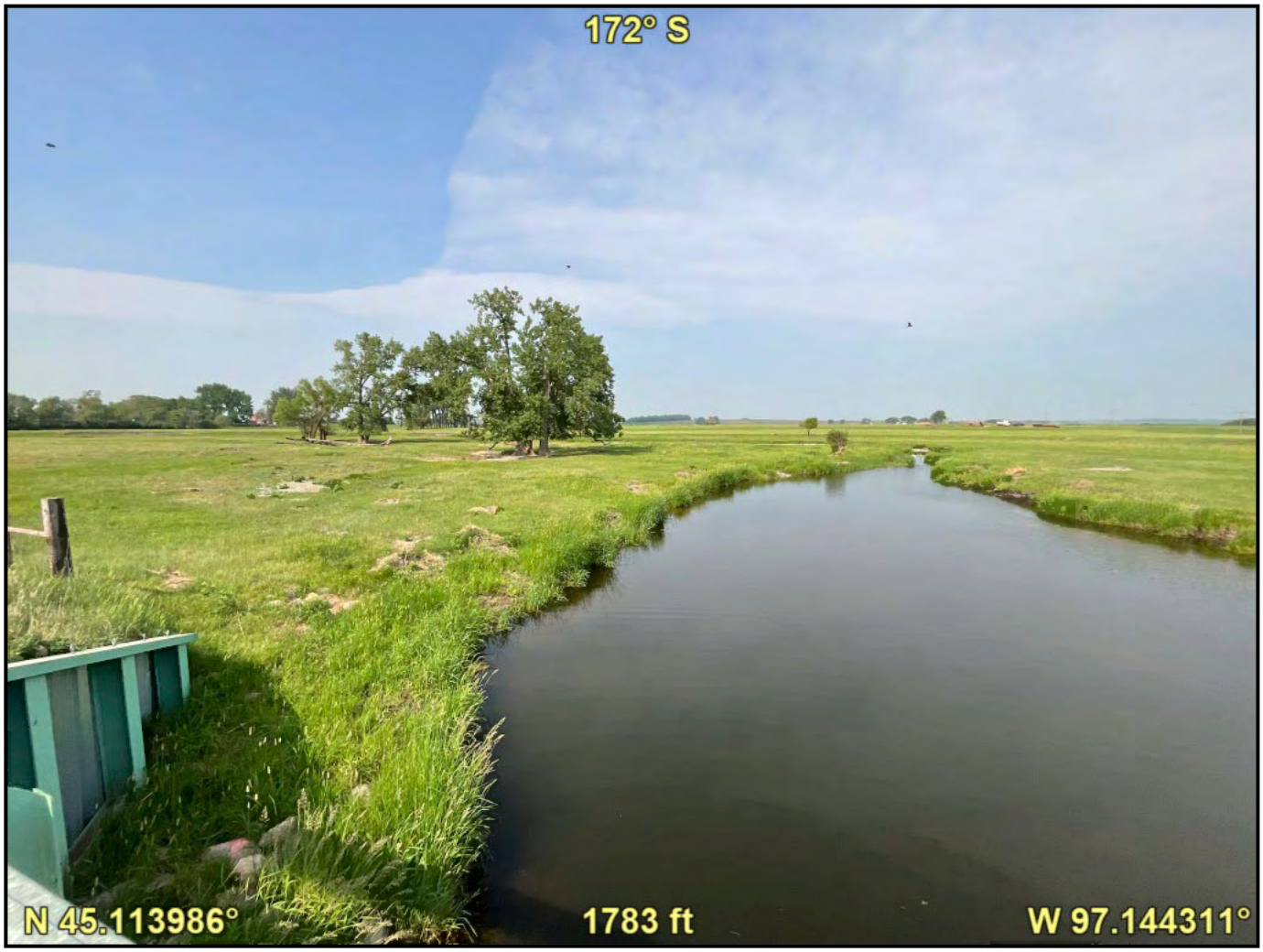
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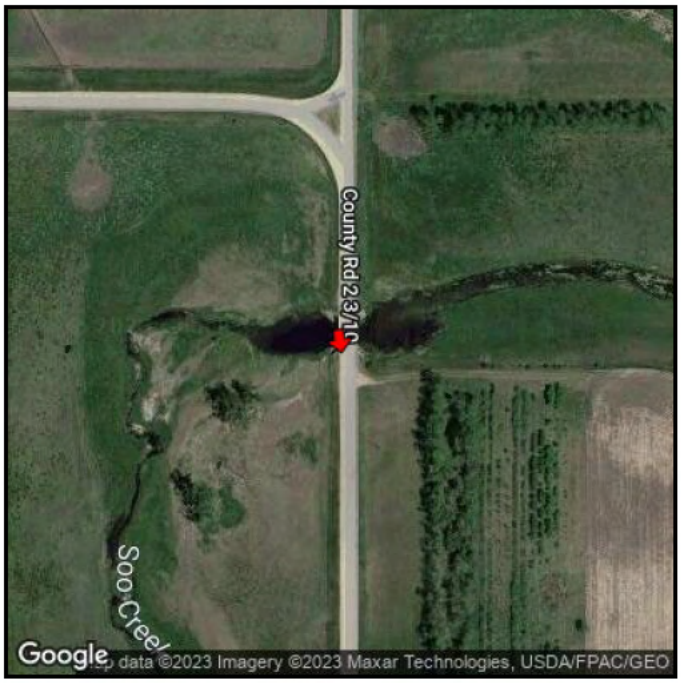






IMG_0499.JPG
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IMG_0500.JPG

Photo Direction: 174° S







IMG_0501.JPG

Photo Direction: 168° SSE







IMG_0502.JPG
Photo Direction: 169° S







IMG_0503.JPG

Photo Direction: 211° SSW







IMG_0505.JPG
Photo Direction: 213° SSW







IMG_0506.JPG
Photo Direction: 334° NNW







IMG_0507.JPG
Photo Direction: 310° NW







IMG_0508.JPG

Photo Direction: 107° ESE







IMG_0509.JPG
Photo Direction: 48° NE







IMG_0510.JPG
Photo Direction: 151° SSE







IMG_0511.JPG
Photo Direction: 197° SSW







IMG_0512.JPG

Photo Direction: 1° N







IMG_0513.JPG

Photo Direction: 167° SSE

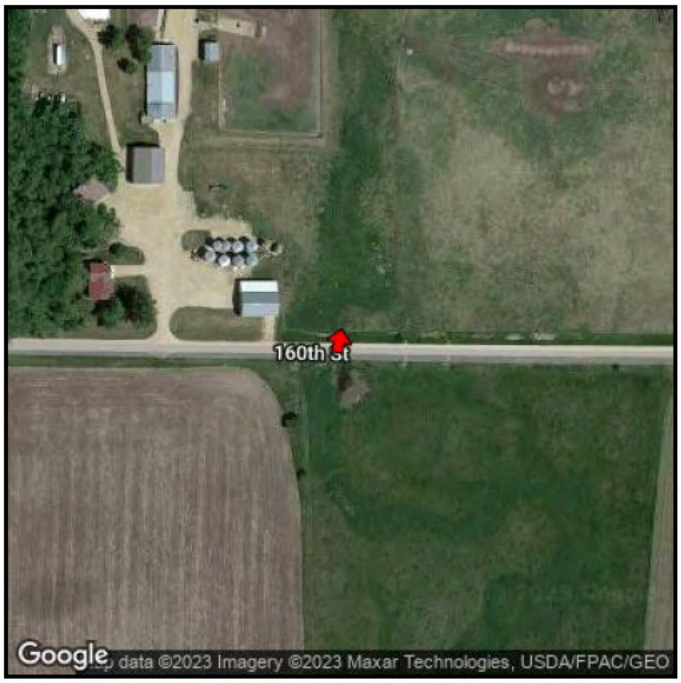






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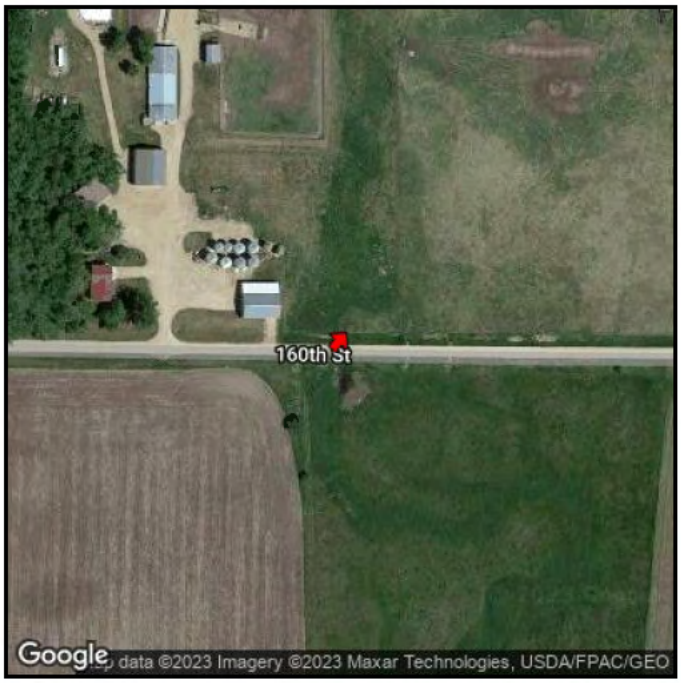




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Photo Direction: 41° NE







IMG_0516.JPG

Photo Direction: 171° S







IMG_0517.JPG

Photo Direction: 228° SW







IMG_0518.JPG
Photo Direction: 226° SW







IMG_0519.JPG
Photo Direction: 229° SW







IMG_0522.JPG

Photo Direction: 46° NE







IMG_0523.JPG
Photo Direction: 120° ESE







IMG_0524.JPG
Photo Direction: 284° WNW







IMG_0527.JPG
Photo Direction: 127° SE







IMG_0529.JPG
Photo Direction: 134° SE







IMG_0530.JPG
Photo Direction: 74° ENE







IMG_0531.JPG
Photo Direction: 243° WSW







IMG_0532.JPG
Photo Direction: 207° SSW







IMG_0533.JPG
Photo Direction: 145° SE







IMG_0534.JPG

Photo Direction: 235° SW







IMG_0535.JPG

Photo Direction: 190° S







IMG_0536.JPG
Photo Direction: 289° WNW







IMG_0537.JPG

Photo Direction: 24° NNE







IMG_0538.JPG

Photo Direction: 95° E







IMG_0539.JPG

Photo Direction: 146° SSE







IMG_0541.JPG
Photo Direction: 230° SW







IMG_0542.JPG

Photo Direction: 165° SSE







IMG_0544.JPG
Photo Direction: 141° SE







IMG_0546.JPG

Photo Direction: 356° N







IMG_0547.JPG
Photo Direction: 335° NNW







IMG_0548.JPG
Photo Direction: 313° NW







IMG_0549.JPG
Photo Direction: 89° E







IMG_0550.JPG
Photo Direction: 147° SSE







IMG_0551.JPG
Photo Direction: 185° S







IMG_0552.JPG
Photo Direction: 287° WNW







IMG_0553.JPG
Photo Direction: 296° WNW







IMG_0554.JPG
Photo Direction: 71° ENE







IMG_0555.JPG

Photo Direction: 159° SSE







IMG_0556.JPG

Photo Direction: 214° SW







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Photo Direction: 247° WSW







IMG_0558.JPG
Photo Direction: 289° WNW







IMG_0559.JPG
Photo Direction: 152° SSE

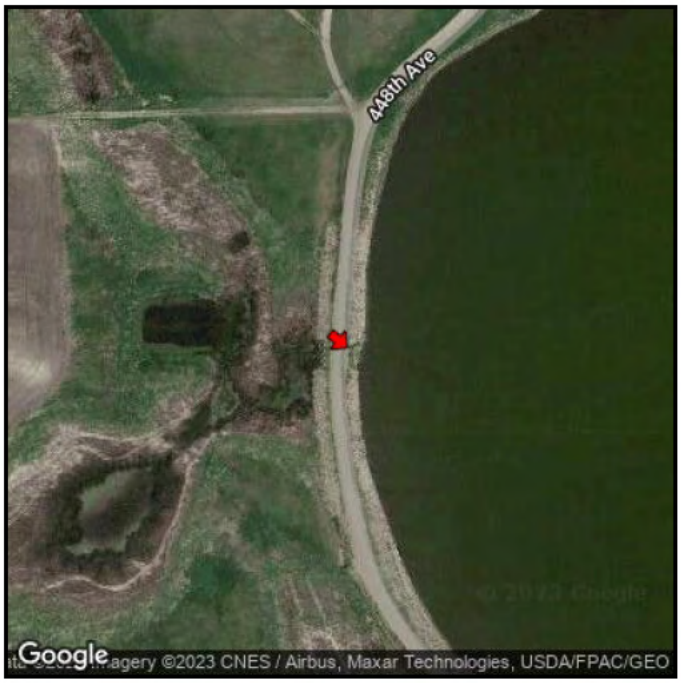






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Photo Direction: 78° ENE







IMG_0562.JPG

Photo Direction: 31° NNE







IMG_0563.JPG
Photo Direction: 55° NE







IMG_0565.JPG
Photo Direction: 145° SE







IMG_0566.JPG
Photo Direction: 351° N







IMG_0567.JPG

Photo Direction: 113° ESE







IMG_0568.JPG
Photo Direction: 45° NE







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IMG_0570.JPG

Photo Direction: 210° SSW







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Photo Direction: 117° ESE







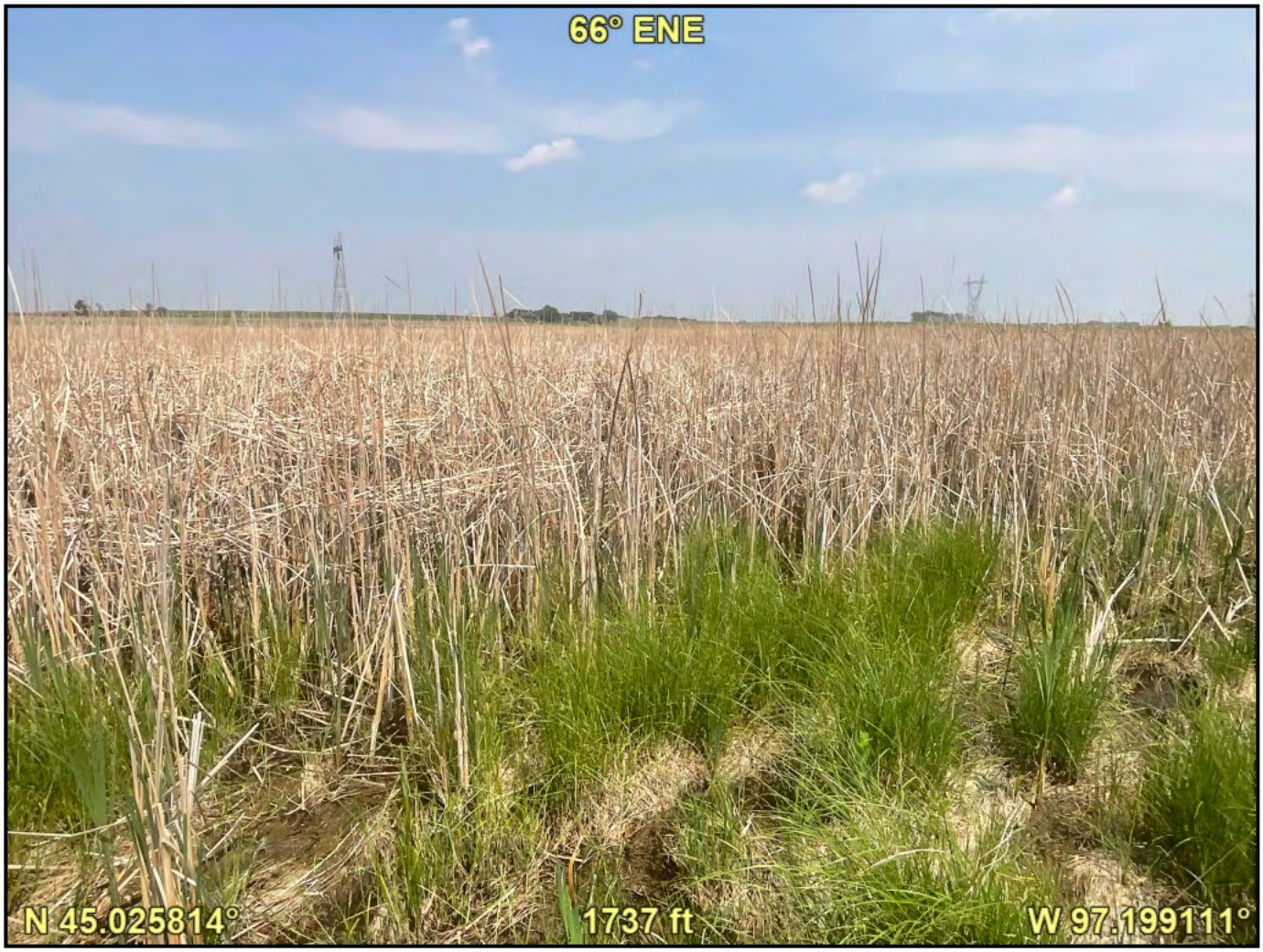
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Photo Direction: 66° ENE







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Photo Direction: 126° SE







IMG_0576.JPG
Photo Direction: 202° SSW







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Photo Direction: 132° SE







IMG_0578.JPG

Photo Direction: 183° S







IMG_0579.JPG

Photo Direction: 240° WSW







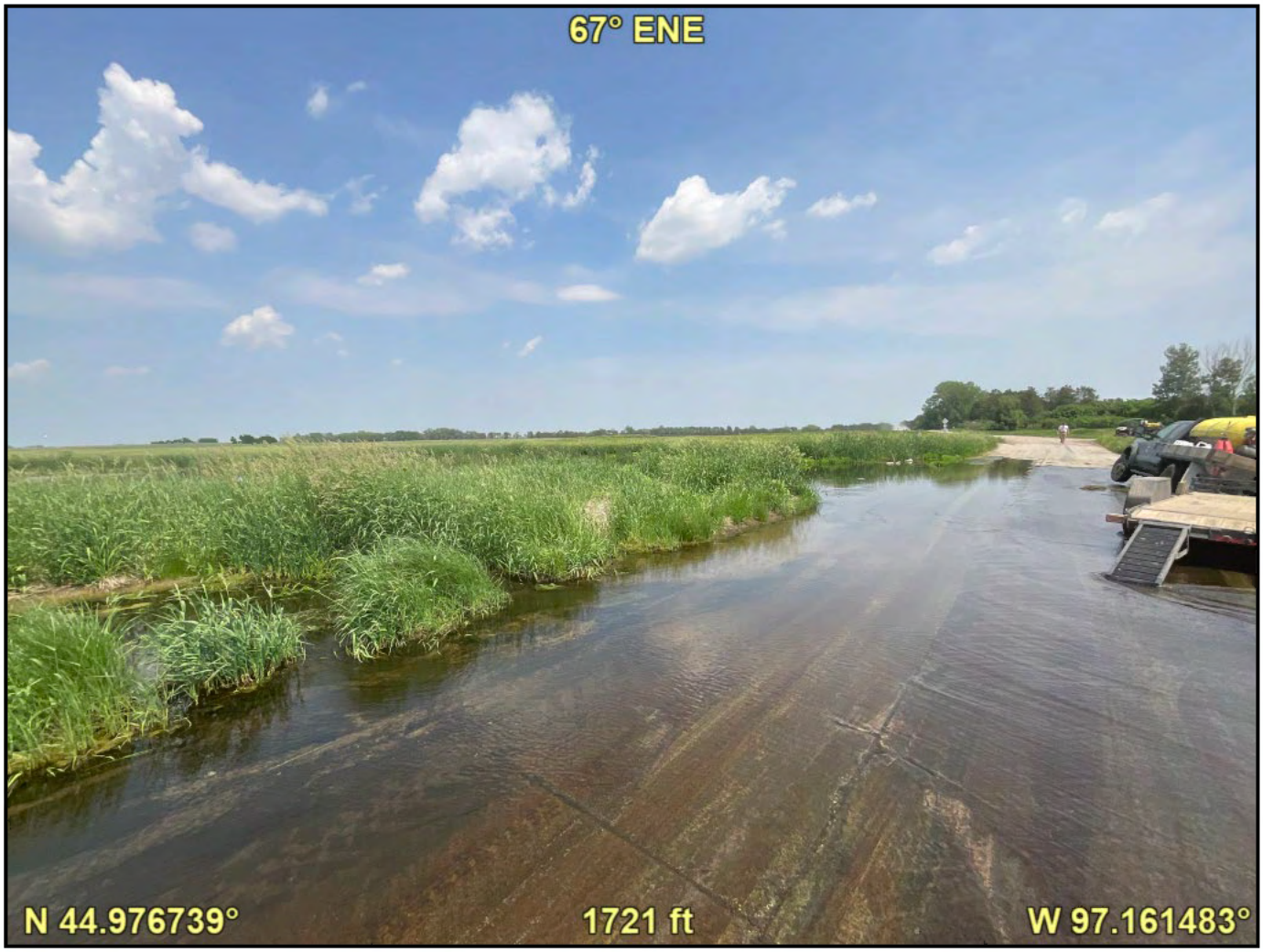
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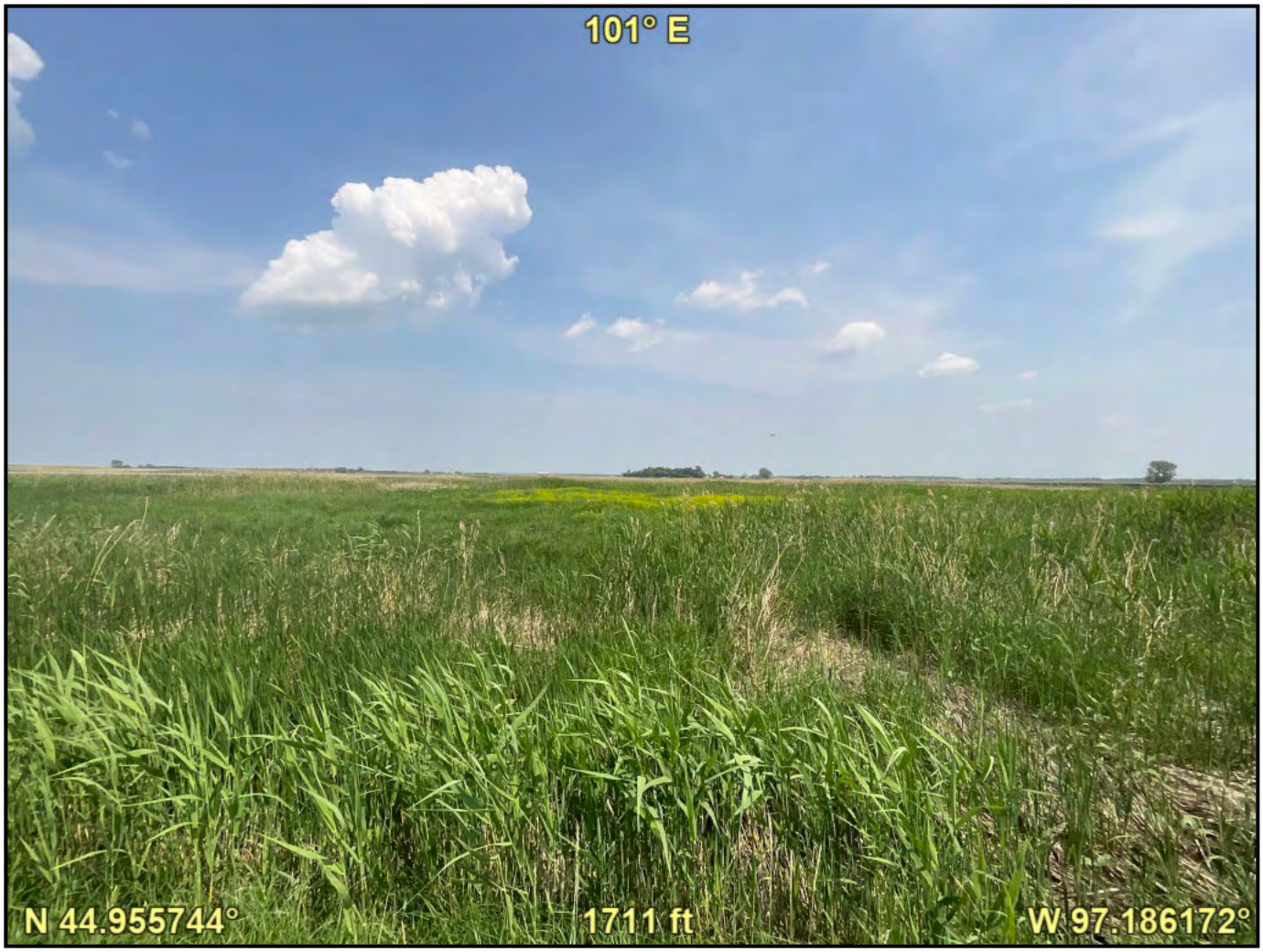
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Photo Direction: 41° NE







IMG_0586.JPG

Photo Direction: 151° SSE







IMG_0587.JPG

Photo Direction: 305° NW







IMG_0588.JPG
Photo Direction: 253° WSW







IMG_0589.JPG
Photo Direction: 204° SSW







IMG_0590.JPG
Photo Direction: 292° WNW







IMG_0591.JPG
Photo Direction: 92° E







IMG_0592.JPG
Photo Direction: 21° NNE







IMG_0593.JPG
Photo Direction: 140° SE







IMG_0594.JPG
Photo Direction: 202° SSW







IMG_0595.JPG
Photo Direction: 334° NNW







IMG_0596.JPG

Photo Direction: 139° SE







IMG_0597.JPG

Photo Direction: 278° W







IMG_0598.JPG
Photo Direction: 89° E







IMG_0599.JPG
Photo Direction: 298° WNW







IMG_0601.JPG

Photo Direction: 254° WSW







IMG_0602.JPG

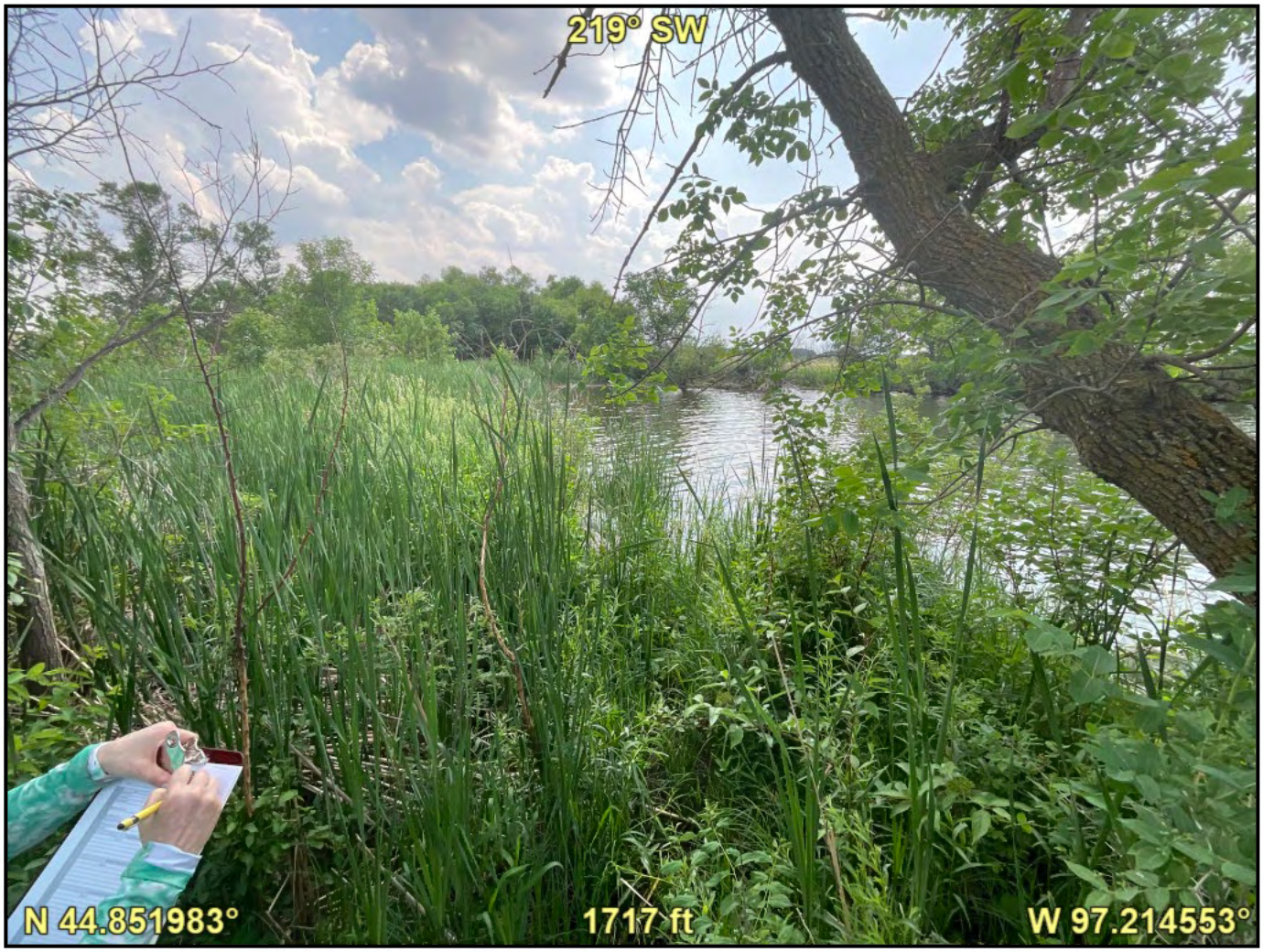
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Photo Direction: 11° NNE







IMG_0606.JPG
Photo Direction: 296° WNW







IMG_0607.JPG

Photo Direction: 214° SW







IMG_0609.JPG
Photo Direction: 54° NE







IMG_0610.JPG
Photo Direction: 75° ENE







IMG_0612.JPG
Photo Direction: 142° SE







IMG_0613.JPG

Photo Direction: 35° NE







IMG_0616.JPG
Photo Direction: 168° SSE







IMG_0617.JPG
Photo Direction: 142° SE







IMG_0619.JPG
Photo Direction: 309° NW







IMG_0620.JPG
Photo Direction: 201° SSW







IMG_0622.JPG
Photo Direction: 238° WSW







IMG_0623.JPG
Photo Direction: 135° SE







IMG_0624.JPG
Photo Direction: 135° SE







IMG_0625.JPG
Photo Direction: 342° NNW







IMG_0626.JPG
Photo Direction: 54° NE







IMG_0632.JPG
Photo Direction: 167° SSE







IMG_0633.JPG
Photo Direction: 237° WSW







IMG_0634.JPG

Photo Direction: 166° SSE







IMG_0636.JPG
Photo Direction: 347° NNW







IMG_0637.JPG
Photo Direction: 141° SE







IMG_0638.JPG
Photo Direction: 337° NNW







IMG_0639.JPG
Photo Direction: 10° N







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Photo Direction: 83° E







IMG_0642.JPG

Photo Direction: 151° SSE







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Photo Direction: 181° S

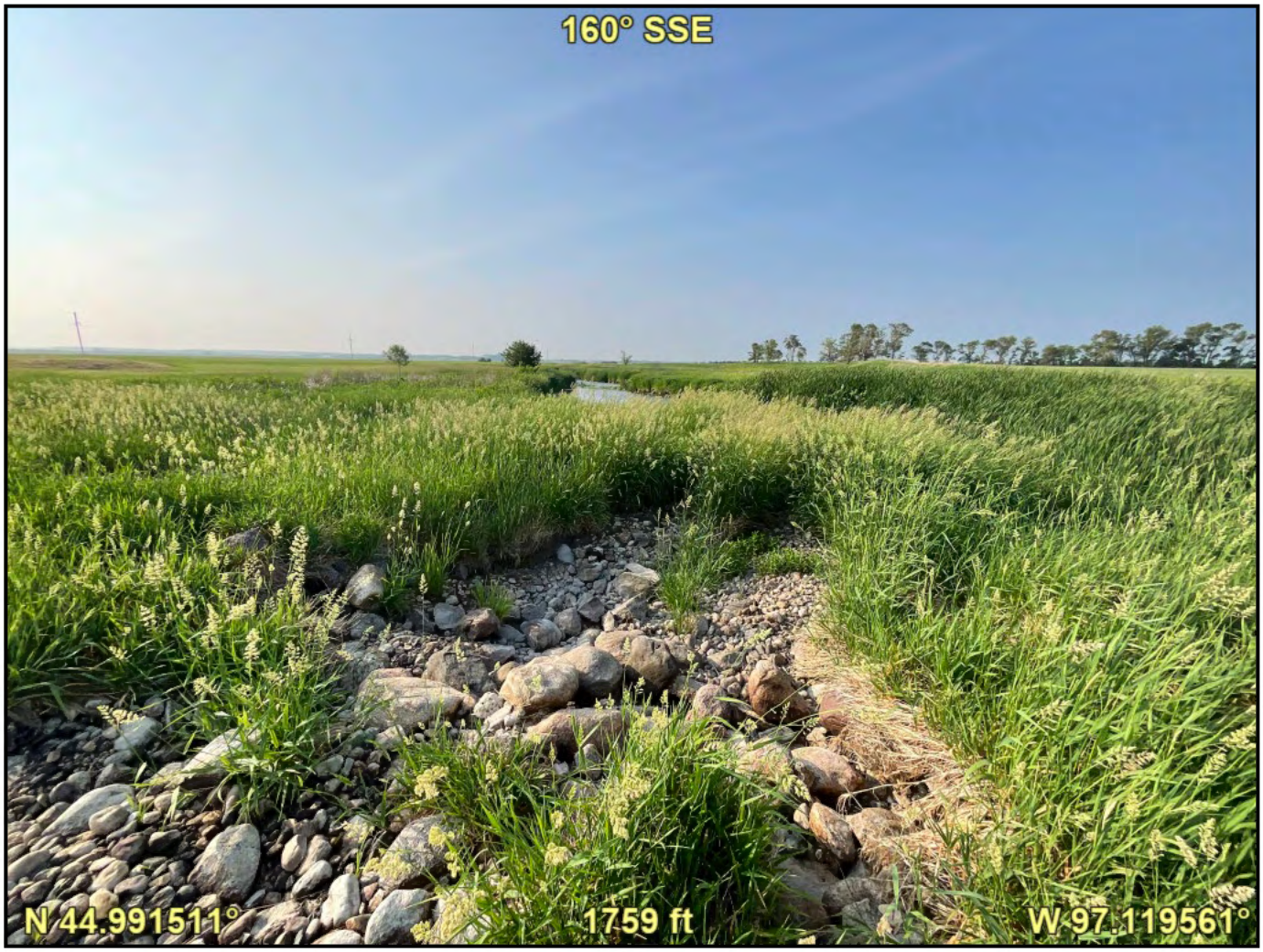






IMG_0644.JPG

Photo Direction: 160° SSE







IMG_0646.JPG

Photo Direction: 177° S







IMG_0647.JPG
Photo Direction: 267° W







IMG_0648.JPG

Photo Direction: 169° S







IMG_0649.JPG

Photo Direction: 310° NW







IMG_0650.JPG
Photo Direction: 106° ESE







IMG_0652.JPG
Photo Direction: 325° NW







IMG_0653.JPG
Photo Direction: 82° E







IMG_0654.JPG
Photo Direction: 231° SW







IMG_0655.JPG
Photo Direction: 281° W







IMG_0656.JPG

Photo Direction: 228° SW







IMG_0657.JPG

Photo Direction: 48° NE







IMG_0658.JPG
Photo Direction: 320° NW







IMG_0660.JPG

Photo Direction: 350° N







IMG_0661.JPG
Photo Direction: 211° SSW







IMG_0662.JPG

Photo Direction: 342° NNW







INSTRUCTIONS – FUNCTIONAL ASSESSMENT OF STREAMS (FACStream) - NWK & NWO DISTRICTS

This document is meant to serve as basic instructions for completing the Functional Assessment of Streams (FACStream) within the U.S. Army Corps of Engineers Kansas City District (NWK) and Omaha District (NWO) civil works boundaries. Below you will first find instructions on how to use this particular spreadsheet, and second, definitions and further guidance on using the FACStream system. FACStream is a reach-scale functional assessment tool for streams that rates functional condition according to the degree of impairment of ten ecological forcing factors, or state variables. Variable ratings are based on best-available evidence of the degree of departure from unimpacted reference standard condition. A web-link to the FACStream 1.0 (2015) Functional Assessment of Colorado Streams user manual is provided below. This model was developed by the principal investigators Colorado State University and EcoMetrics.

User Manual: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

USING THE SPREADSHEET TABS

Tab 1 - Instructions - this tab provides instruction for use of the FACStream model. Additional notes, drop-down lists, and editorial comments (if included, see red triangles located in upper right corner of some cells) within the Alternative Tabs (Alt A0, Alt A1, Alt A2, Alt A3) to provide further guidance.

Tab 2 - AAHUs - this tab automatically takes the FACStream scores (on a 0.0 to 1.0 scale) from the Alternative tabs (Alt A0, Alt A1, Alt A2, Alt A3) by associated Tract (1, 2, 3, etc.) and Time Stamp (Year 0, 10, 25, 50) to calculate final Average Annual Habitat Unit (AAHU) scores. The "green" cells indicate the acres of stream habitat that need to be entered manually for each Alternative and Time Stamp. Once all variables and acres have been completed for all Alternatives, Tracts, and Time Stamps, then the Net AAHUs will be automatically calculated in the "Cumulative and Net AAHU" columns at the top right of the Tab. The number of Alternatives, number of Tracts, and target years for Time Stamps can all be modified within the AAHU Tab and Alt Tabs depending on individual project needs.

Tabs 3-6 - Alt A0, Alt A1, Alt A2, Alt A3 - these tabs contain the Variables for the FACStream model and associated formulas for calculation of each Variable. The Tabs are broken out into separate Alternatives (A0, A1, etc.) with separate Tracts (1, 2, 3, etc.) and Time Stamps (Year 0, 10, 25, 50, etc.) within each Tab. Tracts are used to identify different reaches of stream habitat within a given project area(s). Alternatives, Time Stamps, and/or Tracts can be removed or added if needed to tailor the number of Alternatives, Time Stamps, and/or Tracts to a given project (contact EcoPCX for support in modifying Alternatives, Time Stamps, or Tracts). Additional instructions are provided below relative to the FACStream Variables.

Tabs 7-9 - Field Sheet 1, 2, and 3 - these tabs describe the project/field data that can be collected and recorded to describe the Administrative Characteristics, Site Characterization, and Stressors at each Tract / Assessment Area (AA). These Tabs are for notational purposes only and have no effect on the FACStream scoring.

Tab 10 - Model Changes - this tab can be used to document any spreadsheet errors or inconsistencies that are identified during model use. Any identified errors should be provided to the Eco-PCX upon discovery so that revisions can be made.

NOTE: Cells not used for data entry or comments have been locked to avoid accidental editing. To unlock cells, contact the EcoPCX. The color legend below indicates notational cells (light blue), input cells (green), data not required cells (greyed-out), and output cells that are locked from editing (white, yellow, orange, blue, pink).

XXX	NOTATIONAL: These fields of entry are notational and primarily for inserting comments/notes/assumptions; they do not effect scoring
XXX	INPUT: These fields of entry are required for scoring
XXX	INPUT: These fields of entry are NOT required for scoring (do not enter data's for "greyed out" cells)
XXX	OUTPUT: Total Sub-Variable Section Score
XXX	OUTPUT: Total FACStream Variable Score, summation of Section scores
XXX	OUTPUT: Total Functional Condition Scores
XXX	OUTPUT: Overall Functional Capacity Index Score

FACSTREAM WORKSHEET TABS ALT A0, ALT A1, ALT A2, and ALT A3

1. **General -** complete each worksheet by inserting or selecting data into the "green" cells for each metric / variable; some cells may have a drop down menu and a pop-up description box, if so, select the score that most represents the assessment area.
2. **General -** some cells may provide basic instructions on specific cells within the worksheet. View each comment by hovering the mouse over a cell containing the red triangle in the top right corner. Detailed instructions and definitions are also provided below in the section "USING THE FACSTREAM VARIABLES".
3. **General -** the FACStream excel spreadsheet tallies Variable scores using "all-or-nothing" formulas. Therefore, the Final FACStream Scores (yellow, orange, blue, pink boxes) will not display a value until sufficient values are inputted (or for the blue and pink boxes, until Sub-Variable scores are inputted). If the score displays "DIV/0!" or "#Value!", more information is required.
4. **General -** after all Sub-Variable scores have been inputted (yellow boxes), the Variable scores are computed (orange boxes), the model then calculates the Functional Condition Scores (blue boxes) for weighted Hydraulic, Geomorphic, Physicochemical, and Biotic functions. Final Overall Functional Capacity Index (FCI) Scores are then calculated (pink boxes) for each reach, tract, and time stamp. The FCI values are automatically inputted into the AAHUs tab.

USING THE FACSTREAM VARIABLES

The below modifications were made to the original FACStream model (Version 1.0) based on differences between Colorado streams and those typically found within the broader ecoregions of the Kansas City and Omaha Districts civil works boundaries. It is recommended that this adapted FACStream model be reviewed on a project by project basis to determine if additional model modifications are necessary, depending on stream characteristics and habitat differences within a given area. "Green" text at the end of these instructions provides a location to document any additional, minor project specific modifications for each model Variable such as Assessment Area (AA) boundaries or reach area. Any major model modifications should be coordinated with the ECO-PCX.

Watershed V1. Flow Regime - no changes to the existing Variable (V) 1 and sub-variables (SVs) 1.1, 1.2, 1.3, and 1.4 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Watershed V2. Sediment Regime - no changes to V2 or associated SVs 2.1, 2.2, and 2.3 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Watershed V3. Water Quality - no changes to V3 or associated SVs 3.1, 3.2, and 3.3 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Riparian V4. Floodplain Connectivity - no changes to V4 and associated SVs 4.1, 4.2, and 4.3 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Riparian V5. Riparian Vegetation - no changes to V5 and associated SVs 5.1, 5.2, and 5.3 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Riparian V6. Debris Supply - no changes to V6 and associated SVs 6.1 and 6.2 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Stream V7. Stream Morphology - no changes to V7 and associated SVs 7.1, 7.2, 7.3, and 7.4 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Stream V8. Stability - no changes to V8 and associated SVs 8.1 and 8.2 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Stream V9. Physical Structure - no changes to V9 and associated SVs 9.2, 9.2, and 9.3 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Stream V10. Biotic Structure - no changes to V10 and associated SVs 10.1, 10.2, 10.3, 10.4, and 10.5 are recommended at this time. Any project specific adjustments should be noted for each project in the "green" text at the end of these instructions.

Watershed - Flow Regime (V1): This Variable is described by 4 sub-variables (SVs) **SV 1.1 Total Volume, SV 1.2 Peak Flows, SV 1.3 Base Flows, and SV 1.4 Flow Variability.** These watershed scale hydrologic SVs identify the **Flow** characteristics of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V1 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Flow Regimes are identified below to help document potential flow impairments along with suggested **Parameters** that can be used to help quantify the level of impairment.

Common Stressors		Examples	Explanation	Yes / No
Land	Forest Thinning	Silviculture	Increased runoff rate causing higher peak discharge, increased flashiness. Altered snow deposition/melting patterns.	
		Development		
		Ski Areas / Gold Courses		
	Vegetation / Cover Shift	Grazing	Increased runoff rate causing higher peak discharge, increased flashiness. Altered snow deposition/melting patterns.	
		Agriculture		
		Development		
	Impervious Surface Density	Roof Density	Increased runoff rate causing greater peak flows, increased flashiness, loss of groundwater recharge associated with roads and development.	
		Roads		
		Pavement		
		Compacted Soils		
	Groundwater Pumping	Agricultural Wells	Aquifer depletion or water table depression that limits groundwater recharge or exacerbates loss.	
		Municipal Wells		
Drainage	Dams / Reservoirs	Large Dams	Artificially managed hydrology, attenuated peak flows, evaporative losses.	
		Small Dams		
	Diversions / Augmentation	Irrigation	Water extracted from the watershed or stream system via diversions and ditches.	
		Municipal		
		Intercept Ditches		
		Off-Channel		
	Widespread Floodplain Disconnect	Floodplain Encroachment	Decreased aquifer recharge and diminished water storage in the contributing watershed due to lack of floodplain activation or loss of tributary wetlands.	
		Channelization		
		Incision		
	Widespread Wetland Loss	Various Causes		

Flow Regime Parameters		
Flow volume (annual, seasonal, monthly, daily) (acrefeet)	Duration (of peak flow, base flow)	
Volume or discharge of diversion and augmentation (acrefeet or CFS)	Consecutive days at threshold values (days)	
Discharge max., min., avg. (annual, seasonal, monthly, daily) (CFS)	Timing (of peaks, base flows, other events) (calendar day)	
Discharge or frequency (return interval, percent exceedance)	Rate of change (Δ CFS/time)	
Bankfull or effective discharge (CFS)		

SV 1.1 Total Volume - This SV considers the total annual volume of water delivered to the reach from its contributing watershed. Impacts include any activities that add water (augmentation) or remove it (diversions or depletion) from the watershed before it is delivered to the reach. Consider only impacts to the total volume of water for this SV.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.
0.89 - 0.80	**B -** Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.
0.79 - 0.70	**C -** Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.
0.69 - 0.60	**D -** Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.
0.00 - 0.59	**F -** Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.

SV 1.2: Peak Flows - This SV considers the magnitude and duration of peak flows, or the "high end" of the hydrograph. Stressors affecting annual peak flow values and extreme events include augmentations and withdrawals, especially when these are timed with natural peak flows (snowmelt or storm runoff). Land uses that affect runoff in the watershed such as large scale vegetation shifts or development that involves soil compaction, impervious surfaces, or artificial drainage may also affect the magnitude and duration of peak flows. Some of the most significant peak flow stressors include artificially managed hydrology and attenuation resulting from in-line dams and reservoirs. Dam release operations that mimic natural flow regimes are less of an impact to peak flows than those that do not.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.
0.89 - 0.80	**B -** Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.
0.79 - 0.70	**C -** Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.
0.69 - 0.60	**D -** Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.
0.00 - 0.59	**F -** Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.

SV 1.3: Base Flows - This SV considers the magnitude, and duration of base flows, or the "low end" of the hydrograph. The most obvious stressors affecting base flows are depletions, which are common on over-appropriated river systems. Stressors that increase the flashiness of runoff can also cause uncharacteristically low base flow discharge. More subtle is the cumulative deficit of water storage in watersheds that have diminished floodplain connectivity and/or widespread loss of wetlands, which is a chronic condition in many basins.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.
0.89 - 0.80	**B -** Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.
0.79 - 0.70	**C -** Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.
0.69 - 0.60	**D -** Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.
0.00 - 0.59	**F -** Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.

SV 1.4: Flow Variability - This SV concerns the temporal pattern of flows including the characteristic timing of peaks, base flows, and rate of change. Natural hydrographs have characteristic periods of high and low flow that are driven by natural hydrologic events such as precipitation, snowmelt, runoff, infiltration, and groundwater discharge - resulting in characteristic rates of change and predictable timing of high and low flows. Impacts that affect the temporal pattern of flow regime include watershed factors that cause unnaturally flashy or uniform hydrographs, hydrographs with peak and low flow events that are out of synch with natural processes, or unnatural rates of change in discharge at the reach. Examples include large scale forest thinning, vegetation alteration, or impervious surface development in the contributing watershed. A common stressor is artificially managed flows. Many streams are affected by managed flows from reservoirs and diversions within and between basins that affect the timing of hydrologic peaks, low flow events, and the rate of change to discharge. Rapid diurnal fluctuations from certain water management operations like hydropower generation affect some rivers.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.
0.89 - 0.80	**B -** Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.
0.79 - 0.70	**C -** Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.
0.69 - 0.60	**D -** Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.
0.00 - 0.59	**F -** Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.

* SV 1.1 Score - Inputs from above SV 1.1 Scoring Table (0.0 - 1.0)
* SV 1.2 Score - Inputs from above SV 1.2 Scoring Table (0.0 - 1.0)
* SV 1.3 Score - Inputs from above SV 1.3 Scoring Table (0.0 - 1.0)
* SV 1.4 Score - Inputs from above SV 1.4 Scoring Table (0.0 - 1.0)
* **V1 Score -** The lowest SV score plus the mean SV score divided by two.

Watershed - Sediment Regime (V2): This Variable is described by 3 SVs -**SV 2.1 Land Erosion, SV 2.2 Channel Erosion, and SV 2.3 Transport** . These watershed scale SVs identify the**Sediment characteristics** of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V2 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Sediment Regimes are identified below to help document potential sediment impairments along with suggested**Parameters** that can be used to help quantify the level of impairment.

Common Stressors		Examples	Explanation	Yes / No
Indicators	Listings	State 303d List	Note the reason for the listing and the level of concern (Priority, Listing Type, or Other data).	
		Other Lists		
Point Sources	Dams / Reservoirs	Large Dams, In-Line Reservoirs	In-line dams are major stressors and reservoirs often severely alter the physicochemical properties of water. Specific effects are vary depending on the type of reservoir and the way that water is released (e.g. surface vs. bottom release, timing). Dam effluent may be oligotrophic or eutrophic, unnaturally warm or cold, etc. The specific effects of major reservoirs must be considered on a case-by case basis.	
		Off-Line Reservoirs		
		Cumulative Effect of Small Dams		
	Upland Mining	Mine Effluent	Mine drainage can cause severe changes to physicochemistry. There are examples where mine waste has devastating impacts on stream life for miles. Primary impacts are to water quality, especially heavy metal contamination and pH.	
		Tailings / Waste		
		Mills / Processing		
	In-Stream Mining	Placer Mining	Possible source of turbidity, moderate temperature effects.	
		Gravel Mining		
	Industrial Use	Effluent / Waste	Point-source discharge of waste materials or heat	
Non-Point Sources	Agriculture	Row Crops	Agricultural land use is often a major source of organic material and nutrients, particularly when fertilizer is used. Impacts are greatest when ag practices are not buffered from streams and when irrigation return flows are routed directly into streams. Flood irrigation return water may be a major physicochemical stressor.	
		Hay Crops		
		Pasture		
		Irrigation Runoff		
	Riparian Vegetation Loss	Bottomland Ranching / Farming	The loss or conversion of riparian vegetation along streams in the contributing watershed often results in decreased organic input, increased sun exposure (temperature effects), and stream instability.	
		Development		
	Development (Urban or Rural)	Storm Drainage	The effects of development including roads, buildings, septic systems, sewage treatment, etc. may affect of any of the chemical subvariables.	
		Road Runoff		
		Septic / Sewage		
	Atmospheric Contaminants	Industrial Waste	Atmospheric contamination, particularly in urban areas or near known point sources. Of particular importance are chemicals that are transported in precipitation (rain or snow).	
		Acid Precipitation		
		Cloud Seeding		

Sediment Regime Parameters		
Volume of bedload sediment (annual, seasonal) (cubic feet, tons)	Sediment capacity (volume/year)	
Volume of suspended sediment (annual, seasonal) (cubic feet, tons)		
Sediment discharge (volume/time)		
Channel erosion rates (volume/year/ft)		
Land erosion rates (volume/year/area)		

SV 2.1 - Land Erosion - This SV considers the amount of sediment produced in the watershed via land erosion including both surface erosion and mass erosion. Stressors that affect surface erosion are typically land uses that affect ground cover over significant portions of the watershed area, particularly those that result in exposed or bare soil. Mass erosion events are natural geological disturbances, but the frequency and magnitude of these events can be exacerbated by stressors that affect land stability on steep terrain. Sediment supply impacts from natural disturbances such as forest fires, blowdowns, beetle kill, or other natural processes may or may not be considered stressors depending on the purpose of the assessment. Scoring should consider the proximity of watershed stressors to the reach since sediment impacts are often buffered.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.
0.89 - 0.80	**B -** Highly Functioning Negligible Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.
0.79 - 0.70	**C -** Functioning Mild Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.
0.69 - 0.60	**D -** Functioning Impaired Significant Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.
0.00 - 0.59	**F -** Non-functioning Severe Impact Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.

SV 2.2 - Channel Erosion - This SV considers the rate of sediment produced by channel erosion in the contributing watershed. Erosion is a natural process on all streams and tributaries, but the rate of erosion can be severely altered by human impacts, particularly when alluvial streams become incised to form gullies. In most watersheds, channel erosion is a much greater source of sediment to streams than surface erosion. Stressors include any significant lengths of stream that have excessive instability or erosion owing to direct or indirect human causes. The most reliable indicator of impairment for this SV is the proportion of the contributing drainage network that displays an excessive amount of unnatural erosion.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.
0.89 - 0.80	**B -** Highly Functioning Negligible Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.
0.79 - 0.70	**C -** Functioning Mild Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.
0.69 - 0.60	**D -** Functioning Impaired Significant Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).
0.00 - 0.59	**F -** Non-functioning Severe Impact Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.

SV 2.3 - Transport - The previous sediment SVs dealt with the source of sediment production in the contributing watershed. This SV is concerned with the transport of that sediment to and through the reach. It is meant to provide a rating of the continuity of the sediment transport process through the contributing watershed. In-line dams and reservoirs are the greatest stressor to sediment transport, which may completely override or attenuate any impacts from unnatural sediment production. Even in watersheds with greatly accelerated sediment production, the reaches downstream from dams may be in a "sediment starved" condition because reservoirs are such efficient sediment traps. This subvariable is assessed by considering both the degree to which stressors upstream of the reach inhibit sediment flow and their relative proximity to the assessment reach.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard	There are no significant impediments to sediment transport upstream of the reach.
0.89 - 0.80	**B -** Highly Functioning Negligible Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.
0.79 - 0.70	**C -** Functioning Mild Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.
0.69 - 0.60	**D -** Functioning Impaired Significant Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.
0.00 - 0.59	**F -** Non-functioning Severe Impact Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.

* SV 2.1 Score - Input from above SV 2.1 Scoring Table (0.0 - 1.0)

* SV 2.2 Score - Input from above SV 2.2 Scoring Table (0.0 - 1.0)

* SV 2.3 Score - Input from above SV 2.3 Scoring Table (0.0 - 1.0)

*** V2 Score = The lowest SV score plus the mean SV score divided by two.**

Watershed - Water Quality (V3): This Variable is described by 3 SVs -**SV 3.1 Temperature Regime, SV 3.2 Organics / Nutrients, and SV 3.3 Inorganics / Toxins** . These watershed scale SVs identify the**Water Quality** characteristics of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V3 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Water Quality are identified below to help document potential water impairments along with suggested**Parameters** that can be used to help quantify the level of impairment.

Common Stressors		Examples	Explanation	Yes / No
Land	Forest Thinning	Silviculture	Increased susceptibility to surface erosion and rill formation; consolidation of runoff flows; increased risk of mass erosion when occurring on steep unstable drainages.	
		Development		
		Ski Areas / Golf Courses		
	Vegetation / Cover Shift	Grazing		
		Agriculture		
		Development		
	Roads	Road Surfaces	Surface erosion on unimproved roads, flow consolidation in drainage/borrow ditches, mass erosion risk with cuts at the toe of steep slopes, sediment transport barriers at undersized crossings.	
		Drainage Ditches		
		Road Cuts		
		Crossings		
	Point Sources	Stormflow Effluent	Direct sediment input.	
Channel	Dams / Reservoirs	Large Dams	These are major stressors that can overwhelm all other impacts. Large inline dams and reservoirs typically trap all incoming sediment. Small dams may pass some suspended sediment, but still often interrupt all bedload transport.	
		Small Dams		
		Weirs		
	Direct Stability Impacts	Instream Mining	Direct manipulation of channel leading to excess erosion from lateral instability or incision and gully formation; possible barriers to sediment transport.	
		Channelization		
		Reconstruction		
		Hardening		
		Straightening		
		Culverts / Crossings		
	Indirect Stability Impacts	Many causes, especially riparian vegetation shift	Indirect impacts that lead to channel instability and excess erosion.	

Water Quality Parameters		
Stream Temperature	Conductivity	
Dissolved Oxygen	TDS (Total Dissolved Solids)	
Nutrients (N, P, K)	Turbidity	
Carbon (DOM, POM)	TSS (Total Suspended Solids)	
pH	Other Analytes	
Biotic Community Indicators of Water Quality		

SV 3.1 - Temperature Regime - Temperature regime is a critical abiotic habitat factor that often limits what types of organisms inhabit a reach. It is a direct determinant of biotic structure and physicochemical processes such as metabolic rates. Impacts typically manifest at the extremes (high temperatures in summer or extended freezing in winter). Of the common stressors, reservoirs and irrigation return flows may have the most direct impact on temperature regime but cumulative nonpoint watershed impacts such as the loss of groundwater exchange, loss of shading, or increased W/D can have a significant effect when they are widespread in the contributing watershed.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard Negligible Impact	Natural or minimally affected temperature regime is present.
0.89 - 0.80	**B** - Highly Functioning Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.
0.79 - 0.70	**C** - Functioning Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.
0.69 - 0.60	**D** - Functioning Impaired Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.
0.00 - 0.59	**F** - Non-functioning Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.

SV 3.2 - Organics / Nutrients - The supply of metabolic agents (organic material and nutrients) is critical to a reach since these are the foundation of the trophic structure. Alterations to the amount and timing of these inputs have effects that cascade through the food chain causing altered community structure and impacts to the photosynthesis/respiration ratio on a reach. Agricultural runoff in the watershed is the most common stressor, but inreservoirs can create immediate and severe impacts by delivering uncharacteristically oligotrophic or eutrophic water, depending on the type of reservoir and dam release.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard Negligible Impact	Natural water quality conditions exist.
0.89 - 0.80	**B** - Highly Functioning Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.
0.79 - 0.70	**C** - Functioning Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.
0.69 - 0.60	**D** - Functioning Impaired Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.
0.00 - 0.59	**F** - Non-functioning Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.

SV 3.3 - Inorganics / Toxins - This SV encompasses all of the other physicochemical properties of a reach not accounted for in SV 3.1 or SV 3.2, including parameters such as pH, conductivity, total dissolved solids, turbidity, total suspended solids, dissolved or dissolved metals, and contaminants (especially toxins). For many of these parameters, point sources may be more important than cumulative nonpoint watershed stressors. Common stressors that may have severe impacts include drainage from mines, tailings, and urban runoff.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.
0.89 - 0.80	**B** - Highly Functioning Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.
0.79 - 0.70	**C** - Functioning Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.
0.69 - 0.60	**D** - Functioning Impaired Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.
0.00 - 0.59	**F** - Non-functioning Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.

* SV 3.1 Score - Input from above SV 3.1 Scoring Table (0.0 - 1.0)

* SV 3.2 Score - Input from above SV 3.2 Scoring Table (0.0 - 1.0)

* SV 3.3 Score - Input from above SV 3.3 Scoring Table (0.0 - 1.0)

*** V3 Score = The lowest SV score plus the mean SV score divided by two.**

Riparian - Floodplain Connectivity (V4): This Variable is described by 3 SVs -**SV 4.1 Saturation Frequency, SV 4.2 Floodplain Width, and SV 4.3 Saturation Duration**. These watershed scale SVs identify the**Floodplain Connectivity** characteristics of a given stream reach within the project area. E Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V4 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Connectivity are identified below to help document potential impairments along with suggested **Parameters** that can be used to help quantify the level of impairment.

Common Stressors	Examples	Associated Variable	Explanation	Yes / No
Hydrograph Impacts	Water Volume	SV 1.1	Changes to water supply directly affect the access, extent, and duration of saturation of floodplains.	
	Peak Flows / Floods	SV 1..2		
	Bankfull Discharge			
Channel Alteration	Rerouted Channels		Streams are commonly constructed and/or stabilized in ways that affect floodplain connectivity. Flood control channels are typically designed to contain high floods with 50-100 year return intervals.	
	Flood Channels			
	Navigation Channels			
	Stabilization			
	Bridges / Crossings			
Encroachment (Floodplain Topography)	Development		Most floodplains are significantly limited by development or agriculture. Levees are specifically designed to narrow floodplain extent, usually to protect development or agricultural land uses.	
	Roads			
	Agriculture			
	Dikes / Levees			
Beaver Loss	Extirpation	V8	On medium-sized streams, beaver dams check water which improves floodplain access and lateral extent. On small streams, they often create an anastomosed planform with nearly constant floodplain saturation.	
	Habitat Loss			
	Active Management			
Instability / Lost Resilience	Direct Impacts	V10	Indirect loss of floodplain connectivity via stream instability processes such as channel enlargement, incision, and entrenchment.	
	Indirect Impacts			

Floodplain Connectivity Parameters		
Frequency of inundation (return interval)		
Saturation duration (Total Hydric Days, Consecutive Hydric Days)		
Inundation maps (acres)		
Indirect indicators (stream) - K, Belt width/extent of branching, BHR, RI of		
Indirect indicators (floodplain) - extent of wetland or hydrophytic vegetation		

SV 4.1 - Saturation Frequency - This SV describes the access of water to the floodplain and riparian area from the stream channel(s). Water typically accesses floodplain areas via three routes: overbank flooding, groundwater exchange (through the bed and banks), and distribution through side channels, swales, and floodplain topography. Stressors are typically structural alterations to the channel or floodplain topography either from direct human impacts or indirect impacts brought on by stream evolution or instability.

Sub-Variable Score	Condition Grade	Scoring Guidelines			
		Valley Type	**Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0	**Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4
		Reference Stream Type	**Stream Evolution Model Stage** = 0, 8 **Rosgen Stream Type** = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Stream Evolution Model Stage** = 1, 6 **Rosgen Stream Type** = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Stream Evolution Model Stage** = 2, 3 **Rosgen Stream Type** = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading
1.00 - 0.90	Reference Standard	Typical BHR < 1.0 Return interval < 1.0 yr	Typical BHR 1.0 Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	
0.89 - 0.80	Highly Functioning	Typical BHR 1.0 Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2 Return interval 1.5 - 2.0 yr		
0.79 - 0.70	**A** - Functioning	Typical BHR 1.1 - 1.2 Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4 Return interval 2.0 - 5.0 yr		
0.69 - 0.60	**B** - Negligible Impact Functioning Impaired	Typical BHR 1.3 - 1.4 Return interval 2.0 - 5.0 yr	Typical BHR > 1.5 Return interval 5.0 - 10.0 yr		
0.00 - 0.59	**C** - Mild Impact Non-functioning	Typical BHR > 1.5 Return interval > 5.0 yr	Typical BHR > 1.5 Return interval of FP saturation > 10.0 yr		
	D - Significant Impact				
	E - Severe Impact				
	F - Profound Impact				

SV 4.2 - Floodplain Width - This SV is an assessment of the degree to which the lateral extent (width) of the floodplain is decreased due either to hydrologic impacts (hydrograph), channel impacts (enlargement, entrenchment, channelization) or land uses in the floodplain area that block lateral distribution of water such as levees, drainage ditches, development, or floodplain fills. Scoring guidelines require a comparison of the present day floodplain extent to historic (predisturbance) conditions.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	Floodplain extent is diminished less than 10% (> 90% intact).
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).
0.79 - 0.70	**C** - Functioning Mild Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).
0.00 - 0.59	**F** - Non-functioning Severe Impact	Floodplain extent is diminished more than 70% (< 30% intact).

SV 4.3 - Saturation Duration - The duration of floodplain saturation is the most biologically relevant aspect of connectivity. For this SV, consider the amount of time that the floodplain area is saturated during the growing season. Impairment to saturation duration may be due to lack of floodplain access (SV 4.1), diminished extent (SV 4.2), or other factors such as changes to floodplain topography, soil, or vegetation conditions that affect the storage and retention of water, causing it to drain or fill unnaturally.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	The active floodplain is characteristically saturated for most of the growing season.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.
0.79 - 0.70	**C** - Functioning Mild Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.
0.00 - 0.59	**F** - Non-functioning Severe Impact	The active floodplain is dry except for short durations during extremely rare flood events.

* SV 4.1 Score - Input from above SV 4.1 Scoring Table (0.0 - 1.0)

* SV 4.2 Score - Input from above SV 4.2 Scoring Table (0.0 - 1.0)

* SV 4.3 Score - Input from above SV 4.3 Scoring Table (0.0 - 1.0)

*** V4 Score = The lowest SV score plus the mean SV score divided by two.**

Riparian - Riparian Vegetation (V5): This Variable is described by 3 SVs -**SV 5.1 Woody Vegetation Structure, SV 5.2 Herbaceous Vegetation Structure, and SV 5.3 Species Diversity** . These watershed scale SVs identify the**Riparian Vegetation** characteristics of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V5 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Vegetation are identified below to help document potential impairments along with suggested **Parameters** that can be used to help quantify the level of impairment.

Common Stressors	Examples	Associated Variable	Explanation	Yes / No
Tree and Shrub Removal or Clearing	Silviculture		Direct manipulation of tree or shrub strata, altered light regime for herbaceous stratum.	
	Pasture			
	Hay / Crop			
	Development			
	Landscaping			
	Grazing			
Grazing	Livestock		Species composition shift (grasses and grazing tolerant species), cover depletion, bare ground, introduction of weedy species, biomass and nutrient export.	
	Non-Native Wildlife			
Mowing / Cultivation	Hay Cutting		Suppression of non-grass species, biomass and nutrient export Suppression of non-grass species, biomass and nutrient export.	
	Crops			
	Landscaping			
Unnatural Hydrology	Irrigation		Unnatural hydrology (wetting or drying) on riparian area which favors some species over others Unnatural hydrology (wetting or drying) on riparian area which favors some species over others.	
	Floodplain Disconnect	V4		
	Drying (ditches, tiles, etc.)			
	Water Source Impairment	V1		
Channel Manipulation	Stabilization	V8	Loss of regeneration niche for colonizing species (e.g. willows, cottonwoods, etc.) due to lack of disturbance regime or migration.	
	Channelized	V7		
Non-Native Species	Invasives		Introduced or escaped species, invasives alter vegetation structure.	
	Ornamentals			
	Noxious			

Riparian Vegetation Parameters		
Height Range	Root Density	Percent Non-Native, Invasive, Weeds
Density (stem, leaf, or canopy)	Species Diversity	Root Strength
Cover by Layer	Species Count	
Patchiness	Species Richness	
Rooting Depth	Cover (by species or functional guild)	

SV 5.1 - Woody Vegetation Structure - This SV concerns the physical structure of the woody vegetation layers (trees and shrubs) on the riparian area, including the following characteristics: height distribution, density, aerial cover, and patchiness. Below ground structure is also considered for the following characteristics: root strength, depth, and density. Woody vegetation structure or physiognomy is susceptible to direct manipulation by people, and tree and shrub clearing was a common historical practice when valley bottoms were being settled and converted to farms, ranches, and towns. Stressors that affect the diversity and relative abundance of woody plant species and age classes may also result in significant alteration to above and below ground structural characteristics.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	Woody vegetation cover is similar to reference with only minor changes to structure.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.
0.79 - 0.70	**C** - Functioning Mild Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.
0.00 - 0.59	**F** - Non-functioning Severe Impact Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered. Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.

SV 5.2 - Herbaceous Vegetation Structure - This SV concerns the physical structure of the herbaceous vegetation layers which includes all nonwoody plants (grasses, sedges, rushes, forbs, and mosses) on the riparian area. As in SV5.1, the following above ground structural characteristics are included: height distribution, density, aerial cover, and patchiness. Below ground structural characteristics include root strength, depth, and density. A common impact to herbaceous vegetation is the shift from hydrophytes to upland species following floodplain drying or conversion to crops resulting in typical structural alterations like decreased root depth, density, and strength and decreased height distribution patterns. Conversion of riparian area to nonvegetated surfaces like roads is also a particularly severe stressor. Any stressors that alter the diversity and relative abundance of herbaceous plant species may also result in significant alteration to the above and below ground structural characteristics.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	Herbaceous vegetation cover is similar to reference with only minor changes to structure.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered. Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.
0.79 - 0.70	**C** - Functioning Mild Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.
0.00 - 0.59	**F** - Non-functioning Severe Impact Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.

SV 5.3 - Species Diversity - This SV concerns the species diversity of riparian vegetation across all layers (woody and herbaceous). Diversity characteristics include the distribution and relative abundance of plants by species and percent native vegetation.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	Riparian vegetation species diversity is similar to reference.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Nonnative species or bare ground make up less than 20% of cover.
0.79 - 0.70	**C** - Functioning Mild Impact	Relative abundance of riparian vegetation is significantly different from reference. Nonnative species or bare ground make up less than 40% of cover.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	Most reference species are not present. Nonnative species or bare ground make up less than 60% of cover. Most reference species are not present. Nonnative species or bare ground make up less than 60% of cover.
0.00 - 0.59	**F** - Non-functioning Severe Impact Profound Impact	Riparian vegetation is nearly monoculture, more than 60% nonnative species, or the riparian area is mostly devoid of vegetation. Riparian vegetation is nearly monoculture, more than 60% nonnative species, or the riparian area is mostly devoid of vegetation.

* SV 5.1 Score - Input from above SV 5.1 Scoring Table (0.0 - 1.0)
* SV 5.2 Score - Input from above SV 5.2 Scoring Table (0.0 - 1.0)
* SV 5.3 Score - Input from above SV 5.3 Scoring Table (0.0 - 1.0)
* **V5 Score = The lowest SV score plus the mean SV score divided by two.**

Riparian - Debris Supply (V6): This Variable is described by 2 SVs -**SV 6.1 Large Woody Debris, and SV 6.2 Detritus** . These watershed scale SVs identify the**Debris Supply** characteristics of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V6 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Debris Supply are identified below to help document potential impairments along with suggested**Parameters** that can be used to help quantify the level of impairment.

Common Stressors	Examples	Associated Variable	Explanation	Yes / No
Vegetation Stressors to Tree and Shrub Strata	Tree / Shrub Removal	V5	Vegetation shifts and management that alter the biomass and age structure of woody plants in the fetch area are a direct impact to the source of debris.	
	Grazing			
	Mowing			
	Unnatural			
	Channel			
	Non-Native Species			
Beaver Loss	Extirpation	V10	Beavers are a common vector for transporting LWD and detritus to the stream, caching organic debris, and constructing dams.	
	Habitat / Wood Loss			
	Active			
Active Debris Removal	Navigation		Active removal of debris from the reach.	
	Flood Control			
	Other Reasons			

Debris Supply Parameters		
Large Woody Debris (LWD) Counts (pieces per unit length or area)	Fine Particulate Organic Matter (FPOM) Density (pounds per unit length or area)	
Debris Jam or Dam Counts (# per unit length)		
LWD Indices		
Small Woody Debris (SWD) and Leaf Counts		
Course Particulate Organic Matter (CPOM) Density (pounds per unit length or area)		

SV 6.1 - Large Woody Debris - This SV concerns the supply of Large Woody Debris (LWD) to the reach relative to natural reference condition. Except in very confined valleys, most riparian areas would naturally contain woody vegetation. LWD supply is therefore relevant in most assessments, even where trees and large shrubs are no longer present. There are obviously exceptions, so the evaluator must take care to document cases where LWD would not naturally be present and score these as reference condition, even in the absence of wood. Common stressors are any land uses that deplete wood from the riparian area and adjacent slopes. Beaver loss or extirpation is also a common stressor. In developed areas it is not uncommon for LWD to be actively cleared from streams and floodplains. Examples of mild impairment include fetch areas with minor encroachment, minimal forest clearing, or recovering forests. Reaches with woody riparian areas that are partially cleared or side slopes that had selective logging likely have moderate impairment. Example stressors that usually cause severe impairment include cleared or developed riparian areas with very thin buffer strips, beaver loss from low-order streams, or logged valley side slopes. Profound impairment is likely where riparian areas are fully developed, converted from woody vegetation to grass, clear-cut side slopes, or streams from which LWD or detritus is actively removed.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	LWD supply is natural, or LWD is not a natural part of the particular stream system.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	LWD supply is decreased by up to 25%.
0.79 - 0.70	**C** - Functioning Mild Impact	LWD supply is decreased by up to 50%.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	LWD supply is decreased by up to 75%.
0.00 - 0.59	**F** - Non-functioning Severe Impact Profound Impact	LWD supply is decreased by more than 75%.

SV 6.2 - Detritus - An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation. The conversion of woody riparian areas to grass pastures, agricultural fields, or development is common. Grass or crop riparian areas do still supply detritus but of a different type, rate, and different timing seasonally. Poor floodplain connectivity or physical barriers between the stream and riparian area may also hamper detritus supply. Examples of mild impairment include riparian areas with minimal vegetation changes adjacent to the stream. Woody riparian areas that are mostly cleared or converted to crops or grass are examples of stressors that cause moderate impairment, especially when the characteristic woody vegetation would be deciduous. Example stressors that usually cause severe impairment include riparian areas that are completely converted to grasses or herbaceous riparian areas that are mowed to the banks. Profound impairment is likely where streamside areas are nearly devoid of all vegetation.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	Detritus supply is largely unaffected.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	Detritus supply is decreased by up to 25%.
0.79 - 0.70	**C** - Functioning Mild Impact	Detritus supply is decreased by up to 50%.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	Detritus supply is decreased by up to 75%.
0.00 - 0.59	**F** - Non-functioning Severe Impact Profound Impact	Detritus supply is decreased by more than 75%.

* SV 6.1 Score - Input from above SV 6.1 Scoring Table (0.0 - 1.0)

* SV 6.2 Score - Input from above SV 6.2 Scoring Table (0.0 - 1.0)

* **V6 Score = The lowest SV score plus the mean SV score divided by two.**

Stream -Stream Morphology (V7): This Variable is described by 4 sub-variables (SVs) **SV 7.1 Evolutionary Stage, SV 7.2 Planform, SV 7.3 Dimension, and SV 7.4 Profile.** These watershed scale stream SVs identify the **Stream Morphology** characteristics of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V7 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Stream Morphology are identified below to help document potential impairments along with suggested **Parameters** that can be used to help quantify the level of impairment.

Common Stressors	Examples	Associated Variables	Explanation	Yes / No
Rerouted / Reconstructed Channels	Rerouted Channels		Streams are often re-routed to accommodate infrastructure, development, ranching, or other land uses and sometimes for restoration or habitat projects. Constructed channels may differ from reference in type, planform, dimension, and slope.	
	Flood Channels			
	Navigation Channels			
	Stabilization			
	Bridges / Crossings			
	Restoration Projects			
Encroachment	Development		Fills within the floodplain or belt width of a stream directly affects planform and, depending on the severity, dimension and profile.	
	Roads			
	Dikes / Levees			
Artificial Grade Control	Dams / Diversions		Artificial grade control structures are common. Small structures may have local impacts to dimension and low flow water surface slope, which is usually their intended function. Large structures often have widespread effects to reach-wide bankfull slope, dimension, and planform.	
	Stability Structures			
	Habitat Structures			
	Recreational			
Beaver Loss	Extirpation	V10	Loss of beavers from a reach typically results in a conversion from anastomosed or branching planform to a single-thread channel as well as changes to dimension and profile due to the lack of dams and channels.	
	Habitat Loss			
	Active Management			
Stream Instability / Lost Resilience (V8)	Altered Hydrology	V1	Instability leading to excess deposition (aggradation), scour (degradation), or bank erosion result in stream evolution or altered planform, dimension, and profile.	
	Altered Sediment Supply	V2		
	Riparian Vegetation Impacts	V5		
	Altered LWD Supply	V6		
	Direct Impacts			

Flow Regime Parameters		
Evolutionary Stage (SEM or Rosgen)	Belt Width	Width / Depth Ratio
Bifurcation Ratio (branching)	Facet Width, Depth, Slope	Entrenchment Ratio
Stream Length / Valley Length	Bankfull Slope	Bank Height Ratio
Sinuosity	Cross-Sectional Area	Facet Width, Depth, Slope Ratios
Meander Width, Length, Amplitude	Channel Width, Depth	

SV 7.1 Evolutionary Stage - Stream evolution is the process by which a stream changes type or form. Stream evolution models describe a predictable trajectory of change, or sequence of morphological changes, that a stream goes through in response to perturbation. This SV makes use of these models to identify gross impacts to stream morphology that are caused by a response to direct and indirect impacts. Scores are assigned by identifying the present evolutionary stage relative to the reference stream type.

Sub-Variable Score	Condition Grade	Scoring Guidelines					
		Valley Type	**Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4
		Reference Stream Type	**Stream Evolution Model Stage** = 0 **Rosgen Stream Type** = D, DA, DB	**Stream Evolution Model Stage** = 1 **Rosgen Stream Type** = E	**Stream Evolution Model Stage** = 1 **Rosgen Stream Type** = C	**Stream Evolution Model Stage** = 3s **Rosgen Stream Type** = B	Not Available for A, G, F Stream Types in VC Valleys.
1.00 - 0.90	**A -** Reference Standard, Negligible Impact		Existing SEM Stage (Rosgen Stream Type), 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type), 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type), 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type), 3s (B)	
0.89 - 0.80	**B -** Highly Functioning, Mild Impact		Existing SEM Stage (Rosgen Stream Type), 1 (E, C)	Existing SEM Stage (Rosgen Stream Type), 1 (C)	Existing SEM Stage (Rosgen Stream Type), 1 (E)	--	
0.79 - 0.70	**C -** Functioning, Significant Impact		Existing SEM Stage (Rosgen Stream Type), 6 (C)	Existing SEM Stage (Rosgen Stream Type), 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type), 6 (C), 7 (D)	--	
0.69 - 0.60	**D -** Functioning Impaired, Severe Impact		Existing SEM Stage (Rosgen Stream Type), 6 (C)	Existing SEM Stage (Rosgen Stream Type), 2-3 (B)	Existing SEM Stage (Rosgen Stream Type), 2-3 (B)	5 (F)	
0.00 - 0.59	**F -** Non-functioning, Profound Impact		Existing SEM Stage (Rosgen Stream Type), 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type), 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type), 4-5 (A, G, F)	4 (A, G)	

SV 7.2: Planform - The planform SV deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.

Sub-Variable Score	Condition Grade	Scoring Guidelines					
		Valley Type	**Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2
		Reference Planform	**Anastomosed**	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**
1.00 - 0.90	**A -** Reference Standard, Negligible Impact		Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K
0.89 - 0.80	**B -** Highly Functioning, Mild Impact		Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--
0.79 - 0.70	**C -** Functioning, Significant Impact		Meander High K	Meander High K	Meander Low K	--	Straight
0.69 - 0.60	**D -** Functioning Impaired, Severe Impact		Meander Low K	Meander Low K	Straight	Straight	--
0.00 - 0.59	**F -** Non-functioning, Profound Impact		Straight	Straight	Straight	--	--

SV 7.3: Dimension - The dimension SV considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening. Consider all three of these parameters when scoring, and select the lowest functional category as the SV score.

Sub-Variable Score	Condition Grade	Scoring Guidelines					
		Valley Type	**Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area All**	**Width / Depth All**
		Reference Stream Type	**DA, DB**	**E, C**	**B**	**A, G, F**		
1.00 - 0.90	**A -** Reference Standard, Negligible Impact	No Significant Stressors					No Significant Stressors	No Significant Stressors
0.89 - 0.80	**B -** Highly Functioning, Mild Impact	Stressors Present, but Effects are Minimal					Stressors Present, but Effects are Minimal	Stressors Present, but Effects are Minimal
0.79 - 0.70	**C -** Functioning, Significant Impact	Slight (C or E)	Moderate (ER approximately 2.0)		Degradation Evident, but No Change in ER		Slightly Enlarged, (A:A-Reference 1.2-1.5)	Slightly Over-Wide, (W/D: W/D-Reference 1.2-1.5)
0.69 - 0.60	**D -** Functioning Impaired, Severe Impact	Moderate	Moderate (ER approximately 1.5)		Significant or Recent Degradation		Enlarged, (A:A-Reference 1.6-2.0)	Over-Wide, (W/D: W/D-Reference 1.6-2.0)
0.00 - 0.59	**F -** Non-functioning, Profound Impact	Fully Entrenched (ER < 1.4)				Actively Degrading	Extremely Enlarged, (A:A-Reference > 2.0)	Extremely Over-Wide, (W/D: W/D-Reference > 2.0)

SV 7.4: Profile - The profile SV deals with gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard, Negligible Impact	No significant changes in slope.
0.89 - 0.80	**B -** Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.
0.79 - 0.70	**C -** Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.
0.69 - 0.60	**D -** Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20-40%). Examples: reaches with large grade control structures, major planform changes.
0.00 - 0.59	**F -** Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.

* SV 7.1 Score - Inputs from above SV 7.1 Scoring Table (0.0 - 1.0)
* SV 7.2 Score - Inputs from above SV 7.2 Scoring Table (0.0 - 1.0)
* SV 7.3 Score - Inputs from above SV 7.3 Scoring Table (0.0 - 1.0)
* SV 7.4 Score - Inputs from above SV 7.4 Scoring Table (0.0 - 1.0)

* **V7 Score -** The lowest SV score plus the mean SV score divided by two.

Stream -Stability (V8): This Variable is described by 2 sub-variables (SVs) - SV 8.1 Dynamic Equilibrium, and SV 8.2 Resilience. These watershed scale stream SVs identify th**Stability** characteristics of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V8 score is simply the lowest SV score plus the mean SV score divided by two. Com**Stressors** that affect Stream Equilibrium and Resilience are identified below to help document potential impairments along with suggeste**Parameters** that can be used to help quantify the level of impairment.

Common Stressors		Examples	Associated Variables	Explanation	Yes / No
Energy	Unnatural Hydrology	Water Volume	V1	Impacts to hydrology, particularly bankfull discharge and peak flows directly alters energy.	
		Peak Flows / Floods			
		Bankfull Discharge			
	Evolution	Channel Change	V7	Altered stream morphology changes hydraulics including shear stress, power and work. Sediment transport capacity and competence depend directly on hydraulic characteristics of the channel.	
	Planform Impacts	Branching			
		Sinuosity			
	Dimension Impacts	Entrenchment			
		Cross Sectional Area			
		Width / Depth Ratio			
	Profile Impacts	Bankfull Slope			
		Localized Gradient			
Boundaries	Floodplain Connectivity	FP Access	V4	Floodplains function as "safety valves" that limit stream power by distributing large discharge over wide area. Floodplains provide wide area for channel to move and adjust.	
		FP Extent			
		Saturation Duration			
	Riparian Vegetation	Streamside Vegetation	V5	Riparian vegetation provides roughness, bank protection, and soilbinding root mass. Mechanism for rapid recovery following disturbance.	
		Riparian Vegetation Area			
	Biotic Drivers	Beavers	V10	Biotic drivers such as LWD and beavers provide stabilization functions and a mechanism for rapid recovery following disturbance.	
		LWD	V6		
	Direct Impacts	Channel Hardening	V7	Hardened bed or banks or solid structures affects stability and decreases ability to move or adjust.	
		Bridges, Crossings			
Sediment	Watershed Supply	Land Erosion	V2	Changes to the amount, size, timing of sediment delivery from the watershed is a direct impact to the sediment side of Lane's balance, altering dynamic equilibrium.	
		Channel Erosion			
		Delivery			
	Reach Supply	Degradation	V8	Positive feedback - instability may be increased by rapid sediment production on an unstable eroding reach.	
		Bank Erosion			

Stability Parameters		
Aggradation or Degradation Rates	Bank Strength Indices	
Bank Erosion Rates	Lateral Stability Indices	
Lateral Migration Rates	Vertical Stability Indices	
Sediment Competence Estimates	Stream Power	
Sediment Capacity Estimates	Shear Stress	

SV 8.1: Dynamic Equilibrium - For threshold channels, stability is a function of the channel bed and banks being stronger than the forces acting upon them. Most natural streams are alluvial channels, though, whose bed and banks are mobile. On alluvial streams, stability is maintained in a complex state of dynamic equilibrium between sediment supply and energy (Lane's Balance). Quantifying these factors is difficult even in very detailed studies. At the rapid level, the assessment of vertical stability is made by assembling evidence that documents indicators of impact to the factors that affect Lane's Balance and indicators. The method does not assume that all reaches should be naturally stable. It is rather an evaluation of impacts to the factors that would alter stability.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard	Natural patterns of stability are present.
0.89 - 0.80	**B -** Highly Functioning Negligible Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.
0.79 - 0.70	**C -** Functioning Mild Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, ov**w**idening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.
0.69 - 0.60	**D -** Functioning Impaired Significant Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.
0.00 - 0.59	**F -** Non-functioning Severe Impact Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.

SV 8.2: Resilience - Many factors affecting ecosystems are stochastic. Response to disturbance can be equally or more important than dynamic equilibrium or balance for explaining the characteristic structure and lo**t**rm stability of a stream. Ecological resilience describes the ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance. For streams, resilience depends largely on the ability of the stream to move and adjust, and for damaged components to**s**t or recover quickly.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A -** Reference Standard	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.
0.89 - 0.80	**B -** Highly Functioning Negligible Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.
0.79 - 0.70	**C -** Functioning Mild Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.
0.69 - 0.60	**D -** Functioning Impaired Significant Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.
0.00 - 0.59	**F -** Non-functioning Severe Impact Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.

* SV 8.1 Score - Inputs from above SV 8.1 Scoring Table (0.0 - 1.0)
* SV 8.2 Score - Inputs from above SV 8.2 Scoring Table (0.0 - 1.0)
* **V8 Score -** The lowest SV score plus the mean SV score divided by two.

Stream - Physical Structure (V9): This Variable is described by 3 sub-variables (SVs) - SV 9.1 Hydraulic Structure, SV 9.2 Coarse Scale, and SV 9.3 Fine Scale. These watershed scale stream SVs identify th**Physical Structure** characteristics of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale. The final V9 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Stream Physical Structure are identified below to help document potential impairments along with suggeste**Parameters** that can be used to help quantify the level of impairment.

Common Stressors	Examples	Associated Variables	Explanation	Yes / No
Morphological Impacts	Direct or Indirect Impacts to Planform, Dimension, Profile	V7	Larger-scale stream morphology impacts directly affect the amount and distribution of physical structure.	
Floodplain Connectivity	Extra-Channel Aquatic Habitat	V4	Saturated floodplains provide a large amount of diverse aquatic habitat beyond the channel which is lost when floodplains become disconnected.	
Altered Hydrology	Peak Flows / Floods	V1	Impacts to hydrology, particularly base flows, may limit available habitat via critically low flows or more generally by an altered water stage by season.	
	Base Flows			
	Bankfull Discharge			
Altered Sediment Supply / Distribution	Excess Fine Sediment	V2	Fine sediment deposition creates characteristic microhabitat, substrate conditions. Excess or lack alters the degree and size of interstitial spaces, substrate texture, etc.	
	Lack of Fine Sediment		Altered bedload regime changes scour and deposition of coarse bed features and materials distribution.	
	Bedload Regime			
Altered Debris Source / Distribution	LWD	V6	LWD in the form of tree parts (logs, root wads, large branches) and debris jams and dams are critical structural components on some reaches. Altered supply or distribution of these features has direct structural consequences.	
	Detritus		Detritus is a component in microhabitat and substrate.	
Beavers	Loss from Reach	V10	Beavers are primary agents that maintain structural diversity on some streams.	
Riparian Vegetation	Altered Structure	V5	Vegetation provides structural cover and stability of structural components.	
Direct Impacts, Artificial Structures	Bank Treatments (grading, revetment)		Artificial channel manipulation or in-stream structures including revetment, crossings, bridges, abutments, culverts, etc. can directly affect the amount and diversity of both coarse-scale and fine-scale habitat heterogeneity and the processes that naturally maintain these features.	
	Artificial Channels			
	Cross Channel Structures			
	Habitat Structures			
	Bridges, Crossings			

Physical Structure Parameters		
Froude Number	Aerial Cover by Substrate Type	
Area Within Certain Depth Range	Bank Height	
Area Within Certain Velocity Range	Bank Angle	
Pool:Riffle Ratio	Residual Pool Depth	
Substrate Materials Frequency	Embeddedness	

SV 9.1: Hydraulic Structure - The hydraulic structure SV represents the amount of deviation from characteristic distribution of water depth and velocity in the stream. It is a primary physical habitat parameter for most organisms living within the water column.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	Distribution of velocity and depth is typical of reference condition.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.
0.79 - 0.70	**C** - Functioning Mild Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.
0.00 - 0.59	**F** - Non-functioning Severe Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.

SV 9.2: Coarse Scale - This SV looks specifically at coarsescale physical structure within stream channels, including bed and bank form. When scoring, consider the characteristic diversity of physical structural elements such as LWD, jams and dams, and rock in addition to the shape of bed. Bank structure is another important component of coarse scale physical structure as bank shape can vary from sloping to vertical to overhanging and undercut. The scale is meant to encompass the range important for habitat of large aquatic organisms like fish and amphibians.

Sub-Variable Score	Condition Grade	Scoring Guidelines
1.00 - 0.90	**A** - Reference Standard	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.
0.79 - 0.70	**C** - Functioning Mild Impact	Most typical velocitydepth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	Some typical velocitydepth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.
0.00 - 0.59	**F** - Non-functioning Severe Impact	Severely altered coarsescale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plabed morphology.

SV 9.3: Fine Scale - This SV looks specifically at finescale physical structure within the stream channels. Score by considering impacts to the amount and diversity of microhabitat within the reach, primarily bed materials and the distribution of small organic debris. Typical factors include bed material size distribution, fine sediment deposition and scour, embeddedness, compaction, and macrophyte cover. The scale is meant to encompass the range important for habitat of small aquatic organisms like macroinvertebrates.

Sub-Variable Score	Condition Grade	Scoring Guidelines (for each community structure and diversity)
1.00 - 0.90	**A** - Reference Standard	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.
0.89 - 0.80	**B** - Highly Functioning Negligible Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.
0.79 - 0.70	**C** - Functioning Mild Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.
0.69 - 0.60	**D** - Functioning Impaired Significant Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobbled streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.
0.00 - 0.59	**F** - Non-functioning Severe Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobbled streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.

* SV 9.1 Score - Inputs from above SV 9.1 Scoring Table (0.0 - 1.0)
* SV 9.2 Score - Inputs from above SV 9.2 Scoring Table (0.0 - 1.0)
* SV 9.3 Score - Inputs from above SV 9.3 Scoring Table (0.0 - 1.0)
* **V9 Score** - The lowest SV score plus the mean SV score divided by two.

Stream - Biotic Structure (V10): This Variable is described by 5 sub-variables (SV) - SV 10.1 Microbes, SV 10.2 Macrophytes, SV 10.3 Macroinvertebrates, SV 10.4 Fish & Amphibians, and SV 10.5 Other Animals. This watershed scale stream SVs identify the **Biotic Structure** characteristics of a given stream reach within the project area. Each SV score can be calculated with either the Level 1 Reconnaissance, Level 2 Routine, or Level 3 Intensive assessments, which provides variable scoring from A to F and corresponding 0.0 to 1.0 scale for each community. The final V10 score is simply the lowest SV score plus the mean SV score divided by two. Common **Stressors** that affect Stream Biotic Structure are identified below to help document potential impairments along with suggested **Parameters** that can be used to help quantify the level of impairment.

Common Stressors	Examples	Associated Variables	Explanation	Yes / No
Chemical Habitat	Temperature Regime	V3	Temperature or water quality limitations, tolerance or preferred range exceedance.	
	Water Quality			
Structural Habitat	Stream Morphology	V7	Physical habitat structural limitations.	
	Coarse-Scale	V8		
	Fine-Scale			
Energy / Food Limitations	Nutrients Source	V3	Lack of available energy from lower trophic level biomass.	
	DOM and FPOM			
	CPOM, Detritus	V6		
	Trophic Level Impacts	V10		
Direct Management	Stocking		Direct manipulation of biota.	
	Culling			
	Control			
Migration Barriers	Crossings (e.g., culverts, bridges)		Barriers that limit access of organism access to and/or from the reach. Not that these barriers may be a long distance up or downstream from the reach.	
	Dams / Reservoirs			
	Temperature Barriers	V3		
	Chemical Barriers			
Nonnative Species	Introduced Microbes	V10	Nonnative species that come to occupy natural and novel niches including introduced species and invasives. Aggressive invasives can overwhelm entire functional guilds and have far-reaching effects.	
	Invasive Aquatic Plants			
	Other Invasives			
	Game Species			
Disease / Parasites	Whirling Disease	V10	Introduced diseases or diseases that are exacerbated by human impacts.	
	Others			
Extirpation / Extinction (total or partial loss)	Nativ3e Fishes	V10	Regional or global loss of characteristic species.	
	Amphibians			
	Macroinvertebrates			
	Beaver Loss			

Physical Structure Parameters		
Biomass (by species, population, guild)		
Population Numbers		
Diversity and Richness Indices		
Community-Level Metrics (Index of Biotic Integrity)		

SV 10.1 through 10.5: Biotic Structure - Biotic structure is the biological component of the natural infrastructure of a stream, and the main subject of stream ecology. The biota supported by a stream is not only a category of stream function, but also an essential element of functional condition, by carrying out biochemical processing through a characteristic trophic structure. It is a core feature of reach health and an important factor to consider when rating the ability of a reach to perform other functions. **Five communities represent SVs 10.1 through 10.5 (Microbes, Macrophytes, Macroinvertebrates, Fish & Amphibians, and Other Animals).**

Sub-Variable Score	Condition Grade	Scoring Guidelines	Microbes	Macrophytes	Macroinvertebrates	Fish & Amphibians	Other Animals
1.00 - 0.90	**A -** Reference Standard	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.				
0.89 - 0.80	**B -** Highly Functioning Negligible Impact Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.	Unusually high or low density of macrophytes, mostly native.	Macroinvertebrates: Significant shift in species composition, increase in tolerant species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.	Terrestrial or amphibious species limited by migration barriers or poor habitat.
0.79 - 0.70	**C -** Functioning Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.	Typical species diminished presence, keystone species diminished, e.g. beavers.
0.69 - 0.60	**D -** Functioning Impaired Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.	Exotic invasions , missing or severely limited feeding guilds.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.	Typical species severely limited, exotic infestations, keystone species absent.
0.00 - 0.59	**F -** Non-functioning Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.	Exotic macrophytes completely cover stream bed.	Important functional guilds or trophic levels are completely absent.	Fish communities are nearly 100% non-native with diminished diversity.	Few or none of typical native species are present, keystone species extirpated.

* SV 10.1 Score - Inputs from above SV 10.1 Scoring Table (0.0 - 1.0)
* SV 10.2 Score - Inputs from above SV 10.2 Scoring Table (0.0 - 1.0)
* SV 10.3 Score - Inputs from above SV 10.3 Scoring Table (0.0 - 1.0)
* SV 10.4 Score - Inputs from above SV 10.4 Scoring Table (0.0 - 1.0)
* SV 10.5 Score - Inputs from above SV 10.5 Scoring Table (0.0 - 1.0)
* **V10 Score** -The lowest SV score plus the mean SV score divided by two.

FACStream Score Card

Scoring Procedure:

Variable scores (V1-V10) and SV scores are calculated from the above steps and inputted into the Alt A0, A1, A2, and A3 Tabs. These scores are used in the below FACStream Functional Condition Scores (FCS) scoring process for each AA / Tract by Time Stamp. FCSs are calculated using weighted averages of the ten state variable scores. Individual FCSs may be calculated for each of the reach's functional categories in the EPA function-based framework: **Hydraulic**, **Geomorphic**, **Physicochemical**, and **Biotic**. Relative weights for each of the variables are given in the below table. The overall FCS is calculated as the average of the FCSs for the four individual categories. For calculating the overall FCS directly, the weights given in the below table can be used. The relative contribution of watershed scale variables to overall condition is 35%, 30% for riparian scale variables, and 35% for stream scale variables. It is important that all variables are scored to provide a valid assessment. This is critical for making sure that the overall condition score represents a holistic picture of health and functional capacity of a reach. A common pitfall in ecological assessment is the tendency of evaluators to draw broad conclusions about overall health and functionality from a limited set of metrics that consider only a subset of the components of system health. Rarely will one have detailed data for all variables, but all variables must still be scored using the best available evidence to maintain the holistic picture.

Attribute	Variable	Sub-Variable	Hydraulic Functions	Geomorphic Functions	Phsicochemical Functions	Biotic Functions	Variable Average	Total Function Average
Watershed Scale Variables	V1 - Flow Regime	SV 1.1 Total Volume	30%	15%	15%	20%	20%	35%
		SV 1.2 Peak Flows						
		SV 1.3 Base Flows						
		SV 1.4 Flow Variability						
	V2 - Sediment Regime	SV 2.1 Land Erosion	0%	15%	5%	0	5%	
		SV 2.2 Channel Erosion						
		SV 2.3 Transport						
	V3 - Water Quality	SV 3.1 Temperature Regime	0%	0%	25%	15%	10%	
		SV 3.2 Organics / Nutrients						
		SV 3.3 Inorganics / Toxins						
Riparian Scale Variables	V4 - Floodplain Connectivity	SV 4.1 Saturation Frequency	30%	10%	10%	10%	15%	30%
		SV 4.2 Floodplain Width						
		SV 4.3 Saturation Duration						
	V5 - Riparian Vegetation	SV 5.1 Woody Vegetation Structure	5%	15%	10%	10%	10%	
		SV 5.2 Herbaceous Vegetation Structure						
		SV 5.3 Species Diversity						
	V6 - Debris Supply	SV 6.1 Large Woody Debris	0%	10%	5%	5%	5%	
		SV 6.2 Detritus						
Stream Scale Variables	V7 - Stream Morphology	SV 7.1 Evolutionary Stage	10%	10%	0%	0%	5%	35%
		SV 7.2 Planform						
		SV 7.3 Dimension						
		SV 7.4 Profile						
	V8 - Stability	SV 8.1 Dynamic Equilibrium	10%	15%	5%	10%	10%	
		SV 8.2 Resilience						
	V9 - Physical Structure	SV 9.1 Hydraulic Structure	15%	10%	5%	10%	10%	
		SV 9.2 Coarse Scale						
		SV 9.3 Fine Scale						
	V10 - Biotic Structure	SV 10.1 Biotic Structure	0%	0%	20%	20%	10%	

The **Functional Capacity Index (FCI)** is a dimensionless index that rates the functional capacity of the reach relative to reference standard on a scale of 0.00 to 1.00 reflecting the degree of aquatic habitat functionality from none to 100%. It is calculated directly from the FACStream overall condition score using the equation **FCI = (FCS/50) - 1**

FCI may then be used to provide a quantitative estimate of the amount aquatic function provided by the reach using a measure called the **Habitat Unit (HU)**. One HU is equal to the amount of function performed by one acre of stream in completely unimpaired condition. The general HU equation is derived from the premise that the amount of function is equal to the Reach Area times its relative ability to perform functions compared to a reference standard example of the same type of stream. On pristine sites, the number of HUs will be equal to the reach area since FCI is 100%. On impacted sites, the number of HUs becomes a smaller and smaller fraction of reach length as the degree of impairment increases. The AAHU Tab takes the user acreage inputs and FCI scores from the Alt A0, Alt A1, Alt A2, and Alt A3 Tabs for each reach to calculate the HUs and Average Annual Habitat Unit (AAHU) outputs. These outputs can then be used to determine relative habitat degradation or habitat restoration at a given reach or site.

Documentation of Model Adjustments based on Project Specific Considerations, Individual Stream Characteristics, and Ecoregion:

Variable	Variable Name	Model Adjustments
V1.	Flow Regime	
V2.	Sediment Regime	
V3.	Water Quality	
V4.	Floodplain Connectivity	
V5.	Riparian Vegetation	
V6.	Debris Supply	
V7.	Stream Morphology	
V8.	Stability	
V9	Physical Structure	
V10	Biotic Structure	

Project Name / Area

FACStream Model for NWK and NWO Civil Works Boundaries

Calculation of Habitat Units (HUs), Average Annual Habitat Units (AAHUs), and Net AAHUs

Reach	Restoration Alternative / Measure	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs	Notes / Comments / Descriptions / Assumptions
1	A - no measures	FWOP	0	0	0.76	560	424.95		20096.3	401.93	
			10	10	0.74	560	412.12	4185.38			
			25	15	0.71	560	399.34	6085.96			
			50	25	0.69	560	386.66	9824.97			
	A6- Weir Operations at Lake Kampeska and Levee on L/R Banks to 2% Protection	FWP	0	0	0.76	560	424.95		20097.4	401.95	
			10	10	0.74	560	411.70	4183.28			
			25	15	0.71	560	399.48	6083.86			
			50	25	0.69	560	386.94	9830.22			
	A7 - Weir Operations at Lake Kampeska and LB Levee	FWP	0	0	0.76	560	424.95		20097.4	401.95	
			10	10	0.74	560	411.70	4183.28			
			25	15	0.71	560	399.48	6083.86			
			50	25	0.69	560	386.94	9830.22			
	A8 - Weir Operations at Lake Kampeska, Channel Widening, LB Levee Only	FWP	0	0	0.76	560	424.95		20097.4	401.95	
			10	10	0.74	560	411.70	4183.28			
			25	15	0.71	560	399.48	6083.86			
			50	25	0.69	560	386.94	9830.22			
	A3 - Channel Widening, LB Levee Only	FWP	0	0	0.76	560	424.95		20096.3	401.93	
			10	10	0.74	560	412.12	4185.38			
			25	15	0.71	560	399.34	6085.96			
			50	25	0.69	560	386.66	9824.97			
	A11b- Weir Operations at Lake Kampeska and Levee on L/R Banks (One 3ft Closure)	FWP	0	0	0.76	560	424.95		20097.4	401.95	
			10	10	0.74	560	411.70	4183.28			
			25	15	0.71	560	399.48	6083.86			
			50	25	0.69	560	386.94	9830.22			
	A11c- Weir Operations at Lake Kampeska and Levee on L/R Banks (Two 4ft Closure)	FWP	0	0	0.76	560	424.95		20097.4	401.95	
			10	10	0.74	560	411.70	4183.28			
			25	15	0.71	560	399.48	6083.86			
			50	25	0.69	560	386.94	9830.22			
	Alt 13- Weir Operations at Lake Kampeska	FWP	0	0	0.76	560	424.95		20097.4	401.95	
			10	10	0.74	560	411.70	4183.28			
			25	15	0.71	560	399.48	6083.86			
			50	25	0.69	560	386.94	9830.22			
	Alt 16- Weir Operations at Lake Kampeska, Levee on L/R Banks, Channel Widening in Reach 3 only	FWP	0	0	0.76	560	424.95		20097.4	401.95	
			10	10	0.74	560	411.70	4183.28			
			25	15	0.71	560	399.48	6083.86			
			50	25	0.69	560	386.94	9830.22			
2	A - no measures	FWOP	0	0	0.73	238	174.49		8303.4	166.07	
			10	10	0.71	238	169.96	1722.24			
			25	15	0.69	238	165.21	2513.72			
			50	25	0.67	238	160.18	4067.40			
	A6- Weir Operations at Lake Kampeska and Levee on L/R Banks to 2% Protection	FWP	0	0	0.73	238	174.49		8125.1	162.50	
			10	10	0.70	238	165.74	1701.15			
			25	15	0.68	238	160.89	2449.76			
			50	25	0.66	238	157.04	3974.15			
	A7 - Weir Operations at Lake Kampeska and LB Levee	FWP	0	0	0.73	238	174.49		8193.7	163.87	
			10	10	0.70	238	167.00	1707.44			
			25	15	0.68	238	162.26	2469.41			
			50	25	0.67	238	159.09	4016.85			
	A8 - Weir Operations at Lake Kampeska, Channel Widening, LB Levee Only	FWP	0	0	0.73	238	174.49		8187.8	163.76	
			10	10	0.70	238	166.45	1704.70			
			25	15	0.68	238	162.19	2464.77			
			50	25	0.67	238	159.28	4018.28			
	A3 - Channel Widening, LB Levee Only	FWP	0	0	0.73	238	174.49		8183.4	163.67	
			10	10	0.70	238	166.37	1704.31			
			25	15	0.68	238	162.07	2463.28			
			50	25	0.67	238	159.20	4015.80			
	A11b- Weir Operations at Lake Kampeska and Levee on L/R Banks (One 3ft Closure)	FWP	0	0	0.73	238	174.49		8103.1	162.06	
			10	10	0.70	238	165.54	1700.16			
			25	15	0.67	238	160.25	2443.43			
			50	25	0.66	238	156.51	3959.53			
	A11c- Weir Operations at Lake Kampeska and Levee on L/R Banks (Two 4ft Closure)	FWP	0	0	0.73	238	174.49		8090.3	161.81	
			10	10	0.69	238	164.97	1697.29			
			25	15	0.67	238	160.12	2438.15			
			50	25	0.66	238	156.26	3954.82			
	Alt 13- Weir Operations at Lake Kampeska	FWP	0	0	0.73	238	174.49		8305.4	166.11	
			10	10	0.71	238	169.83	1721.62			
			25	15	0.69	238	165.36	2513.96			
			50	25	0.67	238	160.22	4069.78			
	Alt 16- Weir Operations at Lake Kampeska, Levee on L/R Banks, Channel Widening in Reach 3 only	FWP	0	0	0.73	238	174.49		8090.3	161.81	
			10	10	0.69	238	164.97	1697.29			
			25	15	0.67	238	160.12	2438.15			
			50	25	0.66	238	156.26	3954.82			
3	A - no measures	FWOP	0	0	0.76	296	224.62		10622.3	212.45	
			10	10	0.74	296	217.84	2212.27			
			25	15	0.71	296	211.08	3216.86			
			50	25	0.69	296	204.38	5193.20			
	A6- Weir Operations at Lake Kampeska and Levee on L/R Banks to 2% Protection	FWP	0	0	0.76	296	224.62		10622.9	212.46	
			10	10	0.74	296	217.61	2211.16			
			25	15	0.71	296	211.15	3215.75			
			50	25	0.69	296	204.52	5195.97			
	A7 - Weir Operations at Lake Kampeska and LB Levee	FWP	0	0	0.76	296	224.62		10622.9	212.46	
			10	10	0.74	296	217.61	2211.16			
			25	15	0.71	296	211.15	3215.75			
			50	25	0.69	296	204.52	5195.97			
	A8 - Weir Operations at Lake Kampeska, Channel Widening, LB Levee Only	FWP	0	0	0.76	296	224.62		10665.4	213.31	
			10	10	0.73	296	217.39	2210.05			
			25	15	0.72	296	212.51	3224.26			
			50	25	0.70	296	205.98	5231.12			
	A3 - Channel Widening, LB Levee Only	FWP	0	0	0.76	296	224.62		10676.5	213.53	
			10	10	0.74	296	217.84	2212.27			
			25	15	0.72	296	212.51	3227.59			
			50	25	0.70	296	206.42	5236.67			
	A11b- Weir Operations at Lake Kampeska and Levee on L/R Banks (One 3ft Closure)	FWP	0	0	0.76	296	224.62		10622.9	212.46	
			10	10	0.74	296	217.61	2211.16			
			25	15	0.71	296	211.15	3215.75			
			50	25	0.69	296	204.52	5195.97			
	A11c- Weir Operations at Lake Kampeska and Levee on L/R Banks (Two 4ft Closure)	FWP	0	0	0.76	296	224.62		10622.9	212.46	
			10	10	0.74	296	217.61	2211.16			
			25	15	0.71	296	211.15	3215.75			
			50	25	0.69	296	204.52	5195.97			
	Alt 13- Weir Operations at Lake Kampeska	FWP	0	0	0.76	296	224.62		10622.9	212.46	
			10	10	0.74	296	217.61	2211.16			
			25	15	0.71	296	211.15	3215.75			
			50	25	0.69	296	204.52	5195.97			
	Alt 16- Weir Operations at Lake Kampeska, Levee on L/R Banks, Channel Widening in Reach 3 only	FWP	0	0	0.76	296	224.62		10658.4	213.17	
			10	10	0.74	296	217.63	2211.24			
			25	15	0.72	296	212.20	3223.71			
			50	25	0.69	296	205.68	5223.48			

Restoration Alternative / Measure	Cumulative AAHUs	Net AAHUs
A0 (FWOP)	780.44	
A6	776.91	-3.53
A3	779.12	-1.32
A7	778.28	-2.16
A8	779.01	-1.43
A11b	776.47	-3.97
A11c	776.21	-4.23
A13	780.51	0.07
A16	776.92	-3.52

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.

Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alternative A0 **Future Without Project Conditions (Year 0), Future With Project (Year 10, 25, 50)**	**3**

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) .
Additional information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: **Reach 1 (560 acres)**

Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50								
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park), augmentation	increased development, residental and farming w/in Basin	climate change-increased freq/severity of events, increased annual precip	increased development, climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.75**	**0.70**	**0.70**	
	Sub-Variable	**Magnitude and duration of peak flows, of the "high end" of the hydrograph**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landscapes	climate change-increased freq/severity of events, increased annual precip	climate change-increased freq/severity of events, increased annual precip	increased development and climate change will lead to more impact to natural patterns	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10 -20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20 -40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, of the "low end" of the hydrograph**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	base flows adequate	climate change-drought or floods-increased frequency/severity of precip	climate change-drought or floods-increased frequency/severity of precip	climate change-drought or floods-increased frequency/severity of precip	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10 -20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20 -40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change-drought or floods, increase in variability from natural hydrograph	climate change-drought or floods, increase in variability from natural hydrograph	climate change-drought or floods, increase in variability from natural hydrograph	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.84	0.83	0.82	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.84**	**0.83**	**0.82**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed-overgrazed slopes	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.78	0.76	0.74	0.72	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear -cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human -caused erosion. There are no significant stressors.	0.84	0.82	0.8	0.78	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches, or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.82**	**0.80**	**0.78**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well -designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most of all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.79**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.1	some lack of shading, little	temps increase	temps increase	temps increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					

	Temperature Regime	Irrigation, some reservoir impact	due to climate change	due to climate change	due to climate change	0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Watershed	**SV 3.2 Organics Nutrients**	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**

Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 / **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 / **Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4 / **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	SV Score	SV Score	SV Score	SV Score
Riparian V4 Floodplain Connectivity	**SV 4.1 Saturation Frequency**	development isolation from flood plain,	continued development, increased isolation from flood plain,	continued development, increased isolation from flood plain,	continued development, increased isolation from flood plain,	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr					
										TOTAL SV 4.1	**0.80**	**0.78**	**0.76**	**0.74**
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 4.2 Floodplain Width	**development**	**increased development**	**increased development**	**increased development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).			0.85	0.85	0.8	0.75
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).						
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2			**0.85**	**0.85**	**0.80**	**0.75**
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.			0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.						
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.						
								TOTAL SV 4.3			**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4			**0.82**	**0.80**	**0.77**	**0.75**

Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	some loss of riparian coordior but this is also a shortgrass prairie/ prairie pothole region
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**	
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non-woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agricutlure**	**primarily rural/agricutlure**	**primarily rural/agricutlure**	**primarily rural/agricutlure**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**	
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	**RCG, leafy spurge, and other non native prevelent over native, PCG**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non -native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non -native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non -native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**	
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.				
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.				
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard Negligible	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning Mild Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70 C - Functioning Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59 F - Non-functioning Profound	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
											TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2					
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)	SV Score	SV Score	SV Score	SV Score
	SV 7.2	unconfined, slight meander, straightened, so low K.				1.00 - 0.90 A - Reference Standard Negligible	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning Mild Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70 C - Functioning Significant Impact	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59 F - Non-functioning Profound	Straight	Straight	Straight	--	--				
											TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50	
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F		SV Score	SV Score	SV Score	SV Score	
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard Negligible	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	Assumes encroachment increases, non-federal project involving unnatural re-routing or stabilization projects
						0.89 - 0.80 B - Highly Functioning Mild Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70 C - Functioning Significant Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59 F - Non-functioning Profound	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
											TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines			Year 0	Year 10	Year 25	Year 50	

		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.				
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10 -20%). Examples: reaches with significant grade control, moderate planform changes.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.				
									TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
									TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**
Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**		Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
Stream V8 Stability	**SV 8.1 Dynamic Equilibrium**	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.				
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, poor riffling, unnatural bars, over -widening,				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete poor riffling, reach wide aggradation, or recent head cute. Artificially hardened channels in unconfined alluvial valleys also meet this.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.				
									TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**		Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.				
									TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**
									TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**		Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
Stream V9 Physical Structure	**SV 9.1 Hydraulic Structure**	development, ag mostly	increase in development/ag	increase in development/ag	increase in development/ag	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.				
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.				
									TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**
	Sub-Variable	**Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**		Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse-scale physical structure is present. Examples include reaches with slightly altered morphology arising from typical velocity deployment anomalies not present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed fine: pool ratio, or lack of bank structure. Some typical velocity deployment anomalies or undesirable structural elements are absent, making the reach uncharacteristically homogenous. Examples include reaches with grazed or heavily				
						0.79 - 0.70	C - Functioning, Significant Impact					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.				
									TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**		Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine-scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus				
						0.79 - 0.70	C - Functioning, Significant Impact	Some typical fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution, moderate levels of excess of fine sediment deposition (or, less obviously, excess fine sediment), or limited organic debris.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Severely altered fine-scale structural diversity. Examples include gravel or cobble bed streams with unnatural materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and ecosystems severely limited. Examples include gravel or cobble bed streams that are aggrading with fine material, unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact					
									TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**
									TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
										TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
										TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
		mosquitoes,	Anticipated	Anticipated		1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.				

Stream V10 Biotic Structure	SV 10.3 Macroinvertebrates	damsels, known presence of zebra mussels, unknown type and presence of native mussels	zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.	0.65	0.6	0.6	0.6	
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
								TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
								TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
								TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**	
								Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
								Geomorphic Functional Condition Score	**0.77**	**0.75**	**0.72**	**0.70**	
								Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.71**	**0.69**	
								Biotic Functional Condition Score	**0.75**	**0.72**	**0.70**	**0.68**	
								Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.71**	**0.69**	

Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park), augmentation	increased development, residental and farming w/in Basin	climate change-increased freq/severity of events, increased annual precip	**increased development, climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	Existing berms that semi-function as a levee along much of this reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.75**	**0.70**	**0.70**	

Sub-Variable	Magnitude and duration of peak flows, of the "high end" of the hydrograph				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 1.2 Peak Flows	**Lake Kampeska gates, urbanized landscapes**	**climate change-increased freq/severity of events, increased annual precip**	**climate change-increased freq/severity of events, increased annual precip**	**increased development and climate change will lead to more impact to natural patterns**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
					0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10 -20%.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20 -40%.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
							TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	

Sub-Variable	Magnitude and duration of base flows, of the "low end" of the hydrograph				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 1.3 Base Flows	**base flows adequate**	**climate change-drought or floods-increased frequency/severity of precip**	**climate change-drought or floods-increased frequency/severity of precip**	**climate change-drought or floods-increased frequency/severity of precip**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10 -20%, or the duration of low flows is extended.					
					0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20 -40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
							TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	

Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change-drought or floods, increase in variability from natural hydrograph**	**climate change-drought or floods, increase in variability from natural hydrograph**	**climate change-drought or floods, increase in variability from natural hydrograph**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.84	0.83	0.82	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
					0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
							TOTAL SV 1.4	**0.85**	**0.84**	**0.83**	**0.82**	
							TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	

Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.78	0.76	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density or unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear -cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.82**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	**signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human -caused erosion. There are no significant stressors.	0.88	0.86	0.84	0.82	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches, or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contribution area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.88**	**0.86**	**0.84**	**0.82**	
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well –designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.84**	**0.82**	**0.80**	**0.77**	
Variable	Sub-Variable	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter)				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 3.2 Organics Nutrients	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	Sub-Variable	Access of water to the floodplain and riparian area from the stream channel(s)				SV Scores	Condition Grade	Scoring Guidelines					
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			**Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading		SV Score	SV Score	SV Score	SV Score	
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	development isolation from flood plain,	continued development, increased isolation from flood plain,	continued development, increased isolation from flood plain,	continued development, increased isolation from flood plain,	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr		Not Available for A, G, F Stream Types in VC Valleys.	0.7	0.7	0.7	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr							
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr							
												TOTAL SV 4.1	**0.70**	**0.70**	**0.70**	**0.70**	
	Sub-Variable	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 4.2 Floodplain Width	**development**	**increased development**	**increased development**	**increased development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	0.75	0.72	0.7	0.68	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
								TOTAL SV 4.2	**0.75**	**0.72**	**0.70**	**0.68**	
	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.75	0.75	0.75	0.75	Most of the ecological floodplain is built out- additional homes and buisnesses would not be allowed due to floodplain regulations. Saturation frequency degraded from lack of natural hydrograph and floodplain interaction but assumed increases in precip freq/severity. Likely stable across 50 years
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					

						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.				
									TOTAL SV 4.3	**0.75**	**0.75**	**0.75**	**0.75**
									TOTAL V4	**0.72**	**0.71**	**0.71**	**0.70**

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.59	0.57	0.54	0.5
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
									TOTAL SV 5.1	**0.59**	**0.57**	**0.54**	**0.50**
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non-woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.72	0.72	0.7	0.67
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
									TOTAL SV 5.2	**0.72**	**0.72**	**0.70**	**0.67**
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous)				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 5.3 Species Diversity	RCG, leafy spurge, and other non native prevelent over native, RCG	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.69	0.65	0.6	0.55
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non -native species or bare ground make up less than 20% of cover.				
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non -native species or bare ground make up less than 40% of cover.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.				
									TOTAL SV 5.3	**0.69**	**0.65**	**0.60**	**0.55**
									TOTAL V5	**0.63**	**0.61**	**0.58**	**0.54**

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.				
									TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.8	0.8	0.75	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.				
									TOTAL SV 6.2	**0.80**	**0.80**	**0.75**	**0.70**
									TOTAL V6	**0.81**	**0.81**	**0.76**	**0.72**

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score
	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard Negligible	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning Mild Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70 C - Functioning Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59 F - Non-functioning Profound	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
											TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2				
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)	SV Score	SV Score	SV Score	SV Score
		unconfined,				1.00 - 0.90 A - Reference Standard Negligible	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K				
						0.89 - 0.80 B - Highly Functioning Mild Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				

	SV 7.2	slight meander, straightened, so low K.				0.79 - 0.70 C - Functioning Significant Impact	Meander High K	Meander High K	Meander Low K	--	Straight	0.85	0.85	0.85	0.85	
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Meander Low K	Meander Low K	Straight	Straight	--					
Stream V7 Morphology						0.00 - 0.59 F - Non-functioning Profound	Straight	Straight	Straight	--	--					
											TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50	Condition Grade	Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All	SV Score	SV Score	SV Score	SV Score	
						Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F						
SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard Negligible	No Significant Stressors				No Significant Stressors	0.8	0.8	0.75	0.75	
					0.89 - 0.80 B - Highly Functioning Mild Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
					0.79 - 0.70 C - Functioning Significant Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
					0.69 - 0.60 D - Functioning Impaired Severe Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
					0.00 - 0.59 F - Non-functioning Profound	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
										TOTAL SV 7.3	**0.80**	**0.80**	**0.75**	**0.75**	

Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
					0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10 -20%). Examples: reaches with significant grade control, moderate planform changes.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	increased scour with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over -widening,					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	enlargement, or mild incision. Unnaturally stabilized channels may fit this ration.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this. Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
									TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	

Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	Existing berms that semi-function as a levee along much of this reach
					0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
					0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material,					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	impediments to establishment, or exotics. Limited resilience. Examples include reaches that depend upon artificial stabilization of structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source					
					0.00 - 0.59	F - Non-functioning, Profound Impact	impairment that strongly affects peak flows and effective discharge. Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	development, ag mostly	increase in development/ag	increase in development/ag	increase in development/ag	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
									TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	

Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse-scale physical structure is present. Examples include reaches with slightly altered morphology arising					
					0.79 - 0.70	C - Functioning, Significant Impact	from dynamics of recently recovering hydrologic or sediment regime, or distribution of features is skewed. Examples include reaches with altered pool spacing, skewed fine: pool ratio, or lack of bank structure.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Reaches with artificial structures, actively unstable banks, or straightened channels. Some typical velocity, depth and/or substrate patterns are present, but structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with grades or heavily					
					0.00 - 0.59	F - Non-functioning, Profound Impact	reverted banks, or features that are frequently limited by inundation or low flow. Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	

Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine-scale physical structure is present. Examples include reaches with slightly altered fine sediment					
					0.79 - 0.70	C - Functioning, Significant Impact	deposition, moderately limited detritus, or only one facing of limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess of fine sediment deposition					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	for alternatively decreased fine sediment), or limited organic debris. Fine-scale structural diversity is severely limited. Examples include gravel or cobble bed streams with unimodal materials distribution, increased embeddedness, sediment starved reaches that					
					0.00 - 0.59	F - Non-functioning, Profound Impact	lack fine sediment, and reaches lacking characteristic detritus or LWD. Fine-scale structural diversity is severely limited. Examples include gravel or cobble bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
								TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
								TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
								TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
								TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**
								TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**
								Hydraulic Functional Condition Score	**0.73**	**0.71**	**0.70**	**0.68**
								Geomorphic Functional Condition Score	**0.74**	**0.73**	**0.70**	**0.68**
								Physicochemical Functional Condition Score	**0.74**	**0.72**	**0.69**	**0.67**
								Biotic Functional Condition Score	**0.73**	**0.70**	**0.68**	**0.66**
								Overall Functional Capacity Index Score	**0.73**	**0.71**	**0.69**	**0.67**

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Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 1.1	Lake Kampeska gate, small	increased development,	climate change-increased	**increased**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					

	Total Volume	impoundment diversions (lions park), augmentation	residental and farming w/in Basin	freq/severity of events, increased annual precip	**development, climate change**	0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.	0.8	0.75	0.7	0.7
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.				
								TOTAL SV 1.1	**0.80**	**0.75**	**0.70**	**0.70**
	Sub-Variable	**Magnitude and duration of peak flows, of the "high end" of the hydrograph**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 1.2 Peak Flows	**Lake Kampeska gates, urbanized landscapes**	**climate change-increased freq/severity of events, increased annual precip**	**climate change-increased freq/severity of events, increased annual precip**	**increased development and climate change will lead to more impact to natural patterns**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10 -20%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20 -40%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.				
Watershed								**TOTAL SV 1.2**	**0.70**	**0.68**	**0.66**	**0.64**
V1 Flow Regime	**Sub-Variable**	**Magnitude and duration of base flows, of the "low end" of the hydrograph**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 1.3 Base Flows	**base flows adequate**	**climate change-drought or floods-increased frequency/severity of precip**	**climate change-drought or floods-increased frequency/severity of precip**	**climate change-drought or floods-increased frequency/severity of precip**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10 -20%, or the duration of low flows is extended.				
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20 -40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.				
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change-drought or floods, increase in variability from natural hydrograph**	**climate change-drought or floods, increase in variability from natural hydrograph**	**climate change-drought or floods, increase in variability from natural hydrograph**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.84	0.83	0.82
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.				
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.				
								TOTAL SV 1.4	**0.85**	**0.84**	**0.83**	**0.82**
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed-	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.78	0.76	0.74	0.72
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.				
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human caused mass erosion.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear -cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human caused mass erosion.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.				
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**
Watershed	**Sub-Variable**	**Rate of sediment produced by channel erosion in the contributing watershed**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
V2 Sediment Regime	**SV 2.2 Channel Erosion**	**signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human -caused erosion. There are no significant stressors.	0.84	0.82	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.				
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches, or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.				
								TOTAL SV 2.2	**0.84**	**0.82**	**0.80**	**0.78**
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 2.3 Transport	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well -designed weir structures, or major dams located on small tributary drainages.				
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.				
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**
								TOTAL V2	**0.80**	**0.79**	**0.76**	**0.74**
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**
Watershed	**Sub-Variable**	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
V3 Water Quality	**SV 3.2 Organics Nutrients**	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				

											TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**
											TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading					
	SV 4.1 Saturation Frequency	development isolation from flood plain,	continued development, increased isolation from flood plain,	continued development, increased isolation from flood plain,	continued development, increased isolation from flood plain,	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr			0.8	0.78	0.76	0.74
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr		Not Available for A, G, F Stream Types in VC Valleys.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
											TOTAL SV 4.1	**0.80**	**0.78**	**0.76**	**0.74**
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**							SV Score	SV Score	SV Score	SV Score
Riparian	**SV 4.2 Floodplain Width**	**development**	**increased development**	**increased development**	**increased development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).				0.85	0.85	0.8	0.75
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).							
V4						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).							
Floodplain						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).							
Connectivity						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).							
											TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**							SV Score	SV Score	SV Score	SV Score
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.				0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.							
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.							
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.							
											TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
											TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**							SV Score	SV Score	SV Score	SV Score
	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.				0.75	0.73	0.7	0.68
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.							
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.							
											TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non-woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**							SV Score	SV Score	SV Score	SV Score
Riparian	**SV 5.2 Herbaceous Vegetation Structure**	**primarily rural/agricultl ure**	**primarily rural/agricutlure**	**primarily rural/agricutlur e**	**primarily rural/agricutlure**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.				0.75	0.73	0.7	0.67
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.							
V5						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.							
Riparian						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.							
Vegetation						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.							
											TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**							SV Score	SV Score	SV Score	SV Score
	SV 5.3 Species Diversity	**RCG, leafy spurge, and other non native prevelent over native, PCG**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.				0.72	0.69	0.65	0.6
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non -native species or bare ground make up less than 20% of cover.							
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non -native species or bare ground make up less than 40% of cover.							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.							
											TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**
											TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**							SV Score	SV Score	SV Score	SV Score
	SV 6.1 Large Woody Debris	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.				0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.							
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.							
Riparian						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.							
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.							
V6											**TOTAL SV 6.1**	**0.85**	**0.83**	**0.80**	**0.78**
Debris	**Sub-Variable**	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
Supply		**Year 0**	**Year 10**	**Year 25**	**Year 50**							SV Score	SV Score	SV Score	SV Score
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.				0.85	0.82	0.8	0.76
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.							
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.							
											TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**
											TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**
		Stream evolution is the process by which a stream changes type or form.						**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
						SV Scores		**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)**				

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	Condition Grade	Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B	Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score	
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard Negligible	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--						
						0.79 - 0.70 C - Functioning Significant	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--						
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)						
						0.00 - 0.59 F - Non-functioning Profound	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)						
											TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**	

Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50	Condition Grade	Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score	
						Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)					
SV 7.2	unconfined, slight meander, straightened, so low K.				1.00 - 0.90 A - Reference Standard Negligible	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	
					0.89 - 0.80 B - Highly Functioning Mild Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
					0.79 - 0.70 C - Functioning Significant	Meander High K	Meander High K	Meander Low K	--	Straight					
					0.69 - 0.60 D - Functioning Impaired Severe Impact	Meander Low K	Meander Low K	Straight	Straight	--					
					0.00 - 0.59 F - Non-functioning Profound	Straight	Straight	Straight	--	--					
											TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**

Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50	Condition Grade	Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2		Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All	SV Score	SV Score	SV Score	SV Score	
						Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B		Reference Stream Type: A, G, F						
SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard Negligible	No Significant Stressors					No Significant Stressors	0.85	0.8	0.75	0.75	Assumes increase in encroachment, non-federal stabilization or FRM project potential
					0.89 - 0.80 B - Highly Functioning Mild Impact	Stressors Present, but Effects are Minimal					Stressors Present, but Effects are Minimal					
					0.79 - 0.70 C - Functioning Significant	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER			Slightly Enlarged (A:A-Reference 1.2-1.5)					
					0.69 - 0.60 D - Functioning Impaired Severe Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation			Enlarged (A:A-Reference 1.6-2.0)					
					0.00 - 0.59 F - Non-functioning Profound	Fully Entrenched (ER < 1.4)				Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
											TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	

Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
					0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10 -20%). Examples: reaches with significant grade control, moderate planform changes.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, poor riffle, unnatural bars, over - widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
									TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**

Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 8.2 Resilience	some exotic veg.	increased scour, increaseed	increased scour, increaseed	increased scour, increaseed	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
					0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					

		unnatural veg	unnatural veg	unnatural veg	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization of structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	development, ag mostly	increase in development/ag	increase in development/ag	increase in development/ag	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.				
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.				
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed nontoxic stressors or minimal direct impacts.				
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed fine-pool ratio, or lack of bank structure.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent, making the reach architecturally homogenous. Examples include reaches with grazed or heavily				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.				
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment				
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess of fine sediment deposition				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that				
						0.00 - 0.59	F - Non-functioning, Profound Impact	lack fine sediment and overly lacking character(ie pattern, etc) were				
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.			
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.			
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.			
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.			
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.			
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.			
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.			
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.			
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.			
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.			
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.			
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.			
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.			
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.			
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.			

					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**
Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
	Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**
									Geomorphic Functional Condition Score	**0.77**	**0.75**	**0.72**	**0.70**
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.71**	**0.69**
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.70**	**0.68**
									Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.71**	**0.69**

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.

Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alt 3: Left Bank Levee + Channel Widening	

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be found online at: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) . Information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #:	Reach 1												
Variable	**Sub-Variable**	**Total annual volume of water delivered from contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (Ilons park), augmentations from upstream agrian ditching	climate change freq/severity of events increased annual precip; increased development	climate change freq/severity of events increased annual precip; increased development	climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.	0.8	0.75	0.7	0.7	anticpated increase in surface runoff from increase in freq/severity of precip events from climate change; consistent w/ FWOP
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.75**	**0.70**	**0.70**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows	**Lake Kampeska gates, urbanized landscapes**	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.	0.7	0.68	0.66	0.64	anticpated increase in surface runoff from increase in freq/severity of precip events from climate change, increase in ecological floodplain development. Hydrograph is still distrupted between 15-30%
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	**base flows adequate**	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.	0.85	0.83	0.81	0.79	Consistent w/ FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change- drought or floods, increase in variability from natural hydrograph**	**climate change- drought or floods, increase in variability from natural hydrograph**	**climate change- drought or floods, increase in variability from natural hydrograph**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.	0.85	0.84	0.83	0.82	Consistent w/ FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.84**	**0.83**	**0.82**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed- overgrazed slopes contribute to sedimentation and water quality issues	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	**signs of channel erosion**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.	0.84	0.82	0.8	0.78	Impacts from climate change would remain consistent in FWP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.82**	**0.80**	**0.78**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.79**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.2 Organics Nutrients	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0					
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score	
Riparian	SV 4.1 Saturation Frequency	development isolation from flood plain,	continued development, increased isolation from flood plain,	continued development, increased isolation from flood plain,	continued development, increased isolation from flood plain,	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.		0.8	0.78	0.76	0.74	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr							
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr							
								TOTAL SV 4.1				**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.2					1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					No anticipated changes from FWOP in Reach 1

V4 Floodplain Connectivity	Floodplain Width	development	increased development	increased development	increased development	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75		
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**		

	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 4.3 Saturation Duration	moderate wetlands along floodplain	increased encroachment development	increased encroachment development	increased encroachment development	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**	
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	development and urbanization	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	Assumption is that the reference standard condition for this region would primarily not have woody vegetation, prairie stream system though ag activities have likely removed much of the riparian coordior along BSR. No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**	

	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	primarily rural/agriculture	primarily rural/agriculture	primarily rural/agriculture	primarily rural/agriculture	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**	

	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	RCG, leafy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighlty altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**	
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**	

	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 6.2 Detritus	vegetation largely intact	increased development, invasives limit vegetation diversity	increased development, invasives limit vegetation diversity	increased development, invasives limit vegetation diversity	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**	
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	1.00 - 0.90	A - Reference Standard	Valley Type: Unconfined (UC) or Partially Confined (PC) — Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 — Reference Stream Type: Stream Evolution Model Stage = 0, Rosgen Stream Type = D, DA, DB: Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning	Valley Type: Unconfined (UC) or Partially Confined (PC) — Reference Stream Type: Stream Evolution Model Stage = 1, Rosgen Stream Type = E: Existing SEM Stage (Rosgen Stream Type) 1 (E, C)					
						0.79 - 0.70	C - Functioning	Valley Type: Unconfined (UC) or Partially Confined (PC) — Reference Stream Type: Stream Evolution Model Stage = 1, Rosgen Stream Type = C: Existing SEM Stage (Rosgen Stream Type) 6 (C)					
						0.69 - 0.60	D - Functioning Impaired	Valley Type: Unconfined (UC) or Partially Confined (PC) — Reference Stream Type: Stream Evolution Model Stage = 3s, Rosgen Stream Type = B: Existing SEM Stage (Rosgen Stream Type) 2-3 (B)					
						0.00 - 0.59	F - Non-functioning	Valley Type: Unconfined (UC) or Partially Confined (PC) — Reference Stream Type: Stream Evolution Model Stage = 3s, Rosgen Stream Type = B: Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)					
								Valley Type: Confined (CC) — Valley bottom width to bankfull stream width 1.4 to 2.2: Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)					
								Valley Type: Confined (CC) — Reference Stream Type: Stream Evolution Model Stage = 3s, Rosgen Stream Type = B: Existing SEM Stage (Rosgen Stream Type) 3s (B)					
								Valley Type: Very Confined (VC) — Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4: Not Available for A, G, F Stream Types in VC Valleys.					
								TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	k increases	1.00 - 0.90	A - Reference Standard	Valley Type: Unconfined (UC) or Partially Confined (PC) — Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 — Anastomosed: Anastomosed	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning	Meandering with Side Channels: Meander with Side Channel					
						0.79 - 0.70	C - Functioning	Meandering High K (> 1.5): Meander High K					
						0.69 - 0.60	D - Functioning Impaired	Meandering Low K (1.2-1.5): Meander Low K					
						0.00 - 0.59	F - Non-functioning	Straight					
								Valley Type: Confined (CC) — Valley bottom width to bankfull stream width 1.4 to 2.2: Meander Low K (1.2-1.5)					
								Meander Low K					
								Meander High K					
								Straight					
								TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	Valley Type: Unconfined (UC) or Partially Confined (PC) — Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 — Reference Stream Type: DA, DB: No Significant Stressors	0.85	0.8	0.75	0.75	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning	Reference Stream Type: E, C: Stressors Present, but Effects are Minimal					
						0.79 - 0.70	C - Functioning	Valley Type: Confined (CC) — Valley bottom width to bankfull stream width 1.4 to 2.2 — Reference Stream Type: B: Degradation Evident, but No Change in ER					
						0.69 - 0.60	D - Functioning Impaired	Valley Type: Very Confined (VC) — Valley bottom width to bankfull stream width < 1.4 — Reference Stream Type: A, G, F: Actively Degrading					
						0.00 - 0.59	F - Non-functioning	Cross Section Area — All: No Significant Stressors					
								Stressors Present, but Effects are Minimal					
								Slightly Enlarged (A:A-Reference 1.2-1.5)					
								Enlarged (A:A-Reference 1.6-2.0)					
								Extremely Enlarged (A:A-Reference > 2.0)					

							TOTAL SV 7.3	0.85	0.80	0.75	0.75	
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
							TOTAL SV 7.4		0.74	0.72	0.70	0.68	
							TOTAL V7		0.78	0.76	0.74	0.73	
Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	increased scour with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
							TOTAL SV 8.1		0.70	0.68	0.66	0.64	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
							TOTAL SV 8.2		0.79	0.75	0.73	0.69	
							TOTAL V8		0.72	0.70	0.68	0.65	
Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	development, ag mostly	increase in development/ag	increase in development/ag	increase in development/ag	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	FWOP conditions would persist
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
							TOTAL SV 9.1		0.79	0.77	0.75	0.72	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
							TOTAL SV 9.2		0.72	0.75	0.76	0.78	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
							TOTAL SV 9.3		0.68	0.66	0.64	0.62	
							TOTAL V9		0.72	0.73	0.72	0.70	
Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	increase with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms w/in localized stillwater areas of the River or at the inlet/outlet of Lake Kampeska. TMDLs established were for Lake Kampeska and will continue to be implemented by State
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
							TOTAL SV 10.1			0.75	0.73	0.71	0.69	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	Consistent w/ FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
							TOTAL SV 10.1			0.75	0.75	0.70	0.65	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
							TOTAL SV 10.1			0.65	0.60	0.60	0.60	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	game fish will continue to limit native fish	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
							TOTAL SV 10.1			0.80	0.78	0.76	0.74	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	exotics will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				

						TOTAL SV 10.1	0.72	0.70	0.68	0.66	
						TOTAL V10	0.69	0.66	0.65	0.63	
						Hydraulic Functional Condition Score	0.76	0.74	0.72	0.70	
						Geomorphic Functional Condition Score	0.77	0.75	0.72	0.70	
						Physicochemical Functional Condition Score	0.76	0.73	0.71	0.69	
						Biotic Functional Condition Score	0.75	0.72	0.70	0.68	
						Overall Functional Capacity Index Score	0.76	0.74	0.71	0.69	

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Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (Ilons park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	anticipated increase in surface runoff from increase in freq/severity of precip events from climate change- no change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	0.80	0.75	0.70	0.70	
	Sub-Variable	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	anticipated increase in surface runoff from increase in freq/severity of precip events from climate changes. Hydrograph is still distrupted between 15-30%- no change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	0.70	0.68	0.66	0.64	
	Sub-Variable	Magnitude and duration of base flows, or the "low end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	base flows adequate	climate change- drought or floods- increased frequency/severity of precip	climate change- drought or floods- increased frequency/severity of precip	climate change- drought or floods- increased frequency/severity of precip	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.78	0.76	0.74	Base flows will remain consistent with seasonal expectations, but of greater severity for low flows (channel width increases and during normal summer-fall flows thereby decreasing the depths- a low flow channel will help retain a semblance of existing condition in a portion of the channel profile)
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	0.85	0.78	0.76	0.74	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.75	0.73	0.7	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP. Levees on left bank within Reach 2 will further alter the natural hydrograph via cutting off the floodplain, impacting drainage, compacting adjacent soils and necessitating a non-native brome planting along the levee. Additionally, flow variability will remain consistent with seasonal expectations, but of greater severity for low flows (channel width increases and during normal summer-fall flows thereby decreasing the depths- a low flow channel will help retain a semblance of existing condition in a portion of the channel profile)
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	0.85	0.75	0.73	0.70	
								TOTAL V1	0.75	0.71	0.69	0.67	

Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.78	0.76	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5, no anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	0.82	0.80	0.78	0.76	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	few signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.88	0.82	0.8	0.78	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from channel widening (floodplain bench)
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	0.88	0.82	0.80	0.78	
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.86	0.86	Anticipated to not progressively worsen but stay the same across the 50 year period as a result of channel widening improving transport to and through reach- wetlands constructed on benches will assist with transport/deposition. Estimated 24.7 ac of upland habitat will be converted to PEM f/ widening
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	0.86	0.86	0.86	0.86	
								TOTAL V2	0.84	0.81	0.80	0.78	

Variable	Sub-Variable	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	temps increase due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.78	0.76	0.76	stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) Minor increases in temperature throughout channel profile during summer-fall from increase in width- low flow channel will assist in abating substantial effects
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	0.83	0.78	0.76	0.76	
	Sub-Variable	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 3.2 Organics Nutrients	little agricultural runoff, but additions from the reservoir	creation of wetlands will improve sediment trapping	creation of wetlands will improve sediment trapping	creation of wetlands will improve sediment trapping	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.76	0.76	Constructed wetlands along benches will improve sediment trapping Years 10-50. Estimated 24.7 ac of existing upland habitat converted to PEM. 70.2 total acres along channel widening/floodplain bench will assist in trapping organic nutrients.
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	0.79	0.76	0.76	0.76	
	Sub-Variable	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	minimal ag influence, largely groundwater fed (high pH)	creation of wetlands on bench will improve sediment filtering	creation of wetlands on bench will improve sediment filtering	creation of wetlands on bench will improve sediment filtering	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.76	0.76	Constructed wetlands along benches will improve sediment filtering Years 10-50. Estimated 24.7 ac of existing upland habitat converted to PEM. 70.2 total acres along channel widening/floodplain bench will assist in trapping inorganic toxins.
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	0.79	0.76	0.76	0.76	
								TOTAL V3	0.80	0.76	0.76	0.76	

Variable	Sub-Variable	Access of water to the floodplain and riparian area from the stream channel(s).				SV Scores	Condition Grade	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score	
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	Reference Stream Type Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	Reference Stream Type Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading						
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	cut off from ecological floodplain due to industrail and residental areas	degradation due to ecological floodplain being isolated where levees are located, but increase in frequency where channel is widened	degradation due to ecological floodplain being isolated where levees are located, but increase in frequency where channel is widened	degradation due to ecological floodplain being isolated where levees are located, but increase in frequency where channel is widened	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr		Not Available for A, G, F Stream Types in VC Valleys.	0.7	0.7	0.7	0.7	Already existing "berms" - increasing the height for the LB Levee isolates floodplain permanently -encroaching that much further on floodplain, effects are substantial but large portions of the reach are already impacted by urbanization activities. From 14th ave to 13th ave and 10th ave to 6th ave on LB, ecological floodplain will be cut off- reamining segments on LB are primarily already impacted from enrochment of urban/residental/industrial areas. However, approx 24.7 ac of upland will be converted to PEM habitat and a total of 70.2 ac of PEM habitat would exist below the estimated 2-10 year WSE; beyond 10-yr WSE will be channel habitat within widened section
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr							
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr							
												TOTAL SV 4.1	0.70	0.70	0.70	0.70
	Sub-Variable	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				SV Scores	Condition Grade	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50							SV Score	SV Score	SV Score	SV Score	
	SV 4.2 Floodplain Width	development, channelization	increased development	increased development	increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).				0.75	0.7	0.68	0.66	Degradation in FWP from levees permanently removing portions of the BSR from its ecological floodplain. Some areas are already cut off from industrial/residental development and that will continue to perist. Floodplain width will decrease through construciton of levees on both banks and continued pressures of development Reduction in terrestial floodplain from increase in channel habitat during events higher than the 2-10 yr WSE from widened channel
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).								
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).								
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).								
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).								
												TOTAL SV 4.2	0.75	0.70	0.68	0.66
	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 4.3 Saturation Duration	Development				1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.75	0.72	0.72	0.72	Degradation in FWP, saturation duration will decrease spatially though not temporally
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.75**	**0.72**	**0.72**	**0.72**	
								TOTAL V4	**0.72**	**0.70**	**0.69**	**0.68**	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation				1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.59	0.45	0.4	0.4	Degradation from loss of woody vegetation from construction of levees and permanent exclusion of regeneration on or within 15 ft of the toe
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.59**	**0.45**	**0.40**	**0.40**	

	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.2 Herbaceous Vegetation Structure	The reach has urbanziation, trails, mowing, but also has maintained a decent vegetated riparian corridor in City parks/parcels.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.72	0.8	0.82	0.84	Improvement with NBS herbaceous plantings on levee ROW; native plantings w/in widened channel bench (PEM habitat)
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.72**	**0.80**	**0.82**	**0.84**	

	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.3 Species Diversity	RCG, leafy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.69	0.77	0.8	0.82	Improvement with NBS herbaceous levee plantings; PEM plantings in widened channel
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.69**	**0.77**	**0.80**	**0.82**	
								TOTAL V5	**0.63**	**0.56**	**0.54**	**0.54**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.74	0.7	0.68	Degradation due to construction of levees which will require tree removal and inhibit recruitment
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.74**	**0.70**	**0.68**	

	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 6.2 Detritus					1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.8	0.75	0.7	0.7	Degradation from loss of ecological floodplain in segments of Reach 2 as compared to FWOP- detritus supply will decrease from lack of veg inputs
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.80**	**0.75**	**0.70**	**0.70**	
								TOTAL V6	**0.81**	**0.74**	**0.70**	**0.69**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines					Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B						
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--						
						0.79 - 0.70	C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--						
						0.69 - 0.60	D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)						
						0.00 - 0.59	F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)						
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines					Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2					
								Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)					
	SV 7.2	unconfined, slight meander, straightened, so low K.				1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70	C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60	D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59	F - Non-functioning	Straight	Straight	Straight	--	--					
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines					Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All					
								Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F						
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.8	0.8	0.75	0.75	No change from FWOP
						0.89 - 0.80	B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60	D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59	F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
												TOTAL SV 7.3	**0.80**	**0.80**	**0.75**	**0.75**	

	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
		channelization, grade control	increased channelization	increased channelization	increased channelization	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					

	SV 7.4	channelization, grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.	0.74	0.72	0.7	0.68	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure					1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.73	0.71	0.7	Channel widening would result in change in velocity and depth distribution, low flow channel will help abate some of the negative effects for aquatic life
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.73**	**0.71**	**0.70**	
	Sub-Variable	Looks specifically at coarse -scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP (NO Riffle Pool structures and other aquatic features to be implemented due to channel velocities and interference with flood conveyance)
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially reverted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	Looks specifically at fine -scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V9	**0.71**	**0.69**	**0.67**	**0.66**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 2 with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.					
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	It is anticipated that the FWP would remain consistent in Reach 2 with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.					
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.75	0.73	0.71	minor degradation from widening- assume that a low flow channel will help offset impact to a degree
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
									TOTAL SV 10.1	**0.80**	**0.75**	**0.73**	**0.71**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.64	0.62	0.6	No change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
									TOTAL SV 10.1	**0.72**	**0.64**	**0.62**	**0.60**	
									TOTAL V10	**0.69**	**0.65**	**0.64**	**0.63**	
									Hydraulic Functional Condition Score	**0.73**	**0.70**	**0.68**	**0.67**	
									Geomorphic Functional Condition Score	**0.74**	**0.71**	**0.69**	**0.67**	
									Physicochemical Functional Condition Score	**0.74**	**0.70**	**0.69**	**0.68**	
									Biotic Functional Condition Score	**0.73**	**0.69**	**0.67**	**0.66**	

								Overall Functional Capacity Index Score	**0.73**	**0.70**	**0.68**	**0.67**	
A+286:341A / Tract #:	**3**												
Variable	**Sub-Variable**	**Total annual volume of water delivered from contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
	SV 1.1	Lake Kampeska gate, small	increased development	climate change-increased	**increased development,**	0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.	0.8	0.75	0.7	0.7	an anticpated increase in surface runoff from increase in freq/severity of precip events from climate change
	Total	impoundment diversions (lions		freq/severity of events,	**climate change**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
	Volume	park)		increased annual precip		0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.75**	**0.70**	**0.70**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
	SV 1.2	**Lake Kampeska gates,**	**climate change-increased**	**climate change-increased**	**increased development and**	0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from increase in surface runoff from increase in freq/severity of precip events
	Peak	**urbanized landscapes**	**freq/severity of events,**	**freq/severity of events,**	**climate change will lead to**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					from climate change, overall no net change from existing conditions. Hydrograph is still distrupted between
	Flows		**increased annual precip**	**increased annual precip**	**more impact to natural**	0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					15-30%.
					patterns			**TOTAL SV 1.2**	**0.70**	**0.68**	**0.66**	**0.64**	
Watershed	**Sub-Variable**	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
V1						1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
Flow	**SV 1.3**	**base flows adequate**	**climate change- drought or**	**climate change- drought or**	**climate change- drought or**	0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeitions
	Base		**floods- increased**	**floods- increased**	**floods- increased**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					possible due to increased development and demand- overall balance
Regime	**Flows**		**frequency/severity of precip**	**frequency/severity of precip**	**frequency/severity of precip**	0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
	SV 1.4	**flooding in aerial maps shows**	**climate change- drought or**	**climate change- drought or**	**climate change- drought or**	0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.	0.85	0.84	0.83	0.82	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP
	Flow	**variability**	**floods, increase in variability**	**floods, increase in variability**	**floods, increase in variability**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
	Variability					0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.84**	**0.83**	**0.82**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
	SV 2.1	suburban setting, most road	Increase in urbanization, climate	Increase in urbanization, climate	**Increase in urbanization,**	0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
	Land	paved, moderate cultivation in	change adding higher frequency	change adding higher frequency	**climate change adding higher**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
	Erosion	the north of watershed.	of large runoff	of large runoff	**frequency of large runoff**	0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
Watershed	**SV 2.2**	**few signs of channel erosion**	**climate change, more frequent**	**climate change, more frequent**	**climate change, more frequent**	0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.	0.84	0.82	0.8	0.78	Impacts from climate change would remain consistent in FWP
	Channel		**floods could destabilize banks**	**floods could destabilize banks**	**floods could destabilize banks.**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
V2	**Erosion**					0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.82**	**0.80**	**0.78**	
Sediment	**Sub-Variable**	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Regime						1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
	SV 2.3	**a few dams and weirs, but**	**more incumbrances in the**	**more incumbrances in the**	**more incumbrances in the**	0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.	0.86	0.86	0.86	0.86	Anticipated to not progressively worsen but stay the same across the 50 year period as a result of channel
	Transport	**most not impacting transport**	**future as channel destabilizes**	**future as channel destabilizes**	**future as channel destabilizes**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					widening improving transport to and through reach- wetlands constructed on benches will assist with
			due to climate change	**due to climate change**	**due to climate change**	0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					transport/deposition- channel bench only present w/in portion of the Reach 3 segment
								TOTAL SV 2.3	**0.86**	**0.86**	**0.86**	**0.86**	
								TOTAL V2	**0.80**	**0.79**	**0.77**	**0.75**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.1	some lack of shading, little	temps increase due to climate	temps increase due to climate	**temps increase due to climate**	0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns,
	Temperature	irrigation, some reservoir impact	change	change	**change**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					loss of groundwater exchange, increased temps from climate change)
	Regime					0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
Watershed	**SV 3.2**	**little agricultural runoff, but**	**ag could increase, and**	**ag could increase, and**	**ag could increase, and**	0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.76	0.76	Constructed wetlands along benches will improve sediment trapping Years 10-50
	Organics	**additions from the reservoir**	**dependence on the reservoir**	**dependence on the reservoir**	**dependence on the reservoir**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
V3	**Nutrients**		**increase**	**increase**	**increase**	0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.76**	**0.76**	
Water	**Sub-Variable**	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Quality						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.3	**minimal ag influence, largely**	**increase in urbanization and**	**increase in urbanization and**	**increase in urbanization and**	0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.76	0.76	Constructed wetlands along benches will improve sediment filtering Years 10-50
	Inorganics	**groundwater fed (high pH)**	**runoff chemicals, climate**	**runoff chemicals, climate**	**runoff chemicals, climate**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
	Toxins		**change influence**	**change influence**	**change influence**	0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.76**	**0.76**	
								TOTAL V3	**0.80**	**0.77**	**0.77**	**0.76**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score	
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading					
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr					No anticipated changes from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr					
Riparian	**SV 4.1**	development isolation from	continued development,	continued development,	continued development,	0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.78	0.76	
	Saturation	flood plain,	increased isolation from flood	increased isolation from flood	increased isolation from flood	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr					
V4	**Frequency**		**plain,**	**plain,**	**plain,**	0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr					
								TOTAL SV 4.1					
Floodplain											**0.80**	**0.78**	**0.78**	**0.76**	
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
Connectivity		**Year 0**	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
	SV 4.2	**development, channelization**	**increased development**	**increased development**	**increased development**	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75	No anticipated changes from FWOP
	Floodplain					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
	Width					0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
	SV 4.3	**moderate wetlands along**	**increased channelization,**	**increased channelization,**	**increased channelization,**	0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP
	Saturation	**floodplain**	**entrench and development**	**entrench and development**	**entrench and development**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
	Duration												

					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.80**	**0.79**	**0.76**
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian VS Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 5.2 Herbaceous Vegetation Structure	**The reach has urbanstiation, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 5.3 Species Diversity	**RCG, leafy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighlty altered. Non-native species or bare ground make up less than 20% of cover.				
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.				
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.				
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.				
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**
Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85
						0.89 - 0.80	Negligible Impact B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70	Mod Impact C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.				
						0.69 - 0.60	Significant Impact D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	Severe Impact F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
							Profound Impact									
								TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	
								Anastomosed	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**	SV Score	SV Score	SV Score	SV Score
	SV 7.2	unconfined, slight meander, straightened, so low K.				1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85
						0.89 - 0.80	Negligible Impact B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70	Mod Impact C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60	Significant Impact D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59	Severe Impact F - Non-functioning	Straight	Straight	Straight	--	--				
							Profound Impact									
								TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score
								Reference Stream Type: DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75
						0.89 - 0.80	Negligible Impact B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70	Mod Impact C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60	Significant Impact D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59	Severe Impact F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
							Profound Impact									
								TOTAL SV 7.3					**0.85**	**0.80**	**0.75**	**0.75**
	Sub-Variable	**Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 7.4	**channallization, grade control upstream by lake**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.				
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.				
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**
Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50

	no change in FWP
	no change in FWP
	no change in FWP
	FWOP conditions would persist
	FWOP conditions would persist
	FWOP conditions would persist
	Assumes encroachment increases, non-federal project involving unnatural re-routing or stabilization projects- no change
	FWOP conditions would persist

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	FWOP conditions would persist
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	FWOP conditions would persist
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	FWOP conditions would persist
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	
	Sub-Variable	**Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slighlty altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 3 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**	
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
									Geomorphic Functional Condition Score	**0.77**	**0.75**	**0.72**	**0.70**	
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.72**	**0.70**	
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.71**	**0.69**	
									Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.72**	**0.70**	

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.

Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alt 6: Weir Operations + Levee Right/Left Banks 2%	

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be found online at: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) . Information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: Reach 1

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	SV 1.1 Total Volume	Total annual volume of water delivered from contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
		Lake Kampeska gate, small impoundment diversions (Ilons park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.2 Peak Flows	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
		Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.3 Base Flows	Magnitude and duration of base flows, or the "low end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
		base flows adequate	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.4 Flow Variability	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
		flooding in aerial maps shows variability	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
		suburban setting, most road paved, moderate cultivation in the north of watershed- overgrazed slopes contribute to sedimentation and water quality issues	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.2 Channel Erosion	Rate of sediment produced by channel erosion in the contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
		signs of channel erosion	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.3 Transport	Transport of sediment to and through the reach.				1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
		a few dams and weirs, but most not impacting transport	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
		some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.2 Organics Nutrients	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
		agricultural runoff, 303d list	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.3 Inorganics Toxins	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
		ag influence, largely groundwater fed (high pH),	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Riparian	SV 4.1 Saturation Frequency	Access of water to the floodplain and riparian area from the stream channel(s).				1.00 - 0.90	A - Reference Standard, Negligible Impact	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes: Typical BHR < 1.0, Return interval < 1.0 yr	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2; **Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains: Typical BHR 1.0, Return interval 1.0 - 1.5 yr	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2; **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading: Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4: Not Available for A, G, F Stream Types in VC Valleys.					No anticipated changes from FWOP in Reach 1
		channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr		0.8	0.78	0.76	0.74	
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
									TOTAL SV 4.1		**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 4.2	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					No anticipated changes from FWOP in Reach 1

V4 Floodplain Connectivity	Floodplain Width	development, channelization	increased development	increased development	increased development	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75		
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**		
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.						
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.						
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**		
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**		
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	Assumption is that the reference standard condition for this region would primarily not have woody vegetation, prairie stream system though ag activities have likely removed much of the riparian coordior along BSR. No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**		
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**		
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighlty altered. Non-native species or bare ground make up less than 20% of cover.						
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.						
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**		
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**		
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.						
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**		
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.						
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**		
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**		
Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score		
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B						
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--						
						0.79 - 0.70	C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--						
						0.69 - 0.60	D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)						
						0.00 - 0.59	F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)						
								TOTAL SV 7.1					**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score		
								Anastomosed	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**						
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--						
						0.79 - 0.70	C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight						
						0.69 - 0.60	D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--						
						0.00 - 0.59	F - Non-functioning	Straight	Straight	Straight	--	--						
								TOTAL SV 7.2					**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score		
								Reference Stream Type: DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F							
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal						
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)						
						0.69 - 0.60	D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)						
						0.00 - 0.59	F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)						
								TOTAL SV 7.3					**0.85**	**0.8**	**0.75**	**0.75**		

							TOTAL SV 7.3	0.85	0.80	0.75	0.75	
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
							TOTAL SV 7.4		0.74	0.72	0.70	0.68	
							TOTAL V7		0.78	0.76	0.74	0.73	
Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	increased scour with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
							TOTAL SV 8.1		0.70	0.68	0.66	0.64	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
							TOTAL SV 8.2		0.79	0.75	0.73	0.69	
							TOTAL V8		0.72	0.70	0.68	0.65	
Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channnalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
							TOTAL SV 9.1		0.79	0.75	0.73	0.70	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
							TOTAL SV 9.2		0.72	0.75	0.76	0.78	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
							TOTAL SV 9.3		0.68	0.66	0.64	0.62	
							TOTAL V5		0.71	0.69	0.68	0.66	
Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	increase with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
							TOTAL SV 10.1			0.75	0.73	0.71	0.69	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
							TOTAL SV 10.1			0.75	0.75	0.70	0.65	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
							TOTAL SV 10.1			0.65	0.60	0.60	0.60	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	game fish will continue to limit native fish	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
							TOTAL SV 10.1			0.80	0.78	0.76	0.74	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	exotics will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				

TOTAL SV 10.1	0.72	0.70	0.68	0.66
TOTAL V10	0.69	0.66	0.65	0.63
Hydraulic Functional Condition Score	0.76	0.74	0.72	0.70
Geomorphic Functional Condition Score	0.77	0.74	0.72	0.70
Physicochemical Functional Condition Score	0.76	0.73	0.71	0.69
Biotic Functional Condition Score	0.75	0.72	0.70	0.68
Overall Functional Capacity Index Score	0.76	0.74	0.71	0.69

A+286:341A / Tract #: **2- Impacts from levee on both sides and releases from Lake Kampeska - to the 2%**

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	**SV 1.1 Total Volume**	Lake Kampeska gate, small impoundment diversions (Ilons park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
	TOTAL SV 1.1								0.80	0.75	0.70	0.70	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.2 Peak Flows	**Lake Kampeska gates, urbanized landcapes**	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
	TOTAL SV 1.2								0.70	0.68	0.66	0.64	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.3 Base Flows	**drying out does not seem to occur**	**climate change- drought or floods**	**climate change- drought or floods**	**climate change- drought or floods**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
	TOTAL SV 1.3								0.85	0.83	0.81	0.79	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.78	0.76	0.74	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph. Levees on both banks within Reach 2 will further alter the natural hydrograph via cutting off the floodplain, impacting drainage, compacting adjacent soils and necessitating a non-native brome planting along the levee
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
	TOTAL SV 1.4								0.85	0.78	0.76	0.74	
	TOTAL V1								0.75	0.72	0.70	0.68	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V2 Sediment Regime	**SV 2.1 Land Erosion**	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.78	0.76	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5, no anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
	TOTAL SV 2.1								0.82	0.80	0.78	0.76	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.2 Channel Erosion	**few signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.88	0.84	0.82	0.8	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
	TOTAL SV 2.2								0.88	0.84	0.82	0.80	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.3 Transport	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
	TOTAL SV 2.3								0.86	0.86	0.82	0.78	
	TOTAL V2								0.84	0.82	0.79	0.77	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V3 Water Quality	**SV 3.1 Temperature Regime**	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.1								0.83	0.81	0.79	0.77	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.2 Organics Nutrients	**little agricultural runoff, but additions from the reservoir**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.2								0.79	0.76	0.73	0.70	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.3 Inorganics Toxins	**minimal ag influence, largely groundwater fed (high pH)**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.3								0.79	0.76	0.73	0.70	
	TOTAL V3								0.80	0.77	0.74	0.71	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Riparian V4 Floodplain Connectivity	**SV 4.1 Saturation Frequency**	cut off from ecological floodplain due to industrail and residental areas	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	1.00 - 0.90	A - Reference Standard, Negligible Impact	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 — **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes: Typical BHR < 1.0, Return interval < 1.0 yr	**Valley Type: Unconfined (UC) or Partially Confined (PC)** — **Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains: Typical BHR 1.0, Return interval 1.0 - 1.5 yr	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 — **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading: Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4: Not Available for A, G, F Stream Types in VC Valleys.	0.7	0.65	0.65	0.65	Already exsting "berms" - increasing the height for the 2% Levee on both bank isolates floodplain permanently -encroaching that much further on floodplain, effects are substantial but large portions of the reach are already impacted by urbanization activities. From 14th ave to 13th ave and 10th ave to 6th ave on LB, ecological floodplain will be cut off- reamining segments on LB and RB are primarily already impacted from enrochment of urban/residental/industrial areas. Assumed that entrenchment may contine
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr — Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr — Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr — Typical BHR > 1.5, Return interval 5.0 - 10.0 yr					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr — Typical BHR > 1, Return interval of FP saturation > 10.0 yr					
	TOTAL SV 4.1								0.70	0.65	0.65	0.65	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 4.2 Floodplain Width	**development, channelization**	**increased development**	**increased development**	**increased development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	0.75	0.7	0.65	0.65	Degradation in FWP from levees permanently removing portions of the BSR from its ecological floodplain. Some areas are already cut off from industrial/residental development and that will continue to perist. Floodplain width will decrease through construciton of levees on both banks and continued pressures of development
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
	TOTAL SV 4.2								0.75	0.70	0.65	0.65	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
	SV 4.3 Saturation Duration	Development				0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.	0.75	0.73	0.73	0.73	Degradation in FWP, saturation duration will decrease spatially though not temporally
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	0.75	0.73	0.73	0.73	
								TOTAL V4	0.72	0.67	0.66	0.66	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation				0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.	0.59	0.45	0.4	0.4	Degradation from loss of woody vegetation from construction of levees and permanent exclusion of regeneration on or within 15 ft of the toe
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	0.59	0.45	0.40	0.40	
Riparian V5 Riparian Vegetation	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
	SV 5.2 Herbaceous Vegetation Structure	The reach has urbanization, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.				0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.	0.72	0.82	0.84	0.86	Improvement from NBS Plantings
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	0.72	0.82	0.84	0.86	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
	SV 5.3 Species Diversity	RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.	0.69	0.79	0.81	0.83	Improvement from NBS Plantings
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	0.69	0.79	0.81	0.83	
								TOTAL V5	0.63	0.57	0.54	0.55	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
						1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.	0.85	0.7	0.67	0.65	Degradation due to construction of levees which will require tree removal and inhibit recruitment
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	0.85	0.70	0.67	0.65	
Riparian V6 Debris Supply	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
	SV 6.2 Detritus					0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.	0.8	0.75	0.7	0.7	Degradation from loss of ecological floodplain in segments of Reach 2 as compared to FWOP- detritus supply will decrease from lack of veg inputs
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	0.80	0.75	0.70	0.70	
								TOTAL V6	0.81	0.71	0.68	0.66	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
						1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)					
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	0.79 - 0.70	C - Functioning, Most Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning, Severe Impact	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
							Profound Impact	TOTAL SV 7.1					0.85	0.85	0.85	0.85
Stream V7 Morphology	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2				
								Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)				
						1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K				
						0.89 - 0.80	B - Highly Functioning, Most Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	k increases	0.79 - 0.70	C - Functioning, Most Impact	Meander High K	Meander High K	Meander Low K	--	Straight	0.85	0.85	0.85	0.85
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59	F - Non-functioning, Severe Impact	Straight	Straight	Straight	--	--				
							Profound Impact	TOTAL SV 7.2					0.85	0.85	0.85	0.85
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
								Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F					
						1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors				
						0.89 - 0.80	B - Highly Functioning, Most Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	0.79 - 0.70	C - Functioning, Most Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)	0.8	0.8	0.75	0.75
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59	F - Non-functioning, Severe Impact	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
							Profound Impact	TOTAL SV 7.3					0.80	0.80	0.75	0.75
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50											
		channelization, grade control	increased channelization	increased channelization	increased channelization	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.								
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.								

	SV 7.4	channelization, grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.	0.74	0.72	0.7	0.68	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure					1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially reverted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 2 with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.					
								TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroiverts: Significant shift in species composition, increase in tolerant species.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
								TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.7	0.67	0.64	Degradation from habitat alteration
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
								TOTAL SV 10.1	**0.80**	**0.70**	**0.67**	**0.64**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.5 Other Animals	no beavers	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.65	0.6	0.55	Degradation from habitat alteration
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
								TOTAL SV 10.1	**0.72**	**0.65**	**0.60**	**0.55**	
								TOTAL V10	**0.69**	**0.64**	**0.63**	**0.59**	
								Hydraulic Functional Condition Score	**0.73**	**0.70**	**0.68**	**0.67**	
								Geomorphic Functional Condition Score	**0.74**	**0.70**	**0.68**	**0.67**	
								Physicochemical Functional Condition Score	**0.74**	**0.70**	**0.68**	**0.66**	
								Biotic Functional Condition Score	**0.73**	**0.69**	**0.67**	**0.65**	

							Overall Functional Capacity Index Score	**0.73**	**0.70**	**0.68**	**0.66**	
A+286:341A / Tract #:	**3**											
Variable	**Sub-Variable**	**Total annual volume of water delivered from contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
	SV 1.1	Lake Kampeska gate, small		climate change-increased	**increased development,**	0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
	Total	impoundment diversions (lions	increased development	freq/severity of events,	**climate change**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
	Volume	park)		increased annual precip		0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
	SV 1.2	**Lake Kampeska gates,**	**climate change-increased**	**climate change-increased**	**increased development and**	0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by 10-20%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
	Peak	**urbanized landscapes**	**freq/severity of events,**	**freq/severity of events,**	**climate change will lead to**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
	Flows		**increased annual precip**	**increased annual precip**	**more impact to natural patterns**	0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
Watershed								**TOTAL SV 1.2**	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
V1		**Year 0**	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
Flow						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
	SV 1.3	**drying out does not seem to**	**climate change- drought or**	**climate change- drought or**	**climate change- drought or**	0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeitions possible due to increased development and demand- overall balance
Regime	**Base**	**occur**	**floods**	**floods**	**floods**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
	Flows					0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
	SV 1.4	**flooding in aerial maps shows**	**climate change- drought or**	**climate change- drought or**	**climate change- drought or**	0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
	Flow	**variability**	**floods, increase in variability**	**floods, increase in variability**	**floods, increase in variability**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
	Variability					0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
	SV 2.1	suburban setting, most road	Increase in urbanization, climate	Increase in urbanization, climate	**Increase in urbanization,**	0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
	Land	paved, moderate cultivation in	change adding higher frequency	change adding higher frequency	**climate change adding higher**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
	Erosion	the north of watershed.	of large runoff	of large runoff	**frequency of large runoff**	0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
	SV 2.2	**few signs of channel erosion**	**climate change, more frequent**	**climate change, more frequent**	**climate change, more frequent**	0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
	Channel		**floods could destabilize banks**	**floods could destabilize banks**	**floods could destabilize banks.**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
	Erosion					0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
	SV 2.3	**a few dams and weirs, but**	**more incumbrances in the**	**more incumbrances in the**	**more incumbrances in the**	0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
	Transport	**most not impacting transport**	**future as channel destabilizes due to climate change**	**future as channel destabilizes due to climate change**	**future as channel destabilizes due to climate change**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.1	some lack of shading, little	temps increase due to climate	temps increase due to climate	**temps increase due to climate**	0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
	Temperature	irrigation, some reservoir impact	change	change	**change**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
	Regime					0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.2	**little agricultural runoff, but**	**ag could increase, and**	**ag could increase, and**	**ag could increase, and**	0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
Watershed	**Organics**	**additions from the reservoir**	**dependence on the reservoir increase**	**dependence on the reservoir increase**	**dependence on the reservoir increase**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
	Nutrients					0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
V3								**TOTAL SV 3.2**	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
Water		**Year 0**	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.3	**minimal ag influence, largely**	**increase in urbanization and**	**increase in urbanization and**	**increase in urbanization and**	0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
Quality	**Inorganics**	**groundwater fed (high pH)**	**runoff chemicals, climate**	**runoff chemicals, climate**	**runoff chemicals, climate**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
	Toxins		**change influence**	**change influence**	**change influence**	0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score	
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = +1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading					No anticipated changes from FWOP in Reach
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr						
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
	SV 4.1	channelized, mod entrenched,	continued entrenchment,	continued entrenchment,	**continued entrenchment,**	0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74	
	Saturation		increased isolation from flood	increased isolation from flood	**increased isolation from flood**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
	Frequency		plain.	plain.	**plain.**	0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
								TOTAL SV 4.1							
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
	SV 4.2	**development, channelization**	**increased development**	**increased development**	**increased development**	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75	No anticipated changes from FWOP in Reach
Riparian	**Floodplain**					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
	Width					0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
V4								**TOTAL SV 4.2**	**0.85**	**0.85**	**0.80**	**0.75**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
Floodplain		**Year 0**	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
	SV 4.3	**moderate wetlands along**	**increased channelization,**	**increased channelization,**	**increased channelization,**	0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.	0.85	0.83	0.8	0.78	no change
Connectivity	**Saturation**	**floodplain**	**entrench and development**	**entrench and development**	**entrench and development**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
	Duration												

					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian VS Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**	
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	**The reach has urbanstiation, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	Improvement with NBS/riparian plantings for levee
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	Improvement with NBS/riparian plantings for levee
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighlty altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**	
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**	
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score	
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85	
						0.89 - 0.80	Negligible Impact B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--						
						0.79 - 0.70	Mild Impact C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.					
						0.69 - 0.60	Significant Impact D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)						
						0.00 - 0.59	Severe Impact F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)						
							Profound Impact										
													TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score	
								Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)					
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	
						0.89 - 0.80	Mild Impact B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70	Mild Impact C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60	Significant Impact D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59	Severe Impact F - Non-functioning	Straight	Straight	Straight	--	--					
							Profound Impact										
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2		Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All	SV Score	SV Score	SV Score	SV Score	
								Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F						
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	
						0.89 - 0.80	Mild Impact B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70	Mild Impact C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60	Significant Impact D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59	Severe Impact F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
							Profound Impact										
												TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	

	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	**channalization, grade control upstream by lake**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
												TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
												TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.75**	**0.73**	**0.70**	
	Sub-Variable	**Looks specifically at coarse -scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**	
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
									Geomorphic Functional Condition Score	**0.77**	**0.74**	**0.72**	**0.70**	
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.71**	**0.69**	
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.70**	**0.68**	
									Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.71**	**0.69**	

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.

Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alt 7: Weir Operations + Left Bank Levee	

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be found online at: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) . Information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: Reach 1

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	SV 1.1 Total Volume	Total annual volume of water delivered from contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
		Lake Kampeska gate, small impoundment diversions (Ilons park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.2 Peak Flows	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
		Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.3 Base Flows	Magnitude and duration of base flows, or the "low end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
		base flows adequate	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.4 Flow Variability	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
		flooding in aerial maps shows variability	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
		suburban setting, most road paved, moderate cultivation in the north of watershed- overgrazed slopes contribute to sedimentation and water quality issues	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.2 Channel Erosion	Rate of sediment produced by channel erosion in the contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
		signs of channel erosion	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.3 Transport	Transport of sediment to and through the reach.				1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
		a few dams and weirs, but most not impacting transport	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
		some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.2 Organics Nutrients	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
		agricultural runoff, 303d list	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.3 Inorganics Toxins	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
		ag influence, largely groundwater fed (high pH),	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines: Valley Type: Unconfined (UC) or Partially Confined (PC) — Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Scoring Guidelines: Valley Type: Confined (CC) — Valley bottom width to bankfull stream width 1.4 to 2.2	Scoring Guidelines: Very Confined (VC) — Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Access of water to the floodplain and riparian area from the stream channel(s).						**Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading						
Riparian	SV 4.1 Saturation Frequency	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr		Not Available for A, G, F Stream Types in VC Valleys.					No anticipated changes from FWOP in Reach 1
		channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr			0.8	0.78	0.76	0.74	
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr							
								TOTAL SV 4.1				**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**				**Year 0 SV Score**	**Year 10 SV Score**	**Year 25 SV Score**	**Year 50 SV Score**	
	SV 4.2	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).								No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).								

V4 Floodplain Connectivity	Floodplain Width	development, channelization	increased development	increased development	increased development	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75		
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**		
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.						
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.						
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**		
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**		
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	Assumption is that the reference standard condition for this region would primarily not have woody vegetation, prairie stream system though ag activities have likely removed much of the riparian coordior along BSR. No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**		
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**		
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.3 Species Diversity	**RCG, leafy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighlty altered. Non-native species or bare ground make up less than 20% of cover.						
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.						
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**		
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**		
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.						
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**		
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.						
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**		
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**		
Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score		
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B						
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	--						
						0.79 - 0.70	C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	--						
						0.69 - 0.60	D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
								TOTAL SV 7.1			**0.85**	**0.85**	**0.85**	**0.85**	
	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**			Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score	
								Anastomosed	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**			
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	
						0.89 - 0.80	B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70	C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60	D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59	F - Non-functioning	Straight	Straight	Straight	--	--					
								TOTAL SV 7.2			**0.85**	**0.85**	**0.85**	**0.85**	
	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**			Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score	
								Reference Stream Type: DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	
						0.89 - 0.80	B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60	D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59	F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					

								TOTAL SV 7.3	0.85	0.80	0.75	0.75	
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	0.74	0.72	0.70	0.68	
								TOTAL V7	0.78	0.76	0.74	0.73	
Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	increased scour with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	0.70	0.68	0.66	0.64	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	0.79	0.75	0.73	0.69	
								TOTAL V8	0.72	0.70	0.68	0.65	
Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	0.79	0.75	0.73	0.70	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	0.72	0.75	0.76	0.78	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	0.68	0.66	0.64	0.62	
								TOTAL V9	0.71	0.69	0.68	0.66	
Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	increase with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
								TOTAL SV 10.1		0.75	0.73	0.71	0.69	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
								TOTAL SV 10.1		0.75	0.75	0.70	0.65	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
								TOTAL SV 10.1		0.65	0.60	0.60	0.60	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	game fish will continue to limit native fish	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
								TOTAL SV 10.1		0.80	0.78	0.76	0.74	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	exotics will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				

							TOTAL SV 10.1	0.72	0.70	0.68	0.66	
							TOTAL V10	0.69	0.66	0.65	0.63	
							Hydraulic Functional Condition Score	0.76	0.74	0.72	0.70	
							Geomorphic Functional Condition Score	0.77	0.74	0.72	0.70	
							Physicochemical Functional Condition Score	0.76	0.73	0.71	0.69	
							Biotic Functional Condition Score	0.75	0.72	0.70	0.68	
							Overall Functional Capacity Index Score	0.76	0.74	0.71	0.69	

A+286:341A / Tract #:	2- Impacts from levee on both sides and releases from Lake Kampeska - to the 2%											
Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.				
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.				
								TOTAL SV 1.1	0.80	0.75	0.70	0.70
	Sub-Variable	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.				
								TOTAL SV 1.2	0.70	0.68	0.66	0.64
	Sub-Variable	Magnitude and duration of base flows, or the "low end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 1.3 Base Flows	base flows adequate	climate change- drought or floods- increased frequency/severity of precip	climate change- drought or floods- increased frequency/severity of precip	climate change- drought or floods- increased frequency/severity of precip	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.				
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.				
								TOTAL SV 1.3	0.85	0.83	0.81	0.79
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.78	0.76	0.74	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph. Levees on both banks within Reach 2 will further alter the natural hydrograph via cutting off the floodplain, impacting drainage, compacting adjacent soils and necessitating a non-native brome planting along the levee
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.				
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.				
								TOTAL SV 1.4	0.85	0.78	0.76	0.74
								TOTAL V1	0.75	0.72	0.70	0.68
Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.78	0.76	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5, no anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.				
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.				
								TOTAL SV 2.1	0.82	0.80	0.78	0.76
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 2.2 Channel Erosion	few signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.88	0.84	0.82	0.8	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.				
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.				
								TOTAL SV 2.2	0.88	0.84	0.82	0.80
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.				
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.				
								TOTAL SV 2.3	0.86	0.86	0.82	0.78
								TOTAL V2	0.84	0.82	0.79	0.77
Variable	Sub-Variable	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	temps increase due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.1	0.83	0.81	0.79	0.77
	Sub-Variable	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 3.2 Organics Nutrients	little agricultural runoff, but additions from the reservoir	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.2	0.79	0.76	0.73	0.70
	Sub-Variable	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 3.3 Inorganics Toxins	minimal ag influence, largely groundwater fed (high pH)	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.3	0.79	0.76	0.73	0.70
								TOTAL V3	0.80	0.77	0.74	0.71
Variable	Sub-Variable	Access of water to the floodplain and riparian area from the stream channel(s).				SV Scores	Condition Grade	Scoring Guidelines			Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	Reference Stream Type Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	Reference Stream Type Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	cut off from ecological floodplain due to industrail and residental areas	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr		Not Available for A, G, F Stream Types in VC Valleys.	0.7	0.68	0.68	0.68	Already exsting "berms" - increasing the height for the 2% Levee on both bank isolates floodplain permanently -encroaching that much further on floodplain, effects are substantial but large portions of the reach are already impacted by urbanization activities. From 14th ave to 13th ave and 10th ave to 6th ave on LB, ecological floodplain will be cut off- reamining segments on LB are primarily already impacted from enrochment of urban/residental/industrial areas. Assumed that entrenchment may contine
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
								TOTAL SV 4.1				0.70	0.68	0.68	0.68
	Sub-Variable	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				SV Scores	Condition Grade	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50							SV Score	SV Score	SV Score	SV Score
	SV 4.2 Floodplain Width	development, channelization	increased development	increased development	increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).				0.75	0.72	0.68	0.68	Degradation in FWP from levees permanently removing portions of the BSR from its ecological floodplain. Some areas are already cut off from industrial/residental development and that will continue to perist. Floodplain width will decrease through construciton of levees on both banks and continued pressures of development
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).							
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).							
								TOTAL SV 4.2				0.75	0.72	0.68	0.68
	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50

Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
SV 4.3 Saturation Duration	Development				1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.75	0.74	0.74	0.74	Degradation in FWP, saturation duration will decrease spatially though not temporally
					0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
					0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
							TOTAL SV 4.3	**0.75**	**0.74**	**0.74**	**0.74**	
							TOTAL V4	**0.72**	**0.70**	**0.69**	**0.69**	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation				1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.59	0.45	0.4	0.4	Degradation from loss of woody vegetation from construction of levees and permanent exclusion of regeneration on or within 15 ft of the toe
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.59**	**0.45**	**0.40**	**0.40**	
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.2 Herbaceous Vegetation Structure	The reach has urbanziation, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.72	0.8	0.82	0.84	Improvement with NBS Riparian Plantings
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.72**	**0.80**	**0.82**	**0.84**	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.3 Species Diversity	RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.69	0.77	0.8	0.82	Improvement with NBS Riparian Plantings
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.69**	**0.77**	**0.80**	**0.82**	
								TOTAL V5	**0.63**	**0.56**	**0.54**	**0.54**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.74	0.7	0.68	Degradation due to construction of levees which will require tree removal and inhibit recruitment
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.74**	**0.70**	**0.68**	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 6.2 Detritus					1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.8	0.75	0.7	0.7	Degradation from loss of ecological floodplain in segments of Reach 2 as compared to FWOP- detritus supply will decrease from lack of veg inputs
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.80**	**0.75**	**0.70**	**0.70**	
								TOTAL V6	**0.81**	**0.74**	**0.70**	**0.69**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70	C - Functioning, Most Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning Severe Impact, Profound Impact	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2				
								Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)				
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	k increases	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Most Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70	C - Functioning, Most Impact	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59	F - Non-functioning Severe Impact, Profound Impact	Straight	Straight	Straight	--	--				
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
								Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.8	0.8	0.75	0.75	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70	C - Functioning, Most Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59	F - Non-functioning Severe Impact, Profound Impact	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
												TOTAL SV 7.3	**0.80**	**0.80**	**0.75**	**0.75**
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50											
		channelization, grade control	increased channelization	increased channelization	increased channelization	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.								No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.								

	SV 7.4	channelization, grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.	0.74	0.72	0.7	0.68	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure					1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 2 with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.					
								TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
								TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
								TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.64	0.62	0.6	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
								TOTAL SV 10.1	**0.72**	**0.64**	**0.62**	**0.60**	
								TOTAL V10	**0.69**	**0.65**	**0.64**	**0.63**	
								Hydraulic Functional Condition Score	**0.73**	**0.70**	**0.69**	**0.68**	
								Geomorphic Functional Condition Score	**0.74**	**0.71**	**0.69**	**0.67**	
								Physicochemical Functional Condition Score	**0.74**	**0.70**	**0.68**	**0.67**	
								Biotic Functional Condition Score	**0.73**	**0.69**	**0.67**	**0.66**	

Overall Functional Capacity Index Score				0.73	0.70	0.68	0.67	
A+286:341A / Tract #:	3							

Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park)	increased development	climate change-increased freq/severity of events, increased annual precip	increased development, climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	0.80	0.80	0.80	0.80	
	Sub-Variable	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landscapes	climate change-increased freq/severity of events, increased annual precip	climate change-increased freq/severity of events, increased annual precip	increased development and climate change will lead to more impact to natural patterns	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	0.70	0.68	0.66	0.64	
	Sub-Variable	Magnitude and duration of base flows, or the "low end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	base flows adequate	climate change- drought or floods- increased frequency/severity of precip	climate change- drought or floods- increased frequency/severity of precip	climate change- drought or floods- increased frequency/severity of precip	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeitions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	0.85	0.83	0.81	0.79	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	0.85	0.78	0.76	0.76	
								TOTAL V1	0.75	0.73	0.71	0.69	

Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	0.78	0.76	0.74	0.72	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	few signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	0.84	0.80	0.78	0.76	
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	0.86	0.86	0.82	0.78	
								TOTAL V2	0.80	0.78	0.76	0.74	

Variable	Sub-Variable	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	temps increase due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	0.83	0.81	0.79	0.77	
	Sub-Variable	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 3.2 Organics Nutrients	little agricultural runoff, but additions from the reservoir	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	0.79	0.76	0.73	0.70	
	Sub-Variable	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	minimal ag influence, largely groundwater fed (high pH)	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	0.79	0.76	0.73	0.70	
								TOTAL V3	0.80	0.77	0.74	0.71	

Variable	Sub-Variable	Access of water to the floodplain and riparian area from the stream channel(s).				SV Scores	Condition Grade	Scoring Guidelines			Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score	
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	Reference Stream Type Stream Evolution Model Stage = +1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	Reference Stream Type Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading					
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74	No anticipated changes from FWOP in Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
									TOTAL SV 4.1		0.80	0.78	0.76	0.74	
	Sub-Variable	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				SV Scores	Condition Grade	Scoring Guidelines			Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50						SV Score	SV Score	SV Score	SV Score	
	SV 4.2 Floodplain Width	development, channelization	increased development	increased development	increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).			0.85	0.85	0.8	0.75	No anticipated changes from FWOP in Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).							
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).							
								TOTAL SV 4.2			0.85	0.85	0.80	0.75	
	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines			Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50						SV Score	SV Score	SV Score	SV Score	
	SV 4.3 Saturation Duration	moderate wetlands along floodplain	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.			0.85	0.83	0.8	0.78	no change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.							
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.							

					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**	

	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	**The reach has urbanization, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**	

	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighhly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**	
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**	

	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**	
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score	
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard No Significant Impact		Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--						
						0.79 - 0.70 C - Functioning Significant Impact		Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)						
						0.00 - 0.59 F - Non-functioning Profound Impact		Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)						
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	SV Score	SV Score	SV Score	SV Score	
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90 A - Reference Standard No Significant Impact		Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70 C - Functioning Significant Impact		Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59 F - Non-functioning Profound Impact		Straight	Straight	Straight	--	--					
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F		SV Score	SV Score	SV Score	SV Score	
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard No Significant Impact		No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70 C - Functioning Significant Impact		Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59 F - Non-functioning Profound Impact		Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
												TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	

	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	**channallization, grade control upstream by lake**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
									TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
									TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.75**	**0.73**	**0.70**	
	Sub-Variable	**Looks specifically at coarse -scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine -scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slighlty altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**	
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
									Geomorphic Functional Condition Score	**0.77**	**0.74**	**0.72**	**0.70**	
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.71**	**0.69**	
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.70**	**0.68**	
									Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.71**	**0.69**	

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.
Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alt B: Weir Operations + Levee Left Bank + Channel Widening	

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be found online at: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) . Information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: Reach 1

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	SV 1.1 Total Volume	Total annual volume of water delivered from contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
		Lake Kampeska gate, small impoundment diversions (Ilons park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	SV 1.2 Peak Flows	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
		Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	SV 1.3 Base Flows	Magnitude and duration of base flows, or the "low end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
		base flows adequate	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	SV 1.4 Flow Variability	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
		flooding in aerial maps shows variability	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
		suburban setting, most road paved, moderate cultivation in the north of watershed- overgrazed slopes contribute to sedimentation and water quality issues	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	SV 2.2 Channel Erosion	Rate of sediment produced by channel erosion in the contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
		signs of channel erosion	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	SV 2.3 Transport	Transport of sediment to and through the reach.				1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
		a few dams and weirs, but most not impacting transport	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	Ablotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
		some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	SV 3.2 Organics Nutrients	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
		agricultural runoff, 303d list	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	SV 3.3 Inorganics Toxins	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
		ag influence, largely groundwater fed (high pH),	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines: Valley Type: Unconfined (UC) or Partially Confined (PC) — Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) — Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) — Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Riparian	SV 4.1 Saturation Frequency	Access of water to the floodplain and riparian area from the stream channel(s).				1.00 - 0.90	A - Reference Standard, Negligible Impact	**Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	Not Available for A, G, F Stream Types in VC Valleys.					No anticipated changes from FWOP in Reach 1
		Year 0	**Year 10**	**Year 25**	**Year 50**											
		channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr							
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr			0.8	0.78	0.76	0.74	
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr							
												TOTAL SV 4.1	**0.80**	**0.78**	**0.76**	**0.74**	
	SV 4.2	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).								
		Year 0	**Year 10**	**Year 25**	**Year 50**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).								No anticipated changes from FWOP in Reach 1

V4 Floodplain Connectivity	Floodplain Width	development, channelization	increased development	increased development	increased development	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75		
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**		
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.						
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.						
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**		
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**		
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	Assumption is that the reference standard condition for this region would primarily not have woody vegetation, prairie stream system though ag activities have likely removed much of the riparian coordior along BSR. No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**		
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**		
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.						
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.						
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**		
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**		
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.						
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**		
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.						
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**		
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**		

Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type** Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score		
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--							
						0.79 - 0.70	C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--							
						0.69 - 0.60	D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)							
						0.00 - 0.59	F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)							
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Anastomosed**	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**						
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--						
						0.79 - 0.70	C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight						
						0.69 - 0.60	D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--						
						0.00 - 0.59	F - Non-functioning	Straight	Straight	Straight	--	--						
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type:** DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F							
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal						
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)						
						0.69 - 0.60	D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)						
						0.00 - 0.59	F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)						

							TOTAL SV 7.3	0.85	0.80	0.75	0.75	
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
							TOTAL SV 7.4		0.74	0.72	0.70	0.68	
							TOTAL V7		0.78	0.76	0.74	0.73	
Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	increased scour with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
							TOTAL SV 8.1		0.70	0.68	0.66	0.64	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
							TOTAL SV 8.2		0.79	0.75	0.73	0.69	
							TOTAL V8		0.72	0.70	0.68	0.65	
Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
							TOTAL SV 9.1		0.79	0.75	0.73	0.70	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
							TOTAL SV 9.2		0.72	0.75	0.76	0.78	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
							TOTAL SV 9.3		0.68	0.66	0.64	0.62	
							TOTAL V9		0.72	0.70	0.68	0.65	
Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	increase with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
							TOTAL SV 10.1			0.75	0.73	0.71	0.69	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
							TOTAL SV 10.1			0.75	0.75	0.70	0.65	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
							TOTAL SV 10.1			0.65	0.60	0.60	0.60	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	game fish will continue to limit native fish	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
							TOTAL SV 10.1			0.80	0.78	0.76	0.74	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	exotics will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				

TOTAL SV 10.1	0.72	0.70	0.68	0.66
TOTAL V10	0.69	0.66	0.65	0.63
Hydraulic Functional Condition Score	0.76	0.74	0.72	0.70
Geomorphic Functional Condition Score	0.77	0.74	0.72	0.70
Physicochemical Functional Condition Score	0.76	0.73	0.71	0.69
Biotic Functional Condition Score	0.75	0.72	0.70	0.68
Overall Functional Capacity Index Score	0.76	0.74	0.71	0.69

A+286:341A / Tract #: 2

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Total annual volume of water delivered from contributing watershed.											
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.75**	**0.70**	**0.70**	
		Magnitude and duration of peak flows, or the "high end" of the hydrograph.											
	SV 1.2 Peak Flows	**Lake Kampeska gates, urbanized landscapes**	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
		Magnitude and duration of base flows, or the "low end" of the hydrograph.											
	SV 1.3 Base Flows	**base flows adequate**	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	**climate change- drought or floods- increased frequency/severity of precip**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.78	0.76	0.74	Base flows will remain consistent with seasonal expectations, but of greater severity for low flows (channel width increases and during normal summer-fall flows thereby decreasing the depths- a low flow channel will help retain a semblance of existing condition in a portion of the channel profile)
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.78**	**0.76**	**0.74**	
		Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.											
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.75	0.73	0.7	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph. Levees on both banks within Reach 2 will further alter the natural hydrograph via cutting off the floodplain, impacting drainage, compacting adjacent soils and necessitating a non-native brome planting along the levee.
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.75**	**0.73**	**0.70**	Additionally, flow variability will remain consistent with seasonal expectations, but of greater severity for low flows (channel width increases and during normal summer-fall flows thereby decreasing the depths- a low flow channel will help retain a semblance of existing condition in a portion of the channel profile)
								TOTAL V1	**0.75**	**0.71**	**0.69**	**0.67**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Amount of sediment produced in the watershed via both surface erosion and mass erosion.											
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.78	0.76	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5, no anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.82**	**0.80**	**0.78**	**0.76**	
		Rate of sediment produced by channel erosion in the contributing watershed.											
	SV 2.2 Channel Erosion	**few signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.88	0.82	0.8	0.78	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska and channel widening
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable inised channels or eroding gullies.					
								TOTAL SV 2.2	**0.88**	**0.82**	**0.80**	**0.78**	
		Transport of sediment to and through the reach.											
	SV 2.3 Transport	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.86	0.86	Anticipated to not progressively worsen but stay the same across the 50 year period as a result of channel widening improving transport to and through reach- wetlands constructed on benches will assist with transport/deposition
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.86**	**0.86**	
								TOTAL V2	**0.84**	**0.81**	**0.80**	**0.78**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).											
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.78	0.76	0.76	stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps Minor increases in temperature throughout channel profile during summer-fall from increase in width- low flow channel will assist in abating substantial effects
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.78**	**0.76**	**0.76**	
		The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.											
	SV 3.2 Organics Nutrients	**little agricultural runoff, but additions from the reservoir**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.76	0.76	Constructed wetlands along benches will improve sediment trapping Years 10-50
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.76**	**0.76**	
		Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).											
	SV 3.3 Inorganics Toxins	**minimal ag influence, largely groundwater fed (high pH)**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.76	0.76	Constructed wetlands along benches will improve sediment filtering Years 10-50
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.76**	**0.76**	
								TOTAL V3	**0.80**	**0.76**	**0.76**	**0.76**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Access of water to the floodplain and riparian area from the stream channel(s).						**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 — **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes / **Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 — **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	cut off from ecological floodplain due to industrail and residental areas	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.7	0.7	0.7	0.7	Already exsting "berms" - increasing the height for the 2% Levee on both bank isolates floodplain permanently -encroaching that much further on floodplain, effects are substantial but large portions of the reach are already impacted by urbanization activities. From 14th ave to 13th ave and 10th ave to 6th ave on LB, ecological floodplain will be cut off- reamining segments on LB are primarily already impacted from enrochment of urban/residental/industrial areas. Assumed that entrenchment may contine
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr					
										TOTAL SV 4.1	**0.70**	**0.70**	**0.70**	**0.70**	
		Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.											
	SV 4.2 Floodplain Width	**development, channelization**	**increased development**	**increased development**	**increased development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).			0.75	0.7	0.68	0.66	Degradation in FWP from levees permanently removing portions of the BSR from its ecolgical floodplain. Some areas are already cut off from industrial/residental development and that will continue to perist. Floodplain width will decrease through construction of levees on both banks and continued pressures of development Reduction in floodplain from increase in channel habitat
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).							
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).							
										TOTAL SV 4.2	**0.75**	**0.70**	**0.68**	**0.66**	
		Amount of time that the floodplain area is saturated during the growing season.											

Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
SV 4.3 Saturation Duration	Development				1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.75	0.72	0.72	0.72	Degradation in FWP, saturation duration will decrease spatially though not temporally
					0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
					0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
							TOTAL SV 4.3	**0.75**	**0.72**	**0.72**	**0.72**	
							TOTAL V4	**0.72**	**0.70**	**0.69**	**0.68**	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation				1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.59	0.45	0.4	0.4	Degradation from loss of woody vegeation from construction of levees and permanent exclusion of regeneration on or within 15 ft of the toe as well as increase in channel habitat
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.59**	**0.45**	**0.40**	**0.40**	
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.2 Herbaceous Vegetation Structure	The reach has urbanization, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.72	0.8	0.82	0.84	NBS
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.72**	**0.80**	**0.82**	**0.84**	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.3 Species Diversity	RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.69	0.77	0.8	0.82	NBS
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.69**	**0.77**	**0.80**	**0.82**	
								TOTAL V5	**0.63**	**0.56**	**0.54**	**0.54**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.74	0.7	0.68	Degradation due to construction of levees which will require tree removal and inhibit recruitment
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.74**	**0.70**	**0.68**	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 6.2 Detritus					1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.8	0.75	0.7	0.7	Degradation from loss of ecological floodplain in segments of Reach 2 as compared to FWOP- detritus supply will decrease from lack of veg inputs
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.80**	**0.75**	**0.70**	**0.70**	
								TOTAL V6	**0.81**	**0.74**	**0.70**	**0.69**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70	C - Functioning, Most Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning, Severe Impact	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
							Profound Impact					**TOTAL SV 7.1**	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2					
								Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)				
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	k increases	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Most Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70	C - Functioning, Most Impact	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59	F - Non-functioning, Severe Impact	Straight	Straight	Straight	--	--				
							Profound Impact					**TOTAL SV 7.2**	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
								Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.8	0.8	0.75	0.75	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70	C - Functioning, Most Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59	F - Non-functioning, Severe Impact	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
							Profound Impact					**TOTAL SV 7.3**	**0.80**	**0.80**	**0.75**	**0.75**
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50											
		channelization, grade control	increased channelization	increased channelization	increased channelization	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.								
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.								No change from FWOP

	SV 7.4	channelization, grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.	0.74	0.72	0.7	0.68	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure					1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.73	0.71	0.7	Minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach Channel widening would result in change in velocity and depth distribution, low flow channel will help abate some of the negative effects for aquatic life
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.73**	**0.71**	**0.70**	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.77	0.79	0.8	Minor improvement from FWOP as a result of installation of riffle/pool features and low flow channel
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially reverted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.77**	**0.79**	**0.80**	
	Sub-Variable	Looks specifically at fine -scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 2 with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.					
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.					
								TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
								TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.75	0.73	0.71	minor degradation from widening- assume that a low flow channel will help offset impact to a degree
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
								TOTAL SV 10.1	**0.80**	**0.75**	**0.73**	**0.71**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.64	0.62	0.6	No change in FWP
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
								TOTAL SV 10.1	**0.72**	**0.64**	**0.62**	**0.60**	
								TOTAL V10	**0.69**	**0.65**	**0.64**	**0.63**	
								Hydraulic Functional Condition Score	**0.73**	**0.70**	**0.68**	**0.67**	
								Geomorphic Functional Condition Score	**0.74**	**0.71**	**0.69**	**0.67**	
								Physicochemical Functional Condition Score	**0.74**	**0.70**	**0.69**	**0.68**	
								Biotic Functional Condition Score	**0.73**	**0.69**	**0.67**	**0.66**	

Overall Functional Capacity Index Score	0.73	0.70	0.68	0.67	

A+286:341A / Tract #: 3

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	SV 1.1 Total Volume	Total annual volume of water delivered from contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
		Lake Kampeska gate, small impoundment diversions (lions park)	increased development	climate change-increased freq/severity of events, increased annual precip	increased development, climate change	0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landscapes	climate change-increased freq/severity of events, increased annual precip	climate change-increased freq/severity of events, increased annual precip	increased development and climate change will lead to more impact to natural patterns	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	base flows adequate	climate change- drought or floods- increased frequency/severity of precip	climate change- drought or floods- increased frequency/severity of precip	climate change- drought or floods- increased frequency/severity of precip	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeitions possible due to increased development and demand- overall balance
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	few signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.	0.86	0.86	0.86	0.86	No anticipated changes in FWP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.86**	**0.86**	
								TOTAL V2	**0.80**	**0.78**	**0.77**	**0.75**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	temps increase due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.2 Organics Nutrients	little agricultural runoff, but additions from the reservoir	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.76	0.76	
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.76**	**0.76**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	minimal ag influence, largely groundwater fed (high pH)	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.76	0.76	
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.76**	**0.76**	
								TOTAL V3	**0.80**	**0.77**	**0.77**	**0.76**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 — **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = +1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 — **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score	
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.78	0.76	No anticipated changes from FWOP in Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr				
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr				
										TOTAL SV 4.1	**0.80**	**0.78**	**0.78**	**0.76**	
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.2 Floodplain Width	development, channelization	increased development	increased development	increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.82	0.79	0.73	minor decrease in width from increase in channel width
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
								TOTAL SV 4.2	**0.85**	**0.82**	**0.79**	**0.73**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.3 Saturation Duration	moderate wetlands along floodplain	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.	0.85	0.83	0.8	0.78	no change
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					

					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.80**	**0.79**	**0.74**
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 5.2 Herbaceous Vegetation Structure	**The reach has urbanization, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighlty altered. Non-native species or bare ground make up less than 20% of cover.				
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.				
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.				
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.				
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**

Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Condition Grade**	**Reference Stream Type** Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70 C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.				
						0.69 - 0.60 D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59 F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
											TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**

	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Condition Grade**	**Anastomosed**	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**				
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90 A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70 C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60 D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59 F - Non-functioning	Straight	Straight	Straight	--	--				
											TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**

	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Condition Grade**	**Reference Stream Type:** DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75
						0.89 - 0.80 B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70 C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60 D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59 F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
											TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**

	Sub-Variable	**Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 7.4	**channallization, grade control upstream by lake**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.				
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.				
									TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
									TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**

Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.75**	**0.73**	**0.70**	
	Sub-Variable	**Looks specifically at coarse -scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine -scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slighlty altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	most keystone species and other native wildlife pushed out of basin due to agricultural, commerical activities and residental areas	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**	
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
									Geomorphic Functional Condition Score	**0.77**	**0.74**	**0.72**	**0.70**	
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.72**	**0.70**	
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.71**	**0.69**	
									Overall Functional Capacity Index Score	**0.76**	**0.73**	**0.72**	**0.70**	

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.
Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alt 11b: Weir Operations + Levee Right/Left Banks (One 3ft Closure)	

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be found online at: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) . Information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #:		Reach 1											
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	SV 1.1 Total Volume	Total annual volume of water delivered from contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
		Lake Kampeska gate, small impoundment diversions (Ioms park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.2 Peak Flows	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
		Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.	0.7	0.68	0.66	0.64	
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.3 Base Flows	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
		drying out does not seem to occur	**climate change- drought or floods**	**climate change- drought or floods**	**climate change- drought or floods**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.	0.85	0.83	0.81	0.79	
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.4 Flow Variability	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
		flooding in aerial maps shows variability	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.	0.85	0.78	0.76	0.76	
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					No change from FWOP- land management and contributing stressors would remain consistent in FWP
		suburban setting, most road paved, moderate cultivation in the north of watershed- overgrazed slopes contribute to sedimentation and water quality issues	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.	0.78	0.76	0.74	0.72	
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.2 Channel Erosion	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
		signs of channel erosion	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.	0.84	0.8	0.78	0.76	
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.3 Transport	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					No anticipated changes in FWP
		a few dams and weirs, but most not impacting transport	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.	0.86	0.86	0.82	0.78	
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
		some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.83	0.81	0.79	0.77	
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.2 Organics Nutrients	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
		agricultural runoff, 303d list	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.3 Inorganics Toxins	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
		ag influence, largely groundwater fed (high pH),	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Riparian	SV 4.1 Saturation Frequency	**Year 0**	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 — **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 — **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					No anticipated changes from FWOP in Reach 1
		channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
											TOTAL SV 4.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 4.2	**Year 0**	**Year 10**	**Year 25**	**Year 50**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					

V4 Floodplain Connectivity	Floodplain Width	development, channelization	increased development	increased development	increased development	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75		
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**		
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.						
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.						
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**		
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**		
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	Assumption is that the reference standard condition for this region would primarily not have woody vegetation, prairie stream system though ag activities have likely removed much of the riparian coordior along BSR. No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**		
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**		
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.						
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.						
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**		
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**		
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.						
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**		
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.						
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**		
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**		

Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type** Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score		
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--							
						0.79 - 0.70	C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--							
						0.69 - 0.60	D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)							
						0.00 - 0.59	F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)							
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Anastomosed**	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**						
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--						
						0.79 - 0.70	C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight						
						0.69 - 0.60	D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--						
						0.00 - 0.59	F - Non-functioning	Straight	Straight	Straight	--	--						
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type:** DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F							
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal						
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)						
						0.69 - 0.60	D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)						
						0.00 - 0.59	F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)						

								TOTAL SV 7.3	0.85	0.80	0.75	0.75	
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	0.74	0.72	0.70	0.68	
								TOTAL V7	0.78	0.76	0.74	0.73	
Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	increased scour with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	0.70	0.68	0.66	0.64	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	0.79	0.75	0.73	0.69	
								TOTAL V8	0.72	0.70	0.68	0.65	
Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	0.79	0.75	0.73	0.70	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	0.72	0.75	0.76	0.78	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	0.68	0.66	0.64	0.62	
								TOTAL V9	0.72	0.70	0.68	0.65	
Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	increase with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
								TOTAL SV 10.1		0.75	0.73	0.71	0.69	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
								TOTAL SV 10.1		0.75	0.75	0.70	0.65	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
								TOTAL SV 10.1		0.65	0.60	0.60	0.60	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	game fish will continue to limit native fish	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No Change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
								TOTAL SV 10.1		0.80	0.78	0.76	0.74	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	exotics will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				

							TOTAL SV 10.1	0.72	0.70	0.68	0.66	
							TOTAL V10	0.69	0.66	0.65	0.63	
							Hydraulic Functional Condition Score	0.76	0.74	0.72	0.70	
							Geomorphic Functional Condition Score	0.77	0.74	0.72	0.70	
							Physicochemical Functional Condition Score	0.76	0.73	0.71	0.69	
							Biotic Functional Condition Score	0.75	0.72	0.70	0.68	
							Overall Functional Capacity Index Score	0.76	0.74	0.71	0.69	

A+286:341A / Tract #:		2										
Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50								
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	0.80	0.75	0.70	0.70	
	Sub-Variable	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	0.70	0.68	0.66	0.64	
	Sub-Variable	Magnitude and duration of base flows, or the "low end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.3 Base Flows	drying out does not seem to occur	climate change- drought or floods	climate change- drought or floods	climate change- drought or floods	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	0.85	0.83	0.81	0.79	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.78	0.76	0.74	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph. Levees on both banks within Reach 2 will further alter the natural hydrograph via cutting off the floodplain, impacting drainage, compacting adjacent soils and necessitating a non-native brome planting along the levee
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	0.85	0.78	0.76	0.74	
								TOTAL V1	0.75	0.72	0.70	0.68	
Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.78	0.76	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5, no anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	0.82	0.80	0.78	0.76	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.2 Channel Erosion	few signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.88	0.84	0.82	0.8	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	0.88	0.84	0.82	0.80	
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	0.86	0.86	0.82	0.78	
								TOTAL V2	0.84	0.82	0.79	0.77	
Variable	Sub-Variable	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	temps increase due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	0.83	0.81	0.79	0.77	
	Sub-Variable	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 3.2 Organics Nutrients	little agricultural runoff, but additions from the reservoir	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	0.79	0.76	0.73	0.70	
	Sub-Variable	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 3.3 Inorganics Toxins	minimal ag influence, largely groundwater fed (high pH)	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	0.79	0.76	0.73	0.70	
								TOTAL V3	0.80	0.77	0.74	0.71	
Variable	Sub-Variable	Access of water to the floodplain and riparian area from the stream channel(s).				SV Scores	Condition Grade	Scoring Guidelines			Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2					
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	Reference Stream Type Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	Reference Stream Type Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	cut off from ecological floodplain due to industrail and residental areas	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr		Not Available for A, G, F Stream Types in VC Valleys.	0.7	0.64	0.63	0.63	Already exsting "berms" - increasing the height for the 2% Levee on both bank isolates floodplain permanently -encroaching that much further on floodplain, effects are substantial but large portions of the reach are already impacted by urbanization activities. From 14th ave to 13th ave and 10th ave to 6th ave on LB, ecological floodplain will be cut off- reamining segments on LB and RB are primarily already impacted from enrochment of urban/residental/industrial areas. Assumed that entrenchment may contine
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
								TOTAL SV 4.1				0.70	0.64	0.63	0.63	
	Sub-Variable	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50											
	SV 4.2 Floodplain Width	development, channelization	increased development	increased development	increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).				0.75	0.69	0.63	0.63	Degradation in FWP from levees permanently removing portions of the BSR from its ecological floodplain. Some areas are already cut off from industrial/residental development and that will continue to perist. Floodplain width will decrease through construciton of levees on both banks and continued pressures of development
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).								
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).								
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).								
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).								
								TOTAL SV 4.2				0.75	0.69	0.63	0.63	
	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50	

Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
SV 4.3 Saturation Duration	Development				1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.75	0.7	0.7	0.7	Degradation in FWP, saturation duration will decrease spatially though not temporally
					0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
					0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
							TOTAL SV 4.3	0.75	0.70	0.70	0.70	
							TOTAL V4	0.72	0.66	0.64	0.64	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation				1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.59	0.46	0.41	0.41	Degradation from loss of woody vegetation from construction of levees and permanent exclusion of regeneration on or within 15 ft of the toe
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	0.59	0.46	0.41	0.41	
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.2 Herbaceous Vegetation Structure	The reach has urbanization, trails, mowing, but also has maintained a decent vegetated riparian corridor in City parks/parcels.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.72	0.82	0.84	0.86	Degradation due to construction of levees which will necessitate non native smooth brome. Not only will this impact the levees but the smooth brome will spread to other areas, degrading other portions within the reach that are not necessarily within the levee footprint -existing berms now but not managed as levees
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	0.72	0.82	0.84	0.86	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.3 Species Diversity	RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.69	0.79	0.81	0.83	Degradation as a result of increase in invasive species from climate change, smooth brome, restriction of ecological floodplain
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	0.69	0.79	0.81	0.83	
								TOTAL V5	0.63	0.58	0.55	0.56	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.71	0.68	0.66	Degradation due to construction of levees which will require tree removal and inhibit recruitment
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	0.85	0.71	0.68	0.66	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 6.2 Detritus					1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.8	0.76	0.71	0.7	Degradation from loss of ecological floodplain in segments of Reach 2 as compared to FWOP- detritus supply will decrease from lack of veg inputs
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	0.80	0.76	0.71	0.70	
								TOTAL V6	0.81	0.72	0.69	0.67	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70	C - Functioning, Most Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
												TOTAL SV 7.1	0.85	0.85	0.85	0.85
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2				
								Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)				
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	k increases	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Most Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70	C - Functioning, Most Impact	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Straight	Straight	Straight	--	--				
												TOTAL SV 7.2	0.85	0.85	0.85	0.85
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
								Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.8	0.8	0.75	0.75	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Most Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
												TOTAL SV 7.3	0.80	0.80	0.75	0.75
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50											
		channelization, grade control	increased channelization	increased channelization	increased channelization	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.								
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.								No change from FWOP

	SV 7.4	channelization, grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.	0.74	0.72	0.68	0.68	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.68**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.73**	**0.73**	
Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	**SV 8.1 Dynamic Equilibrium**	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	**SV 9.1 Hydraulic Structure**					1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	
	Sub-Variable	**Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially reverted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	**SV 10.1 Microbes**	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 2 with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.7	0.67	0.64	Degradation from habitat alteration
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.70**	**0.67**	**0.64**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.65	0.6	0.55	Degradation from habitat alteration
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.65**	**0.60**	**0.55**	
									TOTAL V10	**0.69**	**0.64**	**0.63**	**0.59**	
									Hydraulic Functional Condition Score	**0.73**	**0.69**	**0.67**	**0.66**	
									Geomorphic Functional Condition Score	**0.74**	**0.71**	**0.68**	**0.67**	
									Physicochemical Functional Condition Score	**0.74**	**0.70**	**0.68**	**0.65**	
									Biotic Functional Condition Score	**0.73**	**0.69**	**0.66**	**0.64**	

							Overall Functional Capacity Index Score	**0.73**	**0.70**	**0.67**	**0.66**	
A+286:341A / Tract #:	**3**											
Variable	**Sub-Variable**	**Total annual volume of water delivered from contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed	**SV 1.1 Total Volume**	Lake Kampeska gate, small impoundment diversions (lions park)	increased development	climate change-increased freq/severity of events, increased annual precip	**increased development, climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows	**Lake Kampeska gates, urbanized landscapes**	**climate change-increased freq/severity of events, increased annual precip**	**climate change-increased freq/severity of events, increased annual precip**	**increased development and climate change will lead to more impact to natural patterns**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
V1 Flow Regime								**TOTAL SV 1.2**	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	**drying out does not seem to occur**	**climate change- drought or floods**	**climate change- drought or floods**	**climate change- drought or floods**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeitions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed	**SV 2.1 Land Erosion**	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	**few signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed	**SV 3.1 Temperature Regime**	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
V3 Water Quality	**SV 3.2 Organics Nutrients**	**little agricultural runoff, but additions from the reservoir**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	**minimal ag influence, largely groundwater fed (high pH)**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = +1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading					
Riparian	**SV 4.1 Saturation Frequency**	channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74	No anticipated changes from FWOP in Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
										TOTAL SV 4.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
V4 Floodplain Connectivity	**SV 4.2 Floodplain Width**	**development, channelization**	**increased development**	**increased development**	**increased development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	0.85	0.85	0.8	0.75	No anticipated changes from FWOP in Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	no change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					

					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**	

	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	**The reach has urbanization, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**	

	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighhly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**	
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**	

	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**	
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score	
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard No Significant Impact		Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--						
						0.79 - 0.70 C - Functioning Significant Impact		Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)						
						0.00 - 0.59 F - Non-functioning Profound Impact		Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)						
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	SV Score	SV Score	SV Score	SV Score	
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90 A - Reference Standard No Significant Impact		Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70 C - Functioning Significant Impact		Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59 F - Non-functioning Profound Impact		Straight	Straight	Straight	--	--					
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F		SV Score	SV Score	SV Score	SV Score	
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard No Significant Impact		No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70 C - Functioning Significant Impact		Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59 F - Non-functioning Profound Impact		Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
												TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	

	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	**channallization, grade control upstream by lake**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
									TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
									TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.75**	**0.73**	**0.70**	
	Sub-Variable	**Looks specifically at coarse -scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine -scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**	
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
									Geomorphic Functional Condition Score	**0.77**	**0.74**	**0.72**	**0.70**	
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.71**	**0.69**	
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.70**	**0.68**	
									Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.71**	**0.69**	

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.

Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alt 11c: Weir Operations + Levee Right/Left Banks (Two 4ft Closure)	

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be found online at: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) . Information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #:		Reach 1											
Variable	**Sub-Variable**	**Total annual volume of water delivered from contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V1 Flow Regime	**SV 1.1 Total Volume**	Lake Kampeska gate, small impoundment diversions (Ioms park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows	**Lake Kampeska gates, urbanized landscapes**	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	**drying out does not seem to occur**	**climate change- drought or floods**	**climate change- drought or floods**	**climate change- drought or floods**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	**SV 2.1 Land Erosion**	suburban setting, most road paved, moderate cultivation in the north of watershed- overgrazed slopes contribute to sedimentation and water quality issues	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	**signs of channel erosion**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V3 Water Quality	**SV 3.1 Temperature Regime**	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionaly exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.2 Organics Nutrients	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	SV Score	SV Score	SV Score	SV Score	
Riparian	**SV 4.1 Saturation Frequency**	channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
											TOTAL SV 4.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**								SV Score	SV Score	SV Score	SV Score	
	SV 4.2					1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).									No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).									

V4 Floodplain Connectivity	Floodplain Width	development, channelization	increased development	increased development	increased development	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75		
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**		
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.						
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.						
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**		
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**		
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	Assumption is that the reference standard condition for this region would primarily not have woody vegetation, prairie stream system though ag activities have likely removed much of the riparian coordior along BSR. No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**		
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**		
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.						
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.						
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**		
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**		
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.						
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**		
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.						
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**		
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**		

Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type** Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score		
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--							
						0.79 - 0.70	C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--							
						0.69 - 0.60	D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)							
						0.00 - 0.59	F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)							
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Anastomosed**	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**						
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--						
						0.79 - 0.70	C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight						
						0.69 - 0.60	D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--						
						0.00 - 0.59	F - Non-functioning	Straight	Straight	Straight	--	--						
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type:** DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F							
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal						
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)						
						0.69 - 0.60	D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)						
						0.00 - 0.59	F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)						

								TOTAL SV 7.3	0.85	0.80	0.75	0.75	
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	0.74	0.72	0.70	0.68	
								TOTAL V7	0.78	0.76	0.74	0.73	
Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	increased scour with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	0.70	0.68	0.66	0.64	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	0.79	0.75	0.73	0.69	
								TOTAL V8	0.72	0.70	0.68	0.65	
Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	0.79	0.75	0.73	0.70	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	0.72	0.75	0.76	0.78	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	0.68	0.66	0.64	0.62	
								TOTAL V9	0.72	0.70	0.68	0.65	
Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	increase with climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
								TOTAL SV 10.1		0.75	0.73	0.71	0.69	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
								TOTAL SV 10.1		0.75	0.75	0.70	0.65	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
								TOTAL SV 10.1		0.65	0.60	0.60	0.60	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	game fish will continue to limit native fish	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No Change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
								TOTAL SV 10.1		0.80	0.78	0.76	0.74	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	exotics will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				

							TOTAL SV 10.1	0.72	0.70	0.68	0.66	
							TOTAL V10	0.69	0.66	0.65	0.63	
							Hydraulic Functional Condition Score	0.76	0.74	0.72	0.70	
							Geomorphic Functional Condition Score	0.77	0.74	0.72	0.70	
							Physicochemical Functional Condition Score	0.76	0.73	0.71	0.69	
							Biotic Functional Condition Score	0.75	0.72	0.70	0.68	
							Overall Functional Capacity Index Score	0.76	0.74	0.71	0.69	

A+286:341A / Tract #:	2

Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50								
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	0.80	0.75	0.70	0.70	
	Sub-Variable	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	0.70	0.68	0.66	0.64	
	Sub-Variable	Magnitude and duration of base flows, or the "low end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.3 Base Flows	drying out does not seem to occur	climate change- drought or floods	climate change- drought or floods	climate change- drought or floods	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	0.85	0.83	0.81	0.79	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.78	0.76	0.74	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph. Levees on both banks within Reach 2 will further alter the natural hydrograph via cutting off the floodplain, impacting drainage, compacting adjacent soils and necessitating a non-native brome planting along the levee
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	0.85	0.78	0.76	0.74	
								TOTAL V1	0.75	0.72	0.70	0.68	

Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.78	0.76	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5, no anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	0.82	0.80	0.78	0.76	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.2 Channel Erosion	few signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.88	0.84	0.82	0.8	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	0.88	0.84	0.82	0.80	
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	0.86	0.86	0.82	0.78	
								TOTAL V2	0.84	0.82	0.79	0.77	

Variable	Sub-Variable	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	temps increase due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	0.83	0.81	0.79	0.77	
	Sub-Variable	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 3.2 Organics Nutrients	little agricultural runoff, but additions from the reservoir	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	0.79	0.76	0.73	0.70	
	Sub-Variable	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 3.3 Inorganics Toxins	minimal ag influence, largely groundwater fed (high pH)	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	0.79	0.76	0.73	0.70	
								TOTAL V3	0.80	0.77	0.74	0.71	

Variable	Sub-Variable	Access of water to the floodplain and riparian area from the stream channel(s).				SV Scores	Condition Grade	Scoring Guidelines			Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	Reference Stream Type Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	Reference Stream Type Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading					
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	cut off from ecological floodplain due to industrail and residental areas	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr		Not Available for A, G, F Stream Types in VC Valleys.	0.7	0.63	0.63	0.63	Already exsting "berms" - increasing the height for the 2% Levee on both bank isolates floodplain permanently -encroaching that much further on floodplain, effects are substantial but large portions of the reach are already impacted by urbanization activities. From 14th ave to 13th ave and 10th ave to 6th ave on LB, ecological floodplain will be cut off- reamining segments on LB and RB are primarily already impacted from enrochment of urban/residental/industrial areas. Assumed that entrenchment may contine
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
								TOTAL SV 4.1				0.70	0.63	0.63	0.63
	Sub-Variable	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score
		Year 0	Year 10	Year 25	Year 50										
	SV 4.2 Floodplain Width	development, channelization	increased development	increased development	increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).				0.75	0.68	0.63	0.63	Degradation in FWP from levees permanently removing portions of the BSR from its ecological floodplain. Some areas are already cut off from industrial/residental development and that will continue to perist. Floodplain width will decrease through construciton of levees on both banks and continued pressures of development
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).							
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).							
								TOTAL SV 4.2				0.75	0.68	0.63	0.63
	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50

Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
SV 4.3 Saturation Duration	Development				1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.75	0.7	0.7	0.7	Degradation in FWP, saturation duration will decrease spatially though not temporally
					0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
					0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
							TOTAL SV 4.3	0.75	0.70	0.70	0.70	
							TOTAL V4	0.72	0.65	0.64	0.64	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation				1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.59	0.45	0.4	0.4	Degradation from loss of woody vegetation from construction of levees and permanent exclusion of regeneration on or within 15 ft of the toe
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	0.59	0.45	0.40	0.40	
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.2 Herbaceous Vegetation Structure	The reach has urbanization, trails, mowing, but also has maintained a decent vegetated riparian corridor in City parks/parcels.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.72	0.82	0.84	0.86	Degradation due to construction of levees which will necessitate non native smooth brome. Not only will this impact the levees but the smooth brome will spread to other areas, degrading other portions within the reach that are not necessarily within the levee footprint -existing berms now but not managed as levees
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	0.72	0.82	0.84	0.86	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.3 Species Diversity	RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.69	0.79	0.81	0.83	Degradation as a result of increase in invasive species from climate change, smooth brome, restriction of ecological floodplain
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	0.69	0.79	0.81	0.83	
								TOTAL V5	0.63	0.57	0.54	0.55	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.7	0.67	0.65	Degradation due to construction of levees which will require tree removal and inhibit recruitment
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	0.85	0.70	0.67	0.65	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 6.2 Detritus					1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.8	0.75	0.7	0.7	Degradation from loss of ecological floodplain in segments of Reach 2 as compared to FWOP- detritus supply will decrease from lack of veg inputs
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	0.80	0.75	0.70	0.70	
								TOTAL V6	0.81	0.71	0.68	0.66	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70	C - Functioning, Most Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
												TOTAL SV 7.1	0.85	0.85	0.85	0.85
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2					
		Year 0	Year 10	Year 25	Year 50			Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)				
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	k increases	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Most Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70	C - Functioning, Most Impact	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Straight	Straight	Straight	--	--				
												TOTAL SV 7.2	0.85	0.85	0.85	0.85
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.8	0.8	0.75	0.75	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Most Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
												TOTAL SV 7.3	0.80	0.80	0.75	0.75
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50											
		channelization, grade control	increased channelization	increased channelization	increased channelization	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.								
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.								No change from FWOP

	SV 7.4	channelization, grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.	0.74	0.72	0.7	0.68	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure					1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially reverted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V9	**0.71**	**0.69**	**0.68**	**0.66**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 2 with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.					
								TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
								TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.7	0.67	0.64	Degradation from habitat alteration
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
								TOTAL SV 10.1	**0.80**	**0.70**	**0.67**	**0.64**	

Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
	Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
SV 10.5 Other Animals	no beavers	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.65	0.6	0.55	Degradation from habitat alteration
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
								TOTAL SV 10.1	**0.72**	**0.65**	**0.60**	**0.55**	
								TOTAL V10	**0.69**	**0.64**	**0.63**	**0.59**	
								Hydraulic Functional Condition Score	**0.73**	**0.69**	**0.67**	**0.66**	
								Geomorphic Functional Condition Score	**0.74**	**0.70**	**0.68**	**0.67**	
								Physicochemical Functional Condition Score	**0.74**	**0.70**	**0.67**	**0.65**	
								Biotic Functional Condition Score	**0.73**	**0.68**	**0.66**	**0.64**	

							Overall Functional Capacity Index Score	**0.73**	**0.69**	**0.67**	**0.66**	
A+286:341A / Tract #:	**3**											
Variable	**Sub-Variable**	**Total annual volume of water delivered from contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
	SV 1.1	Lake Kampeska gate, small		climate change-increased	**increased development, climate change**	0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
	Total Volume	impoundment diversions (lions park)	increased development	freq/severity of events, increased annual precip		0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
	SV 1.2	**Lake Kampeska gates, urbanized landscapes**	**climate change-increased freq/severity of events, increased annual precip**	**climate change-increased freq/severity of events, increased annual precip**	**increased development and climate change will lead to more impact to natural patterns**	0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by 10-20%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
	Peak Flows					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
Watershed								**TOTAL SV 1.2**	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
V1		**Year 0**	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Flow						1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
Regime	**SV 1.3**	**drying out does not seem to occur**	**climate change- drought or floods**	**climate change- drought or floods**	**climate change- drought or floods**	0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeitions possible due to increased development and demand- overall balance
	Base Flows					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
	SV 1.4	**flooding in aerial maps shows variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
	Flow Variability					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
	SV 2.1	suburban setting, most road	Increase in urbanization, climate	Increase in urbanization, climate	**Increase in urbanization, climate change adding higher frequency of large runoff**	0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
	Land Erosion	paved, moderate cultivation in the north of watershed.	change adding higher frequency of large runoff	change adding higher frequency of large runoff		0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
	SV 2.2	**few signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
Watershed	**Channel Erosion**					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
	SV 2.3	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
	Transport					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.1	some lack of shading, little	temps increase due to climate	temps increase due to climate	**temps increase due to climate change**	0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
	Temperature Regime	irrigation, some reservoir impact	change	change		0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
Watershed	**SV 3.2**	**little agricultural runoff, but additions from the reservoir**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
	Organics Nutrients					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
V3						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
Water	**Sub-Variable**	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.3	**minimal ag influence, largely groundwater fed (high pH)**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
	Inorganics Toxins					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0					
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = +1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr					
	SV 4.1	channelized, mod entrenched,	continued entrenchment, increased isolation from flood	continued entrenchment, increased isolation from flood	**continued entrenchment, increased isolation from flood plain.**	0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr		Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74	No anticipated changes from FWOP in Reach
	Saturation Frequency		plain.	plain.		0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr					
								TOTAL SV 4.1							
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**0.80**	**0.78**	**0.76**	**0.74**	
		Year 0	**Year 10**	**Year 25**	**Year 50**				Year 0	Year 10	Year 25	Year 50	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	SV Score	SV Score	SV Score	SV Score	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
Riparian	**SV 4.2**	**development, channelization**	**increased development**	**increased development**	**increased development**	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75	No anticipated changes from FWOP in Reach
	Floodplain Width					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
V4						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**	
Floodplain	**Sub-Variable**	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Connectivity						1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
	SV 4.3	**moderate wetlands along floodplain**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.	0.85	0.83	0.8	0.78	no change
	Saturation Duration					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					

					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**	

	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	**The reach has urbanization, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**	

	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighhly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**	
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**	

	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**	
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score	
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard No Significant Impact		Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--						
						0.79 - 0.70 C - Functioning Significant Impact		Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)						
						0.00 - 0.59 F - Non-functioning Profound Impact		Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)						
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	SV Score	SV Score	SV Score	SV Score	
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90 A - Reference Standard No Significant Impact		Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70 C - Functioning Significant Impact		Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59 F - Non-functioning Profound Impact		Straight	Straight	Straight	--	--					
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F		SV Score	SV Score	SV Score	SV Score	
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard No Significant Impact		No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70 C - Functioning Significant Impact		Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59 F - Non-functioning Profound Impact		Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
												TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	

	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	**channallization, grade control upstream by lake**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
									TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
									TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.75**	**0.73**	**0.70**	
	Sub-Variable	**Looks specifically at coarse -scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine -scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slighlty altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**	
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
									Geomorphic Functional Condition Score	**0.77**	**0.74**	**0.72**	**0.70**	
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.71**	**0.69**	
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.70**	**0.68**	
									Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.71**	**0.69**	

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.

Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alt 13: Lowering Lake Kampeska to Elev 1718	

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be found online at: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) . Information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: Reach 1

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	SV 1.1 Total Volume	Total annual volume of water delivered from contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
		Lake Kampeska gate, small impoundment diversions (Ioms park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
	SV 1.2 Peak Flows	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
		Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
	SV 1.3 Base Flows	Magnitude and duration of base flows, or the "low end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
		drying out does not seem to occur	**climate change- drought or floods**	**climate change- drought or floods**	**climate change- drought or floods**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
	SV 1.4 Flow Variability	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
		flooding in aerial maps shows variability	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
		suburban setting, most road paved, moderate cultivation in the north of watershed- overgrazed slopes contribute to sedimentation and water quality issues	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
	SV 2.2 Channel Erosion	Rate of sediment produced by channel erosion in the contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
		signs of channel erosion	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
	SV 2.3 Transport	Transport of sediment to and through the reach.				1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
		a few dams and weirs, but most not impacting transport	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
Watershed V3 Water Quality	SV 3.1 Temperature Regime	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
		some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
	SV 3.2 Organics Nutrients	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
		agricultural runoff, 303d list	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
	SV 3.3 Inorganics Toxins	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
		ag influence, largely groundwater fed (high pH),	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
Riparian	SV 4.1 Saturation Frequency	Access of water to the floodplain and riparian area from the stream channel(s).				1.00 - 0.90	A - Reference Standard, Negligible Impact	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes: Typical BHR < 1.0, Return interval < 1.0 yr	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2; **Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains: Typical BHR 1.0, Return interval 1.0 - 1.5 yr	**Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading: Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4: Not Available for A, G, F Stream Types in VC Valleys.					No anticipated changes from FWOP in Reach 1
		Year 0	**Year 10**	**Year 25**	**Year 50**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr			
		channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr		0.8	0.78	0.76	0.74	
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
											TOTAL SV 4.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
	SV 4.2	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					No anticipated changes from FWOP in Reach 1

V4 Floodplain Connectivity	Floodplain Width	development, channelization	increased development	increased development	increased development	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75		
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**		
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.						
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.						
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**		
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**		
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	Assumption is that the reference standard condition for this region would primarily not have woody vegetation, prairie stream system though ag activities have likely removed much of the riparian coordior along BSR. No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**		
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**		
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.						
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.						
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**		
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**		
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.						
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**		
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.						
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**		
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**		

Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type** Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score		
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--							
						0.79 - 0.70	C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--							
						0.69 - 0.60	D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)							
						0.00 - 0.59	F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)							
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Anastomosed**	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**						
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--						
						0.79 - 0.70	C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight						
						0.69 - 0.60	D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--						
						0.00 - 0.59	F - Non-functioning	Straight	Straight	Straight	--	--						
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type:** DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F							
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal						
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)						
						0.69 - 0.60	D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)						
						0.00 - 0.59	F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)						

							TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	
	Sub-Variable	**Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	**grade control upstream by lake**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	
Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	**SV 8.1 Dynamic Equilibrium**	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	**SV 9.1 Hydraulic Structure**	channnalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.75**	**0.73**	**0.70**	
	Sub-Variable	**Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	**SV 10.1 Microbes**	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				

TOTAL SV 10.1	0.72	0.70	0.68	0.66	
TOTAL V10	0.69	0.66	0.65	0.63	
Hydraulic Functional Condition Score	0.76	0.74	0.72	0.70	
Geomorphic Functional Condition Score	0.77	0.74	0.72	0.70	
Physicochemical Functional Condition Score	0.76	0.73	0.71	0.69	
Biotic Functional Condition Score	0.75	0.72	0.70	0.68	
Overall Functional Capacity Index Score	0.76	0.74	0.71	0.69	

A+286:341A / Tract #: 2-

Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.78	0.76	0.74	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
	TOTAL SV 1.1								0.80	0.78	0.76	0.74	
	Sub-Variable	Magnitude and duration of peak flows, or the "high end" of the hydrograph. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
	TOTAL SV 1.2								0.70	0.68	0.66	0.64	
	Sub-Variable	Magnitude and duration of base flows, or the "low end" of the hydrograph. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.3 Base Flows	drying out does not seem to occur	climate change- drought or floods	climate change- drought or floods	climate change- drought or floods	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.8	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
	TOTAL SV 1.3								0.85	0.83	0.81	0.80	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.82	0.8	0.78	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph.
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
	TOTAL SV 1.4								0.85	0.82	0.80	0.78	
	TOTAL V1								0.75	0.73	0.71	0.69	
Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.8	0.78	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
	TOTAL SV 2.1								0.82	0.80	0.80	0.78	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.2 Channel Erosion	few signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.88	0.84	0.82	0.8	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
	TOTAL SV 2.2								0.88	0.84	0.82	0.80	
	Sub-Variable	Transport of sediment to and through the reach. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
	TOTAL SV 2.3								0.86	0.86	0.82	0.78	
	TOTAL V2								0.84	0.82	0.81	0.78	
Variable	Sub-Variable	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter). Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	temps increase due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.1								0.83	0.81	0.79	0.77	
	Sub-Variable	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.2 Organics Nutrients	little agricultural runoff, but additions from the reservoir	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.2								0.79	0.76	0.73	0.70	
	Sub-Variable	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins). Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.3 Inorganics Toxins	minimal ag influence, largely groundwater fed (high pH)	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.3								0.79	0.76	0.73	0.70	
	TOTAL V3								0.80	0.77	0.74	0.71	
Variable	Sub-Variable	Access of water to the floodplain and riparian area from the stream channel(s). Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines: Valley Type: Unconfined (UC) or Partially Confined (PC) — Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0					Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
								Reference Stream Type: Stream Evolution Model Stage = 0, 8; Rosgen Stream Type = 0, DA, DB; Anastomosed, Braided, Depositional, Beaver Complexes	Reference Stream Type: Stream Evolution Model Stage = 1, 6; Rosgen Stream Type = E, C; Sinuous, Quasi-equilibrium, Wide Floodplains	Valley Type: Confined (CC) — Valley bottom width to bankfull stream width 1.4 to 2.2; Reference Stream Type: Stream Evolution Model Stage = 2, 3; Rosgen Stream Type = B; Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					No change in FWP
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	cut off from ecological floodplain due to industrail and residental areas	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.			0.7	0.7	0.7	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr								
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr								
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr								
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr								
	TOTAL SV 4.1												0.70	0.70	0.70	0.70	
	Sub-Variable	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area. Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 4.2 Floodplain Width	development, channelization	increased development	increased development	increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	0.75	0.72	0.7	0.68	No change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
	TOTAL SV 4.2								0.75	0.72	0.70	0.68	
	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	

Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
SV 4.3 Saturation Duration	Development				1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.75	0.75	0.75	0.75	No change in FWP
					0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
					0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
							TOTAL SV 4.3	**0.75**	**0.75**	**0.75**	**0.75**	
							TOTAL V4	**0.72**	**0.71**	**0.71**	**0.70**	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation				1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.59	0.57	0.54	0.5	No change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.59**	**0.57**	**0.54**	**0.50**	
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.2 Herbaceous Vegetation Structure	The reach has urbanziation, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.72	0.72	0.7	0.67	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.72**	**0.72**	**0.70**	**0.67**	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.3 Species Diversity	RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.69	0.65	0.6	0.55	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.69**	**0.65**	**0.60**	**0.55**	
								TOTAL V5	**0.63**	**0.61**	**0.58**	**0.54**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 6.2 Detritus					1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.8	0.8	0.75	0.7	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.80**	**0.80**	**0.75**	**0.70**	
								TOTAL V6	**0.81**	**0.81**	**0.76**	**0.72**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70	C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60	D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2				
								Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)				
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	k increases	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70	C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60	D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59	F - Non-functioning	Straight	Straight	Straight	--	--					
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
								Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.8	0.8	0.75	0.75	No change from FWOP
						0.89 - 0.80	B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70	C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60	D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59	F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
												TOTAL SV 7.3	**0.80**	**0.80**	**0.75**	**0.75**
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50											
		channelization, grade control	increased channelization	increased channelization	increased channelization	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.								
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.								No change from FWOP

	SV 7.4	channelization, grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.	0.74	0.72	0.7	0.68	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	increased scour, increaseed unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure					1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	
	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	lack of structure, minimal riffle/pool	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially reverted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	deposition will increase	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V9	**0.71**	**0.69**	**0.68**	**0.66**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.					
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.					
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.64	0.62	0.6	No change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
									TOTAL SV 10.1	**0.72**	**0.64**	**0.62**	**0.60**	
									TOTAL V10	**0.69**	**0.65**	**0.64**	**0.63**	
									Hydraulic Functional Condition Score	**0.73**	**0.71**	**0.70**	**0.68**	
									Geomorphic Functional Condition Score	**0.74**	**0.73**	**0.70**	**0.68**	
									Physicochemical Functional Condition Score	**0.74**	**0.71**	**0.69**	**0.67**	
									Biotic Functional Condition Score	**0.73**	**0.70**	**0.68**	**0.66**	

								Overall Functional Capacity Index Score	**0.73**	**0.71**	**0.69**	**0.67**	
A+286:341A / Tract #:	**3**												
Variable	**Sub-Variable**	**Total annual volume of water delivered from contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
	SV 1.1	Lake Kampeska gate, small		climate change-increased	**increased development,**	0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
	Total	impoundment diversions (lions	increased development	freq/severity of events,	**climate change**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
	Volume	park)		increased annual precip		0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
	SV 1.2	**Lake Kampeska gates,**	**climate change-increased**	**climate change-increased**	**increased development and**	0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by 10-20%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
	Peak	**urbanized landscapes**	**freq/severity of events,**	**freq/severity of events,**	**climate change will lead to**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
	Flows		**increased annual precip**	**increased annual precip**	**more impact to natural patterns**	0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
Watershed								**TOTAL SV 1.2**	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
V1		**Year 0**	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
Flow						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
	SV 1.3	**drying out does not seem to**	**climate change- drought or**	**climate change- drought or**	**climate change- drought or**	0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeitions possible due to increased development and demand- overall balance
Regime	**Base**	**occur**	**floods**	**floods**	**floods**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
	Flows					0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
	SV 1.4	**flooding in aerial maps shows**	**climate change- drought or**	**climate change- drought or**	**climate change- drought or**	0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
	Flow	**variability**	**floods, increase in variability**	**floods, increase in variability**	**floods, increase in variability**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
	Variability					0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
	SV 2.1	suburban setting, most road	Increase in urbanization, climate	Increase in urbanization, climate	**Increase in urbanization,**	0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
	Land	paved, moderate cultivation in	change adding higher frequency	change adding higher frequency	**climate change adding higher**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
	Erosion	the north of watershed.	of large runoff	of large runoff	**frequency of large runoff**	0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
	SV 2.2	**few signs of channel erosion**	**climate change, more frequent**	**climate change, more frequent**	**climate change, more frequent**	0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
	Channel		**floods could destabilize banks**	**floods could destabilize banks**	**floods could destabilize banks.**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
	Erosion					0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
	SV 2.3	**a few dams and weirs, but**	**more incumbrances in the**	**more incumbrances in the**	**more incumbrances in the**	0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
	Transport	**most not impacting transport**	**future as channel destabilizes due to climate change**	**future as channel destabilizes due to climate change**	**future as channel destabilizes due to climate change**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.1	some lack of shading, little	temps increase due to climate	temps increase due to climate	**temps increase due to climate**	0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
	Temperature	irrigation, some reservoir impact	change	change	**change**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
	Regime					0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
Watershed	**SV 3.2**	**little agricultural runoff, but**	**ag could increase, and**	**ag could increase, and**	**ag could increase, and**	0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
	Organics	**additions from the reservoir**	**dependence on the reservoir increase**	**dependence on the reservoir increase**	**dependence on the reservoir increase**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
V3	**Nutrients**					0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
Water	**Sub-Variable**	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
	SV 3.3	**minimal ag influence, largely**	**increase in urbanization and**	**increase in urbanization and**	**increase in urbanization and**	0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
	Inorganics	**groundwater fed (high pH)**	**runoff chemicals, climate change influence**	**runoff chemicals, climate change influence**	**runoff chemicals, climate change influence**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
	Toxins					0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0					
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = +1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr								No anticipated changes from FWOP in Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr								
	SV 4.1	channelized, mod entrenched,	continued entrenchment,	continued entrenchment,	**continued entrenchment,**	0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Not Available for A, G, F Stream Types in VC Valleys.		0.8	0.78	0.76	0.74	
	Saturation		increased isolation from flood	increased isolation from flood	**increased isolation from flood**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr								
	Frequency		plain.	plain.	**plain.**	0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr								
								TOTAL SV 4.1				**0.80**	**0.78**	**0.76**	**0.74**		
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
	SV 4.2	**development, channelization**	**increased development**	**increased development**	**increased development**	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75	No anticipated changes from FWOP in Reach
Riparian	**Floodplain**					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
	Width					0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
V4								**TOTAL SV 4.2**	**0.85**	**0.85**	**0.80**	**0.75**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
Floodplain		**Year 0**	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
						1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.					
Connectivity						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
	SV 4.3	**moderate wetlands along**	**increased channelization,**	**increased channelization,**	**increased channelization,**	0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.	0.85	0.83	0.8	0.78	no change
	Saturation	**floodplain**	**entrench and development**	**entrench and development**	**entrench and development**	0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
	Duration												

					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**	

	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	**The reach has urbanization, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**	

	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighhly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**	
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	no change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**	

	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**	
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score	
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard No Significant Impact		Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--						
						0.79 - 0.70 C - Functioning Significant Impact		Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)						
						0.00 - 0.59 F - Non-functioning Profound Impact		Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)						
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	SV Score	SV Score	SV Score	SV Score	
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90 A - Reference Standard No Significant Impact		Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70 C - Functioning Significant Impact		Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59 F - Non-functioning Profound Impact		Straight	Straight	Straight	--	--					
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50			Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F		SV Score	SV Score	SV Score	SV Score	
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard No Significant Impact		No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	
						0.89 - 0.80 B - Highly Functioning Mild Impact		Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70 C - Functioning Significant Impact		Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60 D - Functioning Impaired Severe Impact		Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59 F - Non-functioning Profound Impact		Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
												TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	

	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	**channallization, grade control upstream by lake**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	**increased channellization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
									TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
									TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.75**	**0.73**	**0.70**	
	Sub-Variable	**Looks specifically at coarse -scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine -scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.68**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**	
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
									Geomorphic Functional Condition Score	**0.77**	**0.74**	**0.72**	**0.70**	
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.71**	**0.69**	
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.70**	**0.68**	
									Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.71**	**0.69**	

Functional Assessment of Streams (FACStream) for NWK and NWD Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.
Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alt 16: Lowering Lake Kampeska to Elev 1718 + Levee Left/Right Bank + Channel Widening Reach 3 Only	

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be found online at: https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) . Information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: Reach 1- Lake Kampeska winter releases would be only action in Reach 1

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Watershed V1 Flow Regime	SV 1.1 Total Volume	Total annual volume of water delivered from contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.					
		Lake Kampeska gate, small impoundment diversions (lions park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.2 Peak Flows	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.					
		Lake Kampeska gates, urbanized landscapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.3 Base Flows	Magnitude and duration of base flows, or the "low end" of the hydrograph.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.					
		drying out does not seem to occur	**climate change- drought or floods**	**climate change- drought or floods**	**climate change- drought or floods**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 1.4 Flow Variability	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.					
		flooding in aerial maps shows variability	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.	0.85	0.78	0.76	0.76	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.78**	**0.76**	**0.76**	
								TOTAL V1	**0.75**	**0.73**	**0.71**	**0.69**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.					
		suburban setting, most road paved, moderate cultivation in the north of watershed- overgrazed slopes contribute to sedimentation and water quality issues	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.2 Channel Erosion	Rate of sediment produced by channel erosion in the contributing watershed.				1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.					
		signs of channel erosion	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	**climate change, more frequent floods could destabilize banks, minor effect to channel erosion from increase in winter releases from Lake Kampeska**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.	0.84	0.8	0.78	0.76	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 2.3 Transport	Transport of sediment to and through the reach.				1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.					
		a few dams and weirs, but most not impacting transport	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.86**	**0.82**	**0.78**	
								TOTAL V2	**0.80**	**0.78**	**0.76**	**0.74**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
Watershed V3 Water Quality	SV 3.1 Temperature Regime	Ablotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
		some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.83	0.81	0.79	0.77	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.2 Organics Nutrients	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.					
		agricultural runoff, 303d list	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 3.3 Inorganics Toxins	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.					
		ag influence, largely groundwater fed (high pH),	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
Riparian	SV 4.1 Saturation Frequency	Access of water to the floodplain and riparian area from the stream channel(s).						**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0					
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes					
		channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr					
								TOTAL SV 4.1					
	Sub-Variable	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
	SV 4.2	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					

Scoring Guidelines					
Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2					
Reference Stream Type Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	No anticipated changes from FWOP in Reach 1
	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74	
		0.80	**0.78**	**0.76**	**0.74**	
		Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
						No anticipated changes from FWOP in Reach 1

V4 Floodplain Connectivity	Floodplain Width	development, channelization	increased development	increased development	increased development	0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).	0.85	0.85	0.8	0.75		
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).						
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.75**		
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased encroachment development**	**increased encroachment development**	**increased encroachment development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.						
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.						
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**		
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**		
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V5 Riparian Vegetation	**SV 5.1 Woody Vegetation Structure**	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.68	Assumption is that the reference standard condition for this region would primarily not have woody vegetation, prairie stream system though ag activities have likely removed much of the riparian coordior along BSR. No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.68**		
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	**primarily rural/agriculture**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.67	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.						
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.						
								TOTAL SV 5.2	**0.75**	**0.73**	**0.70**	**0.67**		
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighlty altered. Non-native species or bare ground make up less than 20% of cover.						
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.						
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**		
								TOTAL V5	**0.73**	**0.70**	**0.67**	**0.63**		
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.						
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**		
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50		
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score		
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.						
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.						
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**		
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**		

Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4					
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type** Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score		
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--							
						0.79 - 0.70	C - Functioning, Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)							
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Anastomosed**	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**						
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--						
						0.79 - 0.70	C - Functioning, Significant Impact	Meander High K	Meander High K	Meander Low K	--	Straight						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Meander Low K	Meander Low K	Straight	Straight	--						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Straight	Straight	Straight	--	--						
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**		
	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50		
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score		
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Reference Stream Type:** DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F							
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75	No anticipated changes from FWOP in Reach 1	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal						
						0.79 - 0.70	C - Functioning, Significant Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)						

							TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**	
	Sub-Variable	**Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 7.4	**grade control upstream by lake**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	
Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	**SV 8.1 Dynamic Equilibrium**	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No anticipated changes from FWOP in Reach 1
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	**SV 9.1 Hydraulic Structure**	channnalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.75	0.73	0.7	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.75**	**0.73**	**0.70**	
	Sub-Variable	**Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V9	**0.72**	**0.70**	**0.68**	**0.65**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	**SV 10.1 Microbes**	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				

TOTAL SV 10.1	0.72	0.70	0.68	0.66	
TOTAL V10	0.69	0.66	0.65	0.63	
Hydraulic Functional Condition Score	0.76	0.74	0.72	0.70	
Geomorphic Functional Condition Score	0.77	0.74	0.72	0.70	
Physicochemical Functional Condition Score	0.76	0.73	0.71	0.69	
Biotic Functional Condition Score	0.75	0.72	0.70	0.68	
Overall Functional Capacity Index Score	0.76	0.74	0.71	0.69	

A+286:341A / Tract #: 2- Impacts from levee on LB and releases from Lake Kampeska and channel widening

Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50								
Watershed V1 Flow Regime	SV 1.1 Total Volume	Lake Kampeska gate, small impoundment diversions (lions park), augmentations from upstream agrian ditching	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in volume of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.75	0.7	0.7	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
	TOTAL SV 1.1								0.80	0.75	0.70	0.70	
	Sub-Variable	Magnitude and duration of peak flows, or the "high end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.2 Peak Flows	Lake Kampeska gates, urbanized landcapes	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	Minor increases in peak flows of water from Winter release at Lake Kampeska; climate change freq/severity of events increased annual precip; increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
	TOTAL SV 1.2								0.70	0.68	0.66	0.64	
	Sub-Variable	Magnitude and duration of base flows, or the "low end" of the hydrograph.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.3 Base Flows	drying out does not seem to occur	climate change- drought or floods	climate change- drought or floods	climate change- drought or floods	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change from FWOP- base flows likely to increase over time rather than decrease but increase in depeltions possible due to increased development and demand- overall balance
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
	TOTAL SV 1.3								0.85	0.83	0.81	0.79	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph. Levees on both banks within Reach 2 will further alter the natural hydrograph via cutting off the floodplain, impacting drainage, compacting adjacent soils and necessitating a non-native brome planting along the levee. Additionally, flow variability will remain consistent with seasonal expectations, but of greater severity for low flows (channel width increases and during normal summer-fall flows thereby decreasing the depths- a low flow channel will help retain a semblance of existing condition in a portion of the channel profile)
		Year 0	Year 10	Year 25	Year 50								
	SV 1.4 Flow Variability	flooding in aerial maps shows variablity	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	climate change- drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.78	0.76	0.74	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
	TOTAL SV 1.4								0.85	0.78	0.76	0.74	
	TOTAL V1								0.75	0.72	0.70	0.68	
Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.78	0.76	slightly better than Reach 1 due to some hardened armoring in the more urban reaches 2-5, no anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
	TOTAL SV 2.1								0.82	0.80	0.78	0.76	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.2 Channel Erosion	few signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.88	0.84	0.82	0.8	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska and channel widening
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
	TOTAL SV 2.2								0.88	0.84	0.82	0.80	
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.3 Transport	a few dams and weirs, but most not impacting transport	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	more incumbrances in the future as channel destabilizes due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.86	0.82	0.78	No anticipated changes in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
	TOTAL SV 2.3								0.86	0.86	0.82	0.78	
	TOTAL V2								0.84	0.82	0.79	0.77	
Variable	Sub-Variable	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Watershed V3 Water Quality	SV 3.1 Temperature Regime	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	temps increase due to climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.81	0.79	0.77	stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps Minor increases in temperature throughout channel profile during summer-fall from increase in width- low flow channel will assist in abating substantial effects
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.1								0.83	0.81	0.79	0.77	
	Sub-Variable	The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 3.2 Organics Nutrients	little agricultural runoff, but additions from the reservoir	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	ag could increase, and dependence on the reservoir increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.2								0.79	0.76	0.73	0.70	
	Sub-Variable	Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 3.3 Inorganics Toxins	minimal ag influence, largely groundwater fed (high pH)	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	increase in urbanization and runoff chemicals, climate change influence	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
	TOTAL SV 3.3								0.79	0.76	0.73	0.70	
	TOTAL V3								0.80	0.77	0.74	0.71	
Variable	Sub-Variable	Access of water to the floodplain and riparian area from the stream channel(s).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 — Reference Stream Type: Stream Evolution Model Stage = 0, 8; Rosgen Stream Type = D, DA, DB; Anastomosed, Braided, Depositional, Beaver Complexes — Reference Stream Type: Stream Evolution Model Stage = 1, 6; Rosgen Stream Type = E, C; Sinuous, Quasi-equilibrium, Wide Floodplains	Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2 — Reference Stream Type: Stream Evolution Model Stage = 2, 3; Rosgen Stream Type = B; Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
Riparian V4 Floodplain Connectivity	SV 4.1 Saturation Frequency	cut off from ecological floodplain due to industrail and residental areas	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	Substanital degradation due to ecological floodplain being isolated	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.7	0.63	0.63	0.63	Already exsting "berms" - increasing the height for the 2% Levee on both bank isolates floodplain permanently -encroaching that much further on floodplain, effects are substantial but large portions of the reach are already impacted by urbanization activities. From 14th ave to 13th ave and 10th ave to 6th ave on LB, ecological floodplain will be cut off- reamining segments on LB are primarily already impacted from enrochment of urban/residental/industrial areas. Assumed that entrenchment may contine
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr				
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr				
	TOTAL SV 4.1										0.70	0.63	0.63	0.63	
	Sub-Variable	Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.				SV Scores	Condition Grade	Scoring Guidelines			Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50										
	SV 4.2 Floodplain Width	development, channelization	increased development	increased development	increased development	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).			0.75	0.68	0.63	0.63	Degradation in FWP from levees permanently removing portions of the BSR from its ecolgical floodplain. Some areas are already cut off from industrial/residental development and that will continue to perist. Floodplain width will decrease through construction of levees on both banks and continued pressures of development Reduction in floodplain from increase in channel habitat
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).							
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).							
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).							
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).							
	TOTAL SV 4.2										0.75	0.68	0.63	0.63	
	Sub-Variable	Amount of time that the floodplain area is saturated during the growing season.				SV Scores	Condition Grade	Scoring Guidelines			Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	

Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
SV 4.3 Saturation Duration	Development				1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.75	0.7	0.7	0.7	Degradation in FWP, saturation duration will decrease spatially though not temporally
					0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
					0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
							TOTAL SV 4.3	0.75	0.70	0.70	0.70	
							TOTAL V4	0.72	0.65	0.64	0.64	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation				1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.59	0.45	0.4	0.4	Degradation from loss of woody vegetation from construction of levees and permanent exclusion of regeneration on or within 15 ft of the toe as well as increase in channel habitat
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	0.59	0.45	0.40	0.40	
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.2 Herbaceous Vegetation Structure	The reach has urbanization, trails, mowing, but also has maintained a decent vegetated riparian corridor in City parks/parcels.				1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.72	0.82	0.84	0.86	Degradation due to construction of levees which will necessitate non native smooth brome. Not only will this impact the levees but the smooth brome will spread to other areas, degrading other portions within the reach that are not necessarily within the levee footprint and increase in channel habitat
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	0.72	0.82	0.84	0.86	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous).				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 5.3 Species Diversity	RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.69	0.79	0.81	0.83	Degradation as a result of increase in invasive species from climate change, smooth brome, restriction of ecological floodplain
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	0.69	0.79	0.81	0.83	
								TOTAL V5	0.63	0.57	0.54	0.55	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	increased development, lack of tree recruitment	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.7	0.67	0.65	Degradation due to construction of levees which will require tree removal and inhibit recruitment
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	0.85	0.70	0.67	0.65	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 6.2 Detritus					1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.8	0.75	0.7	0.7	Degradation from loss of ecological floodplain in segments of Reach 2 as compared to FWOP- detritus supply will decrease from lack of veg inputs
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	0.80	0.75	0.70	0.70	
								TOTAL V6	0.81	0.71	0.68	0.66	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				SV Scores	Condition Grade	Scoring Guidelines				Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
								Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	1C	1.00 - 0.90	A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)		0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70	C - Functioning, Most Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	Not Available for A, G, F Stream Types in VC Valleys.				
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
												TOTAL SV 7.1	0.85	0.85	0.85	0.85
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines					Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2				
								Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)				
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	k increases	1.00 - 0.90	A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Most Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--					
						0.79 - 0.70	C - Functioning, Most Impact	Meander High K	Meander High K	Meander Low K	--	Straight					
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Meander Low K	Meander Low K	Straight	Straight	--					
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Straight	Straight	Straight	--	--					
												TOTAL SV 7.2	0.85	0.85	0.85	0.85	
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines					Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50			Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
								Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90	A - Reference Standard	No Significant Stressors				No Significant Stressors	0.8	0.8	0.75	0.75	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Negligible Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal					
						0.79 - 0.70	C - Functioning, Most Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)					
						0.69 - 0.60	D - Functioning Impaired, Significant Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)					
						0.00 - 0.59	F - Non-functioning, Severe Impact, Profound Impact	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)					
												TOTAL SV 7.3	0.80	0.80	0.75	0.75	
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines					Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50												
		channelization, grade control	increased channelization	increased channelization	increased channelization	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.									
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.									No change from FWOP

	SV 7.4	channelization, grade control upstream by lake	increased channelization, entrench and development	increased channelization, entrench and development	increased channelization, entrench and development	0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.	0.74	0.72	0.7	0.68	No change from FWOP
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**	
								TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.68	0.66	0.64	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.68**	**0.66**	**0.64**	

	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	some exotic veg,	**increased scour, increased unnatural veg**	increased scour, increased unnatural veg	increased scour, increased unnatural veg	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.70**	**0.68**	**0.65**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure					1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	FWOP conditions would persist, in addition, minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	

	Sub-Variable	Looks specifically at coarse -scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	structure may develop	structure may develop	structure may develop	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.76	0.78	No anticipated change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially reverted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.76**	**0.78**	

	Sub-Variable	Looks specifically at fine -scale physical structure within the stream channels.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	some deposition	**deposition will increase**	deposition will increase	deposition will increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V9	**0.71**	**0.69**	**0.68**	**0.66**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 2 with FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Fish & Amphibians	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.7	0.67	0.64	minor degradation from widening- assume that a low flow channel will help offset impact to a degree
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.70**	**0.67**	**0.64**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Other Animals	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	exotics will increase, vegetation removal will displace wildlife from construction of levees on both banks	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.65	0.6	0.55	No change in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.65**	**0.60**	**0.55**	
									TOTAL V10	**0.69**	**0.64**	**0.63**	**0.59**	
									Hydraulic Functional Condition Score	**0.73**	**0.69**	**0.67**	**0.66**	
									Geomorphic Functional Condition Score	**0.74**	**0.70**	**0.68**	**0.67**	
									Physicochemical Functional Condition Score	**0.74**	**0.70**	**0.67**	**0.65**	
									Biotic Functional Condition Score	**0.73**	**0.68**	**0.66**	**0.64**	

							Overall Functional Capacity Index Score	**0.73**	**0.69**	**0.67**	**0.66**	
A+286:341A / Tract #:	**3**											
Variable	**Sub-Variable**	**Total annual volume of water delivered from contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed	**SV 1.1 Total Volume**	Lake Kampeska gate, small impoundment diversions (lions park)	increased development	climate change-increased freq/severity of events, increased annual precip	**increased development, climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.8	0.8	0.8	While minor augmentation would occur between 15-20% of existing flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a increase of depletions
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Magnitude and duration of peak flows, or the "high end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows	**Lake Kampeska gates, urbanized landscapes**	**climate change-increased freq/severity of events, increased annual precip**	**climate change-increased freq/severity of events, increased annual precip**	**increased development and climate change will lead to more impact to natural patterns**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.7	0.68	0.66	0.64	Minor increases in peak flow from winter relases and an anticipated increase in surface runoff from increase in freq/severity of precip events from climate change, this is being balanced by the increase in floodplain development which would likely result in a overall no net change from existing conditions. Hydrograph is still distrupted between 15-30%.. peak flows may be unnatural at winter releases vs spring-fall
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.70**	**0.68**	**0.66**	**0.64**	
V1 Flow Regime	**Sub-Variable**	**Magnitude and duration of base flows, or the "low end" of the hydrograph.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	**drying out does not seem to occur**	**climate change- drought or floods**	**climate change- drought or floods**	**climate change- drought or floods**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.8	0.78	0.76	Base flows will remain consistent with seasonal expectations, but of greater severity for low flows (channel width increases and during normal summer-fall flows thereby decreasing the depths- a low flow channel will help retain a semblance of existing condition in a portion of the channel profile)
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.80**	**0.78**	**0.76**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	**climate change- drought or floods, increase in variability**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.77	0.75	0.72	flow variability will be altered from increase in freq/severity of flood events as it does in FWOP but FWP will result minor changes in variability due to winter releases which would be "unnatural" as compared to a natural hydrograph. Additionally, flow variability will remain consistent with seasonal expectations, but of greater severity for low flows (channel width increases and during normal summer-fall flows thereby decreasing the depths- a low flow channel will help retain a semblance of existing condition in a portion of the channel profile)
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.77**	**0.75**	**0.72**	
								TOTAL V1	**0.75**	**0.72**	**0.70**	**0.69**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed	**SV 2.1 Land Erosion**	suburban setting, most road paved, moderate cultivation in the north of watershed.	Increase in urbanization, climate change adding higher frequency of large runoff	Increase in urbanization, climate change adding higher frequency of large runoff	**Increase in urbanization, climate change adding higher frequency of large runoff**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.78	0.76	0.74	0.72	No change from FWOP- land management and contributing stressors would remain consistent in FWP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past humancaused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.78**	**0.76**	**0.74**	**0.72**	
V2 Sediment Regime	**Sub-Variable**	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	**few signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.84	0.78	0.76	0.74	Impacts from climate change would remain consistent in FWP- minor increases in channel erosion from winter releases at Lake Kampeska and channel widening
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches; or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.84**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	**a few dams and weirs, but most not impacting transport**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	**more incumbrances in the future as channel destabilizes due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.86	0.82	0.8	0.78	Minor changes from FWOP as the newly widened channel reaches a new homeostatis
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.86**	**0.82**	**0.80**	**0.78**	
								TOTAL V2	**0.80**	**0.77**	**0.75**	**0.73**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed	**SV 3.1 Temperature Regime**	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.	0.83	0.8	0.78	0.76	No anticipated changes in FWP, stressors would continue to persist as they do in the FWOP (irrigation returns, loss of groundwater exchange, increased temps from climate change) ; increase in augmentation from winter releases will not alter spring through fall temps. Minor increases in temperature throughout channel profile during summer-fall from increase in width- low flow channel will assist in abating substantial effects
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.80**	**0.78**	**0.76**	
V3 Water Quality	**Sub-Variable**	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.2 Organics Nutrients	**little agricultural runoff, but additions from the reservoir**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on organic inputs will be continued ag activities. Most sediments where organic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.79**	**0.76**	**0.73**	**0.70**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	**minimal ag influence, largely groundwater fed (high pH)**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.79	0.76	0.73	0.7	No anticipated changes in FWP, largest impact on inorganic inputs will be continued ag activities. Most sediments where inorganic nutrients bind will settle out of water that is released in winter
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.79**	**0.76**	**0.73**	**0.70**	
								TOTAL V3	**0.80**	**0.77**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 **Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4 **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	SV Score	SV Score	SV Score	SV Score	
Riparian	**SV 4.1 Saturation Frequency**	channelized, mod entrenched,	continued entrenchment, increased isolation from flood plain.	continued entrenchment, increased isolation from flood plain.	**continued entrenchment, increased isolation from flood plain.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.78	0.76	0.74	No anticipated changes from FWOP in Reach
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr				
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr				
											TOTAL SV 4.1	**0.80**	**0.78**	**0.76**	**0.74**	
V4 Floodplain Connectivity	**Sub-Variable**	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.2 Floodplain Width	**development, channelization**	**increased development**	**increased development**	**increased development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	0.85	0.82	0.78	0.76	Degradation in FWP from levees permanently removing portions of the BSR from its ecolgoical floodplain. Some areas are already cut off from industrial/residental development and that will continue to perist. Floodplain width will decrease through construciton of levees on both banks and continued pressures of development Reduction in floodplain from increase in channel habitat
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
								TOTAL SV 4.2	**0.85**	**0.82**	**0.78**	**0.76**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.3 Saturation Duration	**moderate wetlands along floodplain**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78	no change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					

					0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.80**	**0.77**	**0.75**
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 5.1 Woody Vegetation Structure	The existing reach has 60% or more increased vegetation	development and urbanization	development and urbanization	**development and urbanization**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.71	0.68	0.68
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
								TOTAL SV 5.1	**0.75**	**0.71**	**0.68**	**0.68**
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non -woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian VS Riparian Vegetation	**SV 5.2 Herbaceous Vegetation Structure**	**The reach has urbanization, trails, mowing, but also has maintained a a decent vegetated riparian corridor in City parks/parcels.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	**Population maybe increase slightly, but city parcels for this reach are likely protected, and not likely developed.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.75	0.71	0.69	0.67
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
								TOTAL SV 5.2	**0.75**	**0.71**	**0.69**	**0.67**
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG, Cottonwood.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.69	0.65	0.6
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slighhtly altered. Non-native species or bare ground make up less than 20% of cover.				
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.				
								TOTAL SV 5.3	**0.72**	**0.69**	**0.65**	**0.60**
								TOTAL V5	**0.73**	**0.70**	**0.66**	**0.63**
Variable	**Sub-Variable**	**The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian V6 Debris Supply	**SV 6.1 Large Woody Debris**	semi- developed area, largely cleared, parklike areas, some natural tree growth	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.				
								TOTAL SV 6.1	**0.85**	**0.83**	**0.80**	**0.78**
	Sub-Variable	**An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.85	0.82	0.8	0.76
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.				
								TOTAL SV 6.2	**0.85**	**0.82**	**0.80**	**0.76**
								TOTAL V6	**0.85**	**0.82**	**0.80**	**0.77**

Variable	**Sub-Variable**	**Stream evolution is the process by which a stream changes type or form.**				**SV Scores**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Condition Grade**	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score
							Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B				
Stream V7 Morphology	**SV 7.1 Evolutionary Stage**	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85
						0.89 - 0.80 Negligible Impact B - Highly Functioning	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70 Mild Impact C - Functioning	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60 Significant Impact D - Functioning Impaired	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59 Severe Impact F - Non-functioning	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
						Profound Impact									
											TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**

	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**SV Scores**	**Scoring Guidelines**				Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Condition Grade**	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score
							Anastomosed	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**			
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90 A - Reference Standard	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85
						0.89 - 0.80 Negligible Impact B - Highly Functioning	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70 Mild Impact C - Functioning	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60 Significant Impact D - Functioning Impaired	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59 Severe Impact F - Non-functioning	Straight	Straight	Straight	--	--				
						Profound Impact									
											TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**

	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**SV Scores**	**Scoring Guidelines**					Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Condition Grade**	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score
							Reference Stream Type: DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F					
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.75
						0.89 - 0.80 Negligible Impact B - Highly Functioning	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70 Mild Impact C - Functioning	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60 Significant Impact D - Functioning Impaired	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59 Severe Impact F - Non-functioning	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
						Profound Impact									
											TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.75**

	Sub-Variable	**Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 7.4	**channalization, grade control upstream by lake**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.74	0.72	0.7	0.68
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.				
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.				
									TOTAL SV 7.4	**0.74**	**0.72**	**0.70**	**0.68**
									TOTAL V7	**0.78**	**0.76**	**0.74**	**0.73**

Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.7	0.72	0.74	0.74	stability would be slightly improved frin FWOP with riffle pool complexes
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, pool filling, unnatural bars, over-widening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.70**	**0.72**	**0.74**	**0.74**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	**increased scour, increased unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.75	0.73	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.75**	**0.73**	**0.69**	
								TOTAL V8	**0.72**	**0.73**	**0.73**	**0.70**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	channalization, grade control	increased channelization, entrench and development	increased channelization, entrench and development	**increased channelization, entrench and development**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.74	0.71	0.68	Minor structure alterations during winter releases would occur as depth in the BSR would increase and velocities may negligbly and temporarily increase as water passes through the Reach Channel widening would result in change in velocity and depth distribution, low flow channel will help abate some of the negative effects for aquatic life
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.74**	**0.71**	**0.68**	
	Sub-Variable	**Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale	**lack of structure, minimal riffle/pool**	**structure may develop**	**structure may develop**	**structure may develop**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.72	0.75	0.77	0.79	Minor improvement from FWOP as a result of installation of riffle/pool features and low flow channel
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts.					
						0.79 - 0.70	C - Functioning, Significant Impact	Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle-pool ratio, or lack of bank structure. Reaches with artificial structure or partially revetted banks.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with graded or heavily revetted banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.72**	**0.75**	**0.77**	**0.79**	
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale	**some deposition**	**deposition will increase**	**deposition will increase**	**deposition will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.68	0.66	0.64	0.62	No anticipated change from FWOP- deposition from upstream land erosion may occur. It is not anticipated that winter releases would contribute to an increase in sediment transport and is assumed that most material will settle out prior to winter releases
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slighlty altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is significantly limited. Examples include gravel or cobble-bed streams with bimodal materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and reaches lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.68**	**0.66**	**0.64**	**0.62**	
								TOTAL V5	**0.71**	**0.69**	**0.67**	**0.66**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
Stream V10 Biotic Structure	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	It is anticipated that the FWP would remain consistent in Reach 1 with FWOP- continued degradation to water quality will contribut to algala blooms
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading invasive seed and contributing source waters likely experiencing all of the above	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout the BSR system, further decreasing any native species that may be present	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.65	0.6	0.6	0.6	It is anticipated that the FWP would reamin consistent with FWOP , winter releases will neither help nor hurt the zebra mussel established infestation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	game fish will continue to limit native fish	game fish will continue to limit native fish	**game fish will continue to limit native fish**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.81	0.83	0.83	Minor improvement from FWOP as a result of installation of riffle/pool features and low flow channel
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
									TOTAL SV 10.1	**0.80**	**0.81**	**0.83**	**0.83**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals	no beavers	exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66	No change from FWOP
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
									TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**	
									TOTAL V10	**0.69**	**0.66**	**0.65**	**0.64**	
									Hydraulic Functional Condition Score	**0.76**	**0.74**	**0.72**	**0.70**	
									Geomorphic Functional Condition Score	**0.77**	**0.74**	**0.73**	**0.70**	
									Physicochemical Functional Condition Score	**0.76**	**0.73**	**0.71**	**0.69**	
									Biotic Functional Condition Score	**0.75**	**0.72**	**0.71**	**0.68**	
									Overall Functional Capacity Index Score	**0.76**	**0.74**	**0.72**	**0.69**	

Administrative Description

River/Stream:		**Date of Evaluation:**	
Site/Reach ID:		**Evaluator(s):**	
Project ID:		**Professional Position and Affiliation**	
Permit ID: (and Applicant)			

Site/Reach Location *Description or directions*			
Extent of AA *Describe reach boundaries here and attach a site map*			
Reach Length (feet)		**Measurement Method:**	
Land Ownership:			

Purpose of Assessment	*Other*

Associated Wetland Assessments	*Notes:*

Special Concerns or Priorities	☐ T&E Species Priority	*Notes:*
	☐ Recreation Priority	*Notes:*
	☐ Conservation Priority	*Notes:*
	☐ Other Priority or concern (describe)	*Notes:*

Notes:

Site Characterization

Process Domain Characterization

	Physiographic Region	*Notes:*
	Hydrologic Region	*Notes:*
	Ecoregion (AT, CF, PJF, DF, SL, GL)	*Notes:*
	Strahler Order (1-6)	*Notes:*
	Drainage Area (Sq. Miles)	*Notes:*
	Bankfull Width (Ft)	*Notes:*
	Flow Regime (P, I, E, S)	*Notes:*
	Valley Confinement (VC, CC, PC, UC)	*Notes:*
	Valley Slope VL (<1%), L (1-2%), M (2-4%), H (4-10%), VH (>10%)	*Notes:*
	Riparian Veg. - Reference (Forested, Scrub-Shrub, Herbaceous)	*Notes:*

Existing Stream Morphology

	Planform (Anast., Side Chan., Meander, Braided, Straight)	*Notes:*
	Entrenchment (Entrenched, Moderate, Slight, Not Entrenched)	*Notes:*
	Width-Depth Ratio (Low, Moderate High, Very High, N/A)	*Notes:*
	Sinuosity (Low, Moderate, High, Very High, Anastomosed)	*Notes:*
	Channel Materials (Bedrock, Boulder, Cobble, Gravel, Sand, Silt)	*Notes:*

	Rosgen	SEM	M-B
Existing Morphology Type			
Suggested Morph Reference (From FACStream Guidelines)			
Selected Morph Reference (Suggested type or other)			

Notes:

Rationale for selected reference

Rationale:

Stressor Listings



US Army Corps of Engineers®

WATERTOWN, SOUTH DAKOTA FLOOD RISK MANAGEMENT GENERAL INVESTIGATIONS STUDY

INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX G2: MITIGATION, MONITORING, & ADAPTIVE MANAGEMENT PLAN

OMAHA DISTRICT
NORTHWESTERN DIVISION



June 2026

TABLE OF CONTENTS

1 Overview 1
2 Coordination and Collaboration 1
3 Significance of Ecological Resources 2
3.1 Institutional 2
3.1.1 Wetland and Riparian Habitat 3
3.1.2 Migratory Birds 3
3.1.3 Endangered Species 4
3.2 Public 4
3.2.1 Agency, Tribal, and Public Input 4
3.2.2 Recreation 5
3.2.3 Ecological Resources and Public Interest 5
3.2.4 Ecosystem Services 5
3.3 Technical 6
3.3.1 Scarcity, Status, and Trends 6
3.3.2 Landscape Considerations and Connectivity 6
3.3.3 Biodiversity 6
3.4 Cultural Values 7
4 Mitigation Planning 7
4.1 Avoidance and Minimization 8
4.2 Unavoidable Impacts 10
4.3 Mitigation Planning Objectives 12
5 Mitigation Alternative Formulation 13
5.1 Alternative 1: 14th Avenue and I29 14
5.2 Alternative 2: 166th Ave and Sioux Conifer Road 15
5.3 Alternative 3: Mitigation Bank Credits 18
6 Mitigation Alternative Comparison and Selection 18
7 Recommended Compensatory Mitigation Plan 19
8 Monitoring and Adaptive Management 20
8.1 Native Levee Plantings 21
8.1.1 Performance Objective 21
8.1.2 Success Criteria 21

8.1.3 Monitoring Design 22
8.1.4 Adaptive Management Decision-making 22
8.1.5 Adaptive Management Contingency Plan 22
8.2 Channel Bench Plantings 23
8.2.1 Performance Objectives 23
8.2.2 Success Criteria 23
8.2.3 Monitoring Design 24
8.2.4 Adaptive Management Decision-making 24
8.2.5 Adaptive Management Contingency Plan 25
8.3 Compensatory Mitigation Habitat 27
8.3.1 Performance Objectives 27
8.3.2 Success Criteria 27
8.3.3 Monitoring Design 28
8.3.4 Adaptive Management Decision-making 28
8.3.5 Adaptive Management Contingency Plan 29
8.4 Methods and Analysis 30
8.4.1 Riparian/Wetland Habitat and Levee Sampling Methodology 30
8.4.2 Riparian/Wetland and Levee Data Analysis 31
9 Maintenance Activities 32
10 Literature Cited 33

FIGURES

Figure 1. CEM depicting the cause-and-effect relationships of implementation of the Recommended Plan and mitigation measures 8
Figure 2. NNBF measures and their representative classification across the gradient of infrastructure methods 9
Figure 3. Mitigation Alternatives in context with the Watertown Study Area 14
Figure 4. Top: Option 1 (Yellow Hatch); Bottom: Option 2 (Blue) 16
Figure 5. Top: Option 3 (Green); Bottom: Option 4 (Orange) 17
Figure 6. General orientation of baseline and transects (dotted lines) in a hypothetical project area (USACE, 1987). 30
Figure 7. Schematic of example transect and plot set-up running perpendicular to the BSR 31

TABLES

Table 1. Recommended Native Plantings on the Levee 10
Table 2. Unavoidable Impacts associated with all Alternatives 11
Table 3. Impacted functions from implementation of the structural alternatives and their associated habitat types 13

Table 4. Net gain AAHU of Mitigation Alternative 1 for the Recommended Plan 14
Table 5. Net gain AAHU of Mitigation Alternative 2 for the Recommended Plan 15
Table 6. Mitigation Alternatives and their associated costs.....18
Table 7. Monitoring costs 20
Table 8. Decision-making Framework for Native Levee Plantings.....22
Table 9. Contingency Measures for Native Levee Plantings.....23
Table 10. Decision-making Framework for Channel Bench Plantings 24
Table 11. Contingency Measures for Compensatory Mitigation.....26
Table 12. Decision-making Framework for Compensatory Mitigation 28
Table 13. Contingency Measures for Compensatory Mitigation.....29
Table 14. Daubenmire Cover classes 30

Appendix

Sub-appendix G2a: Mitigation FACStream Calculation Sheets

1 Overview

Federal agencies are required to mitigate for activities that have unavoidable adverse impacts to natural resources such as fish and wildlife, wetlands, and other special aquatic sites. The requirements stem from laws such as the Clean Water Act, the Fish and Wildlife Coordination Act, the Endangered Species Act, and the Magnuson-Stevens Act. The U.S. Army Corps of Engineers (Corps) has additional responsibility under section 906 of the Water Resources Development Act (WRDA) of 1986, as amended (33 U.S.C. 2283), to mitigate for damages to ecological resources, including terrestrial and aquatic resources, and fish and wildlife losses that result from a water resources development project. Section 906(d) of WRDA 1986 introduced comprehensive requirements such that any proposal submitted to Congress to authorize a water resources project must contain a specific mitigation plan unless it is determined that the project will have negligible adverse impacts on ecological resources and fish and wildlife without implementation of mitigation measures.

Engineer Regulation (ER) 1105-2-103 requires that mitigation planning be an integral part of the overall planning process. Mitigation planning includes a sequencing approach: avoiding an impact altogether by not taking a certain action; minimizing impacts by limiting the degree or magnitude of an action; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time; and compensating for non-negligible losses to significant ecological resources through in-kind mitigation employing a watershed approach. In most circumstances, a habitat-based methodology, supplemented with other appropriate information, is used to describe, and evaluate the impacts of alternative project plans, to identify compensatory mitigation needs, and to develop mitigation objectives and measures. Corps policy requires analysis of costs and benefits of mitigation alternatives to determine the most cost-effective manner to provide needed mitigation.

This document presents the compensatory mitigation plan for unavoidable habitat impacts associated with the Watertown GI project. This plan addresses only compensatory mitigation work and not the sequence of other activities performed during project planning to avoid, minimize, rectify, or reduce habitat impacts from each project alternative (see Engineer Regulation (ER) 1105-2-103, Section C-1(e)(8). Details of those sequence actions are included in the plan formulation and environmental consequences sections of the study's main report and environmental compliance document, and those actions are incorporated into the mitigation objectives of this plan. The planning work performed to document those sequencing actions is complete and led the team to the need to develop a compensatory habitat mitigation plan for unavoidable impacts to fish and wildlife resources. This document details the work performed, including coordination, plan formulation, and environmental compliance, to develop the compensatory habitat mitigation plan, monitoring requirements, and adaptive management (AM) measures to ensure the success of the mitigation.

2 Coordination and Collaboration

Development of this plan involved coordination and collaboration with the project's non-federal sponsor, state and federal natural resource agencies, landowners, and the public. Input was sought during interagency meetings, public scoping meetings, and during review of the draft report and environmental compliance document.

An interagency team met in January 2023, May 2024, and September 2024 and is planned for August 2025; the study and resource agencies contributed expertise and information to support

the identification of impacts and the development of compensatory mitigation plan alternatives. The views of resource agencies, including the U.S. Fish and Wildlife Service (USFWS) and South Dakota Game and Fish Department (SDGF), and others were considered in the development of the draft plan and the final Recommended Plan. These organizations will be offered an opportunity to continue to play a role in the design and implementation phases of the mitigation work when the project is authorized and funded.

The cooperating and participating agencies are listed below. An early interagency coordination meeting was held in January 2023 to comply with the provisions of the Water Resources Reform and Development Act of 2014 Section 1001. The meeting afforded agencies an opportunity to learn about the project and to provide initial input into the study.

- Bureau of Indian Affairs**
- South Dakota Department of Game and Fish*
- City of Watertown, South Dakota (NFS)
- U.S. Fish and Wildlife Service*
- U.S. Environmental Protection Agency*
- South Dakota Department of Agriculture and Natural Resources*
- Natural Resource Conservation Service

*Indicates an agency serving as a participating agency under 33 U.S.C. 2348(e).
**Indicates an agency formally serving as a cooperating agency under 42 U.S.C 4321 et seq.

3 Significance of Ecological Resources

In compliance with the Corps 1983 Planning Principals and Guidelines (P&Gs) established pursuant to the Water Resources Planning Act of 1965 (PL 89-80, as amended by 42 USC 1962a-2, d-1) and Engineering Regulation (ER) 1105-2-103, identifying significance is a critical step in Corps ecosystem restoration and mitigation planning. It helps establish federal interest and priority at national, regional, state, and local levels. Criteria are used to evaluate various project plans and communicate information to decision makers to support recommendations and justification for plan selection. Following a recommendation and approved decision document, significance criteria may also be analyzed by decision makers to inform budget priorities and allocation of funds among multiple approved projects.

This section provides a summary of the institutional, public, and technical significance of the Big Sioux River (BSR) as described in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and Resource Significance Protocol for Environmental Project Planning* (IWR Report 97-R-4). It is important to note that these significance-based categories are not necessarily mutually exclusive and the significance of many Environmental Quality (EQ) resources and attributes may be recognized on more than one basis.

3.1 Institutional

Institutional significance is based on the importance of a resource or attribute acknowledged in the laws, adopted in plans and other policy statements of public agencies or private groups. Sources of institutional recognition include laws, executive orders, rules, regulations, plans, directives, codes, ordinances and other policy statements made by local public entities and councils of government.

3.1.1 Wetland and Riparian Habitat

Wetlands are a critically important feature of the riparian system along the Big Sioux River (BSR) and are of federal interest and institutionally significant due to the Clean Water Act (CWA) and Executive Order (EO) 11990. Wetlands are important landscape features that provide a multitude of beneficial services to people and fish and wildlife. This includes protection and improvement of water quality, storing floodwaters, maintaining surface water during dry periods and providing habitat for numerous fish and wildlife species (EPA, 2002). Wetlands improve water quality for future use by acting as a filter for surface water that enters a wetland and percolates through the vegetation, depositing suspended sediment and settling to the wetland floor where plant roots and microorganisms absorb excess nutrients before the water enters the groundwater system. Wetlands also provide vital habitat conditions that cultivates biodiversity. While wetlands only cover approximately 5% of the land surface in the lower 48 states, they provide habitat to 31% of plant species and more than one-third of threatened and endangered plant and animal species live explicitly in wetland habitats and another 20% of threatened and endangered species rely on wetland habitat at least once in their lifecycle (EPA, 2006).

The BSR falls within the Prairie Pothole Region (PPR) which are regionally unique and nationally significant depressional wetlands that formed on the formerly glaciated landscape of the upper Midwest. As of 2009, there are an estimated 6.4 million acres of wetlands in the PPR, which spans regions of Montana, North Dakota, South Dakota, Minnesota, and Iowa. Of those 6.4 million acres, approximately 87% of the total wetland area in the PPR is comprised of emergent wetlands, 8% is comprised of forested or scrub/shrub wetlands, and the remaining 4% is comprised of seasonally flooded marshes (Dahl, 2014). Wetlands in the PPR have been severely altered by agricultural practices, including an estimated 65% of the wetlands have been drained, as well as impacts from other physical manipulation, sedimentation, and chemical drift (Euliss and Mushet, 1996; Dahl 2014). Between 1997 and 2009, the PPR experienced a decrease of 1% average annual (approximately 6,200 acres) net loss of wetland acres per year (Dahl, 2014).

In the Inflation Reduction Act of 2022, $23 million was allocated to Department of Interior (DOI) in funding the restoration and conservation of wetlands and grasslands in the PPR. This funding will help the USFWS conduct these restoration and conservation activities on over 350,000 acres of Waterfowl Production Areas within the PPR, further attesting to the national significance of these this important EQ resource.

3.1.2 Migratory Birds

Protecting, enhancing, and restoring migratory bird habitat (shrubs/forested areas/wetlands) in close proximity to the BSR supports national efforts to comply with the Migratory Bird Treaty Act (MBTA; 16 USC 703-712). USFWS has stated that habitat restoration targeting aquatic, wetland, and riparian habitats would be consistent with goals of the U.S. Shorebird Conservation Plan, the North American Waterbird Conservation Plan, and the North American Waterfowl Management Plan. These plans are adopted by State and Federal agencies and non-governmental organizations across the country to determine species, sites, and habitats that most urgently need conservation and/or restoration, making them institutionally significant for restoration plans within the study area. Currently there are 12 migratory “Birds of Conservation Concern,” defined within the project area, according to the USFWS Information for Planning and Consultation online tool.

The BSR falls within the Central Flyway; a nationally important corridor for bird migration. In studying the migratory routes of birds, specific pathways were delineated and are used to scientifically acknowledge their importance. Over 400 species of birds across 50 families follow

the Central Flyway (Johnsgard, 2012), utilizing wetlands, grasslands, and other habitat types in the study area throughout their lifecycles. The USFWS (in partnership with other agencies) manages migratory birds based largely on routes the birds follow as they migrate between nesting and wintering areas. Based on those routes, four administrative Flyways (Atlantic, Mississippi, Central and Pacific) were established in North America to facilitate management of migratory birds and their habitats. The flyways have Councils consisting of representatives from each state, provincial, and territorial agency within that flyway. Councils are managed by technical committees consisting of biological staff from the member agencies. The technical committees evaluate population and habitat information and make recommendations to the Councils on matters of migratory bird conservation. The Central Flyway was formed in 1948 and consists of the states of Montana, Wyoming, Colorado, New Mexico, Texas, Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota, and the Canadian provinces of Alberta, Saskatchewan and the Northwest Territories.

Migratory birds key in on riverine corridors and rely heavily on the PPR during spring and fall migrations as these areas are more productive and provide food and cover resources. Without this valuable aquatic habitat, migratory birds would not have the needed resources to recover and continue their migration or successfully reproduce. The recent ruling in *Sackett v. EPA* (2023), the jurisdictional scope of wetlands and Waters of the United States (WOTUS) regulated and receiving protections under the CWA was significantly reduced to only those wetlands and WOTUS that have "continuous surface connections" which will have substantial ramifications for protection of these habitat types, particularly PPR wetlands. In a Policy Memorandum titled "*Civil Works Actions to Sustain and Advance the Nations Waters and Wetlands after the Sackett Decision*" dated 22 March 2024 punctuates the importance of all our Nation's wetlands and WOTUS, regardless of jurisdictional protections. Despite the lack of protections under the CWA, these aquatic resources continue to be of vital importance to healthy, functioning watersheds and ecosystems. As such, the Corps is directed to use applicable authorities and available resources to protect, restore, and enhance these important habitat types and jurisdictional status is not determinative for compensatory mitigation requirements.

3.1.3 Endangered Species

Within the study area along the BSR, two endangered species, the Topeka shiner (*Notropis topeka*) and northern long-eared bat (*Myotis septentrionalis*); two threatened species, the rufa red knot (*Calidris canutus rufa*) and Dakota skipper (*Hesperia dacotae*); two proposed threatened species, the western regal fritillary (*Argynnis idalia occidentalis*) and monarch butterfly (*Danaus plexippus*); and two proposed endangered species, the Suckley's Cuckoo Bumble Bee (*Bombus suckley*i) and tri-colored bat (*Perimyotis subflavus*) were identified as having the potential to occur. As discussed in Section 1.2.1.1, 1.2.3.1, riparian corridors and wetland habitats serve as the most dynamic and biologically productive habitat types, which leads to higher biodiversity and the ability of an ecosystem to support rare and keystone species.

3.2 Public

Significance based on public recognition states that some segment of the general public recognizes the importance of an EQ resource. This may take the form of controversy, support, conflict, or opposition and may be expressed formally, or informally.

3.2.1 Agency, Tribal, and Public Input

Public scoping meetings were held in January 2023; comment themes of questions and comments related to the scope of the project, Recommended Plans from historical feasibility studies, floodplain development, and the cost of the project. Approximately 34% of respondents

to an outreach questionnaire noted Nature and Wildlife and 20% of respondents noted Recreation as important considerations in addition to the flood risk management (FRM) objectives. Another interim public meeting was conducted with the City Council and the public in June 2024 to provide an update on the project progress.

Other engagement meetings were held with specific groups of landowners, such as those communities upstream of the City of Watertown (October 2022) and the residents of Lake Kampeska (February 2024). Specific tribal meetings were held in February and June of 2023 and June of 2024. The primary tribal concerns centered on alternatives proximity to Lake Traverse, as well as potential impacts to environmental resources.

Please see Appendices J and K for all agency, tribal, and public comments received during scoping and coordination meetings.

3.2.2 Recreation

The city of Watertown offers a diverse range of recreational opportunities. Its parks and recreation system is well-developed with numerous recreation facilities. Watertown has several parks which offer playgrounds, sports fields, picnic areas, and walking trails. There are multiple sports complexes with facilities for a variety of sports that host local leagues, tournaments, and community sports programs. Two of the most visited parks in Watertown are Stokes-Thomas Lake City Park and Bramble Park. Other parks with relatively high visitation within and adjacent to the study area are Lions Park, Riverside Park, and McKinley Park. Recreation in Watertown is largely lake-based due to the presence of Lake Kampeska and Pelican Lake. Lake Kampeska has approximately 6 boat ramps and several recreation areas along the shore. Similarly, Pelican Lake has approximately 4 boat ramps and recreation areas along the shore.

3.2.3 Ecological Resources and Public Interest

Fish and wildlife resources and their habitat, vegetation, green spaces, and water resources in the riparian corridor of the BSR provide significant local benefit to passive recreation users such as bird watchers, hikers, and photographers as well as active users such as hunters and fisherman. Environmental resources such as these also provide indirect intrinsic value to any individual, even those not necessarily passively or actively experiencing the resource; over two decades of research conclude trending hydrometeorological events increasing threats to human health (IPCC, 2001). A growing body of evidence has found habitat destruction and these forecasted future scenarios may also negatively affect the mental health and wellness of individuals and physiological well-being improves when individuals connect with nature (APA, 2017). Transitively, ensuring the conservation and enhancement of natural resources is imperative to the collective health of the National public. Environmental resources of the BSR contribute to positive ecological productivity and may help alleviate physical and mental health ailments of local users and those who intrinsically value the knowledge of the mere existence of these resources.

3.2.4 Ecosystem Services

Ecosystem services considered the direct and indirect benefits that ecosystems provide to humans. These are grouped into four broad categories: 1) provisioning services- those that are directly consumable such as food, drinking water, timber, fossil fuels, etc; 2) regulating services- those that provide basic services that allow for life to be possible and moderate natural phenomna, such as pollination, water purification, carbon storage, flood control, and climate control; 3) cultural services- those services that we interact with and have in turn influence our cultural, intellectual, and social development; and 4) supporting services- those natural processes such as photosynthesis, nutrient cycling, and the water cycle (NWF, 2024).

Provisioning services provided by the BSR include drinking water and water supply. The BSR is the heaviest populated river basin in SD, and provides drinking water to approximately 40% of the SD population (SDENR, 2016). Across the three States the BSR traverses 420 miles, supporting 11 designated Beneficial Uses, to include water supply, warm water fisheries, irrigation, recreation, and fish and wildlife propagation uses in the State of South Dakota. Regulating and supporting services provided by the study area include benefits of carbon capture and storage as well as flood control as well as nutrient and water cycling by wetland and riparian habitat of the BSR and the PPR. Some cultural services provided to indigenous communities are discussed in Section 3.4.

3.3 Technical

Significance based on technical recognition means that the importance of an EQ resource or attribute is based on scientific or technical knowledge or judgment of critical resource characteristics. Major sources of information that support technical recognition include published and unpublished literature as well as fieldwork.

3.3.1 Scarcity, Status, and Trends

Scarcity is a measure of relative abundance. As noted above in Section 1.2.1.1, the study area lies within the unique PPR. Specifically, within the urbanized area of Watertown, riparian and wetland habitat is rare as compared to historical conditions. It has been noted that “natural riparian corridors are the most diverse, dynamic and complex biophysical habitats on the terrestrial portion of the earth” (Naiman et al., 1993). This is due to the interactions of the aquatic system with the adjacent terrestrial environment and the ecological processes that take place as a result. Urbanization typically leads to habitat fragmentation, associated development of residential and industrial areas in riparian corridors turn a ribbon of continuous habitat into a network of habitat patches which can become isolated from one another (Ellis, 2008). Not only does this lead to connectivity issues which may affect animal movements and migration routes and territory loss of breeding and feeding grounds, but it also increases the likelihood of non-native and generalist species out competing native diversity.

3.3.2 Landscape Considerations and Connectivity

In the face of continued loss of habitat and habitat isolation, ecologists stress the need for providing connectivity, particularly in the form of wildlife movement corridors and stepping stones. Riparian corridors are of exceptional significance in a landscape. Despite discussion over the effectiveness of corridors in enhancing biodiversity, a growing empirical body of research underlines the positive benefits accruing from incorporating higher quality linkages between habitat patches (Dramstad et al., 1996). Continued habitat segmentation from deleterious land uses will continue to disrupt habitat connectivity.

3.3.3 Biodiversity

A functioning ecosystem is predicated on the variability and diversity of its biotic and abiotic components and the subsequent interactions of these components. As natural environments continue to be influenced by factors such as habitat loss, overexploitation, invasive species, pollution, and hazardous hydrometeorological events, species diversity and richness will continue to degrade. Biodiversity at its core, provides stability and resilience in support of a host of ecosystem services such as flood control, food and water security, water filtration, and development of medicines. The economic value of ecosystem services, estimated to be in the hundreds of trillions each year, are greatly impacted from the destruction of healthy, functioning ecosystems. It is estimated that approximately 55% of the global economy is dependent on high functioning, diverse ecosystems and one-fifth of the world’s countries are at risk of their ecosystems collapsing (NRDC, 2022). In addition to the tangible benefits that diverse

ecosystems provide, the intrinsic benefits include the cultural and religious influences guided by nature. This is particularly true for indigenous communities that are deeply tied to the environment.

3.4 Cultural Values

The evolving knowledge acquired by indigenous and local peoples over hundreds or thousands of years through direct contact with the environment through a body of observations, oral and written knowledge, practices, and beliefs that promote environmental sustainability and the responsible stewardship of natural resources through relationships between humans and environmental systems provide insight on cultural values.

The region has been inhabited for thousands of years by indigenous communities. Many communities consider the Prairie Coteau sacred, including the Dakota, Lakota, Ponca, Mandan and Iowa. The BSR served as an important trade route between the Indians and the French. The BSR watershed were the traditional homelands to the Sioux Nation comprised of 7 Major Divisions; Mdewakanton, Wahpekute, Wahpeton, Sisseton, Yankton, Yanktonai, and Teton (Nebraska Indian Community College, 2021) until 1740 where the 3-day Battle of Kathio between the Sioux and Chippewa resulted in the separation and migration of the Sioux people (Lavanger, 2016 and Eastmen 1808-1875) prior to further forced dispersals from white settlement in the early 1800s. The Santee Sioux called the BSR the “Silvery Sioux” due to its gravel bottom and clear waters in 1868 from an expedition to find suitable new land to settle.

In 1870 following the Fort Laramie treaty, 25 families of the Santee Sioux left the Nebraska Reservation, required to volunteer “abandonment” of relations with their Tribe in order to become Citizens of the US to live along the BSR in South Dakota; thus becoming the Flandreau Santee Sioux (Flandreau Santee Sioux Tribe, 2003). Many locations within the study area maintain their traditional Dakota place names in English (e.g. Kampeska, Enemy Swim Lake, Punished Woman’s Butte). Today, the Flandreau Santee Sioux and the Sisseton, Wahpeton, Oyate Indian reservations are found along the BSR in South Dakota.

4 Mitigation Planning

A conceptual ecological model (CEM) was developed to depict anticipated environmental degradation as a result of implementation of the Recommended Plan, as well as potential mitigation measures that could help offset those effects. The effects of the Recommended Plan would continue to perpetuate and exacerbate ecological stressors present in the existing condition. The CEM was developed to help establish mitigation planning objectives.

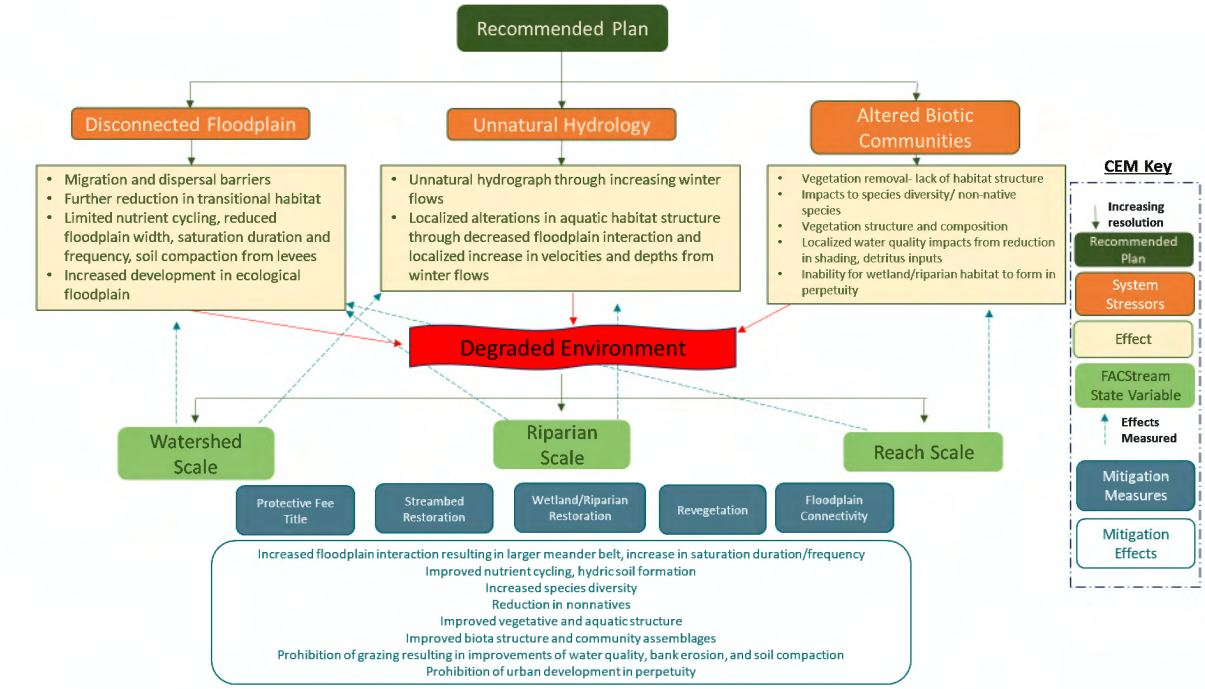


Figure 1. CEM depicting the cause-and-effect relationships of implementation of the Recommended Plan and mitigation measures

Mitigation planning objectives are specific actions taken to avoid and minimize adverse impacts and the identification of compensation required to replace or substitute remaining unavoidable losses.

4.1 Avoidance and Minimization

In recent decades, conventional civil infrastructure practices have begun to shift from disproportionately impacting economically disadvantaged communities and ecosystem services to now incorporating greater consideration of infrastructure development effects and harnessing ecosystem services and ecological functions to deliver outcomes less impactful to ecological and societal communities (Van Rees et al, 2023). In response to the need for more resilient and environmentally beneficial solutions, there has been an international interest in developing and implementing Natural and Nature-based Features (NNBF) for water resource and environmental challenges. Guidance for USACE to consider NNBF was established in Section 1184 of WRDA 2016, where study teams are directed to consider and evaluate NNBF to the same level of detail as other alternatives. Implementation Guidance for Section 1184 of WRDA 2016 defines NNBF as “those created by human design, engineering, and construction that work in concert with natural processes or to mimic as closely as possible conditions which would occur in the area absent human changes to the landscape or hydrology in order to achieve study objectives.” The guidance defines natural features as “those that are created through the action of physical, geological, biological, and chemical processes over time.” NNBF can consist of a variety of forms dependent on project purpose and the environment the feature is being implemented in.

International efforts to promote the implementation of NNBF include the International Union for Conservation of Nature's (IUCN) Global Standard for Nature-based Solutions, which help guide designing, implementing, and evaluating NNBF impacts on ecosystem services. At the national level, the White House has published Nature-Based Solutions Resource Guides in both 2022 and 2023, providing federal agencies, guidance, examples, resources, and more to support the implementation of NNBF. Additionally, a memorandum from the Assistant Secretary of the Army- Civil Works, *Incorporation of Nature-Based Solutions in Civil Works Projects* dated April 22, 2024, directs USACE to formulate for and incorporate NNBF into analyses for all Civil Works projects, as appropriate. The memo emphasizes the variety of benefits NNBF can provide, including environmental, social, and economic benefits, as well as promoting resiliency against hydrometeorological events and other challenges. Natural systems are flexible and adaptable, providing an extra resilience measure for the traditional, gray infrastructure they may be implemented with. While NNBF still require some maintenance like traditional infrastructure, unlike structural measures, many NNBF are able to adapt to future conditions and performance may even improve over time (Bridges et al, 2021). During alternative formulation, NNBF were considered as stand-alone measures and integrated into hybrid flood risk management (FRM) measures. Stand-alone NNBF measures included construction of a wetland/riparian habitat complex upstream of Watertown to provide storage capacity for floodwaters while dually serving as mitigation. NNBF measures hybridized into the Recommended Plan included the use native plantings (Table 1) on constructed levee features instead of nonnative smooth brome (*Bromus inermis*) which is considered an intentional *co-benefit for biodiversity* and maintenance of a low-flow channel in the newly widened cross section which would provide biodiversity supported services (Figure 2). Integration of NNBF in the Recommended Plan resulted in a 51% decrease of required mitigation as compared to implementing the action without incorporation of NNBF.

Other minimization strategies include re-seeding 70.2 acres of the benches of the newly widened channel to PEM wetlands.

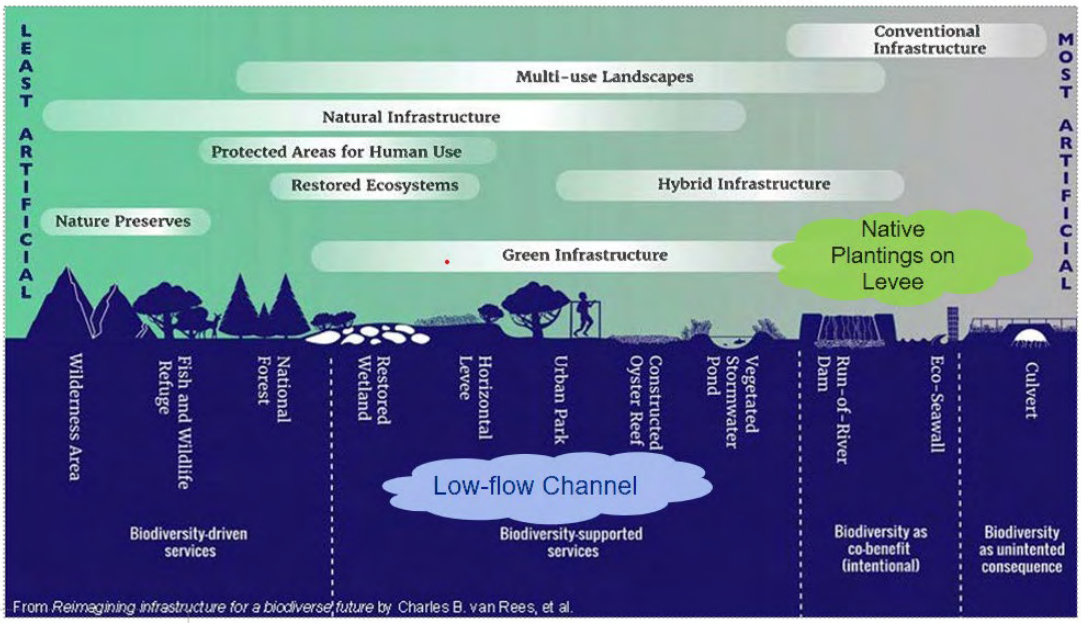


Figure 2. NNBF measures and their representative classification across the gradient of infrastructure methods

Table 1. Recommended Native Plantings on the Levee

SCIENTIFIC NAME	COMMON NAME	% of GROUP	Seeding Rate PLS lbs/Ac (Drilled)
Bouteloua curtipendula	Sideoats grama	10%	0.9
Bouteloua gracilis	Blue grama	5%	0.125
Buchloe dactylodies	Buffalograss	15%	2.25
Elymus canadensis	Canada wildrye	5%	0.65
Elymus lanceolatus	Thickspike wheatgrass	10%	0.9
Panicum virgatum	Switchgrass	10%	0.4
Pascopyrum smithii	Western wheatgrass	15%	2.1
Poa palustris	Fowl bluegrass	5%	0.15
Sorghastrum nutans	Indiangrass	5%	0.5
Spartina pectinata	Prairie cordgrass	20%	1.6
		100%	9.58

4.2 Unavoidable Impacts

Following avoidance and minimization strategies, the remaining unavoidable impacts that necessitate compensatory mitigation are 1.32 average annual habitat units (AAHUs). Unavoidable impacts are primarily the result of levee construction in the floodplain and the perpetual operation and maintenance (O&M) of the levee system. While 3- to 5-foot tall existing berms traverse segments of the banks along the BSR throughout the City limits that function somewhat as a levee, impacts to floodplain ecology would be exacerbated as compared to existing and FWOP conditions with the construction of a federally-compliant levee system. Adverse impacts to the saturation frequency and duration and floodplain width would result from the continuous levee system isolating the BSR from its floodplain and impacting drainage patterns.

Under the Recommended Plan, direct fill in 0.02 acre of emergent (PEM) and 0.10 acre of scrub shrub (PSS) wetlands would result in permanent impacts from levee construction. Approximately 11.65 acres of woody vegetation would be removed for construction of the levee and to accommodate the channel widening. Throughout the newly widened channel right-of-way (ROW) and levee ROW tree recruitment would be perpetually inhibited to maintain channel capacity and hydraulic conveyance and to maintain compliance with ER-1110-2-1913. Large woody debris (LWD) and detritus inputs into the BSR would be adversely impacted as a result of precluding the growth of riparian woody species. Approximately 0.84 acres of unconsolidated bottom (PUB), 3.24 acres of PSS, 0.34 acres of forested bottomlands (PFO), and 23.47 acres of upland habitat types within the floodplain would be excavated to accommodate the newly widened channel cross section and permanently converted to 29.1 acres of PEM upon completion of construction. Another 41.12 acres of existing PEM wetlands would be restored to PEM upon completion of construction resulting in a total of 70.2 acres of emergent wetlands within the newly widened channel ROW (see Table 2).

Table 2. Unavoidable Impacts associated with all Alternatives

Alternative			1	3	7	8	11B	11C	12
AAHUs				-1.32	-2.16	-1.43	-3.97	-4.23	
Riparian Impacts (ac)		Tree Removal		11.65	2.64	11.65	9.78	10.30	
		Perpetual Inhibition of Woody Growth		78.05	7.66	78.05	33.40	35.24	
Aquatic Habitat Impacts (ac)	Levee/Floodwall Impacts	Direct Fill	PUB	0	0	0	0	0	
			PEM	0.02	0.02	0.02	1.26	1.43	
			PSS	0.10	0.10	0.10	0.39	0.44	
			PFO	0	0	0	0.24	0.26	
			TOTAL	***0.12***	***0.12***	***0.12***	***1.89***	***2.12***	
		Isolated	PUB	0	0	0	0.63	0.63	
			PEM	0	0	0	0.05	0.04	
			PSS	0	0	0	0.07	0.06	
			PFO	0	0	0	0.50	0.48	
			TOTAL	***0***	***0***	***0***	***1.25***	***1.22***	
	Channel Widening Impacts	Conversion	PUB to PEM	0.84		0.84			
			PSS to PEM	3.24		3.24			
			PFO to PEM	0.34		0.34			
			UPL to PEM	24.70		24.70			
		Temporary Disturbance	PEM to PEM	41.12		41.12			
			Riverine to Riverine	31.32		31.32			
Upland Habitat Impacts (ac)				23.47	2.48	23.31	12.20	13.10	

No Action Alternative | **Nonstructural**

4.3 Mitigation Planning Objectives

The goal of this mitigation plan is to fully compensate for the unavoidable impacts to significant ecological resources that would occur with project implementation. The objectives of the mitigation plan are defined by the results of the habitat impact assessment model using quantified units (FACStream). FACstream does not explicitly distinguish any single habitat type as being preferable over another. Because FACStream is rooted in a hydrogeomorphic modeling concept, it assesses floodplain effects holistically. As such, FACStream does not focus on any one individual habitat type (i.e., aquatic, emergent wetland, forested wetland, etc) in order for the model user to formulate specific habitat types for compensatory replacement. Rather, a habitat mosaic comprised of all impacted habitat types within the study area should be implemented to replace lost function resultant from the Recommended Plan.

The primary objective of this mitigation plan is to compensate for the loss of 1.32 AAHUs through the construction and restoration of aquatic and terrestrial habitats. Table 2 generally summarizes lost functions and the impacted habitat type.

The overarching Mitigation Objective is to compensate for the loss of 1.32 AAHUs within the Upper Big Sioux Watershed (HUCs 10170201 and 10170202).

- Mitigation Objective #1: Compensate for the direct loss of 0.12 acres of PEM and PSS wetlands from levee construction.
- Mitigation Objective #2: Compensate for the direct loss of an estimated 11.65 acres of mature riparian trees from levee construction and channel widening activities and the perpetual inhibition of 78.05 acres of tree recruitment throughout the levee newly widened channel ROW.
- Mitigation Objective #3: Compensate for the constricted ecological floodplain along 4,435 linear feet (0.84 miles) of the BSR on the left bank from levee construction.
- Mitigation Objective #4: Compensate for the conversion of 23.47 acres of upland herbaceous vegetation from channel widening construction.

Table 3. Impacted functions from implementation of the structural alternatives and their associated habitat types

Impacted Function		Primary Driver	Impacted Habitat Type (*Aquatic- A; Wetland- W; Riparian- R; Upland- U*)
Flow Regime	Unnatural Hydrograph	Winter releases from Lake Kampeska out of sync with natural hydrologic pattern of season	A, W
	Magnitude of Peak Flow	Winter releases from Lake Kampeska results in minor unnatural augmentation out of sync with natural hydrologic pattern of season	A, W
Water Quality	Temperature Regime	Minor localized increases in spring-fall water temperatures through removal of woody vegetation	A, W
	Nutrient Inputs	Reduction in transitional habitat from levee construction and O&M and anticipated increases in urbanization increase organic and inorganic nutrients entering BSR from surface runoff	A, W, R
Floodplain Connectivity	Migration/Dispersal Barrier	Fragmentation from levee impedes movement of small, lesser mobile fauna and reduces shelter/feeding habitat for migrating wildlife	W, R, U
	Reduction in Transitional Habitat	Fragmentation from levee	A, W, R, U
	Reduced Nutrient Cycling	Disconnected floodplain from levee results in reduced aquatic-floodplain habitat interaction	A, W, R
	Reduced Floodplain Width	Ecological floodplain width decreases to zone between constructed levee	W, R
	Decreased saturation duration and frequency	Disconnected floodplain from levee results in reduced aquatic-floodplain habitat interaction	A, W, R
Riparian Vegetation	Reduced woody vegetation structure	Removal of woody species within the levee ROW in perpetuity	W, R
	Reduced woody debris and detritus supply	Removal of woody species within the levee ROW in perpetuity inhibts organic inputs which results in a reduction of energy source as well as formation of microhabitat and substrate structure	A, W, R

5 Mitigation Alternative Formulation

This Section discusses three alternatives assessed to meet the mitigation objectives described above.

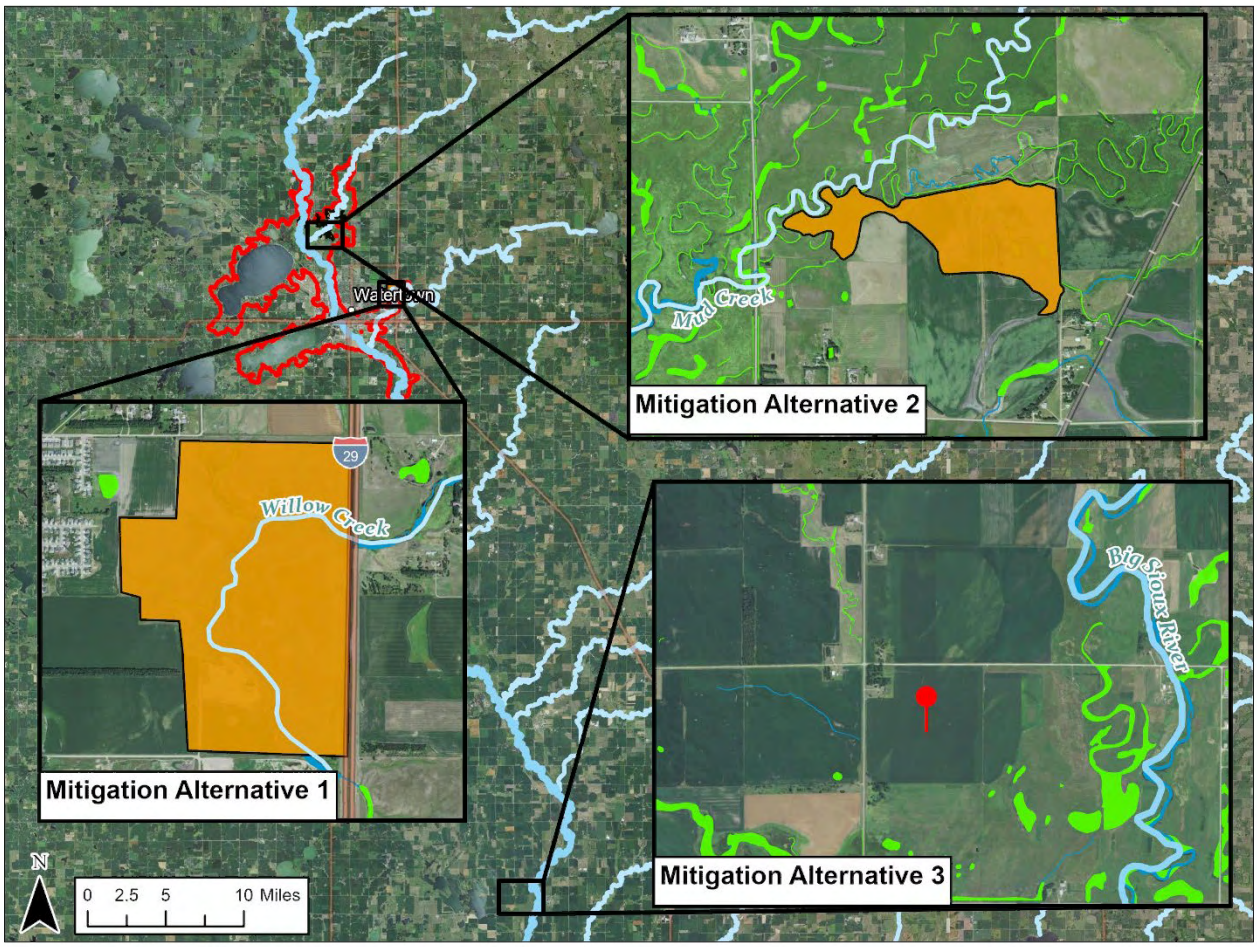


Figure 3. Mitigation Alternatives in context with the Watertown Study Area

5.1 Alternative 1: 14th Avenue and I29

The potential mitigation site located near 14th Avenue and I-29 is directly east of Watertown on Willow Creek, a tributary to the BSR. This site was selected as the Sponsor indicated a potential willing landowner who would sell the site and suggested it could be a potential borrow site for project construction. It was assumed that using an area for mitigation that is also being utilized for borrow would provide cost efficiencies both in real estate and excavation costs.

FACStream was conducted on this site to determine the AAHU lift the area could achieve through construction and restoration efforts associated with mitigation. With 14.5 acres of mitigation, a total of 1.35 AAHU net gain was achieved between the FWOP and FWP condition.

Table 4. Net gain AAHU of Mitigation Alternative 1 for the Recommended Plan

Restoration Alternative / Measure	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs	Net AAHU Gain
Alternative 1: 14th Ave and I29	FWOP	0	0	0.78	14.5	11.29		526.7	10.53	1.35
		10	10	0.75	14.5	10.87	110.80			
		25	15	0.72	14.5	10.41	159.61			
		50	25	0.70	14.5	10.10	256.28			
	FWP	0	0	0.78	14.5	11.29		594.0	11.88	
		10	10	0.81	14.5	11.74	115.11			
		25	15	0.83	14.5	11.99	177.90			
		50	25	0.83	14.5	12.09	300.94			

5.2 Alternative 2: 166th Ave and Sioux Conifer Road

The potential mitigation site located near 166th Avenue and Sioux Conifer is north of Watertown on Mud Creek, a tributary to the BSR. This site was selected as it was initially assessed under the wetland/riparian habitat complex measure during plan formulation. It was assumed that using an area for mitigation that is also being utilized for borrow would provide cost efficiencies both in real estate and excavation costs.

FACStream was conducted on this site to determine the AAHU lift the area could achieve through construction and restoration efforts associated with mitigation. With 17 acres of mitigation, a total of 1.35 AAHU net gain was achieved between the FWOP and FWP condition.

Within the vicinity of the Alternative 2 area, a total of four site options were assessed to refine the specific location mitigation could occur (Figures 4 and 5). Option 1 represents a discontinuous area on both the north and south banks of Mud Creek, embedded between areas currently classified as Wetlands in Agriculture Lands (WAIS) that are mostly in active agriculture production, with approximately 50% overlap in areas that fall with the 5% Annual Exceedance Probability (AEP) event. Option 2 falls on the south bank of Mud Creek, with minor overlap of WAIS areas that are immediately adjacent to Mud Creek and approximately 30% overlap in areas that fall within the 5% AEP. Option 3 is north of Mud Creek, surrounded by WAIS, and approximately 80% within the 5% AEP. Option 4 is on the north and south banks of Mud Creek, with approximately 20% overlap both of WAIS and the 5% AEP.

Option 2 was determined the most preferable with the most efficient and highest restoration opportunity due to access (Options 1 and 4 would require crossing Mud Creek) and connectivity (Option 3 would be entirely cut off from Mud Creek as areas of agricultural production would continue to exist between the mitigation area and the channel).

Table 5. Net gain AAHU of Mitigation Alternative 2 for the Recommended Plan

Restoration Alternative / Measure	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs	Net AAHU Gain
Alternative 2: 166th and Sioux Conifer Rd	FWOP	0	0	0.79	17	13.39		634.5	12.69	1.35
		10	10	0.77	17	13.03	132.07			
		25	15	0.74	17	12.57	192.00			
		50	25	0.72	17	12.26	310.40			
	FWP	0	0	0.79	17	13.39		701.9	14.04	
		10	10	0.82	17	13.86	136.22			
		25	15	0.83	17	14.17	210.18			
		50	25	0.84	17	14.28	355.54			

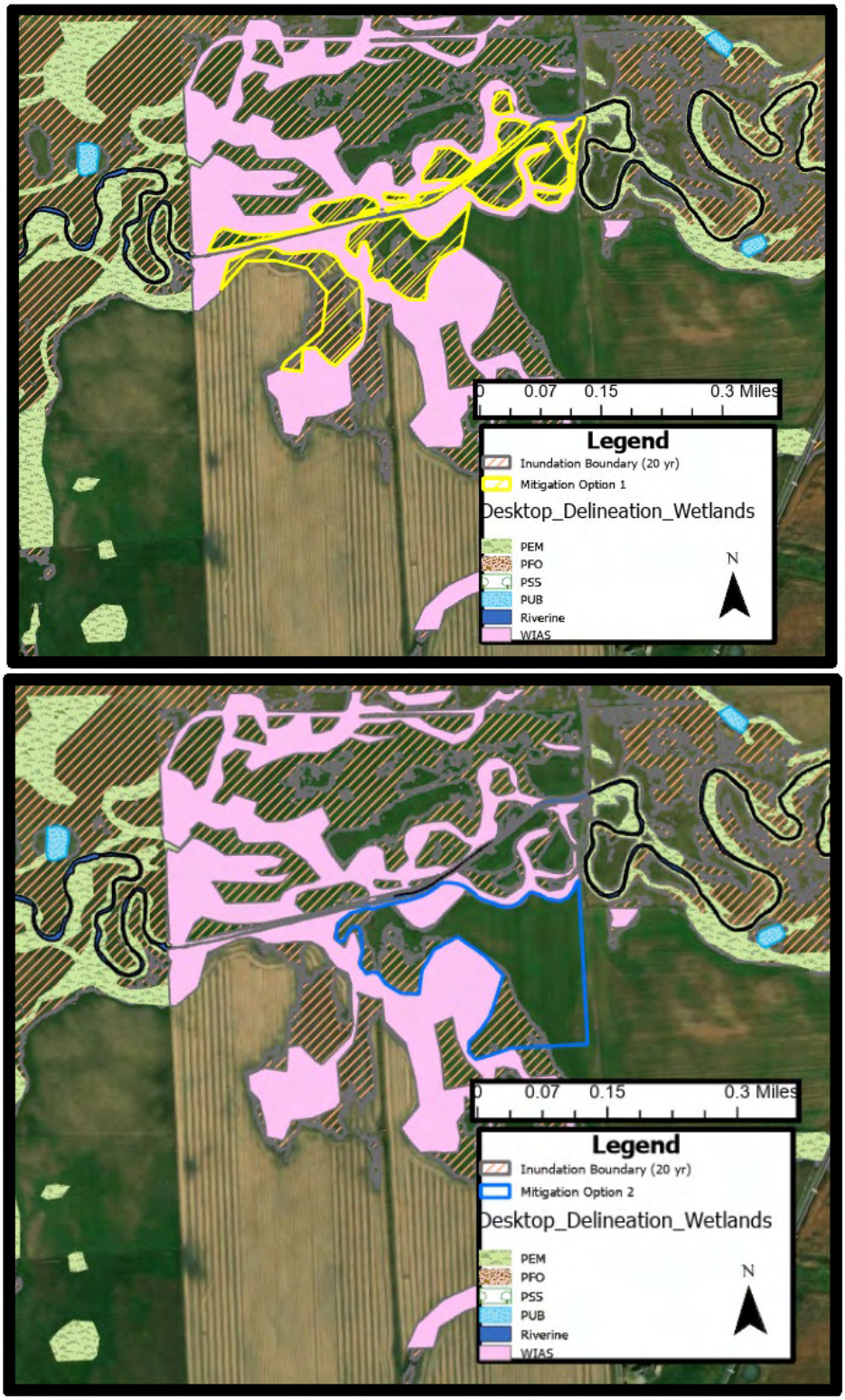


Figure 4. Top: Option 1 (Yellow Hatch); Bottom: Option 2 (Blue)

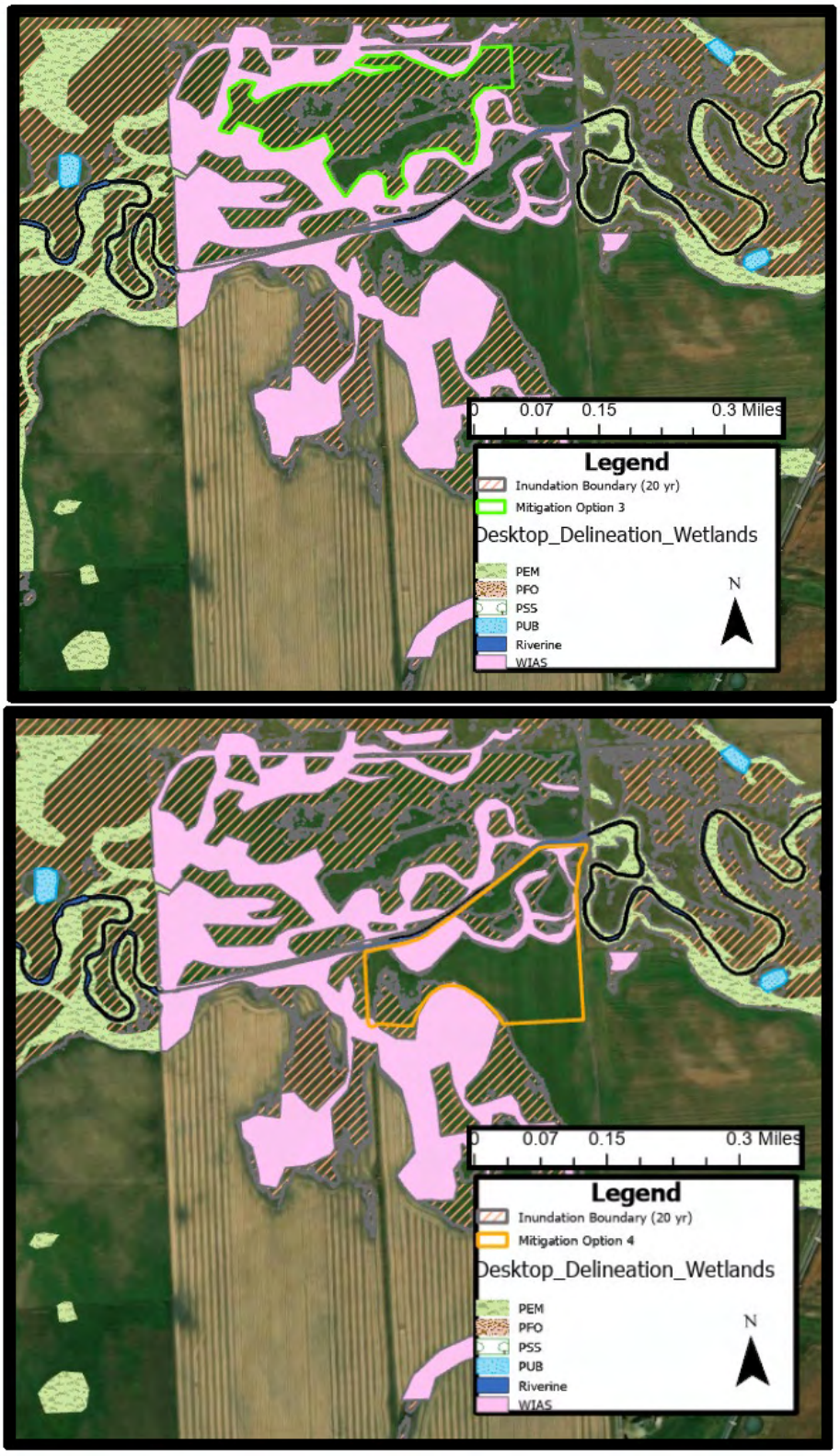


Figure 5. Top: Option 3 (Green); Bottom: Option 4 (Orange)

5.3 Alternative 3: Mitigation Bank Credits

Section 1136 of WRDA 2016 requires to the Corps to consider mitigation banks and in-lieu fee programs where appropriate. Consideration of these options as mitigation strategies may be helpful when available. A planned mitigation bank, Wink Meadow, is anticipated to have approximately 200 riverine and wetland credits available in September 2025, and another 200-300 additional credits following. A call was held with Tetonka Mitigation, the bank owners on 27 June 2024 to obtain information about credit availability, type, and a rough cost per credit. Wink Meadow is located south of Watertown on the BSR and is currently underway for drafting engineering plans. A follow on email was received in May 2026 stating that mitigation bank now had credits to release.

In the State of South Dakota, an interim HGM model is utilized, as required by Corps Regulatory, to determine credit requirements. If a different model is utilized, there is a 5.5 functional credit unit (FCU)/acre conversion factor to equal 1 acre. Because FACStream was not utilized to determine FWOP and FWP conditions of the Wink Meadow Mitigation Bank, as it is not currently constructed, the necessary acreage requirement was estimated at 15.75 acres by averaging the acreage requirement at the Alternative 1 and Alternative 2 sites. This acreage was then multiplied by the 5.5 FCU conversion factor. This would necessitate an estimated 86.63 credits

6 Mitigation Alternative Comparison and Selection

The following table summarizes the lost function of the final array of project alternatives and net gain in AAHUs for all three Mitigation Alternatives for the Recommended Plan, Alternative 3. The cost per acre for mitigation at the sites located under Alternative 1 and 2 costs were estimated at $64,600 for construction, $4,000 per acre for real estate costs, $200,000 for post construction monitoring and adaptive management costs. For the mitigation bank under Alternative 3 the cost per credit of $28,000 was provided to determine the cost per acre (5.5 FCUX $28,000 = $154,000 acre).

Table 6. Mitigation Alternatives and their associated costs

Lost AAHU		Mitigation Alternatives								
		Alternative 1 (14th Ave & I29)			Alternative 2 (166th & Sioux Confier Rd)			Alternative 3 (Mitigation Bank)		
		Acres	Cost~	Gained AAHU	Acres	Cost~	Gained AAHU	Acres*	5.5 FCU/acre = 1 acre**	Cost
-1.32										
Activity	Construction		$936,730			$1,098,234				$2,425,500
	Monitoring		$97,920			$97,920				$0
	Adaptive Management	14.5	$100,000	1.35	17	$100,000	1.35	15.75	86.63	$0
	Real Estate		$58,000			$68,000				$0
Total Cost			$1,192,650			$1,364,154				$2,425,500

~ Cost per acre for construction estimated at $64,602.87/acre

* Acreage requirements are determined from net lift between FWOP and FWP of mitigation site- for Wink Mitigation Bank an acreage was

** Wink Meadow is a riverine bank- conversion factor for bank functional credit unit is 5.5 FCU/acre = 1 acre mitigation for riverine or wetland habitats and at an estimated $28,000/credit; or $154,000/acre (Source: Tetonka Mitigation)

7 Recommended Compensatory Mitigation Plan

Mitigation Alternative 2, Option 2 was selected as the preferred alternative to achieve the mitigation objectives. Alternative 1 and 2 were of comparable costs and while Alternative 2 is nominally more expensive than Alternative 1, it was assumed that incidental flood risk benefits may be achieved through the construction of a wetland/riparian complex upstream of Watertown. Additional ecological benefits of constructing wetland and riparian habitat upstream of Lake Kampeska may capture and reduce the sediment load entering the BSR and Lake Kampeska. Minor incidental water quality improvements may be realized through a reduction in turbidity, dissolved solids, nutrients and a potential localized increase in temperature and dissolved oxygen. While the mitigation bank in Alternative 3 would alleviate the need to conduct monitoring and AM and real estate acquisition, it would be approximately twice the cost of Alternatives 1 and 2.

To achieve the habitat mosaic and restore the lost function described in the mitigation planning objectives (see Table 3 in Section 4.3), the following minimum requirements must be met.

To compensate for the overarching Mitigation Objective and replace the loss of 1.32 AAHUs would require restoration of wetland, riparian, and upland habitat types within 17 acres under Mitigation Alternative 2.

- Mitigation Objective #1: To compensate for the direct loss of 0.12 acres of wetland habitat from levee construction- a minimum of 0.66-acre of PSS must be created. Following the State of South Dakota's USACE Regulatory Program guidance, the FCU/acre conversion factor of 5.5 was applied. PSS was preferred due to the elimination of woody vegetation throughout the channel and levee ROWs and that a total of 24.7 acres of PEM wetland habitat would be incidentally established through conversion of upland habitat as a result of channel widening activities.
- Mitigation Objective #2: To compensate for the direct loss of an estimated 11.65 acres of mature riparian trees and perpetual inhibition of 78.05 acres tree recruitment throughout the levee ROW- a minimum of 14.5 acres of woody vegetation must be restored which would represent a ratio of 1:1.25 to compensate for the establishment phase of riparian plantings, anticipated to establish by Target Year 10 post-construction.
- Mitigation Objective #3: To compensate for the constricted ecological floodplain along 4,435 linear feet (0.84 miles) of the BSR on the left bank from levee construction, the newly established vegetation achieved from Mitigation Objectives #1 and #2 would occur along Mud Creek, providing enhanced floodplain connectivity and interaction between aquatic, wetland, and riparian habitats.
- Mitigation Objective #4: To compensate for the conversion of 23.47 acres of upland herbaceous vegetation from channel widening construction, a minimum of 1.5 acres of an upland buffer should be applied surrounding the wetland and riparian habitats achieved in Mitigation Objective #1 and #2. Note that overlap between woody vegetation requirements and upland habitat is acceptable. Additionally, plantings shall incorporate herbaceous species that are found in "Type B" Dakota skipper habitat, such as bluestem (*Andropogon, Schizachyrium*), needlegrasses (*Stipa spp.*), pale purple coneflower (*Echinacea pallida*), upright coneflower (*E. angustifolia*), blanketflower (*Gaillardia spp.*), bluebell blueflower (*Campanula rotudifolia*) and wood lily (*Lilium philadelphicum*) as well as common milkweed (*Asclepias syriaca*) for the monarch butterfly.

8 Monitoring and Adaptive Management

Monitoring following construction activities would be necessary for both the mitigation site and the native NNBF levee plantings. The level of monitoring should be commensurate with the magnitude of the project and the degree of risk and uncertainty with the probable success of the mitigation. USACE biologists shall be responsible for monitoring the establishment of the native plantings on the levee and the mitigation areas. Following the first growing season after project construction, monitoring would occur annually during the growing season (generally May 1 through October 31, optimally June 15 through August 1) for a minimum of five years to document vegetation establishment and monitoring objective progress, and to identify if any adaptive management (AM) measures are warranted.

An evaluation of the condition of the constructed habitat features and subsequent Monitoring Reports would include at a minimum:

- General site condition observations
- A brief summary of climatic conditions for the growing season and as compared to 50-year averages (precipitation, temperature)
- Species composition (identified to species level)
- Percent vegetative cover of each species
- Identify observed species with Coefficient of Conservation (C) value in accordance with the Coefficients of Conservatism for the Vascular Flora of the Dakotas and Adjacent Grasslands (USGS, 2001)
- Photographs from established photo stations
- Identification of factors, if any, limiting success of constructed features
- Stem count (tree/shrub plantings only)
- A list of all invasive, non-native and undesirable vegetation present and growing
- Discussion of plant loss
- Discussion of survivability of seedlings and plantings
- Estimate of bare ground in planted areas
- Soil profile descriptions
- Species diversity (Shannon-Wiener index value ‘H)
- Species diversity (Shannon-Wiener index value E)

Table 7 provides an estimate of monitoring costs for 5 years post construction. It is assumed Years 1 and 5 would require slightly more labor to account for both setting up the specific monitoring protocol, establishing the base annual report, and for project close out.

Table 7. Monitoring costs

Monitoring Costs		Year 1	Year 2	Year 3	Year 4	Year 5
Labor (2 FTEs)						
Hours		64	40	40	40	64
Cost	$240	$15,360	$9,600	$9,600	$9,600	$15,360
Travel (2 FTEs)						
Hours		32	32	32	32	32
Cost	$240	$7,680	$7,680	$7,680	$7,680	$7,680
Total Hours		**96**	**72**	**72**	**72**	**96**
Total Cost		**$23,040**	**$17,280**	**$17,280**	**$17,280**	**$23,040**

If, after five years of monitoring and adaptively managing any issues that may occur at the site, the areas do not meet the success criteria identified in Section 8.2, more significant AM measures may need to be implemented. USACE Implementation Guidance for Section 1161 (Monitoring Ecosystem Restoration) of the WRDA of 2016, and Section 2036 (Mitigation for Fish and Wildlife and Wetlands Losses) of the WRDA of 2007 require monitoring sufficient to evaluate ecosystem restoration and mitigation success. USACE is required to consider AM for mitigation projects because they often involve uncertainty that can be reduced through an adaptive management approach.

Section 3013 of the Water Resources Reform and Development Act (WRDDA) of 2014 required USACE to review national guidelines to determine if current policy (EP 1110-2-18) is appropriate for all regions of the United States. Part of this review included consideration of managing vegetation on levees without affecting performance of FRM while maintaining flexibility for environmental needs. USACE is in the beginning phases of identifying policies and programs that utilize reference vegetation guidelines and standards and implementing novel practices to analyze the efficacy and practicability of incorporating measures such as what has been proposed under Alternative 3. Because there is 1) uncertainty regarding the outcome of the management measures, 2) an ability to monitor and evaluate the system response to management measures, 3) capacity to learn from monitoring which may also help inform the feasibility of implementation of native vegetation on levee systems, and 4) the ability to apply a decision to change management if needed- it is necessary to define an appropriate management strategy.

These NNBF measures of the constructed Recommended Plan and the mitigation site will be monitored following project construction or after initial implementation to inform decision-makers whether 1) the project is meeting performance measures and should continue as implemented 2) the project is not meeting performance measures and should be adjusted, or 3) the project has met success criteria and no further monitoring for ecological performance is needed.

In the sections below, discussion on performance objectives, measures utilized to achieve performance objectives, success criteria utilized to define achievement of performance objectives, as well as adaptive management decision triggers and contingency plans will be provided for both the implementation of the incorporated NNBF native levee plantings and the activities at the mitigation site will be discussed.

8.1 Native Levee Plantings (Incorporated NNBF Onsite)

The NNBF measures implemented in the Recommended Plan resulted in a 51% reduction of required mitigation.

8.1.1 Performance Objective

Ensure the integrity of the function and protection provided by the flood control system (levee) through appropriate vegetation cover and expedient vegetation establishment.

8.1.2 Success Criteria

- Adequate vegetation percent coverage
    - ≥ 80% of site should be vegetated by Year 1
    - ≥ 90% of site should be vegetated by Year 2

- Floristic Quality Index ([FQI]; ≥ 6.0)
- Invasive and undesirable vegetation percent coverage (≤ 15%)
- Native vegetation presence (≥ 60% recorded species are native)

8.1.3 Monitoring Design

Establish a minimum of 1 data/photo points for every 300 linear feet along the length of the levee and assess the vegetation coverage using the Daubenmire method at the beginning and end of the growing season for the first two years post-construction to determine coverage. See Section 8.3 for detailed discussion.

8.1.4 Adaptive Management Decision-making

There are uncertainties related to the physical and/or biological performance of native levee plantings that could affect the ability to meet the project goals and objectives. This uncertainty predominantly centers on the feasibility of establishing native vegetation on the levee system in an expeditious manner so as to not impact the integrity of FRM.

The overarching decision trigger is if by Year 2 of monitoring, vegetation cover fails to establish to 90%. The trajectory of success and likelihood of favorably reaching this will be assisted by the Year 1 results. Native vegetation typically takes 1 to 2 growing seasons to establish and to best plan for meeting the targeted objective, a higher application rate of an annual cover crop would be utilized to ensure rapid and immediate soil coverage.

Table 8 describes the primary components of the decision-making process which include decisions to be made, decision-making responsibilities, how the decision-making group operates, how they report their decisions, and the required timing of decisions in order for potential adjustments to be effective.

Table 8. Decision-making Framework for Native Levee Plantings

Decision	Decision-making Team	Decision Responsibility	Reporting of Decisions	Required Timing
If vegetation coverage is sufficiently established in an expeditious manner	* Levee Safety * Geotech * Environmental * Project Manager * Non-federal Sponsor	Levee Safety	Monitoring Reports	2 Years Post Construction

Once the results of monitoring have been assessed and evaluated, Levee Safety can decide to: (1) continue the action with no adjustments because performance measures indicate a favorable trajectory, (2) adjust using a contingency plan, or reformulate the plan revisiting the planning process, or (3) decide the action is successful and complete based on meeting success criteria.

8.1.5 Adaptive Management Contingency Plan

To address potential problems with project features, USACE has identified some potential modifications or different measures that could be implemented. Table 9 includes a description of

potential contingency measures, under what circumstances they would be implemented, an estimated cost for implementation, and identifies the responsible parties. The total cost estimate for all contingency measures for native levee plantings is $75,000.

Table 9. Contingency Measures for Native Levee Plantings

Contingency Measure	Decision Trigger	Cost Estimate	Responsible Party
Additional annual cover crop seeding on levee	If vegetation coverage is <70% during the first monitoring period in Year 1	$25,000	USACE
Additional native seeding on levee	If vegetation coverage is < 80% during the second monitoring period in Year 1	$50,000	USACE

8.2 Channel Bench Plantings (Incorporated NNBF Onsite)

The widening of Big Sioux River would be accomplished by excavating a bench adjacent to the existing river channel. This excavation would result in the unavoidable conversion of 0.84 acre palustrine unconsolidated bottom, 3.24 acres of palustrine scrub shrub, 0.34 acres of palustrine forested, and 24.7 acres of upland habitat types to a total of 29.12 of palustrine emergent (PEM) wetland habitat. 41.12 acres of existing PEM wetland habitat would be temporarily disturbed and reestablished upon completion of construction; totaling 70.2 acres of PEM habitat.

8.2.1 Performance Objectives

- *Create/restore emergent plant cover within the widened channel bench*
  - Seed and transplant native obligate, facultative-wet, and facultative species
  - Create conditions conducive for natural succession
- *Improve connectivity of the Big Sioux River to its ecological floodplain on the riverward side of the levee*
  - Excavation of channel bench
  - Plant emergent hydrophytes
- *Increase taxonomic diversity and habitat integrity*
  - Remove invasive species
  - Plant native species

8.2.2 Success Criteria

The metrics of the objectives used to measure progress and their success criteria are listed below.

Wetland Habitat:

- Adequate vegetation percent coverage (≥ 75% of site should be vegetated)
- FQI (≥ 6.0)

- Invasive and undesirable vegetation percent coverage (≤ 15%)
- Native vegetation presence (≥ 60% recorded species are native)
- Prevalence Index ([PI] ≤ 3.0)
- Percent native hydrophytes presence (≥ 50%)
- Percent native hydrophytes coverage (≥ 50%)

8.2.3 Monitoring Design

Establish a minimum of 40 representative data/photo points to assess the vegetation coverage using the Daubenmire method annually for 5 years post-construction. See Section 8.4 for detailed discussion on methods and analysis.

8.2.4 Adaptive Management Decision-making

Potential uncertainties related to the physical and/or biological performance of plantings that could affect the ability to meet the project goals and objectives predominantly centers on the potential for failed plantings which may result from a suite of possibilities such as low seed viability, appropriate soil type and composition, and appropriate hydrology.

The overarching decision trigger is if by Year 3 of monitoring, success criteria identified in Section 8.2.2 are not on a positive trajectory. Native vegetation typically takes 1 to 2 growing seasons to establish. So long as native vegetation coverage steadily increases, hydrophytic vegetation steadily increases in prevalence in aquatic habitat, invasive species are not excessively present by Year 3, it is assumed that the mitigation is adequately establishing and would be expected to reach the necessary targets in Section 8.2.2 by Year 5.

Table 10 describes the primary components of the decision-making process which include decisions to be made, decision-making responsibilities, how the decision-making group operates, how they report their decisions, and the required timing of decisions in order for potential adjustments to be effective.

Table 10. Decision-making Framework for Channel Bench Plantings

Decision	Decision-making Team	Decision Responsibility	Reporting of Decisions	Required Timing
If vegetation coverage, prevalence, and quality sufficiently establish in each annual monitoring year to ensure success criteria will be met by Year 5	* Environmental * Geotech * Hydrology/Hydraulics * Project Manager * Non-federal Sponsor	Environmental	Monitoring Reports	Following annual monitoring in Year 1 through 5

Once the results of monitoring have been assessed and evaluated, Environmental can decide to: (1) continue the action with no adjustments because performance measures indicate a favorable trajectory, (2) adjust using a contingency plan, or reformulate the plan revisiting the planning process, or (3) decide the action is successful and complete based on meeting success criteria.

8.2.5 Adaptive Management Contingency Plan

To address potential problems with project features, USACE has identified some potential modifications or different measures that could be implemented. Table 11 includes a description of potential contingency measures, under what circumstances they would be implemented, an estimated cost for implementation, and identifies the responsible parties. The total cost estimate for all contingency measures associated with the channel bench plantings is $85,000.

Table 11. Contingency Measures for Compensatory Mitigation

Contingency Measure	Decision Trigger	Cost Estimate	Responsible Party
Exercise plant care warranty/1-year gurantee from construction contractor. Use supplemental watering or irrigation during dry periods to support plant establishment and growth	If vegetation coverage is <50% during the first monitoring period in Year 1	$0 (Plant Care Warranty)	Contractor
Additional seeding to increase plant density or introduce species that are well-suited to site conditions	If vegetation coverage is <60% during the first monitoring period in Year 3	$25,000	USACE
Implement soil amendments (e.g., organic matter, mulch) to improve growing conditions and enhance seedling survival	If vegetation coverage is <60% during the first monitoring period in Year 3	$25,000	USACE
Introduce a greater diversity of native species, particularly those that are more sensitive to environmental stressors, to increase the overall quality of the plant community.	If FQI is <4.5 during the second monitoring period in Year 3	$25,000	USACE
Increase monitoring efforts to detect and address invasive species outbreaks promptly.	If invasive vegetation coverage is on an upward trajectory (increasing) between Year 2 and Year 3 monitoring, conduct twice per growing season (at mid- and late-growing season) annually until invasive species coverage decreases	$5,000/year where required	USACE/Sponsor
Implement targeted invasive species control measures, such as manual removal, herbicide application, or biological control methods	If invasive vegetation coverage is on an upward trajectory (increasing) between Year 3 and Year 4 monitoring OR if invasive species coverage >25% by Year 4 monitoring	$5,000-$15,000/year where required	USACE/Sponsor

8.3 Compensatory Mitigation Habitat (Offsite Mitigation)

Compensatory mitigation objectives for wetland and riparian habitats are identified in Section 7 above. To replace 1.32 AAHUs, 17 acres would be restored along Mud Creek to construct a minimum of 0.66 acre of PSS wetlands, plant a minimum of 14.5 acres of woody vegetation, and construct a minimum of 1.5 acre of an upland habitat buffer strip.

8.3.1 Performance Objectives

- *Create/restore riparian woody vegetation and emergent plant cover within the mitigation site*
    - Remove invasive plants
    - Plant shrubs, trees and whips
    - Seed and transplant native obligate, facultative-wet, and facultative species
    - Seed upland buffers with native herbaceous species
    - Create conditions conducive for natural succession
- *Improve connectivity of Willow Creek to its ecological floodplain*
    - Excavation
    - Side channel creation
    - Plant emergent hydrophytes
- *Increase habitat connectivity*
    - Increase extent and proximity of suitable habitat
- *Increase taxonomic diversity and habitat integrity*
    - Remove invasive species
    - Plant native species
- *Increase structural diversity*
    - Plant variety of emergent, shrub and trees

8.3.2 Success Criteria

The metrics of the objectives used to measure progress and their success criteria are listed below.

Upland Habitat:

- Adequate vegetation percent coverage (≥ 75% of site should be vegetated)
- Floristic Quality Index ([FQI]; ≥ 6.0)
- Invasive and undesirable vegetation percent coverage (≤ 15%)

Riparian Habitat:

- Adequate vegetation percent coverage (≥ 75% of site should be vegetated)
- Floristic Quality Index ([FQI]; ≥ 6.0)
- Invasive and undesirable vegetation percent coverage (≤ 15%)
- Native vegetation presence (≥ 60% recorded species are native)
- Tree/shrub stem survivability (≥ 80%)

Wetland Habitat:

- Adequate vegetation percent coverage (≥ 75% of site should be vegetated)
- FQI (≥ 6.0)
- Invasive and undesirable vegetation percent coverage (≤ 15%)
- Native vegetation presence (≥ 60% recorded species are native)

- Prevalence Index ([PI] ≤ 3.0)
- Percent native hydrophytes presence (≥ 50%)
- Percent native hydrophytes coverage (≥ 50%)

8.3.3 Monitoring Design

Establish a minimum of 15 representative data/photo points, capturing each habitat type, to assess the vegetation coverage using the Daubenmire method at annually for 5 years post-construction. See Section 8.4 for detailed discussion on methods and analysis.

8.3.4 Adaptive Management Decision-making

Potential uncertainties related to the physical and/or biological performance of plantings that could affect the ability to meet the project goals and objectives predominantly centers on the potential for failed plantings which may result from a suite of possibilities such as low seed/stem viability, appropriate soil type and composition, and appropriate hydrology.

The overarching decision trigger is if by Year 3 of monitoring, success criteria identified in Section 8.3.2 are not on a positive trajectory. Native vegetation typically takes 1 to 2 growing seasons to establish. So long as native vegetation coverage steadily increases, hydrophytic vegetation steadily increases in prevalence in aquatic habitat, invasive species are not excessively present by Year 3, it is assumed that the mitigation is adequately establishing and would be expected to reach the necessary targets in Section 8.3.2 by Year 5.

Table 12 describes the primary components of the decision-making process which include decisions to be made, decision-making responsibilities, how the decision-making group operates, how they report their decisions, and the required timing of decisions in order for potential adjustments to be effective.

Table 12. Decision-making Framework for Compensatory Mitigation

Decision	Decision-making Team	Decision Responsibility	Reporting of Decisions	Required Timing
If vegetation coverage, prevalence, and quality sufficiently establish in each annual monitoring year to ensure success criteria will be met by Year 5	* Environmental * Geotech * Hydrology/Hydraulics * Project Manager * Non-federal Sponsor	Environmental	Monitoring Reports	Following annual monitoring in Year 1 through 5

Once the results of monitoring have been assessed and evaluated, Environmental can decide to: (1) continue the action with no adjustments because performance measures indicate a favorable trajectory, (2) adjust using a contingency plan, or reformulate the plan revisiting the planning process, or (3) decide the action is successful and complete based on meeting success criteria.

8.3.5 Adaptive Management Contingency Plan

To address potential problems with project features, USACE has identified some potential modifications or different measures that could be implemented. Table 13 includes a description of potential contingency measures, under what circumstances they would be implemented, an estimated cost for implementation, and identifies the responsible parties. The total cost estimate for all contingency measures associated with compensatory mitigation is $100,000.

Table 13. Contingency Measures for Compensatory Mitigation

Contingency Measure	Decision Trigger	Cost Estimate	Responsible Party
Exercise plant care warranty/1-year gurantee from construction contractor. Use supplemental watering or irrigation during dry periods to support plant establishment and growth	If vegetation coverage is <50% during the first monitoring period in Year 1	$0 (Plant Care Warranty)	Contractor
Additional seeding to increase plant density or introduce species that are well-suited to site conditions	If vegetation coverage is <60% during the first monitoring period in Year 3	$25,000	USACE
Implement soil amendments (e.g., organic matter, mulch) to improve growing conditions and enhance seedling survival	If vegetation coverage is <60% during the first monitoring period in Year 3	$25,000	USACE
Introduce a greater diversity of native species, particularly those that are more sensitive to environmental stressors, to increase the overall quality of the plant community.	If FQI is <4.5 during the second monitoring period in Year 3	$25,000	USACE
Increase monitoring efforts to detect and address invasive species outbreaks promptly.	If invasive vegetation coverage is on an upward trajectory (increasing) between Year 2 and Year 3 monitoring, conduct twice per growing season (at mid- and late-growing season) annually until invasive species coverage decreases	$5,000/year where required	USACE/Sponsor
Implement targeted invasive species control measures, such as manual removal, herbicide application, or biological control methods	If invasive vegetation coverage is on an upward trajectory (increasing) between Year 3 and Year 4 monitoring OR if invasive species coverage >25% by Year 4 monitoring	$5,000-$15,000/year where required	USACE/Sponsor
Implement protection measures such as mulching or fencing to reduce herbivory stress.	If by Year 2 15% of shrub/stems exhibit signs of herbivory	$5,000	USACE
If shrub mortality is high, replant or replace dead shrubs with more resilient species or in more favorable locations.	If by Year 2 15% of shrub/stems exhibit signs of environmental stresss	$10,000	USACE

8.4 Methods and Analysis

8.4.1 Riparian/Wetland Habitat and Levee Sampling Methodology

8.4.1.1 Vegetation Coverage and Presence

Sample points along a transect can capture community composition and coverage and may be collected as relative percentages, or by utilizing the Daubenmire Method cover class categories (Table 14). In addition to Daubenmire cover classes, total vegetation cover, regardless of species type, relative to the amount of space that contained leaf litter, dead vegetation, bare soils or any other cover should also be recorded. Helpful guidance for sampling methods may also be found in the *1987 Corps of Engineers Wetland Delineation Manual* and its appropriate regional supplement (Figure 6). The *1987 Delineation Manual* method may help identify transitional communities moving from the upland native levee plantings to the riparian/wetland plantings along the newly widened channel.

Table 14. Daubenmire Cover classes

Cover Class	Range of Coverage	Midpoint of Range
1	1-5%	2.50%
2	5-25%	15%
3	25-50%	37.50%
4	50-75%	62.50%
5	75-95%	85%
6	95-100%	97.50%

Typical plot sizes for vegetation observations of multi-layered communities is usually accomplished utilizing a series of plots for each stratum. An approximate 5-foot radius is used for the herbaceous layer, a 15-foot radius for saplings/shrubs and a 30-foot radius for trees and vines.

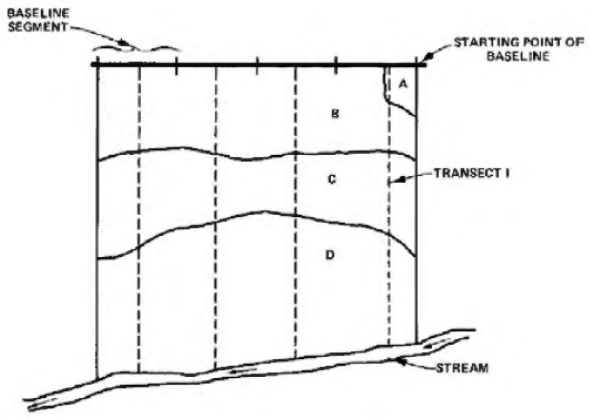


Figure 6. General orientation of baseline and transects (dotted lines) in a hypothetical project area (USACE, 1987).

A method to establish transects to capture vegetation coverage and presence that dissect the gradient of the BSR is depicted in Figure 7. Quadrant-point intercept along a baseline transects would capture vegetation composition and characteristics such as species density and frequency. General hydrology and hydrophytic vegetation observations should still be made along these transects and documented appropriately. Density and stem-counts of woody

vegetation should be made within all transects and plots to monitor survivability of planted shrubs and trees.

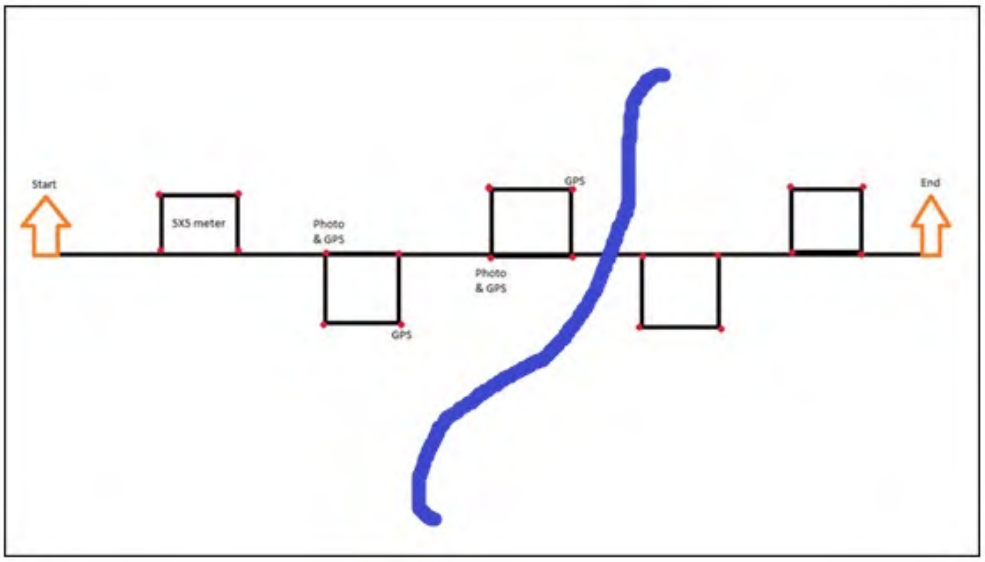


Figure 7. Schematic of example transect and plot set-up running perpendicular to the BSR

8.4.2 Riparian/Wetland and Levee Data Analysis

Statistical analysis of collected field data, and comparative analysis between monitoring years will help determine if the constructed habitat features are meeting the objectives defined in Section 8.1 above, and more specifically, the success criteria set forth in Section 8.2.

8.4.2.1 Floristic Quality Assessment

FQAs are measurements of a natural area's ecological integrity, based on their plant species composition. FQA's are based on C values assigned to the individual plant species based on their tolerance to degradation and the degree to which the species is faithful to natural remnant habitats (Swink and Wilhelm, 1994). C values range from 0 to 10, with the most highly conservative species, >7, that are typically found associated under long, unchanged conditions similar to those under which such species would evolve. The least conservative species, <3, are adapted to extreme anthropogenic or natural degradation of kinds that eliminate both high and mid conservatives.

FQA metrics generally reflect the degree to which the plot or site approximates the vegetative composition of a high quality natural area. Falling values would suggest that quality and biodiversity would be declining (Freyman et al., 2015). The C values for individual species in this region may be found using the Coefficients of Conservatism for the Vascular Flora of the Dakotas and Adjacent Grasslands (USGS, 2001). The C values are used to calculate metrics such as mean C, Floristic Quality Index (FQI) and Adjusted FQI. Mean C is the average C value for all species within the assessment area and FQI weights the mean C by species richness. The mean C and FQI are calculated with all non-native species omitted or assigned a C value of 0. The Adjusted FQI was developed to reduce sensitivity to species richness and include the contribution of nonnative species when assessing sites with high levels of human disturbance.

8.4.2.2 Shannon-Weiner Index

Shannon-Weiner diversity index is a mathematical measure of species diversity in a community. Diversity indices provide more information about community composition than just species

richness (e.g. the total number of species present). The Shannon-Weiner index takes both the richness and the relative abundance of each of these species in a community into account to determine the uncertainty that an individual picked at random would be of a given species. H' = -Σ (pi)(lnpi), where pi = proportion of individuals of species **i** in community (= **ni** /**N**; where **n** is the number of individuals of a given species and **N** is the total number of individuals in a sample) and $E = H/H_{max}$ where $H_{max} = lnS$ (S= number of species or species richness). E assumes a value between 0 and 1, with 1 being complete evenness. As this portion of the South Platte River is a highly and continuously disturbed site, this measurement is only calculated to indicate the condition of diversity and will not be used as a performance metric.

8.4.2.3 Prevalence Index

PI is a weighted-average wetland indicator status of plant species in the sampling plot. The PI ranges from 1 to 5 with a value of 3 or less indicating dominance of hydrophytic vegetation where Obligate (OBL) = 1; Facultative-wet (FACW) = 2; Facultative (FAC) = 3; Facultative-upland (FACU) = 4 and; Upland (UPL) = 5. Each species will have an indicator status specific to region, is assigned this value and weighted by abundance (absolute percentage coverage) as described in the *1987 Delineation Manual*.

9 Maintenance Activities

The sponsor would be responsible for O&M of the mitigation and NNBF features in perpetuity for the life of the project. This would include annual weed management for invasive species. It would include maintaining the protection of plantings from wildlife and human traffic, for a number of years until vegetation is adequately established. In-stream structures may require minor reshaping or material replacement if they are disturbed by high water events. Some large woody debris may accumulate on or around the in-stream rock structures, and if it is deemed to be disturbing to the structural or ecological function, it should be removed to reduce the risk of failure. Annual inspections and reports should be completed for up to five years.

There shall be no filling, excavating, mining or drilling; no removal of natural materials; no dumping of materials; and no alteration of the topography in any manner except as shall be necessary to maintain the constructed mitigation habitat. There shall be no draining, dredging, damming or impounding; no changing the grade or elevation, impairing the flow or circulation of waters, reducing the reach of waters; and, no other discharge or activity requiring a permit under applicable clean water or water pollution control laws and regulations, as amended. There shall be no clearing, burning, cutting or destroying of trees or vegetation, except for undesirable, invasive species.

There shall be no planting or introduction of non-native or exotic species of trees or vegetation. No agricultural, industrial, or commercial activity shall be undertaken or allowed which would interfere with or damage the mitigation habitat types. Furthermore, no placement of utilities or related facilities shall be constructed. There shall be no construction, erection, or placement of buildings, billboards, or any other structures, nor any additions to existing structures. There shall be no construction of new roads, trails or walkways within the constructed mitigation habitat areas.

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Project Name / Area

FACStream Model for NWK and NWO Civil Works Boundaries

Calculation of Habitat Units (HUs), Average Annual Habitat Units (AAHUs), and Net AAHUs

Reach	Restoration Alternative / Measure	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs	Notes / Comments / Descriptions / Assumptions
	Alternative 1: 14th Ave and I29	FWOP	0	0	0.78	1	0.78		36.3	0.73	
			10	10	0.75	1	0.75	7.64			
			25	15	0.72	1	0.72	11.01			
			50	25	0.70	1	0.70	17.67			
		FWP	0	0	0.78	1	0.78		41.0	0.82	
			10	10	0.81	1	0.81	7.94			
			25	15	0.83	1	0.83	12.27			
			50	25	0.83	1	0.83	20.75			0.09
	Alternative 2: 166th and Sioux Conifer Rd	FWOP	0	0	0.79	1	0.79		37.3	0.75	
			10	10	0.77	1	0.77	7.77			
			25	15	0.74	1	0.74	11.29			
			50	25	0.72	1	0.72	18.26			
		FWP	0	0	0.79	1	0.79		41.3	0.83	
			10	10	0.82	1	0.82	8.01			
			25	15	0.83	1	0.83	12.36			
			50	25	0.84	1	0.84	20.91			0.08
3	A0 - no measures	FWOP	0	0	#REF!		#REF!		#REF!	#REF!	
			10	10	#REF!		#REF!	#REF!			
			25	15	#REF!		#REF!	#REF!			
			50	25	#REF!		#REF!	#REF!			
	A6 -	FWP	0	0	#REF!		#REF!		#REF!	#REF!	
			10	10	#REF!		#REF!	#REF!			
			25	15	#REF!		#REF!	#REF!			
			50	25	#REF!		#REF!	#REF!			
	A7 -	FWP	0	0	#REF!		#REF!		#REF!	#REF!	
			10	10	#REF!		#REF!	#REF!			
			25	15	#REF!		#REF!	#REF!			
			50	25	#REF!		#REF!	#REF!			
	A8 -	FWP	0	0	#REF!		#REF!		#REF!	#REF!	
			10	10	#REF!		#REF!	#REF!			
			25	15	#REF!		#REF!	#REF!			
			50	25	#REF!		#REF!	#REF!			
	A11-	FWP	0	0	#REF!		#REF!		#REF!	#REF!	
			10	10	#REF!		#REF!	#REF!			
			25	15	#REF!		#REF!	#REF!			
			50	25	#REF!		#REF!	#REF!			
	A14-	FWP	0	0	#REF!		#REF!		#REF!	#REF!	
			10	10	#REF!		#REF!	#REF!			
			25	15	#REF!		#REF!	#REF!			
			50	25	#REF!		#REF!	#REF!			

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.
Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Description	Page
Alternative A0 **Future Without Project Conditions (Year 0), Future With Project (Year 10, 25, 50)**	**3**

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) .
Additional information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: **Willow Creek**

Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50								
Watershed V1 Flow Regime	SV 1.1 Total Volume	augmentations from upstream agrian ditching, relatively	increased development, residental and farming	climate change-increased freq/severity of events, increased annual precip	**increased development, climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.78	0.75	0.75	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.78**	**0.75**	**0.75**	
	Sub-Variable	**Magnitude and duration of peak flows, of the "high end" of the hydrograph**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows		**climate change-increased freq/severity of events, increased annual precip**	**climate change-increased freq/severity of events, increased annual precip**	**increased development and climate change will lead to more impact to natural patterns**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.75	0.73	0.71	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10 -20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20 -40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**Magnitude and duration of base flows, of the "low end" of the hydrograph**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	**drying out does not seem to occur**	**climate change-drought or floods**	**climate change-drought or floods**	**climate change-drought or floods**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10 -20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20 -40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	**Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change-drought or floods, increase in variability**	**climate change-drought or floods, increase in variability**	**climate change-drought or floods, increase in variability**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.84	0.83	0.82	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.84**	**0.83**	**0.82**	
								TOTAL V1	**0.78**	**0.76**	**0.74**	**0.73**	
Variable	**Sub-Variable**	**Amount of sediment produced in the watershed via both surface erosion and mass erosion**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Existing herbaceous field	land use not antiicpated to change	increase in impervious surfaces, climate change adding higher frequency of larger runoffs, still anticipated to be low	Increase in impervious surfaces, climate change adding higher frequency of larger runoffs, still anticipated to be low density/developm	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.75	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear -cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.82**	**0.80**	**0.75**	**0.70**	
	Sub-Variable	**Rate of sediment produced by channel erosion in the contributing watershed.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	**signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human -caused erosion. There are no significant stressors.	0.88	0.86	0.82	0.78	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches, or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.88**	**0.86**	**0.82**	**0.78**	
	Sub-Variable	**Transport of sediment to and through the reach.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	**Impediments primarily restricted to bridge crossings which create constriction**	**Impediments primarily restricted to bridge crossings which create constriction points- not**	**Impediments primarily restricted to bridge crossings which create constriction points- not**	**Impediments primarily restricted to bridge crossings which create constriction points- not largely**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.82	0.8	0.78	0.76	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well -designed well structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most of all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.82**	**0.80**	**0.78**	**0.76**	
								TOTAL V2	**0.83**	**0.81**	**0.77**	**0.72**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.1	some lack of shading, little	temps increase	temps increase	**temps increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					

	Temperature Regime	Irrigation, some reservoir impact	due to climate change	due to climate change	due to climate change	0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Watershed	**SV 3.2 Organics Nutrients**	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.78	0.75	0.7	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.2	**0.78**	**0.75**	**0.70**	**0.70**
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.78	0.75	0.7	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.				
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.				
								TOTAL SV 3.3	**0.78**	**0.75**	**0.70**	**0.70**
								TOTAL V3	**0.79**	**0.76**	**0.72**	**0.71**

Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 / **Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 / **Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes / **Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains / **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading				
Riparian	**SV 4.1 Saturation Frequency**	ecological floodplain is connected	ecological floodplain is connected	ecological floodplain is connected	ecological floodplain is connected	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr / Typical BHR 1.0, Return interval 1.0 - 1.5 yr	0.8	0.78	0.75	0.73
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr / Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr				
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr / Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr / Typical BHR > 1.5, Return interval 5.0 - 10.0 yr				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr / Typical BHR > 1, Return interval of FP saturation > 10.0 yr				
								TOTAL SV 4.1	**0.80**	**0.78**	**0.75**	**0.73**
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian	**SV 4.2 Floodplain Width**	**floodplain primarily intact- floodplain may be used for grazing but no**	**Assume the area remains consistent**	**Assume the area remains consistent with land use practicies- maybe some increases in**	**Assume the area remains consistent with land use practicies- maybe some increases in impervious**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	0.85	0.8	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).				
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).				
								TOTAL SV 4.2	**0.85**	**0.80**	**0.80**	**0.78**
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 4.3 Saturation Duration	**Steam moves characteristically moves about its riparian belt**	**Steam moves characteristically moves about its riparian belt**	**Assume the area remains consistent with land use practicies- maybe some increases in**	**Assume the area remains consistent with land use practicies- maybe some increases in impervious**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.83	0.8	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.				
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.				
								TOTAL SV 4.3	**0.85**	**0.83**	**0.80**	**0.78**
								TOTAL V4	**0.82**	**0.79**	**0.77**	**0.75**

Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
Riparian	**SV 5.1 Woody Vegetation Structure**					1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.73	0.7	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
								TOTAL SV 5.1	**0.75**	**0.73**	**0.70**	**0.70**
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non-woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agricutl ure**	**primarily rural/agricutlure**	**primarily rural/agricutlur e**	**primarily rural/agricutlure**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.77	0.74	0.7	0.69
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.				
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.				
								TOTAL SV 5.2	**0.77**	**0.74**	**0.70**	**0.69**
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.68	0.62	0.6
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non -native species or bare ground make up less than 20% of cover.				
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non -native species or bare ground make up less than 40% of cover.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non -native species, or the riparian area is mostly devoid of vegetation.				
								TOTAL SV 5.3	**0.72**	**0.68**	**0.62**	**0.60**
								TOTAL V5	**0.73**	**0.70**	**0.65**	**0.63**

Not Available for A, G, F Stream Types in VC Valleys.	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.83	0.79	0.75	0.7
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.				
								TOTAL SV 6.1	**0.83**	**0.79**	**0.75**	**0.70**

	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.84	0.8	0.78	0.73
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.				
								TOTAL SV 6.2	**0.84**	**0.80**	**0.78**	**0.73**
								TOTAL V6	**0.83**	**0.79**	**0.76**	**0.71**

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B				
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard Negligible	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning Mild Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--				
						0.79 - 0.70 C - Functioning Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--				
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)				
						0.00 - 0.59 F - Non-functioning Profound	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)				
											TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**

	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)				
Stream V7 Morphology	SV 7.2					1.00 - 0.90 A - Reference Standard Negligible	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning Mild Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70 C - Functioning Significant Impact	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59 F - Non-functioning Profound	Straight	Straight	Straight	--	--				
											TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**

	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All	SV Score	SV Score	SV Score	SV Score
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F					
Stream V7 Morphology	SV 7.3					1.00 - 0.90 A - Reference Standard Negligible	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.7
						0.89 - 0.80 B - Highly Functioning Mild Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70 C - Functioning Significant Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59 F - Non-functioning Profound	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
											TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.70**

Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.	SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50

		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 7.4					1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.75	0.7	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
						0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10 -20%). Examples: reaches with significant grade control, moderate planform changes.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.75**	**0.70**	**0.70**	**0.65**	
								TOTAL V7	**0.79**	**0.75**	**0.74**	**0.71**	
Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	**SV 8.1 Dynamic Equilibrium**	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.8	0.75	0.68	0.65	Upstream land uses, grazing destabilizes banks, causing land erosion and subsequent bed degradation/accretion
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, poor riffle, unnatural bars, over -widening,					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cute. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.80**	**0.75**	**0.68**	**0.65**	
	Sub-Variable	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.73	0.7	0.68	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.73**	**0.70**	**0.68**	
								TOTAL V8	**0.79**	**0.74**	**0.69**	**0.66**	
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	**SV 9.1 Hydraulic Structure**	development, ag mostly	increase in development/ag	increase in development/ag	increase in development/ag	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.70**	
	Sub-Variable	**Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale					1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.8	0.8	0.75	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse-scale physical structure is present. Examples include reaches with slightly altered morphology arising					
						0.79 - 0.70	C - Functioning, Significant Impact	from typical velocity depth combinations that persist, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed mile- pool ratio, or lack of bank structure.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution, moderate levels of excess of fine sediment deposition					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.80**	**0.80**	**0.75**	**0.70**	
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale					1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.75	0.75	0.7	0.68	Increase in fines from land erosion/grazing practicies
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine-scale physical structure is present. Examples include reaches with slightly altered fine sediment					
						0.79 - 0.70	C - Functioning, Significant Impact	deposition, moderately limited detritus					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	(or alternatively decreased fine sediment), or limited organic debris.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Some typical fine-scale structural diversity are lacking or limited. Examples include gravel or cobble bed streams with embedded materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and ecosytes lacking characteristic detritus or LWD. Examples include gravel or cobble bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.75**	**0.75**	**0.70**	**0.68**	
								TOTAL V5	**0.77**	**0.76**	**0.72**	**0.69**	
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.73	0.71	0.69	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.				
									TOTAL SV 10.1	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.				
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.				
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
		mosquitoes,	Anticipated	Anticipated		1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.				

Stream V10 Biotic Structure	**SV 10.3 Macroinvertebrates**	damsels, known presence of zebra mussels, unknown type and presence of native mussels	zebra mussels will persist throughout system, further decreasing any native species that may be present	zebra mussels will persist throughout system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout system, further decreasing any native species that may be present	0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.	0.65	0.6	0.6	0.6
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.				
									TOTAL SV 10.1	**0.65**	**0.60**	**0.60**	**0.60**

Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50
	Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting fecundity	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.78	0.76	0.74
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.				
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.				
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.				
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.				
								TOTAL SV 10.1	**0.80**	**0.78**	**0.76**	**0.74**

Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50
	Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score
SV 10.5 Other Animals		exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.7	0.68	0.66
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.				
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.				
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.				
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.				
								TOTAL SV 10.1	**0.72**	**0.70**	**0.68**	**0.66**
								TOTAL V10	**0.69**	**0.66**	**0.65**	**0.63**
								Hydraulic Functional Condition Score	**0.79**	**0.76**	**0.74**	**0.71**
								Geomorphic Functional Condition Score	**0.79**	**0.76**	**0.72**	**0.70**
								Physicochemical Functional Condition Score	**0.77**	**0.74**	**0.71**	**0.69**
								Biotic Functional Condition Score	**0.77**	**0.74**	**0.70**	**0.69**
								Overall Functional Capacity Index Score	**0.78**	**0.75**	**0.72**	**0.70**

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Worksheet Description	Page
	3

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.

Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) .
Additional information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: Willow Creek

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Total annual volume of water delivered from contributing watershed.											
Watershed V1 Flow Regime	SV 1.1 Total Volume	augmentations from upstream agrian ditching, relatively	increased development, residental and farming	climate change-increased freq/severity of events, increased annual precip	**increased development, climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.85	0.85	0.85	Area would be under conservation easement or fee for mitigation and would thus inhibit the development or use of the area otherwise
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.85**	**0.85**	**0.85**	
	Sub-Variable	Magnitude and duration of peak flows, of the "high end" of the hydrograph				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.2 Peak Flows		climate change-increased freq/severity of events, increased annual precip	climate change-increased freq/severity of events, increased annual precip	increased development and climate change will lead to more impact to natural patterns	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.75	0.73	0.71	0.69	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10 -20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20 -40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	Magnitude and duration of base flows, of the "low end" of the hydrograph				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.3 Base Flows	drying out does not seem to occur	climate change-drought or floods	climate change-drought or floods	climate change-drought or floods	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10 -20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20 -40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change-drought or floods, increase in variability	climate change-drought or floods, increase in variability	climate change-drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.86	0.89	0.91	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.86**	**0.89**	**0.91**	
								TOTAL V1	**0.78**	**0.77**	**0.76**	**0.75**	
Variable	**Sub-Variable**	Amount of sediment produced in the watershed via both surface erosion and mass erosion				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	**Comments / Descriptions / Assumptions**
		Year 0	**Year 10**	**Year 25**	**Year 50**								
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Existing herbaceous field	land use not antiicipated to change	increase in impervious surfaces, climate change adding higher frequency of larger runoffs, still anticipated to be low	Increase in impervious surfaces, climate change adding higher frequency of larger runoffs, still anticipated to be low density/developm	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.85	0.85	0.85	Area would be under conservation easement or fee for mitigation and would thus inhibit the development or use of the area otherwise; land erosion would improve as grazing would be disallowed
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear -cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.82**	**0.85**	**0.85**	**0.85**	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.2 Channel Erosion	signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human -caused erosion. There are no significant stressors.	0.88	0.9	0.9	0.9	Area would be under conservation easement or fee for mitigation and would thus inhibit the development or use of the area otherwise; channel erosion would improve as grazing would be disallowed which impacts land erosion
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches, or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.88**	**0.90**	**0.90**	**0.90**	
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.3 Transport	Impediments primarily restricted to bridge crossings which create constriction	Impediments primarily restricted to bridge crossings which create constriction points- not	Impediments primarily restricted to bridge crossings which create constriction points- not	Impediments primarily restricted to bridge crossings which create constriction points- not largely	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.82	0.8	0.78	0.76	No change
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well -designed well structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.82**	**0.80**	**0.78**	**0.76**	
								TOTAL V2	**0.83**	**0.83**	**0.81**	**0.80**	
Variable	**Sub-Variable**	Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	**Year 10**	**Year 25**	**Year 50**								
	SV 3.1	some lack of shading, little	temps increase	temps increase	**temps increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					riparian and herbaceous plantings will help with localized water temps
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					

	Temperature Regime	Irrigation, some reservoir impact	due to climate change	due to climate change	due to climate change	0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.86	0.9	0.9	
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.86**	**0.90**	**0.90**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed	**SV 3.2 Organics Nutrients**	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.78	0.82	0.85	0.85	No increase in intensity of land use due to protective easement
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.78**	**0.82**	**0.85**	**0.85**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.78	0.82	0.85	0.85	No increase in intensity of land use due to protective easement
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.78**	**0.82**	**0.85**	**0.85**	
								TOTAL V3	**0.79**	**0.83**	**0.86**	**0.86**	

Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 / **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 / **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4	SV Score	SV Score	SV Score	SV Score
Riparian	**SV 4.1 Saturation Frequency**	ecological floodplain is connected	ecological floodplain is connected	ecological floodplain is connected	ecological floodplain is connected	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr		Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.83	0.85	0.85
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
											TOTAL SV 4.1	**0.80**	**0.83**	**0.85**	**0.85**
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.2 Floodplain Width	**floodplain primarily intact- floodplain may be used for grazing but no**	**Assume the area remains consistent**	**Assume the area remains consistent with land use practicies- maybe some increases in**	**Assume the area remains consistent with land use practicies- maybe some increases in impervious**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	0.85	0.87	0.9	0.9	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
								TOTAL SV 4.2	**0.85**	**0.87**	**0.90**	**0.90**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.3 Saturation Duration	**Steam moves characteristically moves about its riparian belt**	**Steam moves characteristically moves about its riparian belt**	**Assume the area remains consistent with land use practicies- maybe some increases in**	**Assume the area remains consistent with land use practicies- maybe some increases in impervious**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.87	0.9	0.9	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.87**	**0.90**	**0.90**	
								TOTAL V4	**0.82**	**0.84**	**0.87**	**0.87**	

Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Riparian	**SV 5.1 Woody Vegetation Structure**					1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.85	0.88	0.9	woody veg may be present along willow creek but primarily herbaceous grassland structure due to prairie - some woody veg may have been removed as part of grazing/land management practices but not substantially, if any
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.85**	**0.88**	**0.90**	
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non-woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agricutlure**	**primarily rural/agricutlure**	**primarily rural/agricutlure**	**primarily rural/agricutlure**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.77	0.88	0.92	0.95	Plantings
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.77**	**0.88**	**0.92**	**0.95**	
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.72	0.88	0.92	0.95	Plantings
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non -native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non -native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non -native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.72**	**0.88**	**0.92**	**0.95**	
								TOTAL V5	**0.73**	**0.86**	**0.89**	**0.92**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.83	0.88	0.91	0.95	Increase in tree recruitment from plantings and easement
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.					
								TOTAL SV 6.1	**0.83**	**0.88**	**0.91**	**0.95**	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.84	0.88	0.95	0.95	Increase in detrituts supply from riparian plantings and canopy establishment
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.					
								TOTAL SV 6.2	**0.84**	**0.88**	**0.95**	**0.95**	
								TOTAL V6	**0.83**	**0.88**	**0.92**	**0.95**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form				SV Scores	Condition Grade	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50	
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
		Year 0	Year 10	Year 25	Year 50			**Reference Stream Type** Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score	
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90	A - Reference Standard Negligible	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85	
						0.89 - 0.80	B - Highly Functioning Mild Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70	C - Functioning Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60	D - Functioning Impaired Severe Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59	F - Non-functioning Profound	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
												TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Condition Grade	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0				**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score
		Year 0	Year 10	Year 25	Year 50			**Anastomosed**	**Meandering with Side Channels**	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**	**Meandering Low K (1.2-1.5)**				
	SV 7.2					1.00 - 0.90	A - Reference Standard Negligible	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85
						0.89 - 0.80	B - Highly Functioning Mild Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70	C - Functioning Significant Impact	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60	D - Functioning Impaired Severe Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59	F - Non-functioning Profound	Straight	Straight	Straight	--	--				
												TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Condition Grade	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50
								Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4	**Cross Section Area** All	SV Score	SV Score	SV Score	SV Score
		Year 0	Year 10	Year 25	Year 50			**Reference Stream Type:** DA, DB	**Reference Stream Type:** E, C	**Reference Stream Type:** B	**Reference Stream Type:** A, G, F					
	SV 7.3					1.00 - 0.90	A - Reference Standard Negligible	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.7
						0.89 - 0.80	B - Highly Functioning Mild Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70	C - Functioning Significant Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60	D - Functioning Impaired Severe Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59	F - Non-functioning Profound	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
												TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.70**
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines					Year 0	Year 10	Year 25	Year 50

	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 7.4					1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.75	0.7	0.7	0.65	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
					0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10 -20%). Examples: reaches with significant grade control, moderate planform changes.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
							TOTAL SV 7.4	**0.75**	**0.70**	**0.70**	**0.65**	
							TOTAL V7	**0.79**	**0.75**	**0.74**	**0.71**	

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.8	0.8	0.85	0.88	adjacent land practices improved through conservation easement tool - upstream influences still present
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, poor riffle, unnatural bars, over -widening, excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cute. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.80**	**0.80**	**0.85**	**0.88**	

	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.79	0.83	0.88	0.92	increase in species presence and diversity, protected floodplain connectivity from protective easement, no opportunity for development within area
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.79**	**0.83**	**0.88**	**0.92**	
								TOTAL V8	**0.79**	**0.81**	**0.86**	**0.89**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	development, ag mostly	increase in development/ag	increase in development/ag	increase in development/ag	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.85	0.88	0.88	improvements in structure for riffle pool complexes that could be installed
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.85**	**0.88**	**0.88**	

	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale					1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.8	0.83	0.85	0.88	improvements in structure for riffle pool complexes that could be installed
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse-scale physical structure is present. Examples include reaches with slightly altered morphology arising from typical velocity depth combinations and riparian vegetation.					
						0.79 - 0.70	C - Functioning, Significant Impact	Some typical velocity depth combinations or vegetation are absent. Examples include reaches with altered pool spacing, skewed mile- pool ratio, or lack of bank structure.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Some typical velocity depth combinations or vegetation are absent. Structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with grazed or heavily trampled banks, or features that are frequently limited by inundation or low flow.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.80**	**0.83**	**0.85**	**0.88**	

	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale					1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.75	0.8	0.8	0.82	improvements in structure for riffle pool complexes that could be installed
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine-scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus,					
						0.79 - 0.70	C - Functioning, Significant Impact	Some typical fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution, moderate levels of excess or fine sediment deposition (or, alternatively, decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Fine-scale structural diversity is severely limited. Examples include gravel or cobble bed streams with embedded materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and ecosytes lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered fine-scale structural diversity. Examples include gravel or cobble bed streams that are aggrading with fine material, unaltered streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.75**	**0.80**	**0.80**	**0.82**	
								TOTAL V5	**0.77**	**0.81**	**0.82**	**0.84**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.8	0.82	0.85	Minor improvements in localized water qualit, increase in divesity and native species
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.					
									TOTAL SV 10.1	**0.75**	**0.80**	**0.82**	**0.85**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.78	0.83	0.86	Minor improvements in localized water qualit, increase in divesity and native species
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.					
									TOTAL SV 10.1	**0.75**	**0.78**	**0.83**	**0.86**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
		mosquitoes,	Anticipated	Anticipated		1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.					

Stream V10 Biotic Structure	**SV 10.3 Macroinvertebrates**	damsels, known presence of zebra mussels, unknown type and presence of native mussels	zebra mussels will persist throughout system, further decreasing any native species that may be present	zebra mussels will persist throughout system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout system, further decreasing any native species that may be present	0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.	0.65	0.7	0.72	0.75	Zebra mussles still will be present but other macro inverts will improve from habitat improvement, water quality improvement, structure impvoement etc
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
									TOTAL SV 10.1	**0.65**	**0.70**	**0.72**	**0.75**	

Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
	Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting fecundity	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.8	0.88	0.9	0.95	Improvement from habitat enhancement and protection
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
								TOTAL SV 10.1	**0.80**	**0.88**	**0.90**	**0.95**	

Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
	Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
SV 10.5 Other Animals		exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.72	0.8	0.85	0.9	Improvement from habitat enhancement and protection
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
								TOTAL SV 10.1	**0.72**	**0.80**	**0.85**	**0.90**	
								TOTAL V10	**0.69**	**0.75**	**0.77**	**0.81**	
								Hydraulic Functional Condition Score	**0.79**	**0.81**	**0.82**	**0.82**	
								Geomorphic Functional Condition Score	**0.79**	**0.82**	**0.83**	**0.84**	
								Physicochemical Functional Condition Score	**0.77**	**0.81**	**0.83**	**0.84**	
								Biotic Functional Condition Score	**0.77**	**0.80**	**0.83**	**0.84**	
								Overall Functional Capacity Index Score	**0.78**	**0.81**	**0.83**	**0.83**	

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries
(Based on the FACStream 1.0 Functional Assessment of Colorado Streams)

Worksheet Description	Page
	3

Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores.

Consult model documentation for applicability and limitations before using this spreadsheet!

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be https://www.researchgate.net/publication/355752959_FACStream_10_2015_Functional_Assessment_of_Colorado_Streams

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) .
Additional information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #: Mud Creek

Variable	Sub-Variable	Year 0	Year 10	Year 25	Year 50	SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	Comments / Descriptions / Assumptions
		Total annual volume of water delivered from contributing watershed											
Watershed V1 Flow Regime	SV 1.1 Total Volume	augmentations from upstream agrian ditching, relatively	increased development, residental and farming	climate change-increased freq/severity of events, increased annual precip	increased development, climate change	1.00 - 0.90	A - Reference Standard, Negligible Impact	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.78	0.75	0.75	Unnatural hydrograph impacted by ag tiling
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						0.79 - 0.70	C - Functioning, Significant Impact	Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Net change from augmentations and depletions more than 40% of the total annual volume.					
								TOTAL SV 1.1	**0.80**	**0.78**	**0.75**	**0.75**	
	Sub-Variable	Magnitude and duration of peak flows, of the "high end" of the hydrograph				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.2 Peak Flows		climate change-increased freq/severity of events, increased annual precip	climate change-increased freq/severity of events, increased annual precip	increased development and climate change will lead to more impact to natural patterns	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.75	0.73	0.71	0.69	Unnatural hydrograph impacted by ag tiling
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10 -20%.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20 -40%.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
								TOTAL SV 1.2	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	Magnitude and duration of base flows, of the "low end" of the hydrograph				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.3 Base Flows	drying out does not seem to occur	climate change-drought or floods	climate change-drought or floods	climate change-drought or floods	1.00 - 0.90	A - Reference Standard, Negligible Impact	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical low flow discharge is uniformly decreased by 10 -20%, or the duration of low flows is extended.					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical low flow discharge is uniformly decreased by 20 -40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
								TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 1.4 Flow Variability	flooding in aerial maps shows variability	climate change-drought or floods, increase in variability	climate change-drought or floods, increase in variability	climate change-drought or floods, increase in variability	1.00 - 0.90	A - Reference Standard, Negligible Impact	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.84	0.83	0.82	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						0.79 - 0.70	C - Functioning, Significant Impact	Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
								TOTAL SV 1.4	**0.85**	**0.84**	**0.83**	**0.82**	
								TOTAL V1	**0.78**	**0.76**	**0.74**	**0.73**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Year 0 SV Score**	**Year 10 SV Score**	**Year 25 SV Score**	**Year 50 SV Score**	**Comments / Descriptions / Assumptions**
		Amount of sediment produced in the watershed via both surface erosion and mass erosion											
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Existing herbaceous field	land use not antiicpated to change	increase in impervious surfaces, climate change adding higher frequency of larger runoffs, still anticipated to be low	Increase in impervious surfaces, climate change adding higher frequency of larger runoffs, still anticipated to be low density/developm	1.00 - 0.90	A - Reference Standard, Negligible Impact	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.8	0.75	0.7	Ag/grazing land uses
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear -cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
								TOTAL SV 2.1	**0.82**	**0.80**	**0.75**	**0.70**	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.2 Channel Erosion	signs of channel erosion	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks	climate change, more frequent floods could destabilize banks.	1.00 - 0.90	A - Reference Standard, Negligible Impact	The streams and tributaries in the contributing drainage network do not show excessive human -caused erosion. There are no significant stressors.	0.85	0.83	0.8	0.78	Continued tiling will likely cause degradation
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						0.79 - 0.70	C - Functioning, Significant Impact	Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches, or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable enriched alluvial channels (gullies).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
								TOTAL SV 2.2	**0.85**	**0.83**	**0.80**	**0.78**	
	Sub-Variable	Transport of sediment to and through the reach.				SV Scores	Condition Grade	Scoring Guidelines	Year 0 SV Score	Year 10 SV Score	Year 25 SV Score	Year 50 SV Score	
		Year 0	Year 10	Year 25	Year 50								
	SV 2.3 Transport	Impediments primarily restricted to bridge crossings which create constriction	Impediments primarily restricted to bridge crossings which create constriction points- not	Impediments primarily restricted to bridge crossings which create constriction points- not	Impediments primarily restricted to bridge crossings which create constriction points- not largely	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant impediments to sediment transport upstream of the reach.	0.82	0.8	0.78	0.76	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well -designed well structures, or major dams located on small tributary drainages.					
						0.79 - 0.70	C - Functioning, Significant Impact	Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Major impediments to sediment transport trap most of all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.					
								TOTAL SV 2.3	**0.82**	**0.80**	**0.78**	**0.76**	
								TOTAL V2	**0.83**	**0.81**	**0.76**	**0.72**	
Variable	**Sub-Variable**	**Year 0**	**Year 10**	**Year 25**	**Year 50**	**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Year 0 SV Score**	**Year 10 SV Score**	**Year 25 SV Score**	**Year 50 SV Score**	
		Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter).											
	SV 3.1	some lack of shading, little	temps increase	temps increase	temps increase	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural or minimally affected temperature regime is present.					
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					

	Temperature Regime	Irrigation, some reservoir impact	due to climate change	due to climate change	due to climate change	0.79 - 0.70	C - Functioning, Significant Impact	Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.	0.83	0.81	0.79	0.77	
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.1	**0.83**	**0.81**	**0.79**	**0.77**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Watershed	**SV 3.2 Organics Nutrients**	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist.	0.8	0.77	0.71	0.7	Some exisitng wetlands located adjacent to help filter out nutrients
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.2	**0.80**	**0.77**	**0.71**	**0.70**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural water quality conditions exist. Natural water quality conditions exist.	0.8	0.77	0.71	0.7	Some exisitng wetlands located adjacent to help filter out nutrients
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded.					
						0.79 - 0.70	C - Functioning, Significant Impact	Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.					
								TOTAL SV 3.3	**0.80**	**0.77**	**0.71**	**0.70**	
								TOTAL V3	**0.81**	**0.78**	**0.72**	**0.71**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**			**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 / **Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 / **Very Confined (VC)** Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4		SV Score	SV Score	SV Score	SV Score	
								Reference Stream Type Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes / **Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains / **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading						
Riparian	**SV 4.1 Saturation Frequency**	ecological floodplain is connected	ecological floodplain is connected	ecological floodplain is connected	ecological floodplain is connected	1.00 - 0.90	A - Reference Standard, Negligible Impact	Typical BHR < 1.0, Return interval < 1.0 yr / Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Not Available for A, G, F Stream Types in VC Valleys.	0.8	0.8	0.8	0.8	Saturation frequency fairly mimcs natural cycles, adjacent wetlands provide connection to floodplain and are frequently saturated
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Typical BHR 1.0, Return interval 1.0 - 1.5 yr / Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr					
						0.79 - 0.70	C - Functioning, Significant Impact	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr / Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr / Typical BHR > 1.5, Return interval 5.0 - 10.0 yr					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Typical BHR > 1.5, Return interval > 5.0 yr / Typical BHR > 1, Return interval of FP saturation > 10.0 yr					
								TOTAL SV 4.1	**0.80**	**0.80**	**0.80**	**0.80**	
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Riparian	**SV 4.2 Floodplain Width**	**floodplain primarily intact- floodplain may be used for grazing but no**	**Assume the area remains consistent**	**Assume the area remains consistent with land use practicies- maybe some increases in**	**Assume the area remains consistent with land use practicies- maybe some increases in impervious**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Floodplain extent is diminished less than 10% (> 90% intact).	0.85	0.85	0.8	0.8	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Floodplain extent is diminished 10 - 30% (70 - 90% intact).					
						0.79 - 0.70	C - Functioning, Significant Impact	Floodplain extent is diminished 30 - 50% (50 - 70% intact).					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Floodplain extent is diminished 50 - 70% (30 - 50% intact).					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Floodplain extent is diminished more than 70% (< 30% intact).					
								TOTAL SV 4.2	**0.85**	**0.85**	**0.80**	**0.80**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.3 Saturation Duration	**Steam moves characteristically moves about its riparian belt**	**Steam moves characteristically moves about its riparian belt**	**Assume the area remains consistent with land use practicies- maybe some increases in**	**Assume the area remains consistent with land use practicies- maybe some increases in impervious**	1.00 - 0.90	A - Reference Standard, Negligible Impact	The active floodplain is characteristically saturated for most of the growing season.	0.85	0.85	0.8	0.8	Saturation frequency fairly mimcs natural cycles, adjacent wetlands provide connection to floodplain and are frequently saturated
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season.					
						0.79 - 0.70	C - Functioning, Significant Impact	The active floodplain is saturated less than 14 consecutive days per year during growing season.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	The active floodplain is dry except for short durations during extremely rare flood events.					
								TOTAL SV 4.3	**0.85**	**0.85**	**0.80**	**0.80**	
								TOTAL V4	**0.82**	**0.82**	**0.80**	**0.80**	
Variable	**Sub-Variable**	**Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
Riparian	**SV 5.1 Woody Vegetation Structure**					1.00 - 0.90	A - Reference Standard, Negligible Impact	Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.75	0.71	0.71	woody veg may be present but primarily herbaceous grassland structure due to prairie - some woody veg may have been removed as part of grazing/land management practices but not substantially, if any
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.1	**0.75**	**0.75**	**0.71**	**0.71**	
	Sub-Variable	**Physical structure of the herbaceous vegetation layers which, includes all non-woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	**primarily rural/agricutl ure**	**primarily rural/agricutlure**	**primarily rural/agricutlur e**	**primarily rural/agricutlure**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.8	0.78	0.76	0.74	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						0.79 - 0.70	C - Functioning, Significant Impact	Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
								TOTAL SV 5.2	**0.80**	**0.78**	**0.76**	**0.74**	
	Sub-Variable	**Species diversity of riparian vegetation across all layers (woody and herbaceous)**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	**RCG, leagy spurge, and other non native prevelent over native, PCG**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	**Climate change and urban development increasing invasive species.**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Riparian vegetation species diversity is similar to reference.	0.76	0.73	0.69	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non -native species or bare ground make up less than 20% of cover.					
						0.79 - 0.70	C - Functioning, Significant Impact	Relative abundance of riparian vegetation is significantly different from reference. Non -native species or bare ground make up less than 40% of cover.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Riparian vegetation is nearly monoculture, more than 60% non -native species, or the riparian area is mostly devoid of vegetation.					
								TOTAL SV 5.3	**0.76**	**0.73**	**0.69**	**0.65**	
								TOTAL V5	**0.76**	**0.74**	**0.71**	**0.68**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	1.00 - 0.90	A - Reference Standard, Negligible Impact	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.84	0.8	0.78	0.78
						0.89 - 0.80	B - Highly Functioning, Mild Impact	LWD supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	LWD supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	LWD supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	LWD supply is decreased by more than 75%.				
								TOTAL SV 6.1	**0.84**	**0.80**	**0.78**	**0.78**
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Detritus supply is largely unaffected.	0.84	0.82	0.8	0.76
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Detritus supply is decreased by up to 25%.				
						0.79 - 0.70	C - Functioning, Significant Impact	Detritus supply is decreased by up to 50%.				
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Detritus supply is decreased by up to 75%.				
						0.00 - 0.59	F - Non-functioning, Profound Impact	Detritus supply is decreased by more than 75%.				
								TOTAL SV 6.2	**0.84**	**0.82**	**0.80**	**0.76**
								TOTAL V6	**0.84**	**0.81**	**0.79**	**0.77**

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Very Confined (VC) Valley Type: Very Confined (VC); Valley bottom width to bankfull stream width < 1.4				
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Reference Stream Type Stream Evolution Model Stage = 0 Rosgen Stream Type = D, DA, DB	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = C	Reference Stream Type Stream Evolution Model Stage = 3s Rosgen Stream Type = B		SV Score	SV Score	SV Score	SV Score
Stream V7 Morphology	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	1.00 - 0.90 A - Reference Standard Negligible	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)	Not Available for A, G, F Stream Types in VC Valleys.	0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning Mild Impact	Existing SEM Stage (Rosgen Stream Type) 1 (E, C)	Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					
						0.79 - 0.70 C - Functioning Significant Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--					
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Existing SEM Stage (Rosgen Stream Type) 6 (C)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)					
						0.00 - 0.59 F - Non-functioning Profound	Existing SEM Stage (Rosgen Stream Type) 2-5 (B, A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)					
											TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2					
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Anastomosed	Meandering with Side Channels	Meandering High K (> 1.5)	Meandering Low K (1.2-1.5)	Meandering Low K (1.2-1.5)	SV Score	SV Score	SV Score	SV Score
	SV 7.2	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	1.00 - 0.90 A - Reference Standard Negligible	Anastomosed	Meander with Side Channel	Meander High K	Meander Low K	Meander Low K	0.85	0.85	0.85	0.85
						0.89 - 0.80 B - Highly Functioning Mild Impact	Meander with Side Channel	Meander High K	Meander Low K	Meander High K	--				
						0.79 - 0.70 C - Functioning Significant Impact	Meander High K	Meander High K	Meander Low K	--	Straight				
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Meander Low K	Meander Low K	Straight	Straight	--				
						0.00 - 0.59 F - Non-functioning Profound	Straight	Straight	Straight	--	--				
											TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**
	Sub-Variable	Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.				SV Scores	Scoring Guidelines				Year 0	Year 10	Year 25	Year 50
							Valley Type: Unconfined (UC) or Partially Confined (PC) Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		Valley Type: Confined (CC) Valley bottom width to bankfull stream width 1.4 to 2.2	Valley Type: Very Confined (VC) Valley bottom width to bankfull stream width < 1.4	Cross Section Area All				
		Year 0	Year 10	Year 25	Year 50	Condition Grade	Reference Stream Type: DA, DB	Reference Stream Type: E, C	Reference Stream Type: B	Reference Stream Type: A, G, F		SV Score	SV Score	SV Score	SV Score
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	1.00 - 0.90 A - Reference Standard Negligible	No Significant Stressors				No Significant Stressors	0.85	0.8	0.75	0.7
						0.89 - 0.80 B - Highly Functioning Mild Impact	Stressors Present, but Effects are Minimal				Stressors Present, but Effects are Minimal				
						0.79 - 0.70 C - Functioning Significant Impact	Slight (C or E)	Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER		Slightly Enlarged (A:A-Reference 1.2-1.5)				
						0.69 - 0.60 D - Functioning Impaired Severe Impact	Moderate	Moderate (ER approximately 1.5)	Significant or Recent Degradation		Enlarged (A:A-Reference 1.6-2.0)				
						0.00 - 0.59 F - Non-functioning Profound	Fully Entrenched (ER < 1.4)			Actively Degrading	Extremely Enlarged (A:A-Reference > 2.0)				
											TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.70**
	Sub-Variable	Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.				SV Scores	Condition Grade	Scoring Guidelines			Year 0	Year 10	Year 25	Year 50

	Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
SV 7.4					1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant changes in slope.	0.75	0.7	0.7	0.65	
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes.					
					0.79 - 0.70	C - Functioning, Significant Impact	Localized gradient impacts and/or bankfull slope is impacted to a moderate degree (10 -20%). Examples: reaches with significant grade control, moderate planform changes.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Major local gradient impacts at low flow and/or significant changes to bankfull slope (20 -40%). Examples: reaches with large grade control structures, major planform changes.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull.					
								TOTAL SV 7.4	**0.75**	**0.70**	**0.70**	**0.65**
								TOTAL V7	**0.79**	**0.75**	**0.74**	**0.71**

Variable	Sub-Variable	An evaluation of forces and impacts that can alter the stability of channel bed and banks				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V8 Stability	SV 8.1 Dynamic Equilibrium	scour by culverts/bridges, unnatural channel	increased scour with climate change	increased scour with climate change	**increased scour with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural patterns of stability are present.	0.82	0.8	0.77	0.75	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						0.79 - 0.70	C - Functioning, Significant Impact	Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, poor riffle, unnatural bars, over -widening, excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cute. Artificially hardened channels in unconfined alluvial valleys also meet this.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.					
								TOTAL SV 8.1	**0.82**	**0.80**	**0.77**	**0.75**	

	Sub-Variable	The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	1.00 - 0.90	A - Reference Standard, Negligible Impact	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components.	0.81	0.77	0.75	0.72	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.					
								TOTAL SV 8.2	**0.81**	**0.77**	**0.75**	**0.72**	
								TOTAL V8	**0.81**	**0.78**	**0.76**	**0.73**	

Variable	Sub-Variable	Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
Stream V9 Physical Structure	SV 9.1 Hydraulic Structure	development, ag mostly	increase in development/ag	increase in development/ag	increase in development/ag	1.00 - 0.90	A - Reference Standard, Negligible Impact	Distribution of velocity and depth is typical of reference condition.	0.79	0.77	0.75	0.72	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows.					
						0.79 - 0.70	C - Functioning, Significant Impact	Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.					
								TOTAL SV 9.1	**0.79**	**0.77**	**0.75**	**0.72**	

	Sub-Variable	Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.2 Coarse Scale					1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.8	0.8	0.76	0.72	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural coarse-scale physical structure is present. Examples include reaches with slightly altered morphology arising from typical velocity depth combinations that persist, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed mile- pool ratio, or lack of bank structure. Some typical velocity depth combinations or bed elements					
						0.79 - 0.70	C - Functioning, Significant Impact						
						0.69 - 0.60	D - Functioning Impaired, Severe Impact						
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.					
								TOTAL SV 9.2	**0.80**	**0.80**	**0.76**	**0.72**	

	Sub-Variable	Looks specifically at fine-scale physical structure within the stream channels				SV Scores	Condition Grade	Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50				SV Score	SV Score	SV Score	SV Score	
	SV 9.3 Fine Scale					1.00 - 0.90	A - Reference Standard, Negligible Impact	Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type.	0.75	0.75	0.7	0.68	Increase in fines from land erosion/grazing practicies
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Significant stressors are present but the combined effects are minimal. Mostly natural fine-scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus					
						0.79 - 0.70	C - Functioning, Significant Impact	Some typical fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution, moderate levels of excess of fine sediment deposition (or alternatively decreased fine sediment), or limited organic debris.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Bank erosion, accelerated channel migration, or cobble-bed streams with embedded materials distribution, increased embeddedness, sediment starved reaches that lack fine sediment, and ecotypes lacking characteristic detritus or LWD.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Severely altered fine-scale structural diversity. Examples include gravel or cobble bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.					
								TOTAL SV 9.3	**0.75**	**0.75**	**0.70**	**0.68**	
								TOTAL V5	**0.77**	**0.76**	**0.72**	**0.69**	

Variable	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Microbes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.78	0.74	0.72	0.7	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Typically reaches with moderate V3 scores, no known microbial impairment.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Severe microbial infestation or completely disrupted microbial community.					
									TOTAL SV 10.1	**0.78**	**0.74**	**0.72**	**0.70**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macrophytes	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.75	0.75	0.7	0.65	
						0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Unusually high or low density of macrophytes, mostly native.					
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Highly unnatural density of macrophytes, significant presence of exotic aquatic plants.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Exotic macrophytes completely cover stream bed.					
									TOTAL SV 10.1	**0.75**	**0.75**	**0.70**	**0.65**	

	Sub-Variable	The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.				SV Scores	Condition Grade	Scoring Guidelines	Macroinvertebrates	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50					SV Score	SV Score	SV Score	SV Score	
		mosquitoes,	Anticipated	Anticipated		1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.					

Stream V10 Biotic Structure	**SV 10.3 Macroinvertebrates**	damsels, known presence of zebra mussels, unknown type and presence of native mussels	zebra mussels will persist throughout system, further decreasing any native species that may be present	zebra mussels will persist throughout system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout system, further decreasing any native species that may be present	0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.	0.68	0.62	0.62	0.62	
						0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
						0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
						0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
									TOTAL SV 10.1	**0.68**	**0.62**	**0.62**	**0.62**	

Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	
	Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting fecundity	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.82	0.8	0.78	0.76	Floodplain connectivity, existing wetlands host fish and ambipian richness and diversity
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
								TOTAL SV 10.1	**0.82**	**0.80**	**0.78**	**0.76**	

Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**SV Scores**	**Condition Grade**	**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	
	Year 0	**Year 10**	**Year 25**	**Year 50**					SV Score	SV Score	SV Score	SV Score	
SV 10.5 Other Animals		exotics will increase	exotics will increase	**exotics will increase**	1.00 - 0.90	A - Reference Standard, Negligible Impact	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or exotic species are not a significant portion of the community.	0.76	0.74	0.72	0.7	Floodplain connectivity, existing wetlands host fish and ambipian richness and diversity
					0.89 - 0.80	B - Highly Functioning, Mild Impact	Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
					0.79 - 0.70	C - Functioning, Significant Impact	Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
					0.69 - 0.60	D - Functioning Impaired, Severe Impact	Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
					0.00 - 0.59	F - Non-functioning, Profound Impact	Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
								TOTAL SV 10.1	**0.76**	**0.74**	**0.72**	**0.70**	
								TOTAL V10	**0.72**	**0.68**	**0.66**	**0.65**	
								Hydraulic Functional Condition Score	**0.79**	**0.78**	**0.76**	**0.74**	
								Geomorphic Functional Condition Score	**0.80**	**0.78**	**0.75**	**0.72**	
								Physicochemical Functional Condition Score	**0.78**	**0.76**	**0.73**	**0.71**	
								Biotic Functional Condition Score	**0.78**	**0.75**	**0.73**	**0.71**	
								Overall Functional Capacity Index Score	**0.79**	**0.77**	**0.74**	**0.72**	

Functional Assessment of Streams (FACStream) for NWK and NWO Civil Works Boundaries (Based on the FACStream 1.0 Functional Assessment of Colorado Streams)	Worksheet Description	Page
Enter data below for metrics which are highlighted in green; if a cell text turns "grey" do not enter/select a value for that metric; cells showing a "0.00" indicates that Variable and Sub-Variable inputs have not been inputted; blue cells are notational only and do not affect scores. *Consult model documentation for applicability and limitations before using this spreadsheet!*	**Alternative A0** **Future Without Project Conditions (Year 0), Future With Project (Year 10, 25, 50)**	**3**

Worksheet Notes

Cells not used for data entry, comments, descriptions, or assumptions have been locked to avoid accidental editing. To unlock cells or report any errors, please contact Kansas City District, Jeff Tripe.

At the time of writing, a PDF of the original model user manual and field sheets can be https://www.researchgate.net/publication/355752959_FACStream_10

Use the "Year 0, 10, 25, 50, etc." time step data columns to document conditions for Stream AAs / Tracts under each Alternative tab (A0, A1, A2, A3, etc.).

Note: If data inputs for Variables and Sub-Variables use drop down lists (click on the data cell, click on the downward arrow to the right, and select the appropriate description for each Variable / Sub-Variable) .
Additional information and instructions may be included in cells with a "red triangle" in the upper right corner of applicable cells and in pop-up text within each data cell. Additional information can be found in the "Instructions" tab.

AA / Tract #:	Mud Creek

Variable	Sub-Variable	Total annual volume of water delivered from contributing watershed.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
Watershed V1 Flow Regime	SV 1.1 Total Volume	augmentations from upstream agrian ditching, relatively	increased development, residental and farming	climate change-increased freq/severity of events, increased annual precip	**increased development, climate change**	Net change from augmentations and depletions less than 5% of the total annual volume.	0.8	0.85	0.85	0.85	Area would be under conservation easement or fee for mitigation and would thus inhibit the development or use of the area otherwise
						Net change from augmentations and depletions between 5% and 15% of the total annual volume.					
						Net change from augmentations and depletions between 15% and 25% of the total annual volume.					
						Net change from augmentations and depletions between 25% and 40% of the total annual volume.					
						Net change from augmentations and depletions more than 40% of the total annual volume.					
						TOTAL SV 1.1	**0.80**	**0.85**	**0.85**	**0.85**	
	Sub-Variable	Magnitude and duration of peak flows, of the "high end" of the hydrograph.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
	SV 1.2 Peak Flows		**climate change-increased freq/severity of events, increased annual precip**	**climate change-increased freq/severity of events, increased annual precip**	**increased development and climate change will lead to more impact to natural patterns**	Magnitude and duration of annual discharge peaks closely resembles natural hydrograph. Bankfull discharge is not significantly altered.	0.75	0.73	0.71	0.69	No change
						Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered by up to 10%.					
						Hydrograph has a natural pattern but peaks are attenuated, elevated, extended, or shortened. Bankfull discharge is altered 10-20%.					
						Disrupted hydrograph patterns or severely altered peak flows with bankfull discharge alteration of 20-40%.					
						Peak flow patterns do not resemble the natural hydrograph. Highly altered flow regimes. Bankfull discharge is altered by more than 40%.					
						TOTAL SV 1.2	**0.75**	**0.73**	**0.71**	**0.69**	
	Sub-Variable	Magnitude and duration of base flows, of the "low end" of the hydrograph.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
	SV 1.3 Base Flows	**drying out does not seem to occur**	**climate change-drought or floods**	**climate change-drought or floods**	**climate change-drought or floods**	Magnitude and duration of base flows closely resembles the natural hydrograph.	0.85	0.83	0.81	0.79	No change
						Typical low flow discharge is uniformly decreased by 10-20%, or the duration of low flows is extended.					
						Typical low flow discharge is uniformly decreased by 20-40%, critically low flows occur occasionally. Naturally ephemeral or intermittent streams that are converted to perennial also fit this category.					
						The stream bed has significant periods of unnatural drying, frequent and extended times of critically low flow, including perennial streams that occasionally run dry.					
						Naturally perennial streams that regularly dry up or reaches where critically low flow conditions exist for most of the season.					
						TOTAL SV 1.3	**0.85**	**0.83**	**0.81**	**0.79**	
	Sub-Variable	Temporal pattern of flows with characteristic timing of peaks, base flows, and rate of change.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
	SV 1.4 Flow Variability	**flooding in aerial maps shows variability**	**climate change-drought or floods, increase in variability**	**climate change-drought or floods, increase in variability**	**climate change-drought or floods, increase in variability**	Timing of discharge and rate of change closely resembles natural hydrograph. Peak and low flow events are tightly coupled to natural processes.	0.85	0.88	0.9	0.92	Improvement from aquatic habitat enhancement and protection
						Rate of change in discharge is similar to natural hydrograph, high and/or low flow events are slightly out of phase with the natural hydrograph.					
						Rate of change in discharge is similar to natural hydrograph, but significant high or low flow periods occur during unnatural times of the season.					
						Timing of high and low flows is seasonally out of phase with natural runoff processes, or rates of change are extremely altered. Rapid daily fluctuations are not common.					
						Timing of discharge is fully decoupled from natural weather and runoff events, or rates of change. Artificially uniform hydrograph or hydrographs in which rapid daily fluctuations are common.					
						TOTAL SV 1.4	**0.85**	**0.88**	**0.90**	**0.92**	
						TOTAL V1	**0.78**	**0.78**	**0.76**	**0.75**	

Variable	Sub-Variable	Amount of sediment produced in the watershed via both surface erosion and mass erosion.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	Comments / Descriptions / Assumptions
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
Watershed V2 Sediment Regime	SV 2.1 Land Erosion	Existing herbaceous field	land use not antiicpated to change	Increase in impervious surfaces, climate change adding higher frequency of larger runoffs, still anticipated to be low density/develop	Increase in impervious surfaces, climate change adding higher frequency of larger runoffs, still anticipated to be low density/developm	The amount and timing of sediment production from land erosion is relatively unaffected by human land use.	0.82	0.85	0.85	0.85	Area would be under conservation easement or fee for mitigation and would thus inhibit the development or use of the area otherwise; land erosion would improve as grazing would be disallowed
						Significant stressors are present and rates of surface erosion and mass erosion events moderately impacted. Examples include watersheds with low road or development density or grazing practices that do not deplete vegetation cover.					
						Land uses in the watershed are causing significant changes to the amount of land erosion. Examples include overgrazed slopes with increased bare ground, high density of unimproved roads, or evidence of past human-caused mass erosion.					
						Greatly increased land erosion caused by human activity or land use is evident. Examples include widespread overgrazed or clear-cut slopes, erosion associated with roads adjacent to the stream, or evidence of recent human-caused mass erosion.					
						Land uses in the watershed are causing an overwhelming amount of sediment from land erosion. Examples include widespread loss of ground cover on adjacent slopes with rill or gully formation or very large or frequent human caused mass erosion.					
						TOTAL SV 2.1	**0.82**	**0.85**	**0.85**	**0.85**	
	Sub-Variable	Rate of sediment produced by channel erosion in the contributing watershed.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
	SV 2.2 Channel Erosion	**signs of channel erosion**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks**	**climate change, more frequent floods could destabilize banks.**	The streams and tributaries in the contributing drainage network do not show excessive human-caused erosion. There are no significant stressors.	0.85	0.87	0.89	0.89	Area would be under conservation easement or fee for mitigation and would thus inhibit the development or use of the area otherwise; channel erosion would improve as grazing would be disallowed which impacts land erosion- channel erosion natural factor in braided channel
						Contributing reaches have accelerated bank erosion, but major systemic channel instability is not present. Examples include watersheds where anastomosed systems were converted to meandering streams or alluvial systems with vegetation shift.					
						Widespread accelerated bank erosion in the watershed or along adjacent contributing reaches, or localized areas with major instability, incision, and/or gully formation that are not adjacent to the assessment reach but within the contributing area.					
						Anthropogenic channel erosion is a major source of sediment to the reach. Adjacent contributing reaches are incised, or up to 20% of the contributing tributaries are unstable entrenched alluvial channels (gullies).					

					Anthropogenic channel erosion is an overwhelming source of sediment to the reach. Adjacent reaches are severely incised and unstable or more than 20% of the contributing tributaries are unstable incised channels or eroding gullies.					
					TOTAL SV 2.2	**0.85**	**0.87**	**0.89**	**0.89**	
	Sub-Variable	**Transport of sediment to and through the reach.**			**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**	SV Score	SV Score	SV Score	SV Score	
	SV 2.3 Transport	**Impediments primarily restricted to bridge crossings which create constriction**	**Impediments primarily restricted to bridge crossings which create constriction points- not**	**Impediments primarily restricted to bridge crossings which create constriction points- not**	**Impediments primarily restricted to bridge crossings which create constriction points not largely**	There are no significant impediments to sediment transport upstream of the reach. Impediments to sediment transport exist, but they are either very small or they block sediment from only a small portion of the overall contributing area. Examples include well-designed weir structures, or major dams located on small tributary drainages. Impediments to sediment transport block sediment from a large portion of the overall contributing area. Examples include dams or large structures located on major tributary drainages. Major impediments to sediment transport exist upstream from the reach, but they either pass some portion of sediment or block sediment from less than 2/3 of the contributing area. Reaches within several miles downstream of major dams are an example. Major impediments to sediment transport trap most or all incoming sediment, supplying the reach with "clear water discharge". Examples include tail waters where major dams are located close upstream from the assessment reach.	0.82	0.8	0.78	0.76	No change
						TOTAL SV 2.3	**0.82**	**0.80**	**0.78**	**0.76**	
						TOTAL V2	**0.83**	**0.82**	**0.81**	**0.80**	
Variable	**Sub-Variable**	**Abiotic habitat factor with impacts that typically manifest at the extremes (high temperatures in summer or extended freezing in winter)**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score	
Watershed **V3 Water Quality**	**SV 3.1 Temperature Regime**	some lack of shading, little irrigation, some reservoir impact	temps increase due to climate change	temps increase due to climate change	**temps increase due to climate change**	Natural or minimally affected temperature regime is present. Temperature regime is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded. Temperature regime is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower. Temperature regime is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower. The temperature regime is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.	0.83	0.85	0.9	0.9	riparian and herbaceous plantings will help with localized water temps
						TOTAL SV 3.1	**0.83**	**0.85**	**0.90**	**0.90**	
	Sub-Variable	**The supply of organic material and nutrients are the foundation of the trophic structure. Alterations to inputs can cascade through the food chain**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score	
	SV 3.2 Organics Nutrients	**agricultural runoff, 303d list**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	**ag could increase, and dependence on the reservoir increase**	Natural water quality conditions exist. Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded. Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower. Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower. The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.	0.8	0.84	0.86	0.87	No increase in intensity of land use due to protective easement
						TOTAL SV 3.2	**0.80**	**0.84**	**0.86**	**0.87**	
	Sub-Variable	**Other physicochemical properties of a reach (pH, conductivity, total dissolved solids, turbidity, total suspended solids, metals, toxins).**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score	
	SV 3.3 Inorganics Toxins	**ag influence, largely groundwater fed (high pH),**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	**increase in urbanization and runoff chemicals, climate change influence**	Natural water quality conditions exist. Natural water quality conditions exist. Water quality is altered but levels are within the range of natural variability, natural aquatic biota are minimally impaired, and standards not exceeded. Water quality is altered to a degree that could significantly affect natural aquatic biota, and/or standards are occasionally exceeded. 303d reaches should be scored in this category or lower. Water quality is altered to a degree that is known to affect natural aquatic biota, and/or standards are frequently exceeded. 303d listed reaches should be scored in this category or lower. The physicochemical environment is fundamentally altered. Natural biota are severely impaired, and/or standards are chronically exceeded.	0.8	0.84	0.86	0.87	No increase in intensity of land use due to protective easement
						TOTAL SV 3.3	**0.80**	**0.84**	**0.86**	**0.87**	
						TOTAL V3	**0.81**	**0.84**	**0.87**	**0.88**	
Variable	**Sub-Variable**	**Access of water to the floodplain and riparian area from the stream channel(s)**				**Scoring Guidelines**			Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0 **Reference Stream Type** Stream Evolution Model Stage = 0, 8 Rosgen Stream Type = D, DA, DB Anastomosed, Braided, Depositional, Beaver Complexes	**Reference Stream Type** Stream Evolution Model Stage = 1, 6 Rosgen Stream Type = E, C Sinuous, Quasi-equilibrium, Wide Floodplains	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 **Reference Stream Type** Stream Evolution Model Stage = 2, 3 Rosgen Stream Type = B Moderate Entrenched, Narrow Floodplains, Channelized, Degrading	SV Score	SV Score	SV Score	SV Score	
Riparian **V4 Floodplain Connectivity**	**SV 4.1 Saturation Frequency**	ecological floodplain is connected	ecological floodplain is connected	ecological floodplain is connected	ecological floodplain is connected	Typical BHR < 1.0, Return interval < 1.0 yr	Typical BHR 1.0, Return interval 1.0 - 1.5 yr		0.8	0.85	0.9	0.9	Saturation frequency fairly mimcs natural cycles, adjacent wetlands provide connection to floodplain and are frequently saturated- protective easement will provide eventual increased floodplain connectivity
						Typical BHR 1.0, Return interval 1.0 - 1.5 yr	Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr						
						Typical BHR 1.1 - 1.2, Return interval 1.5 - 2.0 yr	Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr						
						Typical BHR 1.3 - 1.4, Return interval 2.0 - 5.0 yr	Typical BHR > 1.5, Return interval 5.0 - 10.0 yr						
						Typical BHR > 1.5, Return interval > 5.0 yr	Typical BHR > 1, Return interval of FP saturation > 10.0 yr						
						TOTAL SV 4.1			**0.80**	**0.85**	**0.90**	**0.90**	
	Sub-Variable	**Degree to which the width of the floodplain is decreased due to hydrologic, channel, or land use impacts in the floodplain area.**				**Scoring Guidelines**			Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
	SV 4.2 Floodplain Width	**floodplain primarily intact- floodplain may be used for grazing but no impervious**	**Assume the area remains consistent**	**Assume the area remains consistent with land use practices- maybe some increases in**	**Assume the area remains consistent with land use practices- maybe some increases in impervious**	Floodplain extent is diminished less than 10% (> 90% intact). Floodplain extent is diminished 10 - 30% (70 - 90% intact). Floodplain extent is diminished 30 - 50% (50 - 70% intact). Floodplain extent is diminished 50 - 70% (30 - 50% intact). Floodplain extent is diminished more than 70% (< 30% intact).			0.85	0.85	0.9	0.9	
						TOTAL SV 4.2			**0.85**	**0.85**	**0.90**	**0.90**	
	Sub-Variable	**Amount of time that the floodplain area is saturated during the growing season.**				**Scoring Guidelines**			Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**				SV Score	SV Score	SV Score	SV Score	
		Steam moves		**Assume the area remains**	**Assume the area remains**	The active floodplain is characteristically saturated for most of the growing season.							

	SV 4.3 Saturation Duration	Steam moves characteristically moves about its riparian belt	Steam moves characteristically moves about its riparian belt	Remains consistent with land use practicies- maybe some increases in	Remains consistent with land use practicies- maybe some increases in impervious	The active floodplain is uncharacteristically dry during portions of the growing season, but still saturated more than the than 14 consecutive days per year during growing season	0.85	0.88	0.9	0.92	Saturation frequency fairly mimcs natural cycles, adjacent wetlands provide connection to floodplain and are frequently saturated
						The active floodplain is saturated less than 14 consecutive days per year during growing season.					
						The active floodplain is unnaturally dry for most of the growing season, or complete seasons go by without any saturation at all.					
						The active floodplain is dry except for short durations during extremely rare flood events.					
						TOTAL SV 4.3	**0.85**	**0.88**	**0.90**	**0.92**	
						TOTAL V4	**0.82**	**0.86**	**0.90**	**0.90**	

Variable	Sub-Variable	Physical structure of woody vegetation layers (trees and shrubs) on the riparian area, including characteristics: height distribution, density, aerial cover, and patchiness.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
Riparian V5 Riparian Vegetation	SV 5.1 Woody Vegetation Structure					Woody vegetation cover is similar to reference with only minor changes to structure.	0.75	0.85	0.88	0.9	woody veg may be present but primarily herbaceous grassland structure due to prairie - some woody veg may have been removed as part of grazing/land management practices but not substantially, if any
						Woody vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						Woody vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						Woody vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						Woody vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
						TOTAL SV 5.1	**0.75**	**0.85**	**0.88**	**0.90**	
	Sub-Variable	Physical structure of the herbaceous vegetation layers which, includes all non-woody plants (grasses, sedges, rushes, forbs, and mosses) in the riparian area.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
	SV 5.2 Herbaceous Vegetation Structure	primarily rural/agricutlure	primarily rural/agricutlure	primarily rural/agricutlure	primarily rural/agricutlure	Herbaceous vegetation cover is similar to reference with only minor changes to structure.	0.8	0.9	0.9	0.95	Plantings
						Herbaceous vegetation cover is decreased by more than 10%, or one structural characteristic is significantly altered.					
						Herbaceous vegetation cover is decreased by more than 20%, or multiple structural characteristics are significantly altered.					
						Herbaceous vegetation cover is decreased by more than 40%, or multiple structural characteristics are severely altered.					
						Herbaceous vegetation cover is decreased by more than 60%, or multiple structural characteristics are profoundly altered.					
						TOTAL SV 5.2	**0.80**	**0.90**	**0.90**	**0.95**	
	Sub-Variable	Species diversity of riparian vegetation across all layers (woody and herbaceous)				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
	SV 5.3 Species Diversity	RCG, leagy spurge, and other non native prevelent over native, PCG.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Climate change and urban development increasing invasive species.	Riparian vegetation species diversity is similar to reference.	0.76	0.88	0.92	0.95	Plantings
						Riparian vegetation consists of similar species as reference, but relative abundance is slightly altered. Non-native species or bare ground make up less than 20% of cover.					
						Relative abundance of riparian vegetation is significantly different from reference. Non-native species or bare ground make up less than 40% of cover.					
						Most reference species are not present. Non-native species or bare ground make up less than 60% of cover.					
						Riparian vegetation is nearly monoculture, more than 60% non-native species, or the riparian area is mostly devoid of vegetation.					
						TOTAL SV 5.3	**0.76**	**0.88**	**0.92**	**0.95**	
						TOTAL V5	**0.76**	**0.86**	**0.89**	**0.92**	

Variable	Sub-Variable	The supply of Large Woody Debris (LWD) to the reach relative to natural reference condition				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
Riparian V6 Debris Supply	SV 6.1 Large Woody Debris	ag/rural farming practicies	increased development, lack of tree recruitment	increased development, lack of tree recruitment	**increased development, lack of tree recruitment**	LWD supply is natural, or LWD is not a natural part of the particular stream system.	0.84	0.88	0.91	0.95	Increase in tree recruitment from plantings and easement
						LWD supply is decreased by up to 25%.					
						LWD supply is decreased by up to 50%.					
						LWD supply is decreased by up to 75%.					
						LWD supply is decreased by more than 75%.					
						TOTAL SV 6.1	**0.84**	**0.88**	**0.91**	**0.95**	
	Sub-Variable	An important component in streams, and impacts to detritus supply are common in the form of impacts to riparian vegetation.				Scoring Guidelines	Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50		SV Score	SV Score	SV Score	SV Score	
	SV 6.2 Detritus	**vegetation largely intact**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	**increased development, invasives limit vegetation diversity**	Detritus supply is largely unaffected.	0.84	0.88	0.95	0.95	
						Detritus supply is decreased by up to 25%.					
						Detritus supply is decreased by up to 50%.					
						Detritus supply is decreased by up to 75%.					
						Detritus supply is decreased by more than 75%.					
						TOTAL SV 6.2	**0.84**	**0.88**	**0.95**	**0.95**	
						TOTAL V6	**0.84**	**0.88**	**0.92**	**0.95**	

Variable	Sub-Variable	Stream evolution is the process by which a stream changes type or form.				Scoring Guidelines			Year 0	Year 10	Year 25	Year 50	
		Year 0	Year 10	Year 25	Year 50	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0		**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2	SV Score	SV Score	SV Score	SV Score	
						Reference Stream Type Stream Evolution Model Stage = 1 Rosgen Stream Type = E	**Reference Stream Type** Stream Evolution Model Stage = 1 Rosgen Stream Type = C	**Reference Stream Type** Stream Evolution Model Stage = 3s Rosgen Stream Type = B					
						Existing SEM Stage (Rosgen Stream Type) 0, 7 (D, DA, DB), 1 (E)	Existing SEM Stage (Rosgen Stream Type) 0, 7 (DA, DB), 1 (C)	Existing SEM Stage (Rosgen Stream Type) 3s (B)					
						Existing SEM Stage (Rosgen Stream Type) 1 (C)	Existing SEM Stage (Rosgen Stream Type) 1 (E)	--					

	SV 7.1 Evolutionary Stage	1C	1C	1C	**1C**	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	Existing SEM Stage (Rosgen Stream Type) 6 (C), 7 (D)	--	0.85	0.85	0.85	0.85
						Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	Existing SEM Stage (Rosgen Stream Type) 2-3 (B)	5 (F)				
						Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	Existing SEM Stage (Rosgen Stream Type) 4-5 (A, G, F)	4 (A, G)				
								TOTAL SV 7.1	**0.85**	**0.85**	**0.85**	**0.85**

	Sub-Variable	**Planform deals with gross changes to stream pattern including anastomosis, branching patterns, and sinuosity.**				**Scoring Guidelines**			Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 7.0; Valley bottom width to bankfull stream width 2.2 to 7.0			SV Score	SV Score	SV Score	SV Score	
						Meandering with Side Channels	**Meandering High K (> 1.5)**	**Meandering Low K (1.2-1.5)**					
Stream	**SV 7.2**	unconfined, slight meander, straightened, so low K.	k increases	k increases	**k increases**	Meander with Side Channel	Meander High K	Meander Low K	0.85	0.85	0.85	0.85	
						Meander High K	Meander Low K	Meander High K					
V7 Morphology						Meander High K	Meander Low K	--					
						Meander Low K	Straight	Straight					
						Straight	Straight	--					
								TOTAL SV 7.2	**0.85**	**0.85**	**0.85**	**0.85**	

	Sub-Variable	**Dimension considers gross changes to stream cross section, focusing on entrenchment, cross section area, and Width / Depth and the processes of degradation, enlargement, and widening.**				**Scoring Guidelines**			Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**	**Valley Type: Unconfined (UC) or Partially Confined (PC)** Valley bottom width to bankfull stream width > 2.2 **Reference Stream Type:** E, C	**Valley Type: Confined (CC)** Valley bottom width to bankfull stream width 1.4 to 2.2 **Reference Stream Type:** B	**Valley Type: Very Confined (VC)** Valley bottom width to bankfull stream width < 1.4 **Reference Stream Type:** A, G, F	SV Score	SV Score	SV Score	SV Score	
	SV 7.3	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	stressors present but relatively minimal-	No Significant Stressors			0.85	0.8	0.75	0.7	
						Stressors Present, but Effects are Minimal							
						Moderate (ER approximately 2.0)	Degradation Evident, but No Change in ER						
						Moderate (ER approximately 1.5)	Significant or Recent Degradation						
						Fully Entrenched (ER < 1.4)		Actively Degrading					
								TOTAL SV 7.3	**0.85**	**0.80**	**0.75**	**0.70**	

	Sub-Variable	**Gross changes to stream slope or gradient. Profile impacts are often the result of changes to planform or artificial grade control.**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score	
	SV 7.4					No significant changes in slope.	0.75	0.7	0.7	0.65	
						Localized gradient impacts at low flows and/or bankfull slope is impacted to a small degree (<10%). Examples: reaches with small grade control structures, minimal planform changes					
						Gradient impacts and/or bankfull slope is impacted to a moderate degree (10-20%). Examples: reaches with significant grade control, moderate planform changes					
						Major local gradient impacts at low flow and/or significant changes to bankfull slope (20-40%). Examples: reaches with large grade control structures, major planform changes					
						Severe changes to slope are evident. Examples include anastomosed or meandering streams that were straightened, or streams with very large structures that maintain stepped profile over all flows up to bankfull					
						TOTAL SV 7.4	**0.75**	**0.70**	**0.70**	**0.65**	
						TOTAL V7	**0.79**	**0.75**	**0.74**	**0.71**	

Variable	**Sub-Variable**	**An evaluation of forces and impacts that can alter the stability of channel bed and banks**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50	
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score	
	SV 8.1 Dynamic Equilibrium		increased scour with climate change	increased scour with climate change	**increased scour with climate change**	Natural patterns of stability are present.	0.82	0.82	0.86	0.86	adjacent land practices improved through conservation easement tool - upstream influences still present
						Significant stressors are present, but patterns of deposition, scour, and migration appear to be mostly natural for the reference stream type.					
						Significant impacts to stability are evident in the form of excess deposition, scour, or bank erosion. Indicators include accelerated migration, poor riffle, unnatural bars, overwidening, enlargement, or mild incision. Unnaturally stabilized channels may fit this rating.					
						Excess deposition, scour, or widespread bank erosion are common. Indicators include common avulsions on meandering streams, complete pool filling, reach wide aggradation, or recent head cuts. Artificially hardened channels in unconfined alluvial valleys also meet this.					

						Streams that have rapid aggradation, active incision, or severe enlargement resulting from anthropogenic causes and leading to active stream evolution.				
						TOTAL SV 8.1	**0.82**	**0.82**	**0.86**	**0.86**
Stream V8 Stability	**Sub-Variable**	**The ability of a system to resist change or to rapidly recover from changes arising from extreme events or disturbance.**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score
	SV 8.2 Resilience	**some exotic veg,**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	**increased scour, increaseed unnatural veg**	There are no significant stressors that would impede the physical movement/adjustment of the stream or the recovery of critical components. The reach has a minimally diminished floodplain connectivity, mostly native riparian vegetation, and few structural impediments to movement/adjustment. Structural impediments to physical movement/adjustment are present, significantly diminished floodplain connectivity, or vegetation that is limited due to a lack of local source material, impediments to establishment, or exotics. Limited resilience. Examples include reaches that depend upon artificial stabilization or structures to maintain form, limited floodplain connectivity, very poor riparian vegetation, or water source impairment that strongly affects peak flows and effective discharge. Not resilient. Examples include artificially maintained threshold channels, reaches with severe floodplain disconnect, severely limited mechanism for vegetation recovery, or severely impaired water source.	0.81	0.83	0.88	0.92
						TOTAL SV 8.2	**0.81**	**0.83**	**0.88**	**0.92**
						TOTAL V8	**0.81**	**0.82**	**0.87**	**0.88**
Variable	**Sub-Variable**	**Represents the amount of deviation from characteristic distribution of water depth and velocity in the stream.**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score
Stream V9 Physical Structure	**SV 9.1 Hydraulic Structure**	development, ag mostly	increase in development/ag	increase in development/ag	increase in development/ag	Distribution of velocity and depth is typical of reference condition. Hydraulic structure is altered so that there are increased or decreased frequencies of certain depths or velocities at some flows. Hydraulic structure is altered so that there are major increases or decreases in the frequency of certain depths or velocities at some most stages. Velocity or depth is unnaturally homogenous, but within a range that is tolerable to most native aquatic organisms at most stages. Homogenous velocity and/or depth conditions that are outside tolerance of most native aquatic organisms.	0.79	0.85	0.88	0.88
						TOTAL SV 9.1	**0.79**	**0.85**	**0.88**	**0.88**
	Sub-Variable	**Looks specifically at coarse-scale physical structure within stream channels, including bed and bank form.**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score
	SV 9.2 Coarse Scale					Natural coarse-scale structural heterogeneity on the reach is characteristic of the reference stream type. Significant stressors are present but the combined effects are minimal. Mostly natural coarse-scale physical structure is present. Examples include reaches with slightly altered morphology arising from dispersed systemic stressors or minimal direct impacts. Most typical velocity-depth combinations are present, but distribution of features is skewed. Examples include reaches with altered pool spacing, skewed riffle:pool ratio, or lack of bank structure. Reaches with artificial structure or partially severed banks. Some typical velocity-depth combinations or characteristic structural elements are absent making the reach uncharacteristically homogenous. Examples include reaches with eroded or heavily reworked banks, or features that are frequently limited by inundation or low flow. Severely altered coarse-scale structural diversity. Examples include reaches with severely homogenized physical characteristics such as unnatural plain-bed morphology.	0.8	0.83	0.85	0.88
						TOTAL SV 9.2	**0.80**	**0.83**	**0.85**	**0.88**
	Sub-Variable	**Looks specifically at fine-scale physical structure within the stream channels**				**Scoring Guidelines**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**		SV Score	SV Score	SV Score	SV Score
	SV 9.3 Fine Scale					Natural fine-scale structural heterogeneity on the reach is characteristic of the reference stream type. Significant stressors are present but the combined effects are minimal. Mostly natural fine-scale physical structure is present. Examples include reaches with slightly altered fine sediment deposition, moderately limited detritus. Some aspects of fine-scale structural diversity are lacking or limited. Examples include reaches with slightly altered bed material distribution. Moderate levels of excess or fine sediment deposition (or alternatively decreased fine sediment) or limited organic debris. Fine-scale structural diversity is severely limited. Examples include gravel or cobble-bed streams that are aggrading with fine material, alluvial streams unnaturally scoured to bedrock, or grouted or hardened artificial streambeds.	0.75	0.8	0.8	0.82
						TOTAL SV 9.3	**0.75**	**0.80**	**0.80**	**0.82**
						TOTAL V5	**0.77**	**0.81**	**0.82**	**0.84**
Variable	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**Scoring Guidelines**	**Microbes**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**			SV Score	SV Score	SV Score	SV Score
	SV 10.1 Microbes	algal blooms	increase with climate change	increase with climate change	**increase with climate change**	No significant stressors exist. Community structure is representative of the native, undisturbed condition. Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species. Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species. Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented. Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or Typically reaches with moderate V3 scores, no known microbial impairment. Reaches with impaired V3 scores. Seasonal algal blooms, known microbial impairment. Reaches with nonfunctional V3 scores. Known microbial infestation. 303d listed reaches. Severe microbial infestation or completely disrupted microbial community.	0.78	0.8	0.82	0.85
						TOTAL SV 10.1		**0.78**	**0.80**	**0.82**	**0.85**
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**Scoring Guidelines**	**Macrophytes**	Year 0	Year 10	Year 25	Year 50
		Year 0	**Year 10**	**Year 25**	**Year 50**			SV Score	SV Score	SV Score	SV Score
	SV 10.2 Macrophytes	minimally present	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as	minimally present, anticipate that non-native increases are likely due to degradation in water quality, pressures from increased urbanization and land development, as well as recreators on the river spreading	No significant stressors exist. Community structure is representative of the native, undisturbed condition. Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species. Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species. Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented. Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or Unusually high or low density of macrophytes, mostly native. Highly unnatural density of macrophytes, significant presence of exotic aquatic plants. Extensive streambed cover of exotic macrophytes, or characteristic plant cover is absent. Exotic macrophytes completely cover stream bed.	0.75	0.78	0.82	0.85
						TOTAL SV 10.1		**0.75**	**0.78**	**0.82**	**0.85**

	increase in species presence and diversity, protected floodplain connectivity from protective easement, no opportunity for development within area
	improvements in structure for riffle pool complexes that could be installed
	improvements in structure for riffle pool complexes that could be installed
	improvements in structure for riffle pool complexes that could be installed
	Minor improvements in localized water qualit, increase in divesity and native species
	Minor improvements in localized water qualit, increase in divesity and native species

Stream **V10 Biotic Structure**	**Sub-Variable**	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**Scoring Guidelines**	**Macroinvertebrates**	Year 0	Year 10	Year 25	Year 50	Zebra mussles still will be present but other macro inverts will improve from habitat improvement, water quality improvement, structure impvoement etc
		Year 0	**Year 10**	**Year 25**	**Year 50**			SV Score	SV Score	SV Score	SV Score	
	SV 10.3 Macroinvertebrates	mosquitoes, damsels, known presence of zebra mussels, unknown type and presence of native mussels	Anticipated zebra mussels will persist throughout system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout system, further decreasing any native species that may be present	Anticipated zebra mussels will persist throughout system, further decreasing any native species that may be present	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or	0.68	0.7	0.72	0.75	
						Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Macroinverts: Significant shift in species composition, increase in tolerant species.					
						Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Mostly tolerant species, diminished diversity, specific guilds over or underrepresented.					
						Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Exotic invasions , missing or severely limited feeding guilds.					
						Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Important functional guilds or trophic levels are completely absent.					
							TOTAL SV 10.1	**0.68**	**0.70**	**0.72**	**0.75**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**Scoring Guidelines**	**Fish & Amphibians**	Year 0	Year 10	Year 25	Year 50	Improvement from habitat enhancement and protection
		Year 0	**Year 10**	**Year 25**	**Year 50**			SV Score	SV Score	SV Score	SV Score	
	SV 10.4 Fish & Amphibians	game fish, altered structure (turtles, clams)	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting	non-native and game fish will continue to limit native fish, impediements in upstream limit fish passage, water quality impacts and climate change will impact temp of water thus affecting fecundity	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or	0.82	0.9	0.93	0.95	
						Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Nonnative fish are common, but these fill natural niches, some fish migration barriers.					
						Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Managed game fisheries, highly altered native fish communities, major fish passage barriers.					
						Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Highly managed and augmented game fisheries, rare or extinct native fish, keystone species absent.					
						Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Fish communities are nearly 100% non-native with diminished diversity.					
							TOTAL SV 10.1	**0.82**	**0.90**	**0.93**	**0.95**	
	Sub-Variable	**The biological component of the natural infrastructure of a stream, and the main subject of stream ecology.**				**Scoring Guidelines**	**Other Animals**	Year 0	Year 10	Year 25	Year 50	Improvement from habitat enhancement and protection
		Year 0	**Year 10**	**Year 25**	**Year 50**			SV Score	SV Score	SV Score	SV Score	
	SV 10.5 Other Animals		exotics will increase	exotics will increase	**exotics will increase**	No significant stressors exist. Community structure is representative of the native, undisturbed condition.	Reaches that score well in all variables that support habitat at the scale appropriate for the taxa. Nonnative or	0.76	0.82	0.87	0.92	
						Some significant stressors are present. Community structure consists of mostly native species. Distribution, age structure, or overall biomass of species may be slightly altered, but all functional guilds are appropriately represented and filled by native species.	Terrestrial or amphibious species limited by migration barriers or poor habitat.					
						Community structure is altered. Exotic species may be common, diversity lacking, and/or species distributions skewed, but exotic species generally fill natural niches. Important functional guilds are appropriately represented even when composed of nonnative species.	Typical species diminished presence, keystone species diminished, e.g. beavers.					
						Community structure is severely altered and may include a preponderance of exotic species, major loss of diversity or severely limited keystone species. One or more important functional guilds are impacted or poorly represented.	Typical species severely limited, exotic infestations, keystone species absent.					
						Community structure is fundamentally altered. Examples include communities dominated by exotic species, communities with important functional guilds that are absent or severely diminished.	Few or none of typical native species are present, keystone species extirpated.					
							TOTAL SV 10.1	**0.76**	**0.82**	**0.87**	**0.92**	
							TOTAL V10	**0.72**	**0.75**	**0.78**	**0.81**	
							Hydraulic Functional Condition Score	**0.79**	**0.81**	**0.83**	**0.83**	
							Geomorphic Functional Condition Score	**0.80**	**0.82**	**0.84**	**0.84**	
							Physicochemical Functional Condition Score	**0.78**	**0.82**	**0.84**	**0.85**	
							Biotic Functional Condition Score	**0.78**	**0.81**	**0.83**	**0.84**	
							Overall Functional Capacity Index Score	**0.79**	**0.82**	**0.83**	**0.84**	

US Army Corps of Engineers®



Watertown, South Dakota

Flood Risk Management | General Investigations Study

Integrated Feasibility Report & Environmental Assessment

Appendix G3: Biological Assessment

U.S. Army Corps of Engineers, Omaha District
In Partnership With
The City of Watertown

September 2025

TABLE OF CONTENTS

1 Introduction 1
1.1 Project Authority 1
1.2 Consultation History 2
1.3 Action Area 2
1.4 Background and History 3
1.5 Purpose and Need 4
2 Environmental Baseline 6
2.1 General Setting 6
2.2 Natural Setting 9
2.3 Built Environment 16
2.4 Future without Project 17
3 Species Status 18
3.1 Topeka Shiner 19
3.2 Rufa Red Knot 21
3.3 Dakota Skipper 22
3.4 Western Regal Fritillary 24
3.5 Monarch Butterfly 25
3.6 Suckley's Cuckoo Bumble Bee 26
3.7 Northern Long-eared Bat 27
3.8 Tricolored Bat 28
4 Proposed Action 30
5 Effects of Proposed Action 34
5.1 Topeka Shiner 34
5.2 Rufa Red Knot 35
5.3 Dakota Skipper 35
5.4 Western Regal Fritillary 36
5.5 Monarch Butterfly 37
5.6 Suckley's Cuckoo Bumble Bee 37
5.7 Northern Long-eared Bat 37
5.8 Tricolored Bat 38
5.9 Cumulative Effects 38
6 Determination of Effects Summary and Conclusion 40
7 References and Literature Cited 41

FIGURES

Figure 1. Study Area Map Watertown, South Dakota 3
Figure 2. Comparison of Peak Flow Events for Big Sioux River 4
Figure 3. Historical Aerial Imagery 7
Figure 4. NLCD 2021 within Action Area 8
Figure 5. NWI Wetlands within the Action Area 12
Figure 6. EPA Water Quality Map 15
Figure 7. Population Complexes based on Records from 1999 to 2017 (USFWS 2018a) 20

TABLES

Table 1. NLCD Within Action Area 8
Table 2. Wetlands within the Assessment area Determined through Desktop Methodology 12
Table 3. Impairment Status – Waterbodies Within Study Area 14
Table 4. Summary of Species Included in Analysis and Findings 19
Table 5. Effects Determination for ESA-listed Species in the Proposed Action Area 40

1 INTRODUCTION

A General Investigations (GI) study is being conducted by the U.S. Army Corps of Engineers, Omaha District (USACE) under resolutions adopted by the Committee on Public Works, U.S. Senate on May 8, 1964, and March 26, 1968; and a resolution adopted by the Committee on Public Works, U.S. House of Representatives on August 1, 1963. This authorizes a review of utilization of storage reservoirs for flood control and related water problems in the Big Sioux River basin in South Dakota and Iowa.

The city of Watertown and vicinity has experienced eleven major flood events since 1943 which includes the flood of record in 1997. This has resulted in damaged housing and infrastructure, cut off from emergency services, and millions in insurance claims. This study is necessary to evaluate the feasibility of reducing flood risk throughout the community of Watertown, SD.

An integrated Feasibility Report and Environmental Assessment (FR/EA) documents the existing conditions, evaluation of alternatives, and recommendations for the flood risk management (FRM) of the Big Sioux River in the City of Watertown and its vicinity. These recommendations are intended for authorization and implementation following the approval of this final report. The integrated EA has been completed in accordance with the National Environmental Policy Act (NEPA; 42 U.S.C. § 4331 et seq, as amended) and USACE's Procedures for Implementing NEPA (ER (Engineering Regulation) 200-2-2), and satisfies the requirements of USACE policies that guide water resource development studies, including the Planning Guidance Notebook (Engineer Regulation ER 1105-2-100), Planning Policy for Conducting Civil Works Planning Studies (ER 1105-2-103), and other related guidance.

This Biological Assessment (BA) was prepared to determine whether the Proposed Action may affect threatened or endangered species under Section 7 of the Endangered Species Act (ESA; 7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.) of 1973, as amended. Section 7 of the ESA states that Federal agencies shall ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in destruction or adverse modification to designated critical habitat.

1.1 PROJECT AUTHORITY

The Watertown, SD GI was authorized under resolutions adopted by the Committee on Public Works, U.S. Senate on May 8, 1964, and March 26, 1968; and a resolution adopted by the Committee on Public Works, U.S. House of Representatives on August 1, 1963, which authorizes the Board of Engineers for Rivers and Harbors to review the reports on the Big Sioux River and its Tributaries, Iowa and South Dakota, published as House Document Numbered 133, Eighty-fourth Congress, and other reports, with a view to determining any modifications should be made in the recommendations therein, with particular reference to utilization of storage reservoirs for flood control and related water problems, including municipal water supply, outdoor recreation, fish and wildlife conservation, irrigation, erosion, and water quality control, in the Big Sioux basin upstream from the mouth of the Rock River but including the Rock River basin.

The Letter of Request, received by USACE on 7 April 2020 was submitted by the City of Watertown and Section 201(a)(62) WRDA 2022 authorized the funding for the flood risk management along the Big Sioux River in the City of Watertown and vicinity. A feasibility cost

sharing agreement (FCSA) was executed between USACE and the City of Watertown, the Non-Federal Sponsor (NFS) on August 19, 2022, officially kicking off the feasibility study. Feasibility study costs are shared 50 percent federal and 50 percent non-federal; and design and implementation costs are shared 65 percent federal and 35 percent non-federal.

1.2 CONSULTATION HISTORY

USACE sent scoping letters to the U.S. Fish and Wildlife Service (USFWS), dated 27 December 2022 regarding the initiation of this GI study and held an agency scoping meeting on 31 January 2023. Following the agency scoping meeting, USACE sent an email with attachments to USFWS, dated 8 February 2023, requesting recommendations for additional species that may need to be considered, clarification on tricolored bat (*Perimyotis subflavus*) and northern long-eared bat (*Myotis septentrionalis*) ranges, and observation locations of federally listed species within the project area. Additional correspondence between USACE and USFWS took place, regarding species-specific technical assistance and discussion involving USFWS easements and fee title properties through July 2023. An interagency meeting took place on 16 May 2024 to provide a status update on the GI study and share information about the final array of alternatives and tentatively selected plan (TSP) and representatives from USFWS and the South Dakota Game, Fish and Parks (SDGFP) were in attendance. Additional discussions regarding updates to species presence in the Big Sioux River and City of Watertown vicinity took place via email between USACE, USFWS, and SDGFP from August 29, 2024, to September 5, 2024. Following the draft release of the TSP, USACE and USFWS held a brief phone call on October 25, 2024, to discuss species presence of the tri-colored bat, northern long-eared bat, and Topeka shiner within the action area. On this phone call, USACE was informed a study was anticipated to occur within the vicinity of Watertown that could help inform northern long-eared bat and tri-colored bat presence within the action area. USACE initially submitted this BA to USFWS on May 7, 2025, requesting informal consultation and concurrence. However, due to project updates that potentially required changes to the BA, USACE requested USFWS to pause its review on June 11, 2025. After determining that the proposed action would remain the same and only minor edits were needed, USACE re-initiated Section 7 informal consultation on September 22, 2025. All revisions to the BA were highlighted when provided to the USFWS. USFWS provided concurrence on the BA on November 21, 2025.

1.3 ACTION AREA

The action area includes areas that are potentially impacted by construction and/or operation of the proposed project. The action area falls within the Upper Big Sioux River subbasin (Hydrologic Unit Code 10170201) within Codington County in the vicinity of the City of Watertown. The three major streams draining into the Upper Big Sioux River are Stray Horse Creek, Willow Creek, and Mud Creek. A study area map is shown in Figure 1. The action area is the same as the study area for this GI study. The study area is defined as the existing .02% Annual Exceedance Probability (AEP) floodplain with a buffer of 500 feet.

1.4 BACKGROUND AND HISTORY

The flood risk problem has been studied previously several times by USACE and other agencies dating back to the 1970s. USACE completed a feasibility study and submitted a Chiefs Report in 1994 recommending the construction of the Mahoney Creek Dry Dam upstream of Watertown; however, due to opposition from landowners Congress did not approve the project for construction. Watertown and the surrounding areas experienced the flood of record in 1997 leading the city to request USACE to re-evaluate alternatives with updated hydrology and hydraulic (H&H) models utilizing 1997 flood data as well as impacts to economic land use. USACE completed a re-evaluation report in 2000 that still recommended the Mahoney Creek Dry Dam. Lack of local support for the dry dam alternative still existed which prevented its implementation. USACE conducted additional studies for Watertown and vicinity between 2005 to 2012 which included reviewing additional alternatives, updating H&H modeling, and conducting a value engineering study. No new alternatives were recommended for construction after these studies.

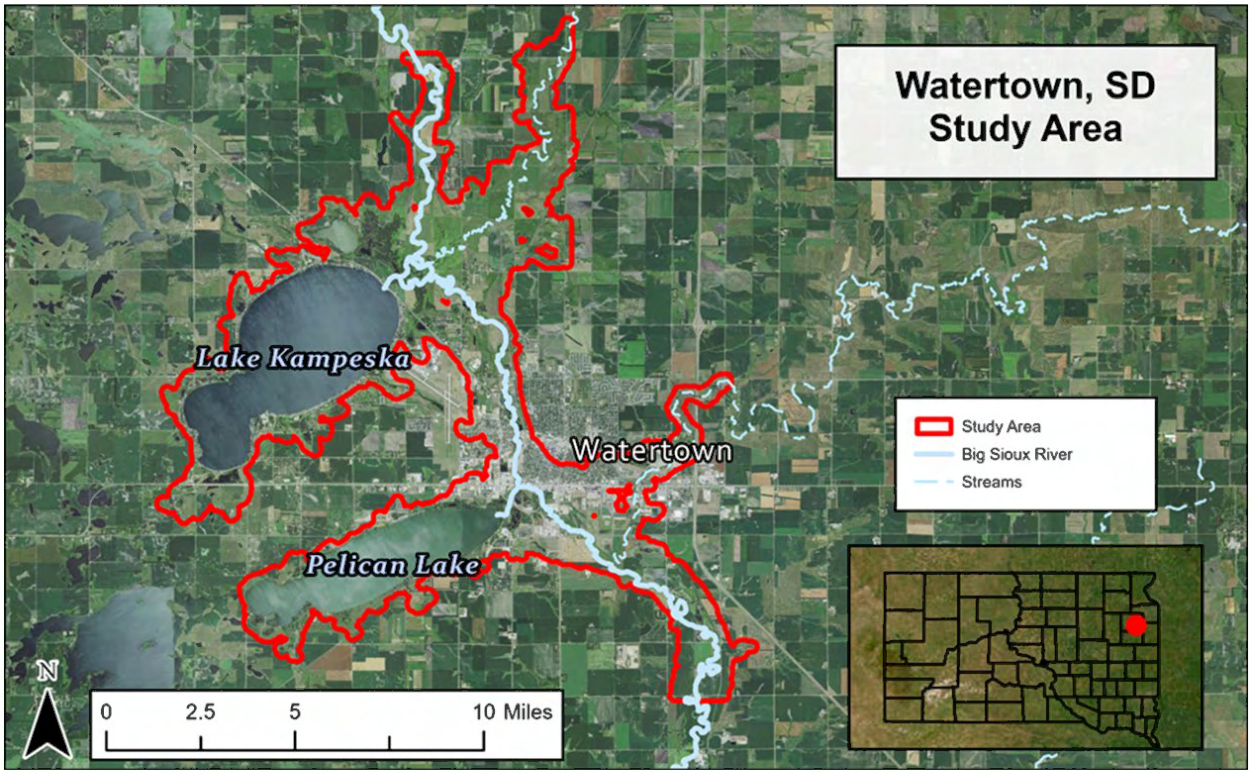


Figure 1. Study Area Map Watertown, South Dakota

1.4.1 FLOOD HISTORY

There have been several significant floods within the study area: 1943, 1952, 1969, 1972, 1986, 1993, 1997, 2001, 2010, 2011, and 2019. These floods have been caused by snowmelt, rain-on-snow, and rainfall events. The study area sustained damage to critical infrastructure, such as utilities, sewers, and roadways during each flood event. The 1997 event was the most severe flood on record for the Big Sioux River and Lake Kampeska, however there are no recorded fatalities for any of the flooding events. For the USGS gage near the Watertown location, the record peak discharge for the 1997 event was 7,820 cubic feet per second (cfs).

This compares to the previous record peak discharge of 5,950 cfs in 1969. See Figure 2 below for comparison of peak flow events between 1997 to 2023 and 1969.

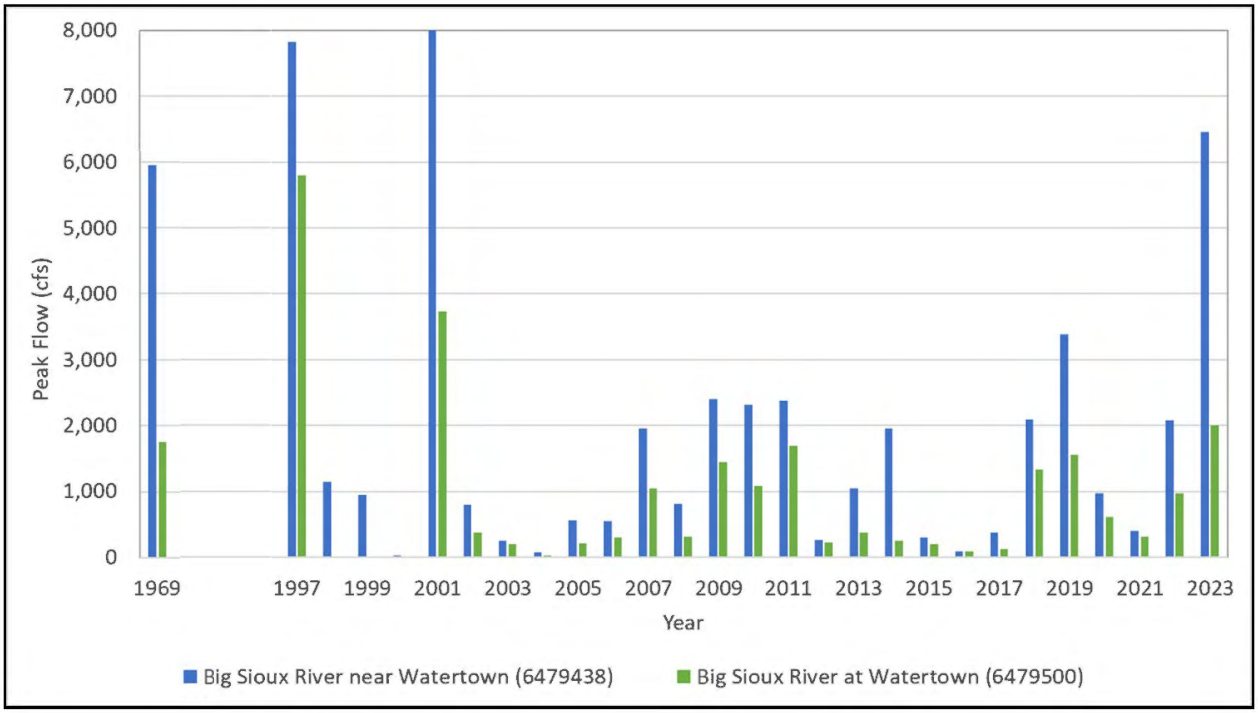


Figure 2. Comparison of Peak Flow Events for Big Sioux River

1.5 PURPOSE AND NEED

The purpose of the project is to address flood risk along the Big Sioux River in and around the vicinity of Watertown, SD in order to reduce flood and life safety risks. Over the 50-year period of analysis, the purpose of the project would be to:

- Reduce the damages and severity of flooding within the vicinity of Watertown.
- Reduce impacts to health and life safety from flooding within the vicinity of Watertown.
- Reduce cost and frequency of deploying emergency response efforts during flood events.
- Provide benefits to and avoid disproportionate impacts to the underserved and disadvantaged communities within the City of Watertown and Lake Traverse Reservation.
- Reduce floodplain requirements within the vicinity of Watertown.
- Increase resiliency of infrastructure to flooding within the vicinity of Watertown.
- Create nature-based features with FRM measures.

The need is there are approximately 1000 structures that are currently vulnerable at the 1% AEP event within the vicinity of Watertown, SD. Several critical facilities are either directly impacted or access has been greatly reduced. This includes facilities such as the hospital which during flood events is difficult for residents who live west of the Big Sioux River to access. There are four main problems occurring within the city of Watertown and vicinity due to flooding of the Big Sioux River:

1. Risks to property and infrastructure within the city of Watertown and its vicinity.
    a. There are roughly 2,800 structures in the 0.2% APE with an approximate structure value of just under $1 billion in the vicinity of Watertown. Majority of these structures (2,300) are residential with the remaining 500 a variety of nonresidential structures.
2. Frequency and severity of flood-fighting and cleanup costs are high.
    a. Since 2010, the City of Watertown has spent nearly $2 million in advanced protection measures and damage repairs.
3. Life risk and human health and safety risks associated with road closures and limiting access to the hospital, flood temperatures during early spring floods, and water.
4. Risk of flooding the wastewater treatment plant and releasing untreated water into the Big Sioux River and the community which could harm water quality, damage aquatic ecosystems, and cause waterborne diseases.

2 ENVIRONMENTAL BASELINE

The environmental baseline is essentially a description of the past and present impacts that have influenced the status of the species (and its habitats) within the action area. The environmental baseline is used as a foundation for evaluating the effects of the action because the Services “add” the effects of the action and the cumulative effects to the environmental baseline. Thus, there is a need to express the environmental baseline in terms that are relevant to the effects analysis.

The period of analysis for this study is 50 years, which is assumed to begin following construction of the Proposed Action. Construction is assumed to be complete in 2030; therefore, the period of analysis is 2026+1 through 2030+50. The period of analysis for this study includes existing current conditions, future conditions without a constructed project (FWOP)- also defined as the No Action Alternative, and future conditions with project (FWP)- defined through the Proposed Action. Section 2 of the FR/EA provides greater detail of the existing condition of the action area.

2.1 GENERAL SETTING

The city of Watertown is located on both banks of the Big Sioux River. With a population of 22,655 at the time of the 2020 Census, Watertown is the second largest community in northeastern South Dakota. Watertown is the trade center for thousands of people in the area. Three industrial parks and an established business community serve local, national, and world markets.

Three major lakes exist as off-channel storage to the Big Sioux River: Lake Kampeska, Lake Pelican, and Lake Poinsett. Lake Kampeska and Lake Pelican are located in Watertown and affect flows on the Big Sioux River through town. Lake Poinsett is located much farther downstream and its impact on Big Sioux River flows does not affect the Watertown area.

The dominant past and present land uses include farming, grazing, rural, and urban development, industrial operations, and recreation. These uses have affected soils, water resources, wetlands, threatened and endangered species, vegetation and invasive species, socioeconomics, wildlife, noise, cultural resources, and recreation.

Urbanization and recreation have also affected the vegetative community within the study area. Management of areas for recreation and aesthetic values have led to an increase in trees and other woody species beyond their natural historical prevalence. Aerial imagery from 1952 shows few trees upstream of 3rd Ave NW and suggests a predominately herbaceous vegetative community (Figure 3).

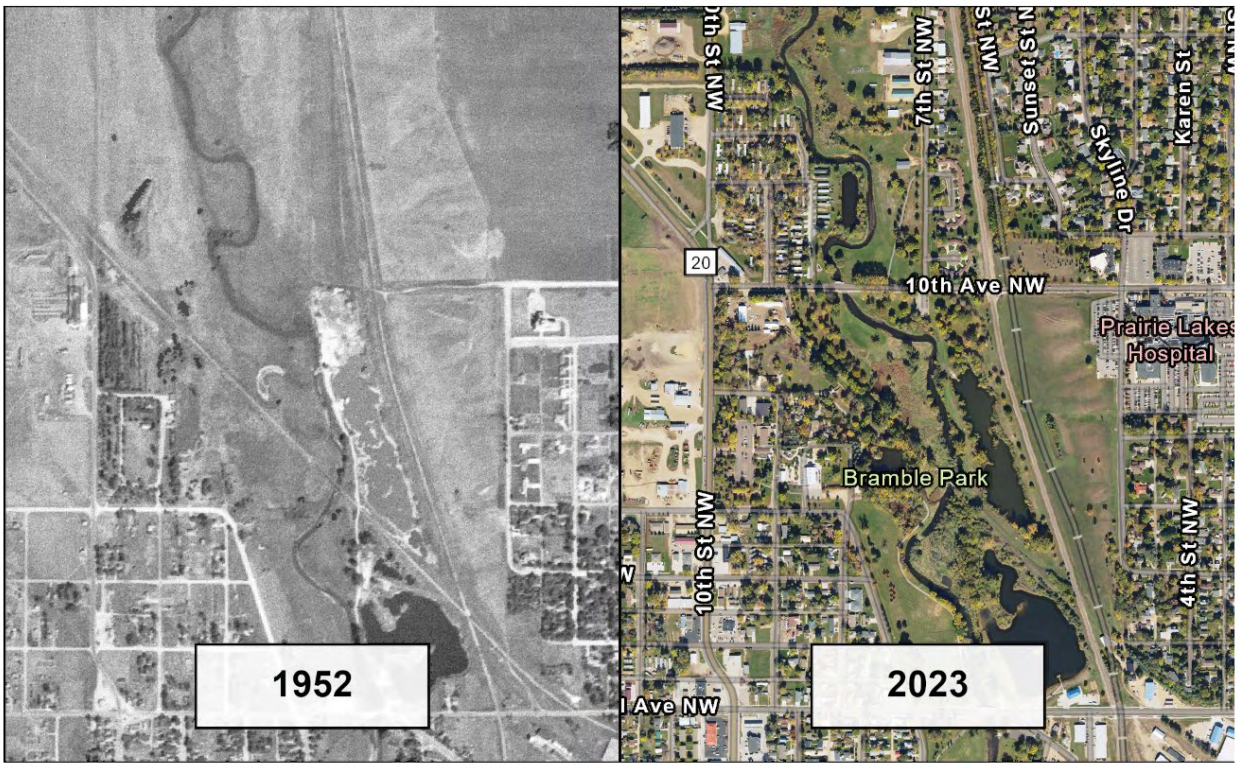


Figure 3. Historical Aerial Imagery

2.1.1 LAND USE

Land use types in the study area include residential, commercial, industrial, agricultural, and open space. The City of Watertown has regulatory authority over land use within the city boundaries which encompasses the majority of the study area. The City of Watertown's Comprehensive Land Use Plan (2020) is the major planning document for the city.

The National Land Cover Database (NLCD) provides land cover data for the United States. From the NLCD 2021 release, the largest land cover type within the study area is open water, comprising 8,470 acres and covering 28.2% of the study area (Figure 4 and Table 1). Agriculture is also a primary land use within the study area, with cultivated crops and pastures composing 16.6% and 15.5% of the study area respectively. The study area encompasses a large amount of developed land within the City of Watertown and adjacent areas. All classifications of developed land account for 16.6% of the study area, concentrated in the center of the study area. The City of Watertown has seen a trend of increased developed land, with new development being concentrated toward the fringes of the city (City of Watertown, 2020). This trend of conversion to developed land is expected to continue under the FWOP conditions.

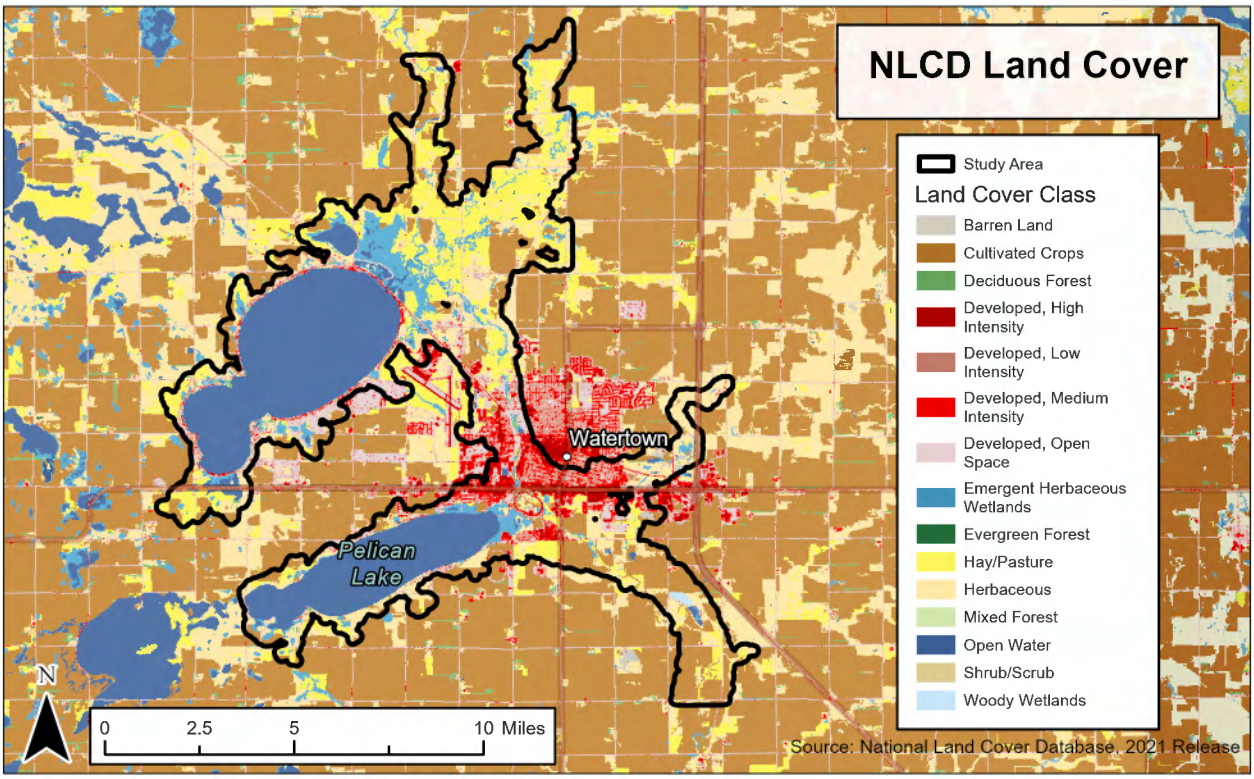


Figure 4. NLCD 2021 within Action Area

Table 1. NLCD Within Action Area

NLCD Land Classification	Acres in Study Area	Percent of Study Area
Open Water	8,470.6	28.2%
Cultivated Crops	4,994.7	16.6%
Hay/Pasture	4,663.5	15.5%
Herbaceous	4,581.5	15.2%
Emergent Herbaceous Wetlands	2,075.7	6.9%
Developed, Open Space	1,628.0	5.4%
Developed, Low Intensity	1,484.7	4.9%
Developed, Medium Intensity	1,358.5	4.5%
Developed, High Intensity	524.5	1.7%
Barren Land	110.0	0.4%
Deciduous Forest	92.4	0.3%
Woody Wetlands	55.2	0.2%
Mixed Forest	5.2	0.0%
Shrub/Scrub	4.9	0.0%
Total	30,049.3	100.0%

Prime farmland, as defined by the Natural Resources Conservation Service (NRCS), is land that has the best combination of physical and chemical characteristics for producing crops. The study area is primarily composed of non-prime farmland (15,800 acres; 52.7%). Prime farmland if drained (5,200 acres; 17.4%), prime farmland if irrigated (4,800 acres, 16%), prime farmland (3,600 acres; 12%), and farmland of statewide importance (590 acres, 2%) compose a minority of the study area (USDA, 2024). The majority of these areas are already developed, although there is agriculture on farmland classifications towards the north and south ends of the study area.

2.1.1.1 RECREATION

The City of Watertown offers a diverse range of recreational opportunities. Its parks and recreation system is well-developed with numerous recreation facilities. Watertown has several parks which offer playgrounds, sports fields, picnic areas, and walking trails. There are multiple sports complexes with facilities for a variety of sports that host local leagues, tournaments, and community sports programs. Recreational trails traverse along the Big Sioux River within the City. Two of the most visited parks in Watertown are Stokes-Thomas Lake City Park and Bramble Park. Other parks with relatively high visitation within and adjacent to the study area are Lions Park, Riverside Park, and McKinley Park. Lake Kampeska has approximately 6 boat ramps and several recreation areas along the shore. Lake Kampeska public access areas and parks include Sandy Shore State Recreation Area and Codington County's Memorial Park. These parks provide public access to boating, camping, nature trails and swimming. Pelican Lake offers similar public recreation opportunities with 4 boat ramps, Pelican Lake State Recreation Area, Thompson's Point and Northwest Lakeside Use Areas. Two golf courses are located adjacent to the south edge of Lake Kampeska.

2.2 NATURAL SETTING

South-central Codington County, in northeastern South Dakota, within EPA Level IV Ecoregion *Big Sioux Basin*, which is within the *Northern Glaciated Plains* Level III Ecoregion. USDA's Major Land Resource Area (MLRA) 52 classifies this area as the *Prairie Coteau*, of the Land Resource Region Central Feed Grains and Livestock Region. The Coteau region is a broad and shallow trough running north to south and stretches up to 60 miles wide. Higher along its western and eastern edges than the middle, this highland escaped the last of the Pleistocene glacial advances. As the Wisconsin ice sheets retreated northward, the Big Sioux River became a major drainage pathway for glacial melt water and outwash. Consequently, throughout much of this region, buried outwash gravels are saturated with groundwater and numerous stream systems flow through this landform. During dry periods, these groundwater sources provide critical inflows to various surface water stream segments in the Big Sioux River Basin. In relatively wet years, high amounts of precipitation during the spring and early summer months lead to seasonal fluctuation in the Big Sioux River and its tributaries.

2.2.1 WATER RESOURCES

The study area is located within the Big Sioux River Basin (hydraulic unit code 101702) which originates in northeastern South Dakota, has a length of approximately 210 mi (338 km) and a maximum width of 75 mi (121 km). It has an area of approximately 8,850 mi^2, of which 6,014 mi^2 (15,576 km^2) are located in South Dakota. The study area is located in the northern-most sub watershed, the Upper Big Sioux Watershed (hydraulic unit code 10170201). The Upper Big

Sioux Watershed has an area of approximately 1,633 mi^2 (4,330 km^2), draining portions of Marshall, Roberts, Day, Grant, Clark, Codington, Duel, and Hamlin Counties. The Upper Big Sioux Watershed is broad, largely without alluvial bottoms nor bordering bluffs. The northern Upper Big Sioux Watershed maintains a channel slope of approximately 1 ft/mi (0.19 m/km), while the average slope in the Watertown vicinity is approximately 7 ft/mi (1.33 m/km).

2.2.1.1 STREAMS, LAKES, AND PONDS

The upper portion of the Big Sioux River is broad, largely without alluvial bottoms and bordering bluffs. The drainage area of the Big Sioux River (including Willow Creek) upstream from Watertown is 1,902 square miles of which 1,391 square miles are usually non-contributing (213 square miles of the non-contributing area contributed starting in 1994). The Big Sioux River also receives storm sewer discharges or additional runoff from the City of Watertown. Direct runoff to the river, as well as numerous tributaries, contributes loadings of sediment and nutrients. The river and tributaries also recharge shallow aquifers found adjacent to these water bodies. These shallow aquifers are the principal source of drinking water for the residents of the region. Other flow alterations of the Big Sioux River include channelization, culverts, and bridges at numerous road crossings of the river and tributaries. Main tributaries to the Big Sioux River in the study area are Mud Creek and Willow Creek.

The retreat of glaciers some 14,000 years ago formed the majority of lakes and ponds in Northeastern South Dakota, including prairie potholes and larger glacial lakes. Within the project area, these glacial lakes include Lake Kampeska and Pelican Lake. Lake Kampeska is a lacustrine lake with an approximate area of 5,060 acres and a maximum depth of 15 ft. Pelican Lake is a lacustrine lake with an approximate area of 2,800 acres and a maximum depth of 12 ft.

Lake Kampeska, a natural lake formed during the glacial period now modified by human development, has a surface area of approximately 4,800 acres and an average depth of 10 feet. The maximum depth is approximately 15 feet. Historically, the lake has been a heavily used recreation resource; developed primarily with cabins. Few were inhabited permanently. However, in the last 45 years, most cabins have been upgraded, remodeled, or removed and replaced with high-cost housing. A low weir has been installed in the channel between the lake and the Big Sioux River to ensure a water supply to the lake and to prevent it from draining too quickly during extended droughts. During major flooding, large portions of flows on the Big Sioux River are diverted into Lake Kampeska and stored. After the Big Sioux River starts to recede, flows are slowly drained from the lake. Another uncontrolled weir structure was constructed in 2002 on the inlet/outlet channel to Lake Kampeska to reduce sediment loading into the lake by diverting the low flows downstream. The length of the weir is 330 feet with the crest at 1719.16 feet. It includes a 3ft fish passage weir and two 7ft X 8ft sluice gates that allow for lowering of the lake after flood events or filling of the lake during drought periods.

Lake Pelican is also a natural glacial lake located just downstream of U.S. Highway 212, one mile southwest of Watertown and about three miles south of Lake Kampeska. At a normal pool of 1709 feet, Lake Pelican is about five miles long and one mile wide and covers 2,800 acres. The maximum depth is seven feet, with a storage capacity of about 7,400 acre-feet at normal pool. A diversion dam across the Big Sioux River with a crest elevation of 1710.7 feet controls flow elevations just downstream of Highway 212 and the confluence with the Lake Pelican inlet channel. This channel also includes a low weir at elevation 1713.3 feet that acts to reduce

sediment loading to the lake by diverting low flows downstream. Lake Pelican functions similarly to Lake Kampeska (though not as significantly) in that part of the flood flows on the Big Sioux River are diverted into the lake and stored then released when flows on the Big Sioux River recede.

Aquatic invasive species (AIS) are present within the study area. The SDGFP first identified zebra mussels (*Dreissena polymorpha*) in Lake Kampeska in 2020 and in the Big Sioux River in 2023. Zebra mussels are now considered prevalent within Lake Kampeska and the Big Sioux River from Lake Kampeska to the confluence with the Missouri River now considered infested. Common carp (*Cyprinus carpio*) and bighead carp (*Hypophthalmichthys nobilis*) are also present in the Big Sioux River (Dieterman & Berry Jr, 1998).

2.2.1.2 WETLANDS

Wetlands are important landscape features that provide a multitude of beneficial services to people and fish and wildlife. This includes protection and improvement of water quality, storing floodwaters, maintaining surface water during dry periods and providing habitat for numerous fish and wildlife species (EPA, 2002). Wetlands improve water quality for future use by acting as a filter for surface water that enters a wetland and percolates through the vegetation, depositing suspended sediment and settling to the wetland floor where plant roots and microorganisms absorb excess nutrients before the water enters the groundwater system. Wetlands also provide vital habitat conditions that cultivates biodiversity. While wetlands only cover approximately 5% of the land surface in the lower 48 states, they provide habitat to 31% of plant species and more than one-third of threatened and endangered plant and animal species live explicitly in wetland habitats and another 20% of threatened and endangered species rely on wetland habitat at least once in their lifecycle (EPA, 2006). The density of wetlands in this highly dissected part of the Big Sioux basin is relatively low, at 13 wetlands per square mile (U.S. Fish and Wildlife Service (FWS) Wetlands Map, 1982). Over 30 percent of the historic wetlands in the Big Sioux basin have been drained or otherwise altered (Wittmier, 1984). A total of 46% of existing wetlands are being used for agricultural purposes, such as tilling, haying, or grazing. This may have affected the hydrology of the area, as well as reducing the quality and availability of wetland habitat for wildlife. Wetlands as inventoried by the USFWS National Wetlands Inventory (NWI) are shown below in Figure 5.

A desktop delineation was conducted within the assessment area utilized for habitat modeling to refine an understanding of wetland habitat types present utilizing historical aerial imagery, digital elevation model (DEM) mapping, normalized difference vegetation index (NDVI), and normalized difference water index (NDWI) (Figure 6). Appendix G5a provides a detailed description of methodology utilized. Table 2 provides an estimate of wetlands present within this assessment area. Palustrine emergent (PEM) wetlands were the most prevalent wetland type followed by palustrine wetlands in agricultural lands (WIAS).

Table 2. Wetlands within the Assessment area Determined through Desktop Methodology

Cowardin Classification	Acres
PEM	287
PFO	2
PSS	7
PUB	16
WIAS	61
Riverine Streambed	52

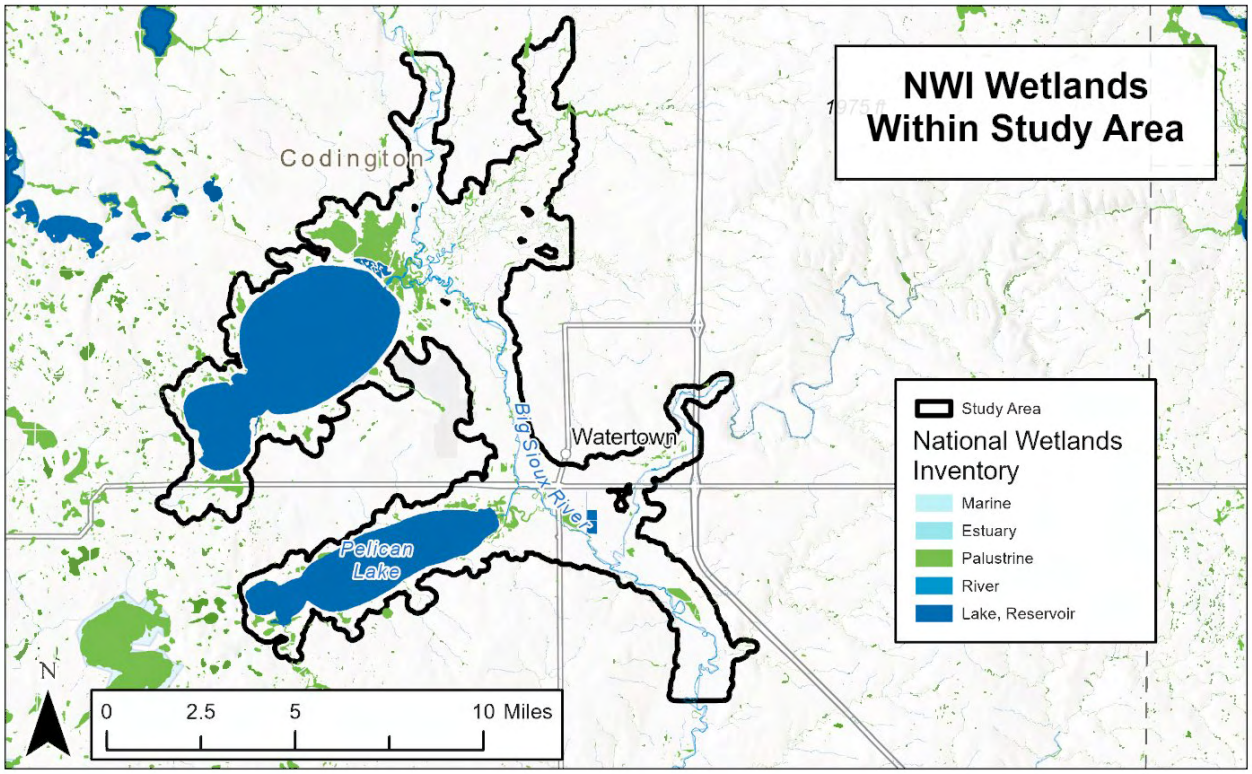


Figure 5. NWI Wetlands within the Action Area

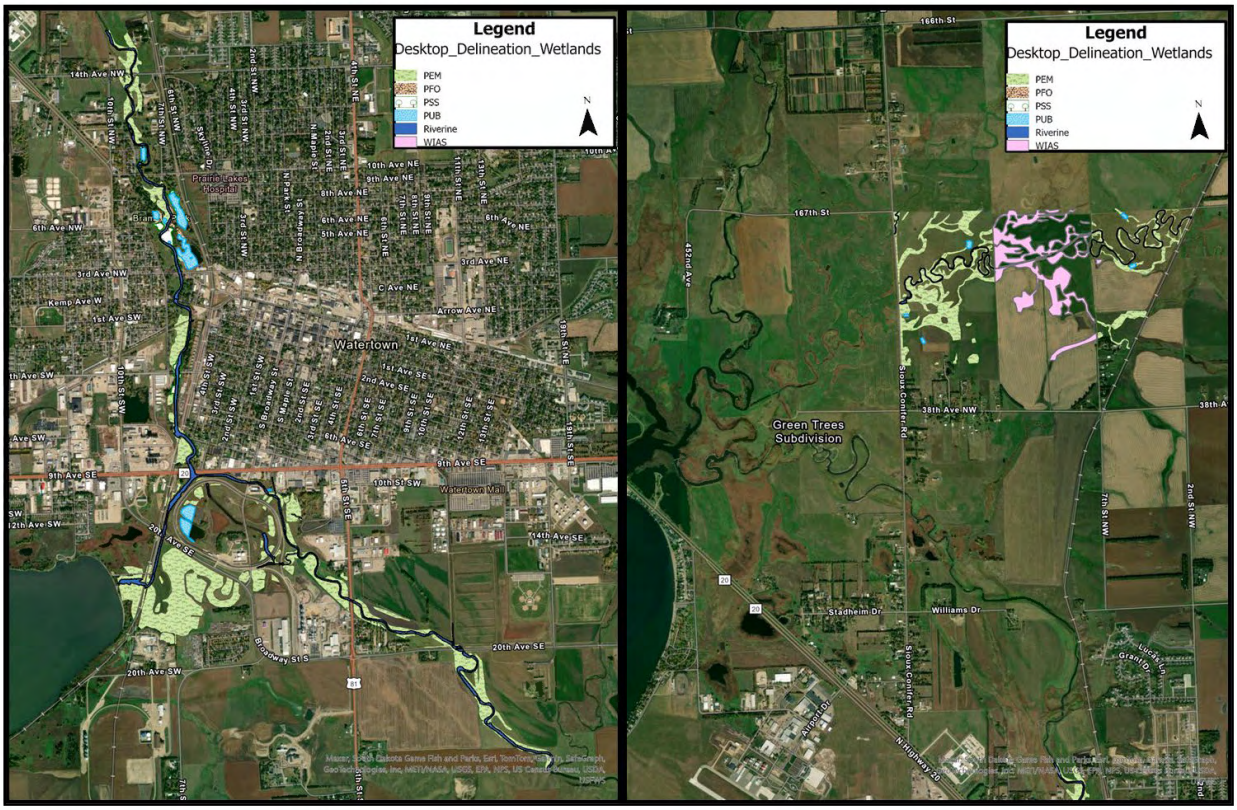


Figure 6. Wetlands within the Assessment Area Determined through Desktop Methodology

2.2.1.3 WATER QUALITY

Designated uses for waterbodies and streams within the Upper Big Sioux River basin include warmwater semipermanent fish life, warmwater marginal fish life, warmwater permanent fish life, recreation, fish and wildlife propagation, irrigation, and water supply use. South Dakota's 2024 Integrated Report for Surface Water Quality Assessment lists 5 impairment rating categories.

- Category 1 - Data indicates that all designated uses are supported with no threat.
- Category 2 - Available data and/or information indicate that at least one designated use is supported, while one or more other uses are either indeterminate or not assessed.
- Category 3 - Available data and/or information are either insufficient or inconclusive and designated use support cannot be determined for any uses.
- Category 4 - Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a total maximum daily load (TMDL) is not needed.
    - 4a - A state-developed TMDL has been approved by or established by USEPA for any segment-pollutant combination.
    - 4b - Designated use support is expected to be restored in a reasonable period of time through other pollution control measures.
- Category 5 waters are placed on South Dakota's 303(d) List of impaired waters requiring TMDLs.

According to the 2024 South Dakota Integrated Report for Surface Water Quality Assessment, within the study area, two streams and one lake are currently listed as 303(d) impaired waters: Big Sioux River, Willow Creek and Lake Kampeska. Impairments are listed in Table 3.

Table 3. Impairment Status – Waterbodies Within Study Area

Waterbody Name	Location	Impairments and Causes	EPA Category	TMDLs (status)
Big Sioux River	To Lake Kampeska	Warmwater Semipermanent Fish Life (DO), Limited Contact Recreation (DO, *E. coli*)	5	*E. coli* (approved 2020), DO (scheduled 2035, low priority)
Big Sioux River	Lake Kampeska to Willow Creek	Limited Contact Recreation (*E. coli*)	5	*E. coli* (scheduled 2036, high priority)
Big Sioux River	Willow Creek to Stray Horse Creek	Limited Contact Recreation (*E. coli*)	4A	Fecal coliform (approved 2008), *E. coli* (approved 2011)
Willow Creek	Big Sioux River to S7, T117N, R50W	Limited Contact Recreation (*E. coli*)	5	Fecal coliform (approved 2008)
Pelican Lake	Codington County	N/A	1	Nutrients/Sediment (approved 1996)
Lake Kampeska	Codington County	Warmwater Permanent Fish Life (MeHg), Fish and Wildlife Prop, Rec, Stock (MeHg)	4a	Nutrients/Sediment (approved 1996), Mercury in Fish Tissue (approved 2016)

A diagnostic Feasibility Study for Lake Kampeska was conducted in 1994 (South Dakota Department of Environment and Natural Resources, 1994) preceding the 1996 TMDL. Historically, anecdotal evidence that Lake Kampeska was composed of a gravel and sand bottom with crystal clear waters in the early 1900's. Promotional marketing encouraged the residential development of the natural lake and by the 1920s the waters had become murky. By the 1940s and 50s, siltation from agricultural practices and continued rapid development in the watershed and disposal of raw sewage in Lake Kampeska resulted in serious water quality issues. All of these water quality issues have continued to persist and compound throughout the decades. Additionally, like almost all lakes of the Prairie Coteau region, Lake Kampeska has experienced water quality problems due to shallow depths which result in high turbidity caused by resuspension of bottom sediments from boat motors, wind, and bottom feeding fish. Algae blooms and loadings of sediment from tributaries add to turbidity issues which further results in an absence of macrophytes, hypereutrophic conditions, and a cascading impact on the aquatic biodiversity.

The Prairie Coteau Watershed Improvement and Protection Project was awarded a Section 319 (of the CWA) grant in 2025 to continue the implementation of efforts that followed the 1996 TMDL. This grant through federal, state, and local funding, is worth a combined $3.8 million with a goal to improve the water quality of northeast South Dakota by implementing conservation practices that reduce fecal coliform bacteria, nutrients and sediment loads entering project

waterbodies, maintaining assigned beneficial uses, and to build on previous efforts and protect water quality improvements realized from previous implementation efforts.

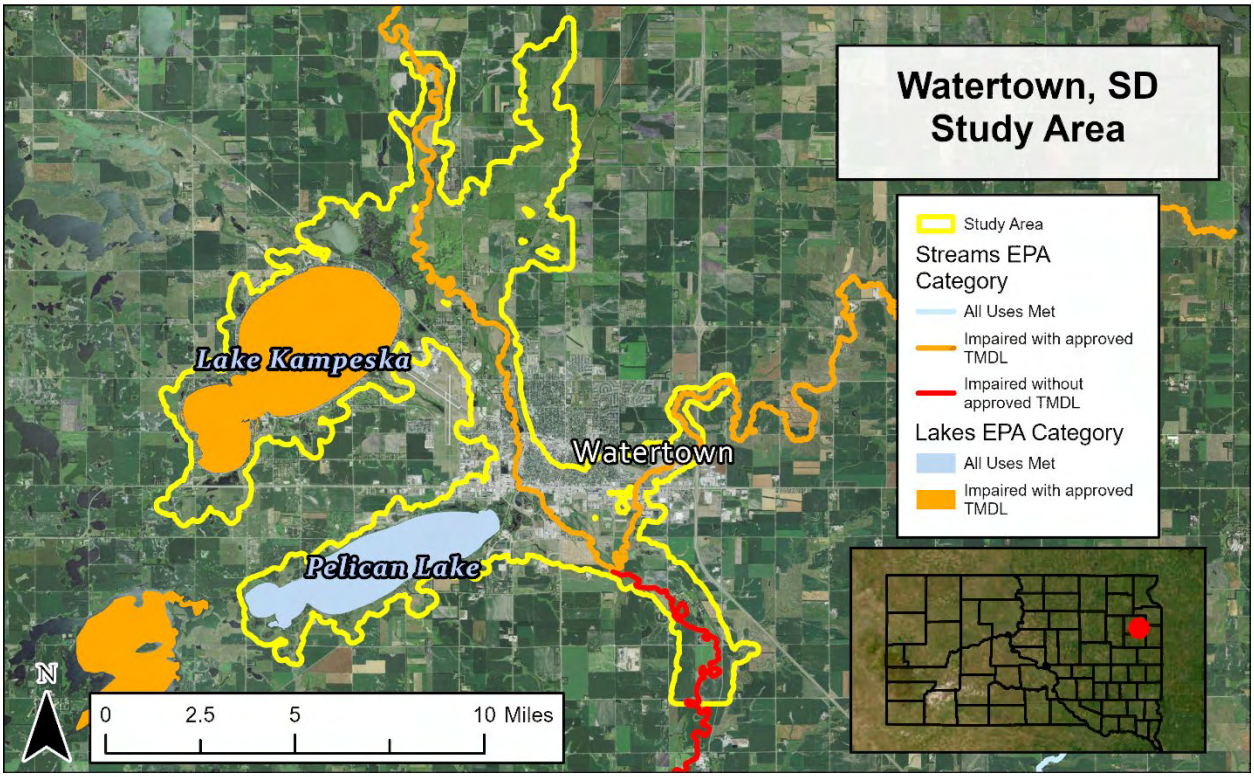


Figure 6. EPA Water Quality Map

Flood events, such as that experienced in 1997, can overwhelm the City of Watertown's drainage and wastewater systems. This increases the risk of releasing untreated and contaminated water into the Big Sioux River, thereby decreasing the water quality. This can increase the *E. coli* concentration in surrounding streams, which are already impaired due to *E. coli* contamination.

Pelican Lake is classified as a eutrophic lake while Lake Kampeska is classified as a mesotrophic lake. The Big Sioux River to Lake Kampeska was included in the nutrient-related assessment sampling where it was found to meet targets for total nitrogen and phosphorus in the water (SDDANR, 2024).

2.2.2 VEGETATION

Tall-grass prairie and wetland vegetation dominated the study area vicinity prior to settlement, but much of the area is now used for agricultural purposes. Only isolated remnants of the virgin tall-grass prairie remain, primarily along rivers, glacial lakes, or in rocky, hummocky upland areas. In the Big Sioux bottom lands, areas of tall-grass prairie or sub irrigated meadow vegetation persist in a few areas and are used for hay or pasture. Dominant native species are switchgrass, prairie cordgrass (*Spartina pectinata*), slough sedge, big bluestem, bluejoint reedgrass, cattails (*Typha spp.*), and western wheatgrass. Native woodlands in the region are nearly absent. Scattered patches of trees may be found along the larger glacial lakes, consisting largely of peachleaf willow, sandbar willow (*Salix exigua*), and cottonwood (*Populus deltoides*).

Field shelterbelts have been planted on the river terraces and on upland soils of the watershed. They contain a mixture of native and introduced woody trees and shrubs. Submerged and emergent aquatic vegetation is present along littoral and pool habitats and in the Big Sioux River. Common species include cattail, curly leaf pondweed, horned pondweed, hardstem bulrush, horsetail, common elodea, sago pondweed, duckweed, and spike rush. These areas provide important cover for juvenile fish and minnows, as well as food for migratory ducks. Some wet pasture lands along the river upstream and downstream from the site provide spawning habitat for vegetation-spawning fish during wet years.

A site visit was conducted June 2023. Dominant native vegetation observed along the Big Sioux River included cottonwood, green ash (*Fraxinus pennsylvanica*), sandbar willow, false indigo (*Amorpha frucitosa*), prairie cordgrass, nettle (*Urtica dioica*), poison ivy (*Toxicodendron radicans*), cattail, and common milkweed (*Asclepias syriaca*). Typical native species observed at the representative data points at Lake Kampeska include cottonwood, sandbar willow, swamp rose (*Rosa palustris*), common milkweed, nettle and cattail.

2.2.2.1 INVASIVE SPECIES

According to the Coddington County Weed and Pest Department, seven State noxious species and three local noxious species are present within the County. Noxious species are legally designated as any plant that may be injurious to public health, agriculture, recreation, wildlife, or property. The State listed species include Canada thistle (*Cirsium arvense*), leafy spurge (*Euphorbia esula*), perennial sowthistle (*Sonchus oleraceus*), hoary cress (*Lepidium draba*), saltcedar (*Tamarix spp.*), absinth wormwood (*Artemisia absinthium*), and purple loosestrife (*Lythrum salicaria*). Locally noxious species include musk thistle (*Carduus nutans*), bull thistle (*Cirsium vulgare*), and plumless thistle (*C. acanthoides*).

During the June 2023 site visit, dominant nonnative vegetation observed included autumn olive (*Elaegnus umbellata*), reed canarygrass (*Phalaris arundinacea*), Kentucky bluegrass (*Poa pratensis*), leafy spurge, and Canada thistle. The dominant nonnative species located at Lake Kampeska included curly dock (*Rumex crispus*), reed canarygrass, Kentucky bluegrass, Canada thistle, and leafy spurge. The dominant native species observed at Pelican Lake included cottonwood, sandbar willow, silver maple (*Acer saccharinum*), prairie cordgrass, cattail, and field mint (*Mentha arvensis*). The dominant nonnative species at Pelican Lake included autumn olive, reed canarygrass, leafy spurge, curly dock, and field bindweed (*Convolvulus arvensis*).

2.3 BUILT ENVIRONMENT

The Lake Kampeska Water Project District (LKWPD) is a local agency tasked with protecting the water resources of Lake Kampeska by implementing projects to improve water quality and flood protection. From 1998 through April 2006, the LKWPD has funded the Upper Big Sioux Water Project with $130,102 for conservation projects. These projects have included riverbank stabilization, assisting in agricultural-waste management strategies and an assortment of other projects that have contributed to the removal of waste products from the Big Sioux River. More work is needed and the LKWPD will continue to provide financial support for this area due to the strong influence the Big Sioux has on the water quality of Lake Kampeska.

The LKWPD board approved a $10,000 water quality improvement project in the Hidden Valley channel on the south end of Lake Kampeska in 2017. The project included installing an aeration system and applying MuckAway (bacteria and enzymes) designed to decrease algae and organic material in the channel.

Rip-rapping large sections of the shores of Lake Kampeska started during the 1990's with financial assistance from the federal government. In the early 2000's, the LKWPD undertook a project to erect a weir at the inlet/outlet of the river. The purpose of the structure is to divert early spring runoff and not allow this sediment into the lake. The weir has a crest of 1719.2 feet NAVD88 and a length of 330 feet. The weir height is set to divert low-river flows, so in the event of a major flood, the lake still will take in a substantial amount of river water. (LKWPD, 2024.) The weir includes a 3 feet fish passage and two 7 feet by 8 feet low flow sluice gates that allow for lowering the lake after floods and filling the lake during drought periods (USACE, 2005).

The City of Watertown repaired and improved the Big Sioux River channel weir in 2016. This weir is located in the Big Sioux River directly downstream of the Lake Kampeska channel. The weir was originally constructed in 1954 to assure water supply to Lake Kampeska and prevent it from draining too quickly during extended droughts. During floods large portions of flows in the Big Sioux River are diverted into Lake Kampeska and stored. After the Big Sioux River starts to recede, flows are slowly drained from the lake back into the river. The Big Sioux River channel weir has a crest height of 1718.8 feet NAVD88 and contains two five feet stop log sections (USACE, 2005).

The Lake Pelican Water Project District (LPWPD) formed in 1988 to improve the quality of the water in Lake Pelican and became a local taxing entity in 1991. Since its formation various projects have been done to improve the quality of water such as: fencing all cattle away from the lake, shoreline stabilization and constructing a silt diversion weir in the inlet-outlet channel of the lake. (LPWPD, 2024.) The silt diversion weir was constructed in 1998 and has a crest elevation of 1713.3 feet NAVD88. The weir is located directly downstream of Highway 212 at the entrance of the Lake Pelican channel. This structure also contains a weir across the Big Sioux River channel that has a lower crest elevation of 1710.7 feet NAVD88 (USACE, 2005).

There exists a non-federal locally constructed embankment system along the Big Sioux River going through the City of Watertown. These berms are not part of the PL84-99 program and are not documented in the National Levee Database. These embankments are non-continuous and come from different sources. Most of the embankments along the Big Sioux River are modified USACE advance measures from the 1997 and 2010 flood fights. There is one stretch of abandoned railroad embankment that acts as a levee. There are also private levees along the Big Sioux River. Preliminary soil borings indicate the modified advance measures, and the railroad embankment are made of lean clay.

2.4 FUTURE WITHOUT PROJECT

In the FWOP, no federally funded FRM project would occur. Economic and residential development in the City of Watertown may suffer as entities would be hesitant to utilize or invest in infrastructure that falls within the regulatory floodplain. Generation of revenue for Watertown could decrease as a result of the loss of businesses. There is also a possibility that an increase in urban development may result from emigration, as indicated during the COVID-19 pandemic where an influx of moving to rural communities in the Midwest occurred (NCA, 2023), and

general projected population growth. Future population growth would continue to place demands on watershed resources, and it seems likely that these demands would inevitably impair watershed health. Increases in population and higher-intensity development would increase demand for water supply, likely precipitating the need for additional reservoir storage and new modifications to streamflow for irrigation supply. Each of these hydrologic modifications would continue to shift the watershed hydrology to a more altered state, further impairing watershed condition and having impacts on environmental resources utilized by fish and wildlife.

Across the 50-year planning horizon, it is anticipated that impacts of hydrometeorological changes would be a major driver on ecological and social conditions. According to the National Climate Assessment (NCA, 2023), the State of South Dakota falls within the Great Plains region, which also includes the states of Montana, Wyoming, North Dakota, Nebraska, Kansas, Oklahoma and Texas. This region is characterized by a diverse variation of day-to-day temperatures and precipitation. This region experiences multiple climate and weather hazards, such as floods, droughts, severe storms, tornados, hurricanes and winter storms. In much of the Great Plains, little precipitation falls to replace what is utilized by humans, animals and plants. Significant climate-related challenges anticipated include increasing rising temperatures which lead to an increased demand for water and energy, increased stress on natural resources and increased competition for water among communities, agriculture, energy production and ecological needs.

For water quality, this increase in development suggests a subsequent increase in nonpoint source pollution throughout the watershed. Nonpoint source pollution, defined as water pollution that comes from many different sources in a watershed, is the leading remaining cause of water quality problems in the United States (EPA, 2005). Increases in the number of septic systems in the non-serviced area of the watershed would likely continue to load nutrients and *E. coli* to downstream waterbodies. Similarly, an increase in stormwater runoff from greater impervious cover and development-related construction activities would inevitably contribute to continued water quality degradation, unless BMPs and restoration activities that directly address these sources are implemented.

3 SPECIES STATUS

Utilizing the USFWS' online tool, the Information for Planning and Conservation (IPaC) website was accessed on February 5, 2025 (consultation code 2024- 0131813). The study area was uploaded into IPAC for a list of species that may have the potential to occur within the study area and be impacted by the Proposed Action (Table 4). The endangered Topeka shiner (*Notropis topeka*), threatened rufa red knot (*Calidris canutus rufa*), threatened Dakota skipper (*Hesperia dacotae*), proposed threatened western regal fritillary (*Argynnis idalia occidentalis*), proposed threatened monarch butterfly (*Danaus plexippus*), and proposed endangered Suckley's cuckoo bumble bee (*Bombus suckleyi)* were included in the list generated from IPaC. In coordination with USFWS, it was recommended that USACE consider the endangered northern long-eared bat (*Myotis septentrionalis*) and the proposed endangered tricolored bat (*Permimyotis subflavus*) in this BA due to the amount of tree removal anticipated under the proposed action (see Section 4.0 for a detailed description of the proposed action), even though they did not populate under IPaC's list.

Table 4. Summary of Species Included in Analysis and Findings

Species	Scientific Name	Status
Topeka Shiner	*Notropis topeka*	Endangered
Rufa Red Knot	*Calidris canutus rufa*	Threatened
Dakota Skipper	*Hesperia dacotae*	Threatened
Western Regal Fritillary	*Argynnis idalia occidentalis*	Proposed Threatened
Monarch Butterfly	*Danaus plexippus*	Proposed Threatened
Suckley's Cuckoo Bumble Bee	*Bombus Suckleyi*	Proposed Endangered
Northern Long-eared Bat	*Myotis septentrionalis*	Endangered
Tricolored Bat	*Perimyotis subflavus*	Proposed Endangered

3.1 TOPEKA SHINER

3.1.1 STATUS AND DISTRIBUTION

In 1998, the Topeka shiner was officially listed as endangered under the Endangered Species Act. Topeka shiner have been found frequently in low order prairie stream systems, similar to those in the project area in east-central and southeastern South Dakota (Tabor 1998, Hatch 2001; Wall and Berry 2004; Wallet al. 2004). In 2004, USFWS designated 836 miles of stream as critical habitat for the Topeka shiner in Minnesota, Nebraska, and Iowa (USFWS 2004). There is currently no critical habitat designated in the state of South Dakota. U.S. Populations of the Topeka shiner have declined by 70% across its range over the past half century. Since 1999, the Topeka shiner has been documented in 223 small streams condensed into 87 HUC10 populations, and distributed among six states that include South Dakota, Minnesota, Iowa, Nebraska, Kansas, and Missouri (USFWS 2018a). Hydrogeomorphic conditions in the upper Big Sioux Basin provide numerous degraded streams with silt substrates, off-channel backwater areas, borrow pits, and sloughs connected to the mainstream channel and therefore opportunities for occupation by the Topeka shiner.

In June 2003, USACE contracted a survey to be conducted within suitable habitat to determine the presence of Topeka shiner in the upper portion of the Big Sioux River watershed, north of the town of Watertown, South Dakota for a previous feasibility study discussed in Section 1.4. The first task of the survey identified suitable habitat within an approximately 7,000-acre project area limit (within the previously estimated 100-year storm pool elevation coverage for the proposed flood control storage reservoir on the Big Sioux River near Mahoney Creek) where a dry dam was proposed. As part of this study, a field reconnaissance conducted on August 25 to 27, 2003 identified 176 potential habitat sites within or near the Big Sioux and its tributaries, in the survey area. The field survey was conducted October 11 through 15, 2003 by experienced fish-sampling personnel, familiar with both the preferred habitat and proper identification of the Topeka shiner. Sampling intensity was adequate to evaluate the presence of the species in all habitat conditions. The Topeka shiner was not found during the survey and was thus presumed to be absent from this portion of the Big Sioux River drainage basin (DMA, Inc., 2004).

USFWS published a Species Status Assessment for Topeka shiner in 2018 and identified thirteen population complexes (Figure 7). The Willow Creek population (HUC10- 1017020107) is located within the action area and was identified as part of the Big Sioux River population

complex. Mud Creek was not listed as an occupied stream. (USFWS 2018a). According to the South Dakota National Heritage Program Data, multiple populations of Topeka shiner have been found within tributaries to Willow Creek with no known occurrence documented within Mud Creek (SDGFP 2023). Through recent coordination with USFWS, USACE was informed that the most recent captures of Topeka shiner near the action area have occurred above and below Watertown in other tributaries. More specifically, a recent capture occurred in Willow Creek, located downstream from the proposed action area. Willow Creek flows into the Big Sioux River, approximately 0.65 miles south of the proposed project action area.

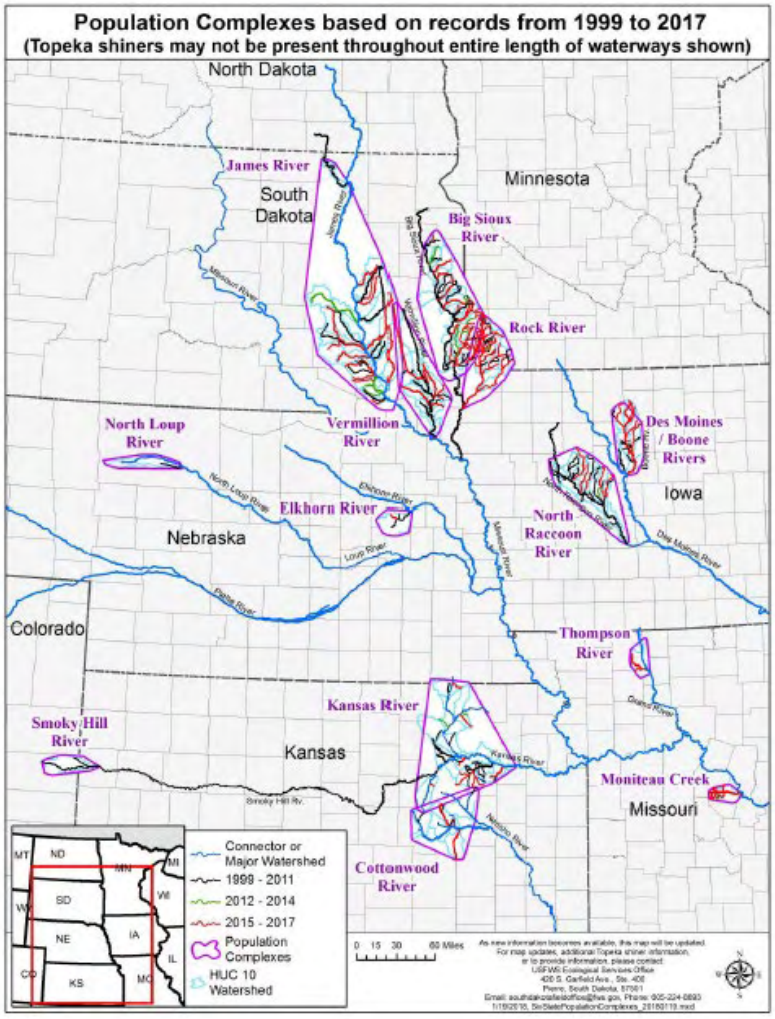


Figure 7. Population Complexes based on Records from 1999 to 2017 (USFWS 2018a)

3.1.2 LIFE HISTORY

The Topeka shiner is a small stocky fish with silvery to olive color and a pronounced black line which extends along the side (Tabor 1998, Hatch 2001; Wall and Berry 2004; Watt et al. 2004). Topeka shiners spawn from May 15th to July 31st and are found in quiet, slow-moving streams or spring-fed pools. They require gravel or sand-bottomed substrates with clear water. Pool areas outside the main channel of a stream are preferred. Topeka shiners are omnivores primarily

feeding on insects and plant material with a life expectancy of less than three years (USFWS 2018a).

3.1.3 THREATS

The three main threats to the Topeka shiner include habitat loss, increased sedimentation in small streams, and reduced water quality (USFWS 2018a). Additional threats include the creation of dams or impoundments on small streams and ponds being stocked with larger predatory fish which prey upon many smaller fish. Dams and impoundments change the water flow, temperature, and water quality to which the Topeka shiner is specifically adapted to. Dams also prevent migration up and downstream to find better habitat during times of low stream flow.

3.2 RUFA RED KNOT

3.2.1 STATUS AND DISTRIBUTION

The rufa red knot was listed as threatened under ESA on December 11, 2014 (USFWS 2014a). In April 2023, the USFWS proposed to designate 683,405 acres of critical habitat across 13 states for the rufa red knot (USFWS 2023a). There is currently no critical habitat designated in the state of South Dakota. The rufa red knot has a large range due to its extensive migratory route, ranging across nearly the full latitude gradient of the Western Hemisphere. The rufa red knot breeds in the Arctic and uses a network of migratory stopover habitats as seasons change (USFWS 2020a). Rufa red knots can be found anywhere along the coastal and inland United States migration corridors during both the spring and fall migrations. Rufa Red Knots have been spotted along the tributaries to the Mississippi River and along the Great Lakes (USFWS 2014b). Available information suggests that rufa red knots use inland saline lakes as stopover habitat in the Northern Great Plains. Available data suggests that small numbers of rufa red knows sometimes use manmade freshwater habitats (e.g., impoundments) along inland migration routes (USFWS 2020a).

3.2.2 LIFE HISTORY

The Rufa Red Knot breeds in the Arctic Tundra and once chicks hatch, they learn to fly at around 18-20 days old. Recently hatched young birds will migrate south to wintering regions. Young birds will then migrate north after their first winter but will stop short of the breeding grounds to spend their first summers in coastal areas from South America to southern Canada before flying back south to their wintering grounds. Most young rufa red knots will migrate to the Arctic breeding grounds during their second spring (USFWS 2024a).

Rufa red knots will concentrate in areas with seasonally abundant food resources at migration stopovers. As molluscivores, rufa red knots eat hard -shelled mollusks but sometimes softer invertebrate prey such as shrimp, crabs, marine worms, and horseshoe crab eggs. They are also known to eat grass shoots, seeds, and other vegetable matter. What they eat largely depend on the season and their location along their migratory route (USFWS 2024a).

3.2.3 THREATS

Primary threats of the rufa red knot are attributed to loss of breeding and nonbreeding habitat due to sea level rise, coastal engineering, coastal development, and changes to the arctic ecosystem. These threats cause disturbances to essential ecological interactions within rufa red

knot habitat and can increase the severity of asynchronies in the timing of the rufa red knot's annual migratory cycle relative to favorable food availability and weather conditions (USFWS 2020a). Additional threats include the hunting of rufa red knots in the Caribbean and the Brazilian/Guianan coast and hunting of horseshoe crabs (affecting availability of horseshoe crab eggs for consumption) (Bognar et al. 2022).

3.3 DAKOTA SKIPPER

3.3.1 STATUS AND DISTRIBUTION

The Dakota skipper was listed as a threatened species under ESA on October 23, 2014 (USFWS 2014c). In October 2015, the USFWS designated approximately 19,903 acres of critical habitat for the Dakota skipper within specific counties in the states of North Dakota and South Dakota. Codington County, South Dakota currently does not contain designated critical habitat (USFWS 2015). Dakota skippers range in scattered, mostly isolated, sites in Minnesota, the Dakotas, and southern Canada. The most significant populations are thought to be in North Dakota, northeastern South Dakota, western Minnesota and southern Manitoba (USFWS 2024b). Britten and Glasford's (2002) genetic analyses support the presumption that this species formerly had a relatively continuous distribution; the small genetic divergence (genetic distance) among seven sites in Minnesota and South Dakota indicate that populations there were once connected. According to South Dakota National Heritage program data, there are no known occurrences of the Dakota skipper within and around the direct vicinity of the action area in both the City of Watertown and proposed mitigation site along Mud Creek. The closest known occurrence to the action area is documented from 1990 and located southwest of Lake Pelican (SDGFP 2023). Additionally, the Predicted Dakota Skipper Occurrence 2024 Revision map found in the USFWS Dakota Skipper Survey Protocol does not show occurrences near Watertown; the closest occurrences to Watertown on this map exhibit an approximate 49 to 64 percent probability of Dakota skipper occurrence (Figure8)(USFWS 2024i).

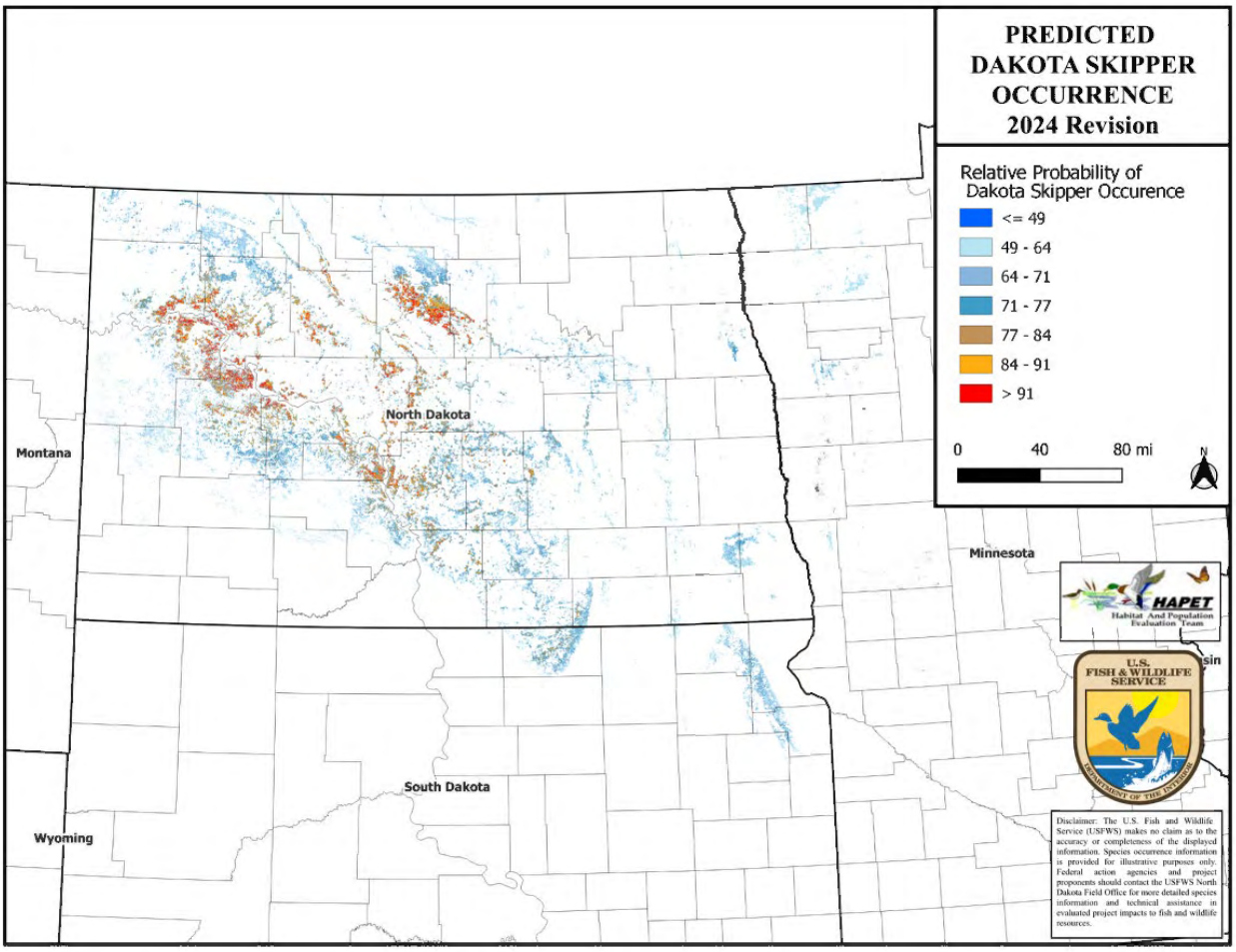


Figure 8. USFWS Predicted Dakota Skipper Occurrence 2024 Revision (USFWS 2024i).

The Dakota skipper is an obligate resident of undisturbed (remnant, untilled) high-quality prairie, ranging from wet-mesic tallgrass prairie to dry-mesic mixed-grass prairie habitat, which typically contains a high diversity of native plant species, including flowering herbaceous plants (forbs). There are two main types of grassland skipper habitat that were mostly intermixed; however, they are now mostly segregated. Both types contain slightly depressional (low topographical relief) areas that allow for water collection (USFWS 2014c).

- The first habitat ('Type A') is flat, moist, native bluestem grass (*Andropogon, Schizachyrium*) prairie where three species of wildflowers are present and in flower during the adult (flight) stage. These wildflowers include wood lily (*Lilium philadelphicum*), bluebell flower (*Campanula rotudifolia*), and mountain death camas (*Zigadenus elegans*). Type A is a low wet-mesic prairie that occurs on near-shore glacial lake deposits that can have a shallow (high) water table that may be subject to intermittent spring floods. Areas where the skipper is found in Type A habitat are located in north-central and southeastern North Dakota as well as in Manitoba, Canada. All Type A skipper habitat are located in close proximity to hill-prairie habitats that are managed with fall haying activities (USFWS 2014c).
- The section habitat ('Type B') is upland, dry prairie that often occurs on ridges and hillsides with rolling terrain over gravelly glacial moraine deposits that is dominated by

bluestems and needle grasses (*Stipa spp*.). Bluestem grasses and needlegrasses dominate these drier habitats, and pale purple coneflower (*Echinacea pallida*), upright coneflower (*Echinacea angustifolia*), and blanketflower (*Gaillardia spp.*) typically are present at high-quality sites suitable for Dakota skipper (USFWS 2014c). Other less dominant forbs include the bluebell blueflower and wood lily. Also present are more extensive stands of the purple coneflower, upright prairie coneflower, and common gaillardia. Type B skipper habitat typically is located in northeastern South Dakota and is abundant with the purple coneflower. They also are located near Type A skipper habitat (USFWS 2014c).

Both Type A and Type B habitats may contain slight depressions, or wetlands, that allow for surface water collection or pooling. Both habitats include highly diversified native plant species (forbs) that are commonly found in high-quality native tall and medium grass prairie habitat typically with minimal disturbance. In North Dakota, the skipper typically is associated with bluestems and needlegrasses that may be invaded by Kentucky bluegrass identified by a Type B skipper habitat (USFWS 2014c).

3.3.2 LIFE HISTORY

Female Dakota skippers lay eggs on the underside of leaves where the eggs then take about 10 days to hatch into larvae. Larvae build shelters at or below the ground surface and feed on grass leaves at night. Larvae become dormant in the fall and then overwinter in shelters often in native bunchgrasses. Development of the larvae continues in the following spring and then in June pupation takes about 10 days (USFWS 2024b). When pupae emerge, adults live for three weeks at most and must reproduce during this time frame. Female Dakota skippers may lay up to 250 eggs if there are adequate flowers with nectar available (USFWS 2024b).

3.3.3 THREATS

The main threats causing the decline of the Dakota skipper are loss of native prairie and degradation of the remaining patches of habitat left. Habitat loss, fragmentation, and degradation have been caused by conversion of native prairie for agriculture or urbanization, ecological succession of native prairie to habitats dominated by brush or trees, invasive species, effects of pesticides and herbicides, flooding, and land management regimes such as grazing, haying, and prescribed fires (USFWS 2018b). Habitat disturbance is a major threat to Dakota Skipper; however, they may survive in areas where lands have some grazing or haying or become dependent on habitat that experience periodic disturbance. If disturbances become too intense, Dakota skippers will disappear from the area (USFWS 2024b).

3.4 WESTERN REGAL FRITILLARY

3.4.1 STATUS AND DISTRIBUTION

The western regal fritillary was proposed to be listed as a threatened species with an accompanying 4(d) rule under the ESA on August 6, 2024 (USFWS 2024c). As a species proposed under the ESA, this species currently has no statutory protection under the ESA but will likely warrant federal protection in the future. No critical habitat is currently designated for this species.

The western regal fritillary is one of two subspecies of the regal fritillary (*Argynnis (Speyeria) idalia*), a large, nonmigratory butterfly found in unaltered grassland landscapes. They occupy portions of 14 states, from Indiana to Colorado and from North Dakota to Oklahoma and are found in intact native grasslands of the central and northeast Great Plains, portions of the Midwest, and a single location in eastern Pennsylvania. Western regal fritillary presence is largely determined by availability of suitable habitat. Periodic grassland disturbances such as fire, grazing, and haying are necessary for sustaining the species' habitat (USFWS 2023b). Regal fritillary (*Speyeria idalia*) habitat is described to consist of "large grassland areas with prairie remnants or lightly grazed pasture lands containing prairie vegetation where topography often includes hills and valleys" (WDNR 2012 as cited in USFWS 2020c). Suitable habitat has also been described as, "…tall grass prairie and other open and sunny locations such as damp meadows, marshes, wet fields, and mountain pastures" (Vaughan and Shepherd 2005; Selby 2007 as cited in USFWS 2020c). A viable population needs about 120 to 240 acres; however, they are known to disperse to degraded prairie habitats within the bounds of their natal prairie (NatureServe 2019 as cited in USFWS 2020c). According to the South Dakota National Heritage Program Data, there are no known occurrences of the western regal fritillary in and around the vicinity of the action area in Watertown and the proposed mitigation site along Mud Creek (SDGFP, 2023).

3.4.2 Life History

The western regal fritillary has one annual generation, consisting of four life stages (eggs, larvae, pupae, and adults). Individual females lay hundreds to thousands of eggs in native grassland habitats in late-summer/early-fall, and the eggs hatch after approximately three weeks. Larvae emerge in early spring and search for violets (*Viola*) (their only food source at this life stage). In late spring/early summer, larvae pupate in leaf litter and warm season grasses for approximately two to five weeks and emerge as adults in June/July when they then rely on nectar sources for food (e.g. milkweed (*Asceplias*), native thistles (*Cirsium*), blazing star (*Liatris*), coneflowers (*Echniacea*), joe-pye weed (*Eutrochium*), wild bergamot (*Monarda*), and ironweeds (*Vernonia*). Males die soon after mating and females will survive into late summer/fall to lay eggs and repeat the cycle (USFWS 2023b).

3.4.3 Threats

The main threats causing the decline of the western regal fritillary are habitat fragmentation and conversion due to agriculture, urban and residential development, road construction and maintenance, herbicides and pesticide use, drought, invasive grasses, and climate change factors (USFWS 2023b).

3.5 Monarch Butterfly

3.5.1 Status and Distribution

The monarch butterfly was proposed for listing as a threatened species with an accompanying 4(d) rule under the ESA on December 12, 2024. Within the proposal on December 12, 2024, USFWS proposed to designate approximately 4,395 acres of critical habitat within California (USFWS 2024e). The monarch butterfly ranges across the entire United States and can be found in a variety of different landscapes if suitable habitat is present. They can be found in

fields, roadside areas, open landscapes, wetlands, urban gardens, etc., where milkweed and flowering plants are present (USFWS 2024d).

3.5.2 LIFE HISTORY

Monarch butterflies have large, bright orange wings surrounded by a black border and covered with black veins. They can be found throughout the United States during the summer breeding season, where they rely on milkweed plants to lay their eggs and feed larvae. Monarchs in temperate climates migrate south to winter in warmer climates and can travel up to 2,000 miles (USFWS 2024d).

3.5.3 THREATS

The main threats causing monarch butterfly population declines in the U.S. have been attributed to climate change, loss of habitat, disease, and the use of pesticides. Additional threats to the monarch butterfly include vehicle mortality, captive rearing, collection, and impacts of tourism at overwintering sites (USFWS 2020b).

3.6 SUCKLEY'S CUCKOO BUMBLE BEE

3.6.1 STATUS AND DISTRIBUTION

The Suckley's cuckoo bumble bee (SCBB) was proposed for listing as an endangered species under the ESA on December 17, 2024. Critical habitat is currently not proposed for the species, largely due to a lack of available data (USFWS 2024g). The SCBB has a wide range across North America, ranging from Yukon to Arizona and all the way east to Newfoundland. In correspondence with South Dakota Ecological Field Services Office for the 2024 PL 84-99 levee rehabilitation programmatic assessment on January 28, 2025, USACE was informed that SCBB have not been caught in South Dakota since 1969 and have not been sighted in the United States since around 2018 (USFWS 2025). While it is uncommon to observe the SCBB, based off recorded occurrences, it is known that they require diverse native floral vegetation, overwinter in or under mulch and decomposing vegetation, and are found in various habitat types such as prairies, grasslands, meadows, woodlands, and urban and agricultural areas. The SCBB is an obligate parasite and cannot collect its own pollen; they completely rely on host species (e.g. Western bumble bee (Bombus occidentalis) and Nevada bumble bee (Bombus nevadensis)) for survival (USFWS 2024g).

3.6.2 LIFE HISTORY

The SCBB is thought to have a similar life cycle as other cuckoo bumble bees (subgenus Psithyrus), largely revolving around the non-parasitic host bumble bee species' life cycle. The female SCBB is thought to emerge from hibernation in early spring shortly after female host bumble bee species (host queens) emerge from hibernation. After the host queen creates her nest and produces worker bees, the female SCBB will invade the nest and hide to prevent being attacked by the host worker bees. Once the female SCBB establishes the scent of the host worker bees, the female SCBB will eradicate the host queen and host eggs, claiming the host nest as its own to lay parasitic eggs. After approximately five weeks, parasitic eggs will emerge in late summer and mate. Mated females will overwinter and repeat the cycle the next season (USFWS 2024g).

3.6.3 THREATS

The SCBB is at risk due to climate change, habitat loss and fragmentation, disease, pesticides, declining host species, and livestock grazing, among other reasons. Within the proposed listing for the SCBB, the inadequacy of existing regulatory mechanisms is also a concern for the species' stability (USFWS 2024f).

3.7 NORTHERN LONG-EARED BAT

3.7.1 STATUS AND DISTRIBUTION

The northern long-eared bat was listed as threatened on April 2, 2015, and reclassified as endangered on November 30, 2022 (USFWS 2022). The status of this species remains centered on range-wide impacts of white-nose syndrome.

The northern long-eared bat is widely distributed throughout the eastern and north central United States, and Canada (USFWS 2016b). During swarming and hibernation, it is commonly encountered in the New England states of the US, Quebec Canada, and Ontario Canada (Caceres and Barclay 2000). Less commonly, the northern long-eared Bat ranges south into Florida and west into Alberta, British Columbia, Montana, and Wyoming (Caceres and Barclay 2000). During the summer months this species could occur in the action area to feed and roost in suitable trees along the Big Sioux River.

3.7.2 LIFE HISTORY

The northern long-eared bat is identifiable by its long ears, medium to dark brown fur, medium-sized body, and relatively longer tail when compared to other similar bat species (USFWS 2016b). The head and body length of an adult northern long-eared bat is less than 50 mm, with overall total body length reaching up to 95mm. This species has a body mass of 5–8 g (0.2–0.3 oz) and females are generally larger and heavier than the males.

Northern long-eared bats typically hibernate mid-fall through mid-spring each year. Prior to hibernation, male and female northern long-eared bats begin to visit hibernacula and copulate in July until September or early October (Caceres and Barclay 2000). Female northern long-eared bats will store sperm throughout the winter months until the spring when they fertilize a single egg (Caceres and Barclay 2000). Following fertilization, females migrate to summer areas where they roost individually or in colonies (USFWS 2016b). Northern long-eared bats do not reproduce in the action area but will rear young in forested areas adjacent to rivers. The northern long-eared bat is an insectivore, feeding at dusk preying on moths, leafhoppers, caddisflies, and beetles while in flight or by gleaning insects from vegetation (USFWS 2016c).

The northern long-eared bat spends its winters hibernating in caves or mines with areas of constant temperatures, high humidity, and no air currents (USFWS 2016c). During summer, suitable habitat includes forested areas, including adjacent areas such as wetlands, agricultural fields, and pastures. The northern long-eared bat spends the summer months roosting in trees underneath bark, in cavities, or in crevices (USFWS 2016c). Generally, northern long-eared bats have a broad roosting niche and are likely not dependent on a particular species of tree. Trees, either live or dead, which form suitable cavities or retain bark, can be considered viable roost trees for northern long-eared bats and will be used if present. The northern long-eared bat has also occasionally been found roosting in structures like barns, bridges, and bat houses,

particularly when other suitable roosts are unavailable. Foraging habitat for this species is predominately forested areas or forested edges along rivers and reservoirs (USFWS 2016b and USFWS 2016c).

3.7.3 THREATS

The primary and most significant threat to the northern long-eared bat is white-nose syndrome. This disease, first discovered in New York has spread rapidly into the Midwest region of the United States and is anticipated to continue to spread throughout the rest of the northern long-eared bat's range and further west. It is estimated that the population of northern long-eared bats in the Northeast has declined by up to 99 percent with the primary factor aiding in this decline being white-nose syndrome (USFWS 2016b). Human activities such as disturbance of hibernacula, summer habitat loss or degradation, the use of pesticides and environmental contaminants, and wind farm operation are all responsible for declines in the northern long-eared bat populations (USFWS 2016b and USFWS 2016c). Through cave commercialization and improper gating, structural and climate characteristics have been altered in a way that is often times harmful to bats. Fragmentation and loss of forest has decreased the availability summer roosting and foraging habitat. The use of pesticides can decrease the amount of available prey (insects) for these species in localized areas and has led to the consumption of contaminated insects and water. Wind turbines have been known kill bats in large numbers through strike and several documented mortality cases for northern long-eared bats exist, although small in number (USFWS 2016b).

3.8 TRICOLORED BAT

3.8.1 STATUS AND DISTRIBUTION

The tricolored bat was proposed for listing as endangered under ESA on September 13, 2022. Tricolored bats also face extinction due to impacts of white-nose syndrome throughout its range. No critical habitat has been designated for this species (USFWS 2024h).

The range of the tricolored bat includes the eastern and midwestern United States east of the Rocky Mountains, southeastern Canada, and eastern Central America. With a similar range in the midwestern states to the northern long-eared bat, the tricolored bat may roost in a variety of habitats that vary regionally, including caves, crevices, and trees structures such as barns. They tend to feed over water bodies, where insects are abundant (USFWS 2021.)

3.8.2 LIFE HISTORY

The tricolored bat is a small species with oblong ears and named for yellowish-orange fur with individual hairs appearing dark at the base, lighter yellow in the middle, and brown at the tip. Flying young are darker in appearance than adults. Average body length is 77 to 89 mm (3-3.5 in). Body mass ranges from 4.6-7.9 g (0.16-0.28 oz), and females are generally slightly larger and heavier than males. Tricolored bats mate in the fall, hibernate during winter months, and emerge in spring each year, generally between April or May in the north, and as early as March in the south (USFWS 2024h). Tricolored bats migrate to summer habitat where females form maternity colonies, and young are born. They may return to the same hibernation and maternity colony sites each year. Females migrate up to 243 km (151 miles) from winter to summer habitat. Prior to hibernation, male and female bats begin to visit hibernacula and copulate

between mid-August and mid-October. Females store sperm throughout the winter months. Fertilization occurs after emergence from hibernation. After fertilization, females migrate to summer areas where they roost in colonies and rear their young in forested areas adjacent to rivers. Females may travel up to 4.3 km (2.7 mi) areas to forage. Females give birth to two (1-3) young between May and July. The young begin flying within three weeks. Maternity roosts may be abandoned after young are weaned, or soon after (USFWS 2021).

3.8.3 THREATS

According to the Species Status Assessment (SSA) Report (USFWS 2021), the primary threats to the tricolored bat include white-nose syndrome, wind energy-related mortality, effects of climate change, and habitat loss. Like many other bat species, white-nose syndrome has had a devastating impact on tricolored bat populations. It is estimated from data collected in 27 states and two Canadian provinces that the population of tricolored bats has declined by 90 to 100 percent throughout 59 percent of its range, primarily due to white nose syndrome (Cheng et al. 2021 cited in USFWS 2021). Through cave commercialization and improper gating, structural and climate characteristics have been altered in a way that is often harmful to bats. Fragmentation and loss of forest has decreased the availability and suitability of summer roosting and foraging habitat. The use of pesticides can decrease the amount of available insect prey for this species in localized areas and has led to the consumption of contaminated insects and water. Wind turbines have been known kill bats in large numbers through strike, and future wind energy-related mortality is projected to increase (USFWS 2016b).

4 PROPOSED ACTION

The Proposed Action (synonymous with “Recommended Plan” or the “Preferred Alternative” under NEPA) is Alternative 3 (Figure 9). Section 3 of the FR/EA provides discussion on alternative formulation, Section 5 discusses alternative comparison and Section 6 and 7 for optimization and alternative selection.

Alternative 3 would include channel widening and a left bank levee. The left bank levee, approximately 4,435 ft long (0.84 mile), will tie into high ground south of West Kemp Ave. The left bank levee would require the excavation of approximately 9,800 cy to remove the existing discontinuous existing berm. This material would then be mixed with approximately 4,000 cy of clean, clay loam from a borrow source and then shaped and graded to construct the levee alignment. The existing berm is made of well-graded sand, underlain by Pierre Shale (characterized as fat clay); this material is suitable to reuse for construction of the new levee. Construction of levee would also include modifications to storm drainage culverts and seepage berms or toe drains depending on available space for underseepage control. Clearing and grubbing existing vegetation would occur within the levee footprint and an additional 15 feet on either side. This area would maintain to perpetually inhibit the growth and establishment for the life of the project in accordance with ER-1110-2-1913. Natural and Nature Based Features[1] (NNBF) that would be incorporated include native herbaceous upland plantings within the levee footprint and 15 feet of either side.

A flood wall would be built in the center of the levee alignment in order to avoid the Watertown Iron and Metal facility which is documented as a recognized environmental condition (REC) under the phase I HTRW assessment (USACE, 2023). The flood wall will be 1,287 ft in length, 2 ft in height, and 1 ft wide. The wall will be cast in place reinforced concrete T shape wall and will be designed to resist the hydrostatic and dynamic flood pressure. The foundation of the wall will extend 4.5 ft below grade for protection from frost heave. Waterstops will be provided between wall segments. Additionally, all six storm sewer crossings on the left bank are planned to be replaced with a 36-inch pipe and a gatewell.

Channel widening would extend just north of the bridge at 14th Ave and continue south to southeast past U.S. Highway 212, where it crosses both 5th St and 20th Ave and ends just south of the 20th Ave bridge. The total length of the BSR that would be widened is approximately 24,366 ft (4.6 miles) and would expand the width of the channel by generally 25 ft on either side of the existing banks for a total width of approximately 150 ft and require the excavation of approximately 296,100 cy of material. NNBF incorporated into any alternative that includes channel widening would consist of maintaining the existing channel alignment as a low-flow channel to support fish passage and limit sedimentation. Widening of the channel would not occur at any of the bridge crossings which includes 14th Ave, 10th Ave, 3rd Ave, Kemp Ave, 4th Ave, U.S. Highway 212, Broadway St., 5th St., and 20th Ave.

[1] Guidance for USACE to consider NNBF was established in Section 1184 of WRDA 2016, where study teams are directed to consider and evaluate NNBF to the same level of detail as other alternatives. Implementation Guidance for Section 1184 of WRDA 2016 defines NNBF as “those created by human design, engineering, and construction that work in concert with natural processes or to mimic as closely as possible conditions which would occur in the area absent human changes to the landscape or hydrology in order to achieve study objectives.” The guidance defines natural features as “those that are created through the action of physical, geological, biological, and chemical processes over time.”

Unavoidable impacts associated with implementation of the Recommended Plan are primarily the result of levee construction in the floodplain and the perpetual operation and maintenance (O&M) of the project. Under the Recommended Plan, direct fill in 0.02 acre of emergent (PEM) and 0.10 acre of scrub shrub (PSS) wetlands would result in permanent impacts from levee construction. Approximately 11.65 acres of woody vegetation would be removed for construction of the levee and to accommodate the channel widening. Throughout the levee right-of-way (ROW) and the newly widened channel ROW, woody vegetation would be perpetually inhibited from establishing within approximately 78.05 acres to maintain compliance with ER 1110-2-1913 and to maintain channel capacity and hydraulic conveyance, respectively. Large woody debris (LWD) and detritus inputs into the Big Sioux River would be adversely impacted as a result of precluding the growth of riparian woody species. Approximately 0.84 acres of unconsolidated bottom (PUB), 3.24 acres of PSS, 0.34 acres of forested bottomlands (PFO), and 24.7 acres of upland habitat types within the floodplain would be excavated to accommodate the newly widened channel cross section and permanently converted to 29.1 acres of PEM upon completion of construction. Another 41.12 acres of existing PEM wetlands would be restored to PEM upon completion of construction. Construction and operation of Alternative 3 would result in 4,149 metric ton equivalent emissions of CO2, or the annual emissions of approximately 900 passenger cars.

To determine impacts to environmental resources, the Functional Assessment of Colorado Streams (FACStream) Method (Version 1.0, 2016) was selected to assess the existing habitat conditions within the study area, as well as the Proposed Action and other study alternatives, and the no action conditions. FACStream is a reach-scale functional assessment tool that rates functional condition based on the degree of impairment in comparison to a reference standard condition. The selection and use of FACStream undergoes a rigorous certification process with the Corps' Environmental Planning Center of Expertise. Approval to utilize this version of FACStream regionally was received in July 2023.

Qualitative model outputs that represent the functional capacity of a given habitat on a 0 to 1 scale is multiplied by acres within the assessment area to produce a habitat unit (HU) for each scenario. These HUs were then annualized over the life of the 50-year planning horizon to produce average annual habitat units (AAHUs) to quantify benefits and impacts to environmental conditions. Following avoidance and minimization and the incorporation of NNBF, the remaining unavoidable impacts that necessitate compensatory mitigation are 1.32 average AAHUs. Compensatory mitigation would occur adjacent to Mud Creek (Figure 10), a tributary of the BSR, upstream of the City of Watertown. Approximately 17 acres of aquatic, wetland, riparian, and upland habitat would be created and enhanced to compensate for 1.32 AAHUs-. This would include a ***minimum*** of 0.66 acre of PSS wetland habitat, 14.5 acres of woody riparian vegetation, and 1.5 acres of upland buffer habitat composition within the 17-acre mitigation complex. The plantings shall incorporate species that are found in "Type B" Dakota skipper habitat, such as bluestem (*Andropogon, Schizachyrium*), needlegrasses (*Stipa spp.*), pale purple coneflower (*Echinacea pallida*), upright coneflower (*E. angustifolia*), blanketflower (*Gaillardia spp.*), bluebell blueflower (*Campanula rotudifolia*) and wood lily (*Lilium philadelphicum*) as well as common milkweed (*Asclepias syriaca*) for the monarch butterfly and violet host plants for the western regal fritillary such as the prairie violet (*Viola pedatifida*). Appendix G2 of the Feasibility Study details the Mitigation, Monitoring and Adaptive Management Plan. All mitigation construction would occur above the ordinary high-water line.

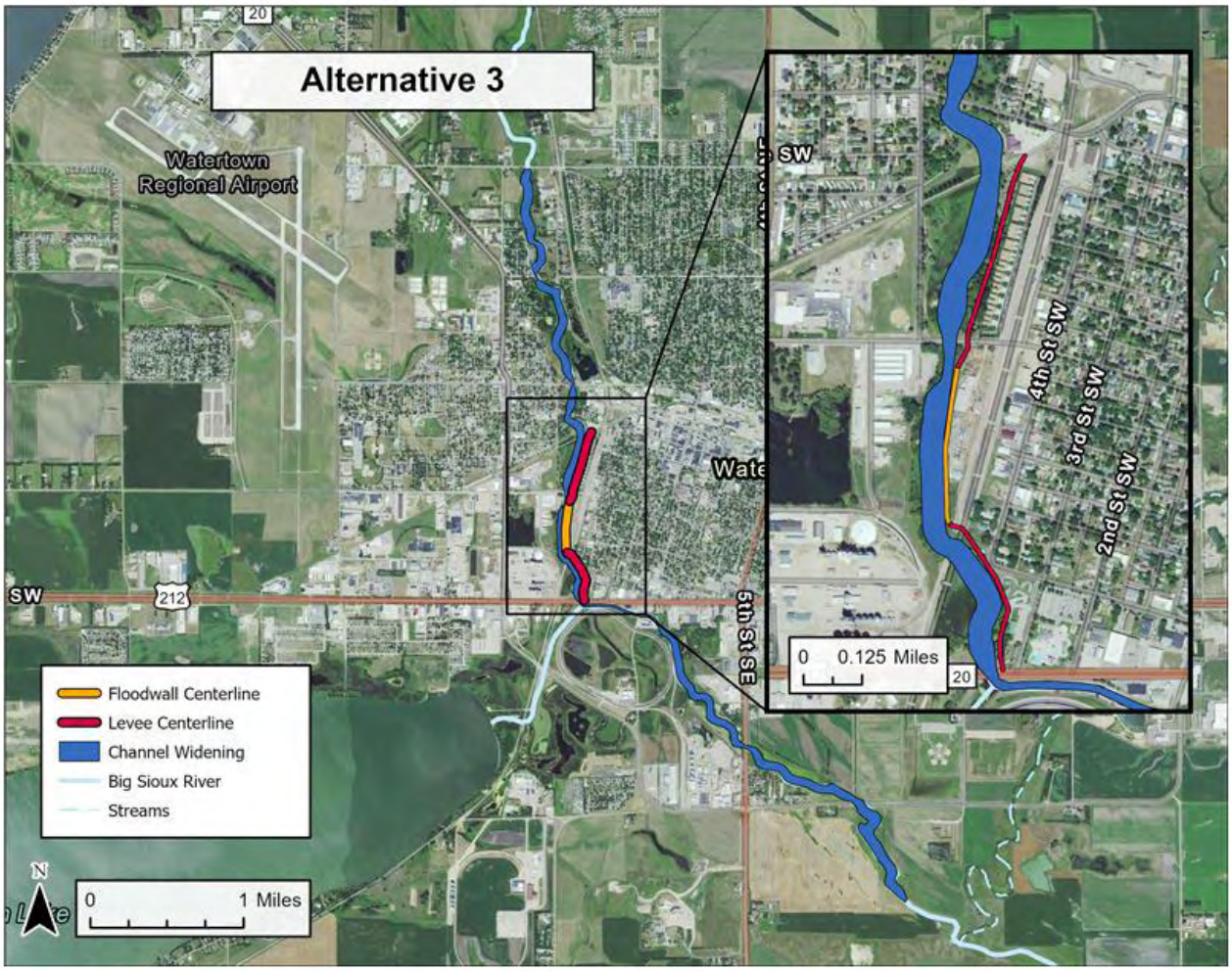


Figure 9. Proposed Action

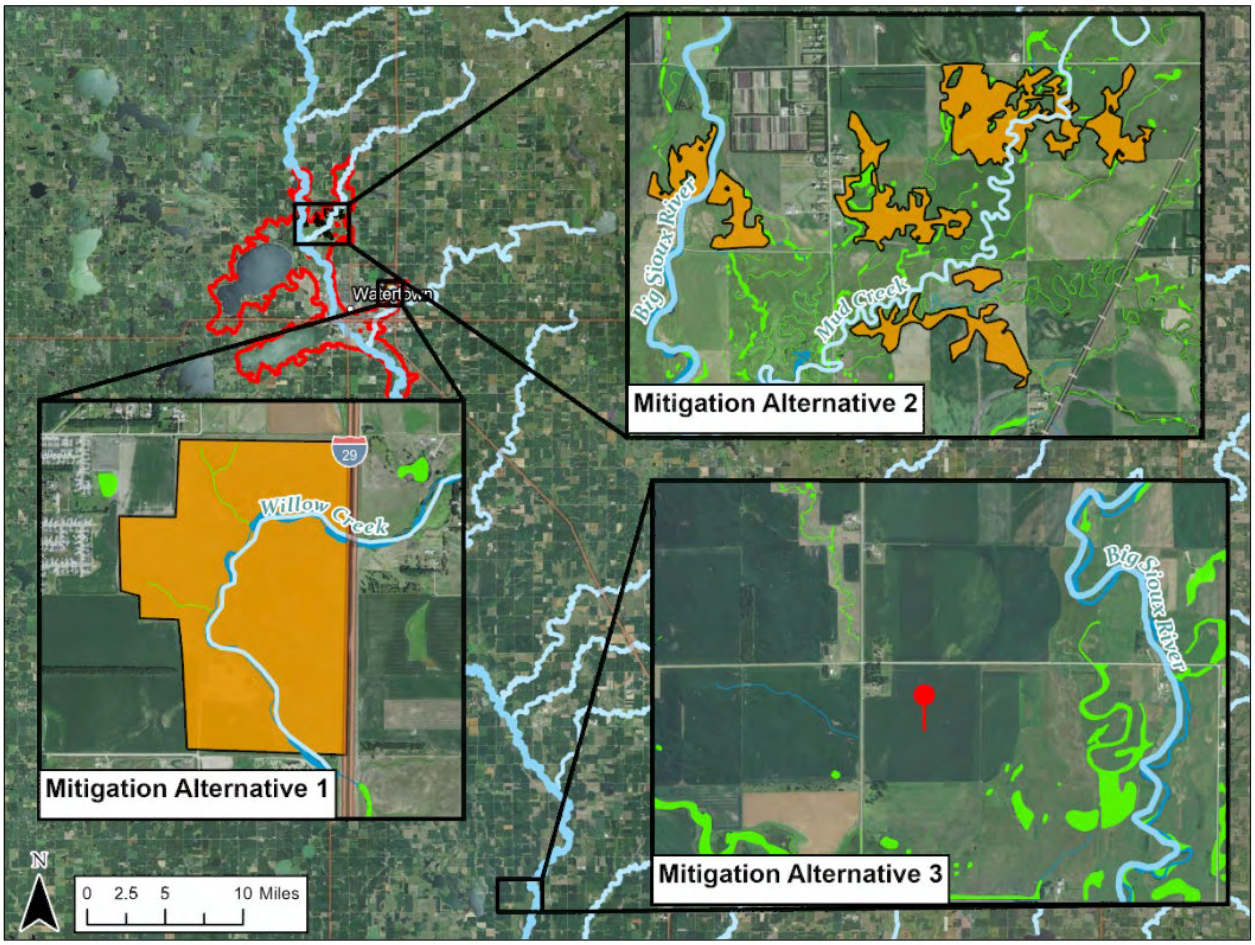


Figure 10. Mitigation on Mud Creek (Mitigation Alternative 2)

5 EFFECTS OF PROPOSED ACTION

This Section provides a detailed description of the elements of the Proposed Action and the associated activities to determine what activities the species would be exposed to and if the exposure produced a likelihood of a response and effect, and if so, the magnitude or significance of that effect. Effects are described as direct or indirect effects. Direct effects include all immediate impacts (adverse and beneficial) from project-related actions. According to the ESA rules and regulations, direct effects occur at, or very close to the time of the action itself. Indirect effects are caused by or result from the proposed action, are later in time and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action.

5.1 TOPEKA SHINER

5.1.1 DIRECT AND INDIRECT EFFECTS

Topeka shiners have not been observed within the proposed action area. Through coordination with USFWS, USACE was informed that it is possible that Topeka shiner could use habitat in the Big Sioux River within the action area during low water years. The most recent captures of Topeka shiner near the action area have occurred above and below Watertown in other tributaries. More specifically, a recent capture occurred in Willow Creek, located downstream from the proposed action area. It is anticipated that excavation of the overbank area for channel widening activities would occur from the bank, utilizing a long arm excavator. It is not anticipated that in-channel work would be necessary but if in-channel work occurs during the Topeka Shiner spawning period from May 15-July 31, Topeka shiner could be directly affected by construction activities if found to be present within the Big Sioux River. Additionally, construction activities may cause temporary sedimentation, leading to water quality impacts downstream of the project site that could lead to indirect effects to the Topeka shiner. Using best available information, Topeka shiner are not known to be present within Mud Creek and mitigation activities would all occur above the ordinary high-water line; therefore, the Topeka shiner is not anticipated to be affected by mitigation activities. However, best management practices (See Section 5.1.2) would still be incorporated during mitigation construction.

5.1.2 CONSERVATION MEASURES

If in-channel construction is determined necessary during the design and implementation phase of the project, due to the unknown presence of Topeka shiner in the Big Sioux River within the action area, Topeka shiner surveys would be completed within the Big Sioux River if in-channel construction occurs within the Topeka shiner spawning period from May 15 to July 31. Regardless of Topeka shiner presence, the following best management practices would be incorporated into construction activities along the Big Sioux River and Mud Creek:

- Avoid in-channel construction activities, should it become necessary, during the spawning period from May 15-July 31.
- Implement comprehensive and effective erosion and sediment controls. These methods would be implemented and maintained for the duration of the project and would be considered at all stages of project planning and design. Close attention would be warranted for the placement and maintenance of temporary erosion control measures at

the construction site to minimize sediment loading. Suck erosion control measures may include sediments/silt screens or curtains and hay bales.

- Erosion and sediment controls would be monitored daily during construction to ensure effectiveness, particularly after storm events, and only the most effective techniques would be utilized.
- Methods that block a stream are not presently anticipated but should it become necessary, they would not be constructed for extended periods of time. If temporary blocks are necessary, flexible water barriers would be used.
- Exposed stream banks would be stabilized immediately after construction activity. Eroded surfaces would not be exposed for greater than one day. If rain is predicted, no construction would commence unless eroded surfaces are immediately treated with geotextile fabric, mulch, seeding or some techniques that would stabilize the bank or exposed areas from eroding.
- Erosion repair and stream bank restoration would use appropriate bioengineering solutions.
- A hazardous materials safety protocol would be developed and implemented. This would include that all temporary storage facilities for petroleum products, other fuels and chemicals must be located and protected to prevent accidental spills from entering streams within the project area.

5.2 RUFA RED KNOT

5.2.1 DIRECT AND INDIRECT EFFECTS

There is a possibility that rufa red knots may use the lakeshores and prairie potholes within Codington County; however, it would be considered extremely rare for a rufa red knot to visit the proposed action area. The portion of the project area along the Big Sioux River and proposed mitigation site along Mud Creek lacks suitable stopover habitat, as there are no desirable habitat features (e.g. sandbars, shoals, sand spits, etc.) present. Additionally, the segment of the Big Sioux River within the project area is surrounded by human development from both the east and west, further limiting the location's ability to provide suitable habitat for the rufa red knot. No direct nor indirect effects to the rufa red knot from the proposed action are anticipated to occur.

5.3 DAKOTA SKIPPER

5.3.1 DIRECT AND INDIRECT EFFECTS

Dakota skippers have not been observed and/or data has not been collected for Dakota skipper presence within the action area (See Section 3.3 for further discussion). Areas where project activities are proposed near the Big Sioux River do not offer suitable habitat for the Dakota skipper, as these areas do not include undisturbed (remnant) high-quality prairie. It is unlikely that the Dakota skipper would be affected by direct or indirect effects from channel widening or construction of the left bank levee. There is potential for habitat "Type B" to be present within the proposed mitigation area along Mud Creek. While the proposed mitigation site along Mud Creek is largely dominated by an existing crop field, some areas contain grasslands and fall within potentially undisturbed areas, connected to a larger section of undisturbed land, designated within the South Dakota Environmental Review Tool. While it is unlikely for Dakota skipper

presence within the proposed mitigation site, suitable habitat may be present. Mitigation construction may indirectly affect the Dakota skipper as a result of disturbance from human presence and the use of heavy machinery if suitable habitat is present.

5.3.2 CONSERVATION MEASURES

- A field evaluation would be completed within the mitigation area during design and implementation to determine the presence of suitable vegetation to support the species. Upon completion of a field evaluation, an occupancy survey may be warranted. USACE would coordinate with USFWS at that time if necessary to request site-specific approval prior to conducting the survey, per the 2024 Dakota skipper Survey Protocol (USFWS 2024i).
- Proposed mitigation would create a minimum of 4.69 acres of upland herbaceous habitat and would include dominant plant species found in “Type B” habitat, such as bluestem (*Andropogon, Schizachyrium*), needlegrasses (*Stipa spp.*), pale purple coneflower (*Echinacea pallida*), upright coneflower (*E. angustifolia*), blanketflower (*Gaillardia spp.*), bluebell blueflower (*Campanula rotudifolia*) and wood lily (*Lilium philadelphicum*).

5.4 WESTERN REGAL FRITILLARY

5.4.1 DIRECT AND INDIRECT EFFECTS

Western Regal Fritillary have not been observed and/or data has not been collected for Western Regal Fritillary presence within the study area, according to the South Dakota National Heritage Program database (SDGFP, 2023). Areas where project activities are proposed near the Big Sioux River do not offer suitable habitat for the Western Regal Fritillary, as these areas are heavily disturbed and do not consist of large native prairie habitat nor remnants within the bounds of native prairie habitat. It is unlikely that the Western Regal Fritillary would be affected by direct or indirect effects from channel widening or construction of the left bank levee. There is potential for suitable habitat to be present within the proposed mitigation area on Mud Creek. Although crop fields are found within parts of the proposed mitigation site, other areas contain grasslands and fall within potentially undisturbed areas, connected to a larger section of undisturbed land, designated within the South Dakota Environmental Review Tool. Construction at these areas may directly or indirectly effect the Western Regal Fritillary as a result of disturbance from human presence and the use of heavy machinery.

5.4.2 CONSERVATION MEASURES

A field evaluation would be completed within the mitigation area during design and implementation to determine the presence of suitable vegetation to support the species. Upon completion of a field evaluation, an occupancy survey may be warranted. USACE would coordinate with USFWS at that time. Proposed mitigation would create and enhance approximately 17 acres of aquatic, wetland, riparian, and upland habitat. This would include a minimum of 0.66 acre of PSS wetland habitat, 11.65 acres of woody riparian vegetation, and 4.69 acres of upland buffer habitat and would incorporate vegetation essential for Western Regal Fritillary suitable habitat such as violet hostplants, nectar sources, and warm-season bunch grasses.

5.5 MONARCH BUTTERFLY

5.5.1 DIRECT AND INDIRECT EFFECTS

Monarch butterflies range throughout the entire study area. Common milkweed (*Asclepias syriaca*) and flowering plants were found to be present throughout the action area along the Big Sioux River and are likely to be present within the proposed mitigation area along Mud Creek. Construction activities have the potential to result in direct effects to the monarch butterfly and suitable habitat as a result of disturbance from human presence and the use of heavy machinery.

5.5.2 CONSERVATION MEASURES

Suitable habitat would be avoided to the maximum extent practicable during construction within the action area along the Big Sioux River. Additionally, proposed mitigation would create and enhance approximately 17 acres of aquatic, wetland, riparian, and upland habitat. This would include a minimum of 0.66 acre of PSS wetland habitat, 11.65 acres of woody riparian vegetation, and 4.69 acres of upland buffer habitat and would incorporate common milkweed (*Asclepias syriaca*) for the monarch butterfly.

5.6 SUCKLEY'S CUCKOO BUMBLE BEE

5.6.1 DIRECT AND INDIRECT EFFECTS

The SCBB ranges throughout the entire action area; however, because this species has not been caught in South Dakota since 1969 nor seen in the United States since around 2018, it is unlikely they would be present in or near areas impacted by implementation of this project. Due to the low likelihood of the SCBB to be present within the action area, no effect is anticipated on the SCBB.

5.7 NORTHERN LONG-EARED BAT

5.7.1 DIRECT AND INDIRECT EFFECTS

Levee construction and channel widening would require the clearing of approximately 11.65 acres of trees and lead to the perpetual inhibition of allowing woody vegetation to establish within an approximate 78.05 acre footprint of the levee and newly widened channel cross section. Any clearing of trees and vegetation in the action area while these bats are roosting and rearing young has the potential to directly disrupt the females and their young if present. Clearing of vegetation of trees also has the potential to reduce the amount of foraging and roosting habitat available to bats present at the time or in the future. Noise and other physical disturbance would be temporary and localized and would not affect the availability of roosting areas or foraging opportunities for the northern long-eared bat. The implementation of conservation measures would minimize effects to this species.

5.7.2 CONSERVATION MEASURES

To avoid impacts to northern long-eared bats, cutting or removal of live trees and snags (standing trees) ≥ 3 inches diameter at breast height (DBH), maternity roost trees (≥9 inches DBH), or individual trees within 1,000 feet of forest would be restricted from April 15th to October

31st. If removal of trees considered suitable habitat are unavoidable within this timeframe, or if tree removal would occur within 0.5 miles of a hibernacula (using best available information, no known hibernacula appear to be within the action area and vicinity of Watertown, SD), additional consultation with USFWS would be required and preconstruction surveys may need to be conducted.

5.8 TRICOLORED BAT

5.8.1 DIRECT AND INDIRECT EFFECTS

Levee construction and channel widening would require the clearing of approximately 11.65 acres of trees and lead to the perpetual inhibition of allowing woody vegetation to establish within an approximate 78.05-acre footprint of the levee and newly widened channel cross section. Any clearing of trees and vegetation in the action area while these bats are roosting and rearing young has the potential to directly disrupt the females and their young if present. Clearing of vegetation of trees also has the potential to reduce the amount of foraging and roosting habitat available to bats present at the time or in the future. Noise and other physical disturbance would be temporary and localized and would not affect the availability of roosting areas or foraging opportunities for the tricolored bat. The implementation of conservation measures would minimize effects to this species.

5.8.2 CONSERVATION MEASURES

To avoid impacts to tricolored bats, cutting or removal of live trees and snags (standing trees) ≥ 3 inches diameter at breast height (DBH), maternity roost trees (≥9 inches DBH), or individual trees within 1,000 feet of forest would be restricted from April 15th to October 31st. If removal of trees considered suitable habitat are unavoidable within this timeframe, or if tree removal would occur within 0.5 miles of a hibernacula (using based available information, no known hibernacula appear to be within the action area and vicinity of Watertown, SD), additional consultation with USFWS would be required and preconstruction surveys may need to be conducted.

5.9 CUMULATIVE EFFECTS

Cumulative effects under the ESA are defined as "…those effects of future State, or private activities not involving federal activities that are reasonably certain to occur within the action area of the federal action subject to consultation" (50 CFR 402.02). Future federal activities that are not inter-related or interdependent to the proposed action are not considered because they would be subject to separate future consultation under the ESA.

The City of Watertown, South Dakota is currently experiencing increasing population growth. Ongoing trends that are likely to occur include further expansion of commercial and residential areas, increased floodplain development (i.e., urban, residential, commercial), management of flood control structures, continued depletions and return flows from municipal, industrial, and agricultural uses on the Big Sioux River and reservoirs, and ongoing construction and maintenance of bridges, local roads, roadways, and utility right-of-way.

The State of South Dakota particularly has warmed by one to two degrees (F) in the past century and there has been an increase in frequency and severity of hydrometeorological

changes. Summers are expected to become increasingly warmer and heavy downpours are expected to account for an increasing fraction of all precipitation over the next several decades. When droughts do occur, they are likely to be more severe due to the trending warmer temperatures (EPA 2016). The increasing concern of these future scenarios and the trends of increasing development in the action area could influence the long-term availability of habitats used by ESA-listed species in this BA. For example, increased flooding and runoff through developed areas could increase pollution, affecting fish species like the Topeka shiner. Higher temperatures could affect the suitability of the area to be a potential migratory stopover for rufa red knot and increases in moisture could affect the suitability of grassland habitats for the Dakota skipper.

6 DETERMINATION OF EFFECTS SUMMARY AND CONCLUSION

Table 5 summarizes USACE determination on the effects on the ESA-listed species analyzed in section 5.0. The proposed action includes widening the Big Sioux River within the project area, constructing an earthen levee along the left bank of the Big Sioux River with a flood wall protecting the Watertown Iron and Metal facility, and mitigation on Mud Creek upstream of Watertown. Under the Proposed Action, USACE concludes that the Proposed Action would have "no effect" on rufa red knot and Suckley's cuckoo bumble bee. USACE concludes that the proposed action, "may affect, not likely to adversely affect" Topeka shiner, Dakota skipper, western regal fritillary, monarch butterfly, northern long-eared bat, and tricolored bat.

Table 5. Effects Determination for ESA-listed Species in the Proposed Action Area

Species	Scientific Name	Status
Topeka Shiner	*Notropis topeka*	May Affect, Not Likely to Adversely Affect
Rufa Red Knot	*Calidris canutus rufa*	No Effect
Dakota Skipper	*Hesperia dacotae*	May Affect, Not Likely to Adversely Affect
Western Regal Fritillary	*Argynnis idalia occidentalis*	May Affect, Not Likely to Adversely Affect
Monarch Butterfly	*Danaus plexippus*	May Affect, Not Likely to Adversely Affect
Suckley's Cuckoo Bumble Bee	*Bombus suckleyi*	No Effect
Northern Long-eared Bat	*Myotis septenrionalis*	May Affect, Not Likely to Adversely Affect
Tricolored Bat	*Perimyotis subflavus*	May Affect, Not Likely to Adversely Affect

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US Army Corps of Engineers®

WATERTOWN, SOUTH DAKOTA FLOOD RISK MANAGEMENT GENERAL INVESTIGATIONS STUDY

INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX G4: EMISSIONS

OMAHA DISTRICT
NORTHWESTERN DIVISION



May 2026

TABLE OF CONTENTS

1 Introduction 1
1.1 Literature Review 1
1.2 Temperature 1
1.3 Precipitation 2
1.4 Streamflow 3
1.5 Impacts of Hydrometeorological Trends 3
1.6 Air Quality 3
2 Framework for Emissions Analysis 4
2.1 Emission Factors 4
2.2 Direct Emissions from Construction 4
2.3 Long-term, Indirect OMRR&R Emissions 5
3 Emissions Assessment 6
4 Literature Cited 7

LIST OF FIGURES

Figure 1. 30-year Monthly Precipitation and Temperature Normals 1
Figure 2. Observed and Projected SD Temperature Change (Frankson et al., 2022) 2
Figure 3. Observed Number of 2-Inch Extreme Precipitation Events (Frankson et al., 2022) 3

LIST OF TABLES

Table 1. Construction Criteria Air Pollutant Emission Rates 5
Table 2. Annualized OMRR&R Emissions 5

1 Introduction

The U.S. Army Corps of Engineers (USACE), Omaha District is conducting a study to address flood risks to the city of Watertown, South Dakota. Part of this study included an emissions analysis for alternatives. This appendix presents the hydrometeorological and air quality background for the project area and an analysis of emissions from all alternatives.

1.1 Literature Review

The Watertown study area is in Water Resource Region (HUC-2 watershed) number 10, the Missouri Region. A January 2015 report conducted by the USACE Institute for Water Resources (IWR) (USACE, 2015) summarizes the available hydrometeorological change literature for region, with data on observed and projected changes. Literature reviewed as part of the 2015 IWR report, the Fourth National Climate Assessment (NCA4) (Conant et al., 2018), and Climate Science Special Report (CSSR) are summarized below. Information from the PRISM Climate Group, based at Oregon University (PRISM Climate Group, 2023) is included. Observed average temperatures and rainfall precipitation for Watertown, SD is shown in Figure 1.

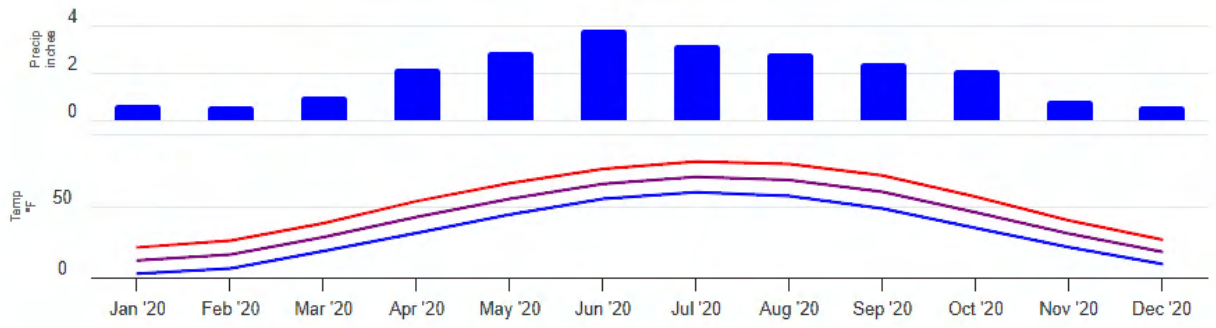


Figure 1. 30-year Monthly Precipitation and Temperature Normals

1.2 Temperature

The annual high temperature for Watertown, SD is 53.2ºF and the annual low temperature is 32.6ºF. Based on 1991-2020 monthly normals, the coldest month is January with an average high of 21ºF and average low of 2.8ºF while the hottest month is July with an average high of 82ºF and average low of 60ºF (PRISM Climate Group, 2023). Temperatures in South Dakota have experienced a 2°F increase since 1900 and are expected to further increase (Frankson et al., 2022). For a graph depicting projected changes, see Figure 2. Observed and Projected SD Temperature Change (Frankson et al., 2022).

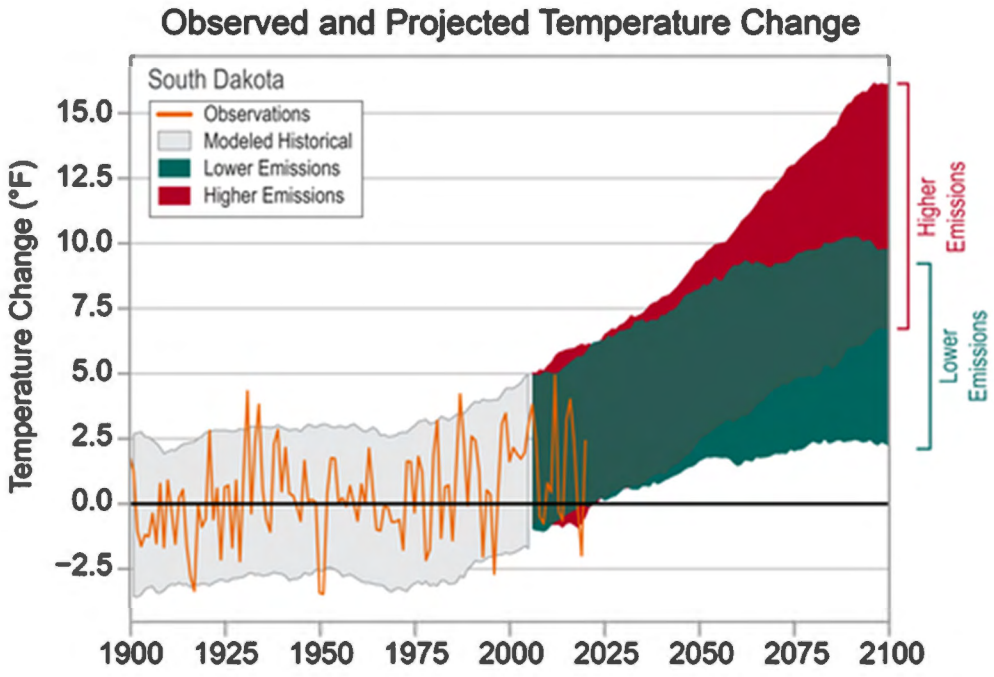


Figure 2. Observed and Projected SD Temperature Change (Frankson et al., 2022)

1.3 Precipitation

Under current projections from the Fourth National Climate Assessment, the amount, distribution, and variability of annual precipitation in the Northern Great Plains is expected to change throughout the current century. Under an RCP8.5 scenario, it is anticipated that spring and winter precipitation is expected to increase by 10%-30% with a decrease in the amount of precipitation in the form of snow. This, coupled with higher temperatures, leads to an expected decrease in snowpack. Summer precipitation may experience little change under an RCP4.5 scenario to 10-20% under an RCP8.5 scenario (Conant et al., 2018).

The intensity of weather events is also expected to increase, with the frequency of two-day heavy precipitation events increasing by 50% while the amount of precipitation in single-day events is projected to increase by 8%-10% under an 8.5 scenario (Conant et al., 2018). Total annual precipitation and number of 2-inch extreme precipitation events has been on an upward trend since 1970, see Figure 3. Observed Number of 2-Inch Extreme Precipitation Events (Frankson et al., 2022).

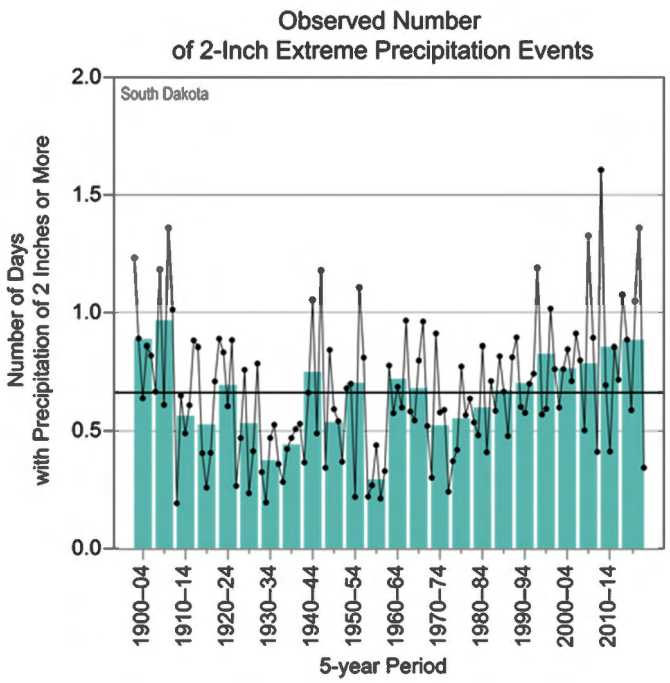


Figure 3. Observed Number of 2-Inch Extreme Precipitation Events (Frankson et al., 2022)

1.4 Streamflow

The Upper Missouri River Basin's distance from the modulating effects of the ocean results in the area being prone to hydrometeorological variability. This sensitivity to climate variations has resulted in extreme drought or flooding events approximately every decade over the past century (Conant et al., 2018).

Increased temperature and changes in snowpack, spring snowmelt, and runoff result in an increased rate of snowpack melting in springtime with an earlier peak. This results in lower streamflow, especially in late summer (Conant et al., 2018). An increase in the frequency and intensity of extreme precipitation events is projected and may lead to increased runoff and flooding (Frankson et al., 2022).

1.5 Impacts of Hydrometeorological Trends

The trend of increasing precipitation extremes and the shift towards rain precipitation can increase the potential for flooding (Frankson et al., 2022). This increased potential of catastrophic flooding has detrimental ecologic impacts while posing increased risk to life safety and property. For these reasons, it is important to seek solutions that increase the resilience of communities.

1.6 Air Quality

Watertown SD is located within Codington County. Codington County is not included in the EPA's list of current nonattainment counties for all criteria pollutants (EPA 2026). Additional air quality data is provided in South Dakota Department of Agriculture and Natural Resources' 2025 Air Monitoring Annual Network Plan for the current Watertown air monitoring site located on 801 4th Ave. SW, Watertown, SD (Lat 44.897784 Long -97.128822). Background air quality for ozone over the three-year 2024 8-hour design value is calculated to be 0.062 ppm, 89% of the

national standard. Background air quality for PM2.5 over the three-year 2024 annual design value is calculated to be 8.0 ug/m^3, 89% of the national standard. Expected annual exceedances of the maximum 24-hour average PM10 concentration of 150 ug/m^3 is calculated to be 0.4 based on 2022-2024 data. Weather and climate events such as extreme wind or wildfires can temporarily elevate PM levels within the project area, reducing air quality.

2 Framework for Emissions Analysis

This section details methodology, assumptions, and the results of summarized emissions for each alternative. For each alternative, a list of construction equipment, equipment hours, and fuel usage for both construction and operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) was supplied by cost engineering. Emissions will be analyzed over the study's 50-year period of analysis.

2.1 Emission Factors

This emissions analysis was developed using emission factors from the EPA's MOVES (Motor Vehicle Emission Simulator), Version 4. Equipment provided in the cost engineering list was grouped into EPA MOVES nonroad equipment classes. Dump truck usage data, including highway usage, was provided in terms of equipment hours by cost engineering. Therefore, on-road dump truck usage was modeled as off-highway trucks and EPA MOVES simulation was exclusively non-road.

Parameters for the EPA MOVES simulation include nonroad model, default scale, inventory calculation type, set in Codington County, SD. The time span was deliberately chosen as weekdays for July 2027 to provide conservative emission factors. High ambient air temperatures in July would increase emission rate for pollutants such as Nitogen Oxides (NOx) and Volatile Organic Compounds (VOCs) while 2027 emission factors would be greatest compared to future years. Selections were made for nonroad diesel and gasoline for commercial, construction, industrial, and logging equipment sectors. Pollutants included in simulation included total gaseous hydrocarbons, carbon monoxide (CO), oxides of nitrogen (NOx), methane (CH4), Sulfur Dioxide (SO2), non-methane hydrocarbons, non-methane organic gases, total organic gases, volatile organic compounds (VOCs), carbon dioxide (CO2), PM10 – total (PM10), and PM2.5 – total (PM2.5). Nitrous oxide (N2O) nor lead (Pb) is not offered as a pollutant for MOVES nonroad analyses. Output emissions options included SCC for all equipment categories and non-road HP classes.

Following simulation, the non-road post-processing script "EmissionFactors_per_OperatingHour_by_Equipment.sql" was executed to produce an output table which reports emission results in grams per hour for each equipment type. Equipment and corresponding emission factors can be found in Attachment 1.

2.2 Direct Emissions from Construction

Direct emissions from construction were obtained by grouping equipment hours by EPA MOVES equipment category prior to multiplying by the respective emission factors obtained from Section 2.1. Cumulative construction emissions for each alternative, broken down by emissions from each EPA equipment category are provided in Attachment 2A. Emissions were subsequently annualized over the 2-year construction period. Resulting annual emissions rates

of criteria air pollutants for the duration of construction may be found in Table 1. Additional pollutant emission rates may be found in Attachment 2B.

Table 1. Construction Criteria Air Pollutant Emission Rates

Alt	Duration (yr)	CO (ton/yr)	NOx (ton/yr)	SO2 (ton/yr)	VOC (ton/yr)	Primary Exhaust PM10 Total (ton/yr)	Primary Exhaust PM2.5 Total (ton/yr)
3	2	0.400	0.754	0.005	0.081	0.045	0.043
7	2	0.324	0.265	0.001	0.050	0.021	0.020
8	2	0.406	0.766	0.005	0.082	0.046	0.044
11B	2	0.980	0.553	0.002	0.146	0.049	0.046
11C	2	1.165	0.622	0.002	0.174	0.056	0.053
12	2	0.014	0.041	0.000	0.002	0.002	0.002

2.3 Long-term, Indirect OMRR&R Emissions

In addition to emissions from initial construction, activities associated with project OMRR&R for all structural alternatives can produce emissions. Therefore, reasonably foreseeable OMRR&R activities must be accounted for in the overall project emissions analysis.

To calculate emissions associated with reasonably foreseeable OMRR&R activities for each alternative, Cost Engineering provided predicted equipment usage per OMRR&R activity unit of measure (e.g. equipment hours to mow 1 acre). This was utilized to determine emissions per unit activity as shown in Attachment 3A (e.g. the amount of emissions from mowing 1 acre). This was then multiplied by the quantity of necessary OMRR&R (e.g. how many acres need to be mowed) and the frequency (how many times the activity needs to take place over the 50-yr lifespan). Emissions from all OMRR&R activities for an alternative were summed and annualized to give the annualized OMRR&R emissions per alternative. Additional pollutant emission rates may be found in Attachment 3B.

Table 2. Annualized OMRR&R Emissions

Alt	CO (ton/yr)	NOx (ton/yr)	SO2 (ton/yr)	VOC (ton/yr)	Primary Exhaust PM10 Total (ton/yr)	Primary Exhaust PM2.5 Total (ton/yr)
3	0.00374	0.01812	0.00015	0.00135	0.00093	0.00090
7	0.00045	0.00140	0.00001	0.00011	0.00009	0.00009
8	0.00374	0.01812	0.00015	0.00135	0.00093	0.00090
11B	0.00317	0.01019	0.00006	0.00082	0.00063	0.00061
11C	0.00397	0.01282	0.00008	0.00105	0.00080	0.00078

3 Emissions Assessment

As shown in Sections 2.2 & 2.3, peak annual emissions would be expected to occur during the construction period. Although the project area is located within an attainment area and a conformity analysis is not applicable, de minimis threshold rates can contextualize the magnitude of emissions from the project. Within a conformity analysis, de minimis thresholds are emission rates that are so insignificant as to not warrant a formal conformity determination.

De minimis emission rates vary based on specific area and pollutant (see 40 CFR 93.153) but are generally 100 tons per year. The highest emitting alternative for any single pollutant is Alternative 11C for CO, which at 1.16 ton/yr during construction, is still less than 2% of the de minimis value. As shown in Table 1, no emission rates for any other criteria pollutant across any other alternative even exceed 1 ton/yr or 1% of the de minimis values. As such, it is determined that impacts to air quality resulting from the project would be minor and temporary in nature.

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Attachment 1 – Equipment Emission Factors

Equipment Name	EPA MOVES Equipment Class	Fuel Type	Total Gaseous Hydrocarbons g/hr	CO g/hr	Nox g/hr	CH4 g/hr	SO2 g/hr	Non-Methane Hydrocarbons g/hr	Non-Methane Organic Gases g/hr)	Total Organic Gases g/hr	VOCs g/hr	Atmospheric CO2 g/hr	Primary Exhaust PM10 - total g/hr	Primary Exhaust PM 2.5 - total g/hr
AIR COMPRESSOR, 265 CFM (7.5 CMM), 205 PSI (1413 KPA),	Air Compressors	Off-road diesel	1.68	9.69	52.03	0.19	0.06	1.49	1.81	2.00	1.81	20461.56	1.51	1.46
BRUSH CHIPPER, 12" (30 CM) CAPACITY, DRUM TYPE,	Shredders > 6 HP	Gasoline	38.14	2003.93	16.60	5.68	0.03	32.46	34.12	39.79	33.60	7609.40	0.83	0.77
CHAIN SAW, 36"-60" (91CM-150CM) GUIDE BAR	Chain Saws > 6 HP	Gasoline	283.21	1268.16	7.29	5.66	0.01	277.55	294.20	299.87	293.37	3270.13	46.47	42.75
COMPACT LOADER/BACKHOE, WHEEL, 0.92 CY FRONT END BUCKET, 2.1 CF, 10.1' DIGGING DEPTH	Tractors/Loaders/Backhoes	Off-road diesel	3.41	20.94	33.31	0.21	0.04	3.20	3.73	3.94	3.72	13061.34	3.55	3.45
COMPACTOR, ROLLER, VIBRATORY, 25.6" (650 MM) W X 15.7" (399 MM) DIA, DOUBLE SMOOTH DRUMS, WALK	Rollers	Off-road diesel	1.81	10.12	46.92	0.20	0.08	1.61	1.97	2.17	1.95	30474.04	1.61	1.56
COMPACTOR, ROLLER, VIBRATORY,25.5" (648 MM) W X 16.5" (419 MM) DIA, DOUBLE SMOOTH DRUM, WALK BEHIND,	Rollers	Off-road diesel	1.81	10.12	46.92	0.20	0.08	1.61	1.97	2.17	1.95	30474.04	1.61	1.56
CONCRETE PAVING MACHINES, SLIPFORM PAVER, CRAWLER, 2-TRACK, 24' (7.3 M) PAVING WIDTH	Pavers	Off-road diesel	1.56	8.12	47.59	0.18	0.11	1.38	1.68	1.85	1.65	40274.75	1.43	1.38
CONCRETE PUMP, 25 CY/HR, SINGLE, TRAILER MTD	Pumps	Off-road diesel	4.35	21.56	59.00	0.34	0.04	4.01	4.78	5.12	4.77	12897.90	3.44	3.34
CONCRETE SAW, 7.70" (20CM) MAX CUTTING DEPTH, WALK BEHIND(ADD COST FOR SAWBLADE WEAR & WATER)	Concrete/Industrial Saws	Off-road diesel	2.14	11.59	55.66	0.26	0.05	1.89	2.32	2.58	2.31	16438.79	1.45	1.41
CONCRETE VIBRATOR, 2.5" (63.5 MM) DIA, W/7.5 HP (5.6	Generator Sets	Off-road diesel	4.02	19.27	55.93	0.33	0.04	3.69	4.42	4.75	4.41	12123.44	2.94	2.85
CRANES, HYDRAULIC, SELF-PROPELLED, YARD, 25T (22.7MT), 64' (19.5M) BOOM, 4X4, NON-ROTATING OPERATOR'S CAB, BOOM ROTATES 360°	Cranes	Off-road diesel	2.33	11.28	49.29	0.20	0.14	2.13	2.55	2.75	2.50	53152.21	2.10	2.04
CRANES, HYDRAULIC, SELF-PROPELLED, YARD, 4.0 TON, 19' BOOM, 4X2, NON-ROTATING OPERATOR'S CAB, BOOM ROTATES 360°	Cranes	Off-road diesel	2.33	11.28	49.29	0.20	0.14	2.13	2.55	2.75	2.50	53152.21	2.10	2.04
CRANES, HYDRAULIC, TRUCK MTD, 80T (72.6MT), 128' (39M)	Cranes	Off-road diesel	2.33	11.28	49.29	0.20	0.14	2.13	2.55	2.75	2.50	53152.21	2.10	2.04
CRANES, HYDRAULIC, TRUCK MTD, BOOM TRUCK, 23.5T	Cranes	Off-road diesel	2.33	11.28	49.29	0.20	0.14	2.13	2.55	2.75	2.50	53152.21	2.10	2.04
CRANES, MECHANICAL, LATTICE BOOM, TRUCK MTD, 30 TON, 50' BOOM, DRAGLINE/CLAMSHELL CAPABLE, 6X4	Cranes	Off-road diesel	2.33	11.28	49.29	0.20	0.14	2.13	2.55	2.75	2.50	53152.21	2.10	2.04
DUMP TRUCK, HIGHWAY, 32 KGVW (14.5 MT), 2 AXLE, 4X2 WITH REAR 10 - 13 CY (7.6 - 10.0 M3) DUMP BODY	Off-highway Trucks; 300 < hp <=600	Off-road diesel	2.45	6.16	30.40	0.11	0.35	2.35	2.69	2.80	2.52	132987.20	1.80	1.74
DUMP TRUCK, HIGHWAY, 80KGVW (36.3MT), 6 AXLE (3 RETRACTABLE) WITH REAR 16 - 20 CY (12.2-15.3 M3) DUMP BODY	Off-highway Trucks; 300 < hp <=600	Off-road diesel	2.45	6.16	30.40	0.11	0.35	2.35	2.69	2.80	2.52	132987.20	1.80	1.74
FOAM SPRAY RIG, UP TO 40 LB/MIN, 40KW GENERATOR & 200 CFM COMPRESSOR INCLUDED, MOUNTED WITHIN ENCLOSED TRAILER	Other Construction Equipment	Off-road diesel	8.65	65.39	171.43	0.67	0.29	7.98	9.44	10.11	9.34	104841.82	9.54	9.25
GRADER, MOTOR, ARTICULATED, 6X4, 12' (3.6M) BLADE W/11 TEETH SCARIFIERS	Graders	Off-road diesel	1.39	5.94	23.17	0.09	0.17	1.30	1.52	1.61	1.46	64860.49	1.39	1.35
GRADER, MOTOR, ARTICULATED, 6X4, 14' (4.3M) BLADE W/7 SHANK RIPPER	Graders	Off-road diesel	1.39	5.94	23.17	0.09	0.17	1.30	1.52	1.61	1.46	64860.49	1.39	1.35
HYDRAULIC EXCAVATOR, CRAWLER, 30,400 LBS, 0.97 CY BUCKET, 19.83' MAX DIGGING DEPTH	Excavators	Off-road diesel	1.44	6.24	33.61	0.12	0.14	1.32	1.57	1.69	1.52	54616.39	1.27	1.24
HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Off-road diesel	1.44	6.24	33.61	0.12	0.14	1.32	1.57	1.69	1.52	54616.39	1.27	1.24
HYDRAULIC EXCAVATOR, CRAWLER, 82,200 LBS (37.3 MT), 2.75 CY (2.1 M3) BUCKET, 27'6" (8.4 M) MAX DIGGING DEPTH	Excavators	Off-road diesel	1.44	6.24	33.61	0.12	0.14	1.32	1.57	1.69	1.52	54616.39	1.27	1.24
HYDRAULIC EXCAVATOR, CRAWLER, 83,703 LBS (38 MT), 2.01 CY (1.54 M3) BUCKET, 22' 11" (7.0 M) MAX DIGGING DEPTH	Excavators	Off-road diesel	1.44	6.24	33.61	0.12	0.14	1.32	1.57	1.69	1.52	54616.39	1.27	1.24
LOADER / BACKHOE, WHEEL, 1.0 CY (0.76 M3) FRONT END BUCKET, 24" (61 CM) DIP, 6.2 CF (0.18 M3), 14.5' (4.4 M) DIGGING DEPTH, 4X2	Tractors/Loaders/Backhoes	Off-road diesel	3.41	20.94	33.31	0.21	0.04	3.20	3.73	3.94	3.72	13061.34	3.55	3.45
LOADER, CONVEYOR BELT & ACCESSORIES, 24" (61 CM) WIDE X 50' (15.2 M) LONG CONVEYOR WITH 24" (61 CM) DEEP LATTICE FRAME, SINGLE AXLE TELESCOPING UNDERCARRIAGE FOR RAISE AND LOWER, CAPABLE OF RADIAL TRAVEL, UP TO 250T (227 MT) PER HOUR	Other Construction Equipment	Off-road diesel	8.65	65.39	171.43	0.67	0.29	7.98	9.44	10.11	9.34	104841.82	9.54	9.25
LOADER, FRONT END, CRAWLER, 2.25 CY (1.7 M3) BUCKET	Tractors/Loaders/Backhoes	Off-road diesel	3.41	20.94	33.31	0.21	0.04	3.20	3.73	3.94	3.72	13061.34	3.55	3.45
LOADER, FRONT END, CRAWLER, 3CY-4CY (2.3M3-3.1M3) BUCKET	Tractors/Loaders/Backhoes	Off-road diesel	3.41	20.94	33.31	0.21	0.04	3.20	3.73	3.94	3.72	13061.34	3.55	3.45
LOADER, FRONT END, WHEEL, 1.40 CY BUCKET, ARTICULATED, 4X4	Rubber Tire Loaders	Off-road diesel	3.79	22.56	97.89	0.32	0.21	3.47	4.15	4.48	4.09	77133.66	4.04	3.92
LOADER, FRONT END, WHEEL, 2.0 CY (1.5 M3) BUCKET, ARTICULATED, 4X4	Rubber Tire Loaders	Off-road diesel	3.79	22.56	97.89	0.32	0.21	3.47	4.15	4.48	4.09	77133.66	4.04	3.92
LOADER, FRONT END, WHEEL, ARTICULATED, 3.50 CY (2.7 M3) BUCKET, 4X4	Rubber Tire Loaders	Off-road diesel	3.79	22.56	97.89	0.32	0.21	3.47	4.15	4.48	4.09	77133.66	4.04	3.92
LOADER, FRONT END, WHEEL, SKID-STEER, 10.5 CF (0.3 M3), 62" (1.6 M) BUCKET	Skid Steer Loaders	Off-road diesel	4.44	24.94	36.49	0.23	0.02	4.20	4.83	5.06	4.81	7987.91	3.68	3.57
PILE HAMMER, DRIVER/EXTRACTOR, VIBRATORY, 100 TON (890 KN)FORCE DRIVE (ADD CRANE)	Other Construction Equipment	Off-road diesel	8.65	65.39	171.43	0.67	0.29	7.98	9.44	10.11	9.34	104841.82	9.54	9.25
PILE HAMMER, SINGLE ACTING, DIESEL, 31,320 FT-LBS (42.4 KJ) (ADD LEADS & CRANE)	Other Construction Equipment	Off-road diesel	8.65	65.39	171.43	0.67	0.29	7.98	9.44	10.11	9.34	104841.82	9.54	9.25
PILE HAMMER, SINGLE ACTING, DIESEL, 31,335 FT-LBS (ADD LEADS & CRANE)	Other Construction Equipment	Off-road diesel	8.65	65.39	171.43	0.67	0.29	7.98	9.44	10.11	9.34	104841.82	9.54	9.25

Equipment Name	EPA MOVES Equipment Class	Fuel Type	Total Gaseous Hydrocarbons g/hr	CO g/hr	Nox g/hr	CH4 g/hr	SO2 g/hr	Non-Methane Hydrocarbons g/hr	Non-Methane Organic Gases g/hr)	Total Organic Gases g/hr	VOCs g/hr	Atmospheric CO2 g/hr	Primary Exhaust PM10 - total g/hr	Primary Exhaust PM 2.5 - total g/hr
PUMP, GROUT, MINI, AIR, 40 CF/HR (1.1 M3/HR), 225 PSI (1.6 MPA), PORTABLE, SKID MTD (ADD 15 CFM (42 CMM) - 100 PSI (689 KPA) COMPRESSOR)	Pumps	Off-road diesel	4.35	21.56	59.00	0.34	0.04	4.01	4.78	5.12	4.77	12897.90	3.44	3.34
PUMP, WATER, DIAPHRAGM, SKID MTD, 2" (5 CM) DIA, 33 GPM (0.12 M3M) (ADD HOSES)	Pumps	Off-road diesel	4.35	21.56	59.00	0.34	0.04	4.01	4.78	5.12	4.77	12897.90	3.44	3.34
ROLLER, STATIC, SELF-PROPELLED, LANDFILL/SOIL COMPACTOR, SHEEPSFOOT, 4X4, 39.2 TON, 51" DIA, 16.00' WIDTH PER 2-PASS, W/BLADE	Rollers	Off-road diesel	1.81	10.12	46.92	0.20	0.08	1.61	1.97	2.17	1.95	30474.04	1.61	1.56
ROLLER, VIBRATORY, TOWED, SINGLE DRUM, SHEEPSFOOT, 15,000 LB OPER. WT., 26,550 LB (13.3 TONS) CENTRIFUGAL FORCE, 67'' WIDE (ADD 180 HP TOWING UNIT)	Rollers	Off-road diesel	1.81	10.12	46.92	0.20	0.08	1.61	1.97	2.17	1.95	30474.04	1.61	1.56
ROOFING EQUIPMENT, ASPHALT KETTLE, 410 GAL (1.5 M3), W/PUMP, TRAILER MTD	Other Construction Equipment	Off-road diesel	8.65	65.39	171.43	0.67	0.29	7.98	9.44	10.11	9.34	104841.82	9.54	9.25
SCRAPER, TANDEM POWERED, STANDARD LOADING, 44 CY, 52 TON, 12.6' CUT WIDTH, 4X4, PUSH-PULL	Scrapers	Off-road diesel	4.56	30.06	75.08	0.36	0.35	4.20	4.99	5.36	4.85	129815.63	4.85	4.71
TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	Crawler Tractor/Dozers	Off-road diesel	2.97	16.13	85.66	0.24	0.22	2.73	3.27	3.51	3.19	82742.32	3.04	2.94
TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Off-road diesel	2.97	16.13	85.66	0.24	0.22	2.73	3.27	3.51	3.19	82742.32	3.04	2.94
TRACTOR, CRAWLER (DOZER), 251-300 HP (187-224 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Off-road diesel	2.97	16.13	85.66	0.24	0.22	2.73	3.27	3.51	3.19	82742.32	3.04	2.94
TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Off-road diesel	2.97	16.13	85.66	0.24	0.22	2.73	3.27	3.51	3.19	82742.32	3.04	2.94
TRENCHER, CHAIN TYPE CUTTER, 63" (1.6M) MAX DEPTH X 6"-12" (15CM - 30CM) WIDTH, RIDE-ON, 4X4	Trencher	Off-road diesel	2.54	14.73	77.70	0.32	0.07	2.22	2.71	3.03	2.70	25863.50	1.94	1.88
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	Off-highway Trucks; 300 < hp <=600	Off-road diesel	2.45	6.16	30.40	0.11	0.35	2.35	2.69	2.80	2.52	132987.20	1.80	1.74
TRUCK, HIGHWAY, 52 KGVW (23.6 MT), 3 AXLE, 6X4 (CHASSIS ONLY-ADD OPTIONS)	Off-highway Trucks; 300 < hp <=600	Off-road diesel	2.45	6.16	30.40	0.11	0.35	2.35	2.69	2.80	2.52	132987.20	1.80	1.74
TRUCK, HIGHWAY, 8,600 GVW, 4X2 (SUBURBAN)	Off-highway Trucks; 300 < hp <=600	Off-road diesel	2.45	6.16	30.40	0.11	0.35	2.35	2.69	2.80	2.52	132987.20	1.80	1.74
TRUCK, HIGHWAY, CONVENTIONAL, 3/4 TON PICKUP, 4X2	Off-highway Trucks; 300 < hp <=600	Off-road diesel	2.45	6.16	30.40	0.11	0.35	2.35	2.69	2.80	2.52	132987.20	1.80	1.74
TRUCK, HIGHWAY, CONVENTIONAL, 3/4 TON PICKUP, 4X4	Off-highway Trucks; 300 < hp <=600	Off-road diesel	2.45	6.16	30.40	0.11	0.35	2.35	2.69	2.80	2.52	132987.20	1.80	1.74
TRUCK, OFF-HIGHWAY, ARTICULATED FRAME, 19.6 CY, 26.7 TON, 6X6, REAR DUMP	Off-highway Trucks; 300 < hp <=600	Off-road diesel	2.45	6.16	30.40	0.11	0.35	2.35	2.69	2.80	2.52	132987.20	1.80	1.74
WELDER, ENGINE DRIVEN, DIESEL, DC-CC, 300 AMP, 3 KW	Welders	Off-road diesel	3.18	17.73	30.56	0.24	0.02	2.94	3.48	3.72	3.47	6428.92	2.38	2.31

Attachment 2A – Cumulative Construction Emissions

Cumulative Construction Emissions For Alternatives By EPA Equipment Category

Alternatives	Sum of Hours Usage	Total Gaseous Hydrocarbons Emissions (g)	CO Emissions (g)	NOx Emissions (g)	CH4 Emissions (g)	SO2 Emissions (g)	Non-Methane Hydrocarbons Emissions (g)	Non-Methane Organic Gases Emissions (g)	Sum of Total Organic Gases (g)	VOC Emissions (g)	Atmospheric CO2 Emissions (g)	Primary Exhaust PM10 - Total Emissions (g)	Primary Exhaust PM2.5 - Total Emissions (g)
3	**39,424**	**140,744.19**	**726,197.75**	**1,368,160.55**	**6,482.22**	**9,411.79**	**134,261.82**	**150,692.08**	**157,174.68**	**146,304.96**	**3,553,962,835.14**	**81,538.68**	**78,681.72**
Air Compressors	179	301.27	1,737.16	9,328.09	34.04	10.03	267.23	325.38	359.41	323.69	3,668,727.62	270.38	262.27
Chain Saws > 6 HP	175	49,629.66	222,229.22	1,276.68	992.59	2.47	48,636.94	51,555.25	52,547.82	51,409.27	573,051.42	8,143.23	7,491.76
Cranes	648	1,512.24	7,311.86	31,948.92	131.02	93.47	1,381.22	1,653.40	1,784.41	1,621.39	34,448,968.33	1,363.24	1,322.34
Crawler Tractor/Dozers	3,394	10,072.69	54,726.57	290,732.88	820.39	752.00	9,252.28	11,081.69	11,902.02	10,840.06	280,815,576.00	10,302.28	9,993.26
Excavators	3,302	4,746.34	20,614.24	110,998.72	386.18	477.91	4,360.16	5,187.85	5,574.02	5,029.40	180,368,339.97	4,206.44	4,080.25
Generator Sets	101	407.57	1,952.50	5,665.83	33.27	3.84	374.30	447.54	480.80	446.66	1,228,118.26	297.42	288.50
Graders	116	161.68	690.61	2,691.98	10.41	19.95	151.27	177.01	187.42	169.23	7,534,790.85	161.56	156.71
N/A	4,990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway Trucks; 300 < hp <=600	21,825	53,579.54	134,380.39	663,454.64	2,359.04	7,654.36	51,220.50	58,690.01	61,049.54	55,061.60	2,902,509,943.54	39,226.09	38,049.28
Other Construction Equipment	376	3,251.90	24,575.60	64,430.21	252.97	110.59	2,998.93	3,547.36	3,800.34	3,508.49	39,403,110.70	3,583.65	3,476.13
Pumps	192	834.05	4,135.05	11,317.13	65.67	7.72	768.39	916.18	981.85	914.32	2,474,164.73	659.54	639.75
Rollers	716	1,296.74	7,248.74	33,607.64	141.17	58.91	1,155.56	1,411.78	1,552.96	1,399.39	21,825,539.27	1,155.18	1,120.52
Rubber Tire Loaders	429	1,625.00	9,674.15	41,974.37	138.49	89.72	1,486.51	1,780.64	1,919.13	1,752.37	33,074,003.72	1,732.99	1,681.00
Scrapers	67	306.64	2,020.62	5,046.89	24.34	23.49	282.30	335.71	360.05	325.79	8,726,491.91	326.13	316.34
Shredders > 6 HP	88	3,341.71	175,582.15	1,454.82	497.57	2.90	2,844.14	2,989.22	3,486.79	2,943.74	666,728.91	73.12	67.27
Skid Steer Loaders	43	192.71	1,083.54	1,584.88	10.15	1.05	182.56	209.63	219.77	208.95	346,985.99	159.80	155.00
Tractors/Loaders/Backhoes	2,777	9,470.37	58,156.85	92,511.54	583.88	103.31	8,886.50	10,368.03	10,951.90	10,335.21	36,269,819.59	9,867.09	9,571.08
Welders	4	14.08	78.51	135.33	1.04	0.09	13.04	15.42	16.46	15.39	28,474.35	10.56	10.24
7	**12,934**	**87,390.20**	**588,568.86**	**481,588.98**	**3,660.17**	**1,716.84**	**83,729.89**	**91,936.55**	**95,596.73**	**91,037.89**	**639,486,220.18**	**37,538.43**	**35,968.36**
Air Compressors	209	351.37	2,026.04	10,879.30	39.70	11.70	311.67	379.49	419.18	377.52	4,278,817.78	315.34	305.88
Chain Saws > 6 HP	189	53,627.97	240,132.66	1,379.53	1,072.56	2.67	52,555.27	55,708.69	56,781.22	55,550.96	619,218.14	8,799.27	8,095.32
Cranes	648	1,512.24	7,311.86	31,948.92	131.02	93.47	1,381.22	1,653.40	1,784.41	1,621.39	34,448,968.33	1,363.24	1,322.34
Crawler Tractor/Dozers	556	1,650.97	8,969.99	47,652.75	134.47	123.26	1,516.50	1,816.35	1,950.81	1,776.75	46,027,246.64	1,688.60	1,637.95
Excavators	499	717.29	3,115.34	16,774.73	58.36	72.22	658.93	784.02	842.38	760.07	27,258,236.63	635.70	616.63
Generator Sets	108	433.83	2,078.27	6,030.81	35.41	4.08	398.42	476.36	511.78	475.43	1,307,229.80	316.58	307.08
Graders	118	164.56	702.92	2,739.95	10.59	20.31	153.97	180.17	190.76	172.24	7,669,078.00	164.44	159.50
N/A	2,745	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway Trucks; 300 < hp <=600	2,637	6,474.40	16,238.15	80,170.01	285.06	924.93	6,189.34	7,091.94	7,377.06	6,653.49	350,731,233.81	4,739.97	4,597.77
Other Construction Equipment	376	3,251.90	24,575.60	64,430.21	252.97	110.59	2,998.93	3,547.36	3,800.34	3,508.49	39,403,110.70	3,583.65	3,476.13
Pumps	195	848.24	4,205.38	11,509.63	66.78	7.85	781.45	931.77	998.55	929.87	2,516,247.98	670.76	650.63
Rollers	751	1,359.31	7,598.53	35,229.39	147.99	61.75	1,211.32	1,479.91	1,627.90	1,466.91	22,878,740.44	1,210.92	1,174.59
Rubber Tire Loaders	616	2,333.48	13,891.93	60,274.56	198.88	128.83	2,134.60	2,556.97	2,755.84	2,516.38	47,493,771.42	2,488.55	2,413.89
Scrapers	109	496.04	3,268.65	8,164.09	39.37	37.99	456.66	543.05	582.43	527.01	14,116,384.73	527.56	511.73
Shredders > 6 HP	95	3,610.93	189,727.46	1,572.02	537.66	3.13	3,073.27	3,230.04	3,767.69	3,180.90	720,442.15	79.01	72.69
Skid Steer Loaders	43	192.71	1,083.54	1,584.88	10.15	1.05	182.56	209.63	219.77	208.95	346,985.99	159.80	155.00
Tractors/Loaders/Backhoes	3,035	10,350.89	63,564.02	101,112.87	638.17	112.91	9,712.73	11,332.00	11,970.16	11,296.13	39,642,033.29	10,784.49	10,460.96
Welders	4	14.08	78.51	135.33	1.04	0.09	13.04	15.42	16.46	15.39	28,474.35	10.56	10.24
8	**40,126**	**142,582.09**	**735,849.54**	**1,389,953.05**	**6,584.57**	**9,516.95**	**135,997.37**	**152,677.34**	**159,262.30**	**148,243.57**	**3,593,483,604.26**	**82,895.72**	**79,994.89**
Air Compressors	209	351.37	2,026.04	10,879.30	39.70	11.70	311.67	379.49	419.18	377.52	4,278,817.78	315.34	305.88
Chain Saws > 6 HP	177	50,010.47	223,934.38	1,286.48	1,000.21	2.49	49,010.13	51,950.83	52,951.02	51,803.74	577,448.44	8,205.71	7,549.24
Cranes	648	1,512.24	7,311.86	31,948.91	131.02	93.47	1,381.22	1,653.39	1,784.41	1,621.39	34,448,963.01	1,363.24	1,322.34
Crawler Tractor/Dozers	3,401	10,095.07	54,848.17	291,378.90	822.21	753.67	9,272.84	11,106.31	11,928.46	10,864.15	281,439,560.69	10,325.17	10,015.46
Excavators	3,324	4,776.64	20,745.85	111,707.37	388.65	480.96	4,387.99	5,220.98	5,609.60	5,061.51	181,519,866.44	4,233.30	4,106.30
Generator Sets	108	433.83	2,078.27	6,030.81	35.41	4.08	398.42	476.36	511.78	475.43	1,307,229.80	316.58	307.08
Graders	118	164.56	702.92	2,739.95	10.59	20.31	153.97	180.17	190.76	172.24	7,669,078.00	164.44	159.50
N/A	5,172	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway Trucks; 300 < hp <=600	22,048	54,124.84	135,748.03	670,206.90	2,383.05	7,732.26	51,741.79	59,287.32	61,670.87	55,621.99	2,932,050,018.63	39,625.31	38,436.53
Other Construction Equipment	376	3,251.90	24,575.60	64,430.21	252.97	110.59	2,998.93	3,547.36	3,800.34	3,508.49	39,403,110.70	3,583.65	3,476.13
Pumps	195	848.24	4,205.39	11,509.64	66.78	7.85	781.46	931.77	998.55	929.87	2,516,251.85	670.76	650.63
Rollers	751	1,359.31	7,598.53	35,229.39	147.99	61.75	1,211.32	1,479.91	1,627.90	1,466.91	22,878,740.44	1,210.92	1,174.59
Rubber Tire Loaders	480	1,820.97	10,840.81	47,036.28	155.20	100.54	1,665.77	1,995.37	2,150.57	1,963.70	37,062,577.62	1,941.98	1,883.72
Scrapers	71	324.68	2,139.48	5,343.77	25.77	24.87	298.91	355.45	381.23	344.96	9,239,821.83	345.31	334.95
Shredders > 6 HP	88	3,367.35	176,929.19	1,465.98	501.39	2.92	2,865.96	3,012.15	3,513.54	2,966.33	671,843.95	73.68	67.79
Skid Steer Loaders	43	192.71	1,083.54	1,584.88	10.15	1.05	182.56	209.63	219.77	208.95	346,985.99	159.80	155.00
Tractors/Loaders/Backhoes	2,913	9,933.84	61,002.96	97,038.93	612.46	108.36	9,321.39	10,875.42	11,487.87	10,841.00	38,044,814.09	10,349.97	10,039.47
Welders	4	14.08	78.52	135.33	1.04	0.09	13.04	15.42	16.46	15.39	28,474.99	10.56	10.24
11B	**26,060**	**255,751.62**	**1,777,810.92**	**1,002,602.67**	**9,674.02**	**3,475.28**	**246,077.12**	**267,320.32**	**276,994.32**	**265,245.44**	**1,294,911,646.97**	**88,145.63**	**83,990.37**
Air Compressors	626	1,052.57	6,069.32	32,590.61	118.92	35.06	933.66	1,136.81	1,255.72	1,130.92	12,817,849.69	944.66	916.32
Chain Saws > 6 HP	644	182,525.45	817,303.36	4,695.31	3,650.50	9.08	178,874.47	189,607.28	193,257.70	189,070.42	2,107,539.47	29,948.75	27,552.82
Concrete/Industrial Saws	4	7.61	41.15	197.59	0.91	0.16	6.70	8.23	9.14	8.21	58,360.99	5.16	5.00
Cranes	1,122	2,616.93	12,653.21	55,287.71	226.73	161.74	2,390.20	2,861.21	3,087.94	2,805.82	59,614,063.24	2,359.09	2,288.32
Crawler Tractor/Dozers	1,826	5,419.01	29,442.36	156,411.46	441.36	404.57	4,977.64	5,961.84	6,403.17	5,831.85	151,076,049.64	5,542.53	5,376.28
Excavators	695	999.44	4,340.75	23,373.06	81.32	100.63	918.12	1,092.41	1,173.72	1,059.04	37,980,263.85	885.75	859.18
Generator Sets	346	1,393.10	6,673.71	19,366.03	113.71	13.11	1,279.39	1,529.69	1,643.40	1,526.69	4,197,753.57	1,016.59	986.09
Graders	179	249.14	1,064.16	4,148.09	16.04	30.75	233.10	272.76	288.80	260.76	11,610,416.28	248.94	241.47
N/A	4,056	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway Trucks; 300 < hp <=600	5,019	12,322.07	30,904.43	152,579.47	542.53	1,760.33	11,779.55	13,497.37	14,040.00	12,662.92	667,511,220.30	9,021.11	8,750.47
Other Construction Equipment	54	468.82	3,542.99	9,288.72	36.47	15.94	432.35	511.41	547.88	505.81	5,680,633.94	516.64	501.14
Pavers	0	0.18	0.92	5.37	0.02	0.01	0.16	0.19	0.21	0.19	4,547.02	0.16	0.16
Pumps	180	784.22	3,887.98	10,640.94	61.74	7.26	722.47	861.44	923.18	859.69	2,326,335.49	620.13	601.52
Rollers	1,852	3,352.65	18,741.24	86,890.82	365.00	152.30	2,987.65	3,650.09	4,015.09	3,618.04	56,428,807.74	2,986.65	2,897.05

Alternatives	Sum of Hours Usage	Total Gaseous Hydrocarbons Emissions (g)	CO Emissions (g)	NOx Emissions (g)	CH4 Emissions (g)	SO2 Emissions (g)	Non-Methane Hydrocarbons Emissions (g)	Non-Methane Organic Gases Emissions (g)	Sum of Total Organic Gases (g)	VOC Emissions (g)	Atmospheric CO2 Emissions (g)	Primary Exhaust PM10 - Total Emissions (g)	Primary Exhaust PM2.5 - Total Emissions (g)
Rubber Tire Loaders	1,910	7,239.80	43,100.81	187,006.54	617.03	399.72	6,622.77	7,933.19	8,550.22	7,807.26	147,353,153.44	7,720.92	7,489.30
Scrapers	340	1,551.24	10,221.97	25,531.33	123.13	118.81	1,428.10	1,698.28	1,821.41	1,648.12	44,145,802.45	1,649.83	1,600.33
Shredders > 6 HP	322	12,289.97	645,746.75	5,350.46	1,829.94	10.66	10,460.03	10,993.58	12,823.52	10,826.35	2,452,060.37	268.93	247.41
Skid Steer Loaders	14	64.24	361.18	528.29	3.38	0.35	60.85	69.88	73.26	69.65	115,661.73	53.27	51.67
Tractors/Loaders/Backhoes	6,826	23,279.70	142,958.91	227,408.29	1,435.28	253.95	21,844.44	25,486.28	26,921.54	25,405.61	89,157,064.04	24,254.89	23,527.25
Welders	43	135.49	755.70	1,302.55	10.02	0.86	125.47	148.38	158.41	148.09	274,063.73	101.64	98.59
11C	**29,857**	**303,961.92**	**2,113,613.22**	**1,129,150.94**	**11,303.42**	**4,190.95**	**292,657.92**	**317,495.45**	**328,798.87**	**314,963.16**	**1,563,821,515.97**	**101,564.53**	**96,696.75**
Air Compressors	724	1,216.89	7,016.83	37,678.47	137.48	40.53	1,079.42	1,314.28	1,451.75	1,307.47	14,818,898.51	1,092.14	1,059.37
Chain Saws > 6 HP	777	219,969.82	984,969.92	5,658.54	4,399.39	10.95	215,569.86	228,504.47	232,903.75	227,857.47	2,539,892.88	36,092.61	33,205.17
Concrete/Industrial Saws	5	9.78	52.88	253.90	1.17	0.21	8.61	10.58	11.75	10.55	74,990.48	6.63	6.43
Cranes	1,180	2,754.03	13,316.09	58,184.16	238.61	170.22	2,515.42	3,011.10	3,249.71	2,952.81	62,737,164.89	2,482.67	2,408.20
Crawler Tractor/Dozers	1,856	5,509.66	29,934.87	159,027.88	448.74	411.33	5,060.90	6,061.57	6,510.28	5,929.40	153,603,215.36	5,635.24	5,466.21
Excavators	884	1,270.17	5,516.58	29,704.37	103.35	127.89	1,166.82	1,388.32	1,491.66	1,345.92	48,268,380.26	1,125.69	1,091.92
Generator Sets	372	1,497.39	7,173.35	20,815.91	122.22	14.09	1,375.17	1,644.22	1,766.44	1,640.99	4,512,025.98	1,092.70	1,059.92
Graders	191	266.50	1,138.31	4,437.11	17.16	32.89	249.34	291.77	308.92	278.93	12,419,401.68	266.29	258.30
N/A	4,610	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway Trucks; 300 < hp <=600	6,623	16,258.97	40,778.38	201,328.53	715.86	2,322.75	15,543.11	17,809.77	18,525.78	16,708.71	880,780,736.84	11,903.35	11,546.24
Other Construction Equipment	109	944.42	7,137.28	18,711.91	73.47	32.12	870.95	1,030.23	1,103.70	1,018.94	11,443,505.80	1,040.77	1,009.54
Pavers	0	0.35	1.83	10.75	0.04	0.02	0.31	0.38	0.42	0.37	9,098.07	0.32	0.31
Pumps	193	837.41	4,151.72	11,362.77	65.93	7.75	771.48	919.88	985.80	918.01	2,484,141.25	662.20	642.33
Rollers	2,081	3,767.39	21,059.60	97,639.53	410.15	171.14	3,357.23	4,101.62	4,511.77	4,065.61	63,409,252.72	3,356.10	3,255.42
Rubber Tire Loaders	2,080	7,882.98	46,929.89	203,620.20	671.84	435.23	7,211.14	8,637.98	9,309.82	8,500.86	160,444,008.44	8,406.85	8,154.64
Scrapers	360	1,641.43	10,816.27	27,015.71	130.29	125.72	1,511.13	1,797.02	1,927.31	1,743.94	46,712,413.13	1,745.75	1,693.38
Shredders > 6 HP	388	14,811.22	778,219.25	6,448.08	2,205.34	12.84	12,605.87	13,248.88	15,454.22	13,047.33	2,955,091.27	324.10	298.17
Skid Steer Loaders	14	64.24	361.18	528.29	3.38	0.35	60.85	69.88	73.26	69.65	115,661.73	53.27	51.67
Tractors/Loaders/Backhoes	7,367	25,123.78	154,283.29	245,422.26	1,548.97	274.06	23,574.83	27,505.15	29,054.11	27,418.10	96,219,571.68	26,176.22	25,390.95
Welders	43	135.49	755.70	1,302.56	10.02	0.86	125.47	148.39	158.41	148.09	274,065.02	101.64	98.59
12	**1,055**	**4,209.88**	**24,541.98**	**73,716.63**	**290.14**	**269.59**	**3,919.74**	**4,599.34**	**4,889.49**	**4,484.68**	**100,073,449.72**	**4,078.35**	**3,956.00**
Crawler Tractor/Dozers	4	11.08	60.21	319.85	0.90	0.83	10.18	12.19	13.09	11.93	308,943.29	11.33	10.99
Excavators	11	15.09	65.54	352.91	1.23	1.52	13.86	16.49	17.72	15.99	573,472.08	13.37	12.97
Generator Sets	52	207.53	994.17	2,884.93	16.94	1.95	190.59	227.88	244.82	227.43	625,333.23	151.44	146.90
Graders	4	5.20	22.20	86.52	0.33	0.64	4.86	5.69	6.02	5.44	242,176.09	5.19	5.04
N/A	109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway Trucks; 300 < hp <=600	486	1,193.13	2,992.43	14,774.04	52.53	170.45	1,140.60	1,306.93	1,359.47	1,226.13	64,634,124.50	873.50	847.29
Other Construction Equipment	278	2,403.75	18,165.88	47,625.75	186.99	81.74	2,216.76	2,622.15	2,809.15	2,593.42	29,126,132.67	2,648.97	2,569.50
Rollers	4	6.76	37.79	175.21	0.74	0.31	6.02	7.36	8.10	7.30	113,783.98	6.02	5.84
Rubber Tire Loaders	42	159.17	947.59	4,111.41	13.57	8.79	145.60	174.41	187.98	171.65	3,239,613.77	169.75	164.65
Tractors/Loaders/Backhoes	42	143.24	879.61	1,399.23	8.83	1.56	134.41	156.82	165.65	156.32	548,576.34	149.24	144.76
Trencher	26	64.93	376.56	1,986.77	8.07	1.80	56.86	69.41	77.49	69.09	661,293.78	49.53	48.04

Attachment 2B – Construction Annualized Emission Rates

Annualized Construction Emissions													
Alternative	**Years of Construction**	**Total Gaseous Hydrocarbons Emissions (ton/yr)**	**CO Emissions (ton/yr)**	**NOx Emissions (ton/yr)**	**CH4 Emissions (ton/yr)**	**SO2 Emissions (ton/yr)**	**Non-Methane Hydrocarbons Emissions (ton/yr)**	**Non-Methane Organic Gases Emissions (ton/yr)**	**Sum of Total Organic Gases (ton/yr)**	**VOC Emissions (ton/yr)**	**Atmospheric CO2 Emissions (ton/yr)**	**Primary Exhaust PM10 - Total Emissions (ton/yr)**	**Primary Exhaust PM2.5 - Total Emissions (ton/yr)**
3	2	0.078	0.400	0.754	0.004	0.005	0.074	0.083	0.087	0.081	1,958.754	0.045	0.043
7	2	0.048	0.324	0.265	0.002	0.001	0.046	0.051	0.053	0.050	352.451	0.021	0.020
8	2	0.079	0.406	0.766	0.004	0.005	0.075	0.084	0.088	0.082	1,980.535	0.046	0.044
11B	2	0.141	0.980	0.553	0.005	0.002	0.136	0.147	0.153	0.146	713.686	0.049	0.046
11C	2	0.168	1.165	0.622	0.006	0.002	0.161	0.175	0.181	0.174	861.895	0.056	0.053
12	2	0.002	0.014	0.041	0.000	0.000	0.002	0.003	0.003	0.002	55.155	0.002	0.002

Attachment 3A – OMRR&R Emissions per Activity Unit

Row Labels	Sum of EQ Hours	Sum of Total Gaseous Hydrocarbons (g)	Sum of CO (g)	Sum of Nox (g)	Sum of CH4 (g)	Sum of SO2 (g)	Sum of Non-Methane Hydrocarbons (g)	Sum of Non-Methane Organic Gases (g)	Sum of Total Organic Gases (g)	Sum of VOCs (g)	Sum of Atmospheric CO2 (g)	Sum of Primary Exhaust PM10 - total (g)	Sum of Primary Exhaust PM 2.5 - total (g)
Cohesive Fill (per CY)	**0.110**	**0.256**	**0.970**	**3.397**	**0.014**	**0.025**	**0.242**	**0.280**	**0.294**	**0.269**	**9,541.151**	**0.213**	**0.207**
Excavators	0.007	0.010	0.044	0.239	0.001	0.001	0.009	0.011	0.012	0.011	387.776	0.009	0.009
N/A	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Off-highway Trucks; 300 < hp <=600	0.064	0.158	0.395	1.952	0.007	0.023	0.151	0.173	0.180	0.162	8,537.778	0.115	0.112
Rollers	0.012	0.021	0.119	0.554	0.002	0.001	0.019	0.023	0.026	0.023	359.594	0.019	0.018
Tractors/Loaders/Backhoes	0.020	0.067	0.410	0.653	0.004	0.001	0.063	0.073	0.077	0.073	256.002	0.070	0.068
Gravel Surfacing (per SY)	**0.010**	**0.019**	**0.095**	**0.351**	**0.001**	**0.001**	**0.018**	**0.021**	**0.022**	**0.021**	**518.601**	**0.018**	**0.018**
Crawler Tractor/Dozers	0.002	0.005	0.026	0.137	0.000	0.000	0.004	0.005	0.006	0.005	132.388	0.005	0.005
Graders	0.002	0.002	0.010	0.037	0.000	0.000	0.002	0.002	0.003	0.002	103.777	0.002	0.002
N/A	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Off-highway Trucks; 300 < hp <=600	0.002	0.004	0.010	0.049	0.000	0.001	0.004	0.004	0.004	0.004	212.780	0.003	0.003
Rollers	0.002	0.003	0.016	0.075	0.000	0.000	0.003	0.003	0.003	0.003	48.758	0.003	0.003
Tractors/Loaders/Backhoes	0.002	0.005	0.034	0.053	0.000	0.000	0.005	0.006	0.006	0.006	20.898	0.006	0.006
Sediment Removal (per CY)	**0.068**	**0.145**	**0.444**	**2.254**	**0.008**	**0.019**	**0.137**	**0.159**	**0.166**	**0.150**	**7,132.554**	**0.114**	**0.110**
Crawler Tractor/Dozers	0.007	0.021	0.114	0.608	0.002	0.002	0.019	0.023	0.025	0.023	587.471	0.022	0.021
Excavators	0.007	0.010	0.044	0.239	0.001	0.001	0.009	0.011	0.012	0.011	387.776	0.009	0.009
N/A	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Off-highway Trucks; 300 < hp <=600	0.046	0.114	0.285	1.407	0.005	0.016	0.109	0.125	0.130	0.117	6,157.308	0.083	0.081
Closure Structures (each)	**243.367**	**847.662**	**5,263.086**	**16,142.227**	**65.154**	**41.596**	**782.507**	**926.061**	**991.217**	**910.344**	**15,229,053.395**	**845.652**	**820.282**
Concrete/Industrial Saws	1.889	4.052	21.900	105.147	0.486	0.085	3.565	4.380	4.866	4.370	31,056.163	2.744	2.661
Cranes	82.883	193.389	935.059	4,085.707	16.755	11.953	176.634	211.440	228.195	207.347	4,405,420.001	174.334	169.104
Crawler Tractor/Dozers	0.238	0.705	3.830	20.345	0.057	0.053	0.647	0.775	0.833	0.759	19,651.302	0.721	0.699
Excavators	1.577	2.266	9.841	52.988	0.184	0.228	2.081	2.477	2.661	2.401	86,102.736	2.008	1.948
Generator Sets	6.505	26.170	125.371	363.806	2.136	0.246	24.034	28.737	30.873	28.680	78,858.157	19.097	18.525
Graders	0.136	0.189	0.806	3.140	0.012	0.023	0.176	0.206	0.219	0.197	8,788.596	0.188	0.183
N/A	44.509	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Off-highway Trucks; 300 < hp <=600	31.445	77.195	193.610	955.879	3.399	11.028	73.796	84.558	87.958	79.331	4,181,822.502	56.515	54.820
Other Construction Equipment	54.183	468.818	3,542.993	9,288.719	36.470	15.943	432.347	511.413	547.884	505.810	5,680,633.936	516.644	501.144
Pavers	0.113	0.176	0.917	5.373	0.020	0.012	0.156	0.189	0.209	0.186	4,547.019	0.161	0.156
Pumps	4.772	20.747	102.859	281.514	1.633	0.192	19.114	22.790	24.423	22.744	61,544.891	16.406	15.914
Rollers	0.238	0.430	2.404	11.145	0.047	0.020	0.383	0.468	0.515	0.464	7,237.585	0.383	0.372
Rubber Tire Loaders	7.320	27.742	165.158	716.589	2.364	1.532	25.378	30.399	32.764	29.917	564,641.540	29.586	28.698
Tractors/Loaders/Backhoes	7.560	25.784	158.339	251.874	1.590	0.281	24.195	28.228	29.818	28.139	98,748.966	26.864	26.058
Debris Removal (per CY)	**0.110**	**0.174**	**0.510**	**2.593**	**0.009**	**0.023**	**0.165**	**0.191**	**0.200**	**0.180**	**8,802.948**	**0.134**	**0.130**
Excavators	0.028	0.040	0.172	0.924	0.003	0.004	0.036	0.043	0.046	0.042	1,501.951	0.035	0.034
N/A	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Off-highway Trucks; 300 < hp <=600	0.055	0.135	0.338	1.669	0.006	0.019	0.129	0.148	0.154	0.139	7,300.997	0.099	0.096
Mowing (per acres)	**1.367**	**4.661**	**28.621**	**45.528**	**0.287**	**0.051**	**4.373**	**5.102**	**5.390**	**5.086**	**17,849.629**	**4.856**	**4.710**
Tractors/Loaders/Backhoes	1.367	4.661	28.621	45.528	0.287	0.051	4.373	5.102	5.390	5.086	17,849.629	4.856	4.710
Remove and Replace Culverts (each)	**75.895**	**223.050**	**1,300.498**	**3,516.019**	**16.115**	**6.776**	**206.935**	**244.228**	**260.343**	**242.136**	**2,486,233.784**	**225.077**	**218.325**
Cranes	10.037	23.419	113.233	494.767	2.029	1.447	21.390	25.605	27.634	25.109	533,483.424	21.111	20.478
Crawler Tractor/Dozers	12.654	37.555	204.042	1,083.964	3.059	2.804	34.496	41.317	44.375	40.416	1,046,988.278	38.411	37.259
Rollers	12.109	21.924	122.553	568.199	2.387	0.996	19.537	23.869	26.256	23.659	369,001.031	19.530	18.944
Tractors/Loaders/Backhoes	41.095	140.153	860.670	1,369.089	8.641	1.529	131.512	153.438	162.078	152.952	536,761.051	146.024	141.643
Seeding (per acre)	**18.221**	**62.142**	**381.610**	**607.037**	**3.831**	**0.678**	**58.311**	**68.032**	**71.864**	**67.817**	**237,993.314**	**64.745**	**62.803**
Tractors/Loaders/Backhoes	18.221	62.142	381.610	607.037	3.831	0.678	58.311	68.032	71.864	67.817	237,993.314	64.745	62.803
Grand Total	**339.146**	**1,138.110**	**6,975.833**	**20,319.406**	**85.421**	**49.169**	**1,052.689**	**1,244.075**	**1,329.496**	**1,226.003**	**17,997,125.376**	**1,140.809**	**1,106.585**

Attachment 3B – OMRR&R Emissions

Alt 7 Levee Left Bank Only

O&M Category	Frequency (Every X years)	Quantity	UoM	50-yr Total Gaseous Hydrocarbons Emissions (g)	50-yr CO Emissions (g)	50-yr NOx Emissions (g)	50-yr CH4 Emissions (g)	50-yr SO2 Emissions (g)	50-yr Non-Methane Hydrocarbons Emissions (g)	50-yr Non-Methane Organic Gases Emissions (g)	50-yr Sum of Total Organic Gases (g)	50-yr VOC Emissions (g)	50-yr Atmospheric CO2 Emissions (g)	50-yr Primary Exhaust PM10 - Total Emissions (g)	50-yr Primary Exhaust PM2.5 - Total Emissions (g)
Mowing	1	1.15	Acres	267.99	1,645.71	2,617.87	16.52	2.92	251.47	293.39	309.91	292.46	1,026,353.68	279.22	270.84
Seed area that died from innudation	5	0.115	Acres	71.46	438.85	698.09	4.41	0.78	67.06	78.24	82.64	77.99	273,692.31	74.46	72.22
Sediment removal	5	0	CY	-	-	-	-	-	-	-	-	-	-	-	-
Debris Removal	1	0	CY	-	-	-	-	-	-	-	-	-	-	-	-
Gravel resurfacing of crest road	7	5,780.00	SY	795.04	3,916.62	14,497.91	55.94	57.04	739.10	870.83	926.76	848.79	21,410,797.71	752.37	729.80
Compacted Fill for Erosion Areas	3	500	CY	2,133.49	8,079.31	28,307.38	118.47	210.35	2,015.02	2,335.26	2,453.75	2,239.85	79,509,589.94	1,775.87	1,722.60
Closure Structure Repairs	10	0	EA	-	-	-	-	-	-	-	-	-	-	-	-
Culvert Repair	10	1	LS	1,115.25	6,502.49	17,580.09	80.58	33.88	1,034.68	1,221.14	1,301.72	1,210.68	12,431,168.92	1,125.38	1,091.62
			50-yr Total	4,383.23	20,582.97	63,701.34	275.91	304.98	4,107.32	4,798.86	5,074.78	4,669.78	114,651,602.55	4,007.30	3,887.09
			50-yr annualized	87.66	411.66	1,274.03	5.52	6.10	82.15	95.98	101.50	93.40	2,293,032.05	80.15	77.74

Alts 3 and 8

O&M Category	Frequency (Every X years)	Quantity	UoM	50-yr Total Gaseous Hydrocarbons Emissions (g)	50-yr CO Emissions (g)	50-yr NOx Emissions (g)	50-yr CH4 Emissions (g)	50-yr SO2 Emissions (g)	50-yr Non-Methane Hydrocarbons Emissions (g)	50-yr Non-Methane Organic Gases Emissions (g)	50-yr Sum of Total Organic Gases (g)	50-yr VOC Emissions (g)	50-yr Atmospheric CO2 Emissions (g)	50-yr Primary Exhaust PM10 - Total Emissions (g)	50-yr Primary Exhaust PM2.5 - Total Emissions (g)
Mowing	1	1.15	Acres	267.99	1,645.71	2,617.87	16.52	2.92	251.47	293.39	309.91	292.46	1,026,353.68	279.22	270.84
Seed area that died from innudation	5	0.115	Acres	71.46	438.85	698.09	4.41	0.78	67.06	78.24	82.64	77.99	273,692.31	74.46	72.22
Sediment removal	5	33056	CY	47,910.92	146,728.52	745,178.23	2,496.03	6,227.23	45,414.87	52,506.13	55,002.45	49,682.04	2,357,737,173.37	37,620.77	36,492.16
Debris Removal	1	100	CY	871.49	2,548.39	12,965.80	45.75	116.17	825.74	954.15	999.90	901.91	44,014,740.70	668.49	648.43
Gravel resurfacing of crest road	7	5,780.00	SY	795.04	3,916.62	14,497.91	55.94	57.04	739.10	870.83	926.76	848.79	21,410,797.71	752.37	729.80
Compacted Fill for Erosion Areas	3	500	CY	2,133.49	8,079.31	28,307.38	118.47	210.35	2,015.02	2,335.26	2,453.75	2,239.85	79,509,589.94	1,775.87	1,722.60
Closure Structure Repairs	10	0	EA	-	-	-	-	-	-	-	-	-	-	-	-
Culvert Repair	10	1	LS	1,115.25	6,502.49	17,580.09	80.58	33.88	1,034.68	1,221.14	1,301.72	1,210.68	12,431,168.92	1,125.38	1,091.62
			50-yr Total	53,165.64	169,859.89	821,845.36	2,817.70	6,648.37	50,347.93	58,259.13	61,077.14	55,253.73	2,516,403,516.63	42,296.56	41,027.68
			50-yr annualized	1,063.31	3,397.20	16,436.91	56.35	132.97	1,006.96	1,165.18	1,221.54	1,105.07	50,328,070.33	845.93	820.55

Alt 11B

O&M Category	Frequency (Every X years)	Quantity	UoM	50-yr Total Gaseous Hydrocarbons Emissions (g)	50-yr CO Emissions (g)	50-yr NOx Emissions (g)	50-yr CH4 Emissions (g)	50-yr SO2 Emissions (g)	50-yr Non-Methane Hydrocarbons Emissions (g)	50-yr Non-Methane Organic Gases Emissions (g)	50-yr Sum of Total Organic Gases (g)	50-yr VOC Emissions (g)	50-yr Atmospheric CO2 Emissions (g)	50-yr Primary Exhaust PM10 - Total Emissions (g)	50-yr Primary Exhaust PM2.5 - Total Emissions (g)
Mowing	1	8	Acres	1,864.28	11,448.40	18,211.25	114.94	20.34	1,749.34	2,040.99	2,155.92	2,034.53	7,139,851.68	1,942.37	1,884.10
Seed area that died from innudation	5	0.8	Acres	497.14	3,052.88	4,856.30	30.65	5.42	466.49	544.26	574.91	542.54	1,903,946.52	517.96	502.42
Sediment removal	5	0	CY	-	-	-	-	-	-	-	-	-	-	-	-
Debris Removal	1	0	CY	-	-	-	-	-	-	-	-	-	-	-	-
Gravel resurfacing of crest road	7	23,109.00	SY	3,178.64	15,659.02	57,964.04	223.64	228.05	2,955.00	3,481.65	3,705.29	3,393.55	85,602,443.63	3,008.06	2,917.83
Compacted Fill for Erosion Areas	3	5000	CY	21,334.88	80,793.06	283,073.76	1,184.71	2,103.55	20,150.17	23,352.64	24,537.47	22,398.51	795,095,899.37	17,758.73	17,225.96
Closure Structure Repairs	10	1	EA	4,238.31	26,315.43	80,711.14	325.77	207.98	3,912.54	4,630.31	4,956.08	4,551.72	76,145,266.97	4,228.26	4,101.41
Culvert Repair	10	1	LS	1,115.25	6,502.49	17,580.09	80.58	33.88	1,034.68	1,221.14	1,301.72	1,210.68	12,431,168.92	1,125.38	1,091.62
			50-yr Total	32,228.50	143,771.28	462,396.58	1,960.29	2,599.22	30,268.21	35,270.98	37,231.39	34,131.52	978,318,577.10	28,580.77	27,723.35
			50-yr annualized	644.57	2,875.43	9,247.93	39.21	51.98	605.36	705.42	744.63	682.63	19,566,371.54	571.62	554.47

Alt11C

O&M Category	Frequency (Every X years)	Quantity	UoM	50-yr Total Gaseous Hydrocarbons Emissions (g)	50-yr CO Emissions (g)	50-yr NOx Emissions (g)	50-yr CH4 Emissions (g)	50-yr SO2 Emissions (g)	50-yr Non-Methane Hydrocarbons Emissions (g)	50-yr Non-Methane Organic Gases Emissions (g)	50-yr Sum of Total Organic Gases (g)	50-yr VOC Emissions (g)	50-yr Atmospheric CO2 Emissions (g)	50-yr Primary Exhaust PM10 - Total Emissions (g)	50-yr Primary Exhaust PM2.5 - Total Emissions (g)
Mowing	1	10.1	Acres	2,353.65	14,453.60	22,991.70	145.11	25.67	2,208.54	2,576.74	2,721.85	2,568.59	9,014,062.75	2,452.25	2,378.68
Seed area that died from innudation	5	1.01	Acres	627.64	3,854.27	6,131.08	38.70	6.85	588.94	687.13	725.82	684.95	2,403,732.48	653.93	634.31
Sediment removal	5	0	CY	-	-	-	-	-	-	-	-	-	-	-	-
Debris Removal	1	0	CY	-	-	-	-	-	-	-	-	-	-	-	-
Gravel resurfacing of crest road	7	23,109.00	SY	3,178.64	15,659.02	57,964.04	223.64	228.05	2,955.00	3,481.65	3,705.29	3,393.55	85,602,443.63	3,008.06	2,917.83
Compacted Fill for Erosion Areas	3	7000	CY	29,868.83	113,110.28	396,303.26	1,658.60	2,944.97	28,210.23	32,693.69	34,352.45	31,357.91	1,113,134,259.12	24,862.22	24,116.34
Closure Structure Repairs	10	1	EA	4,238.31	26,315.43	80,711.14	325.77	207.98	3,912.54	4,630.31	4,956.08	4,551.72	76,145,266.97	4,228.26	4,101.41
Culvert Repair	10	1	LS	1,115.25	6,502.49	17,580.09	80.58	33.88	1,034.68	1,221.14	1,301.72	1,210.68	12,431,168.92	1,125.38	1,091.62
			50-yr Total	41,382.32	179,895.09	581,681.31	2,472.40	3,447.40	38,909.93	45,290.66	47,763.22	43,767.40	1,298,730,933.87	36,330.10	35,240.19
			50-yr annualized	827.65	3,597.90	11,633.63	49.45	68.95	778.20	905.81	955.26	875.35	25,974,618.68	726.60	704.80

US Army Corps of Engineers®

WATERTOWN, SOUTH DAKOTA FLOOD RISK MANAGEMENT GENERAL INVESTIGATIONS STUDY

INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX G5: SECTION 404(B)(1) EVALUATION (40 CFR 230)

OMAHA DISTRICT
NORTHWESTERN DIVISION



March 2026

TABLE OF CONTENTS

1 Introduction 1
2 Alternatives Considered in the Integrated Environmental Assessment 4
3 Section 404(b)(1) Evaluation 11
4 Biological Characteristics 33
5 Selection of the Least Environmentally Damaging, Practicable Alternative 39
6 Findings of Compliance or Non-compliance 41
7 Conclusions 41

Appendix G5a: Desktop Delineation

1 Introduction

This Section 404(b)(1) Evaluation is being conducted for the proposed construction for the Watertown, South Dakota Flood Risk Management General Investigations Study Draft Integrated Feasibility Report and Environmental Assessment. This evaluation will assess the potential effects of each alternative considered in the final array on water quality and the aquatic environment on the effected aquatic resources within the proposed project area. The purpose of this study is to is to address flood risk issues to reduce flood and life safety risks in the Big Sioux River Basin.

The City of Watertown and its vicinity have experienced eleven major flood events since 1943 which includes the flood of record in 1997. This has resulted in damaged housing and infrastructure, isolation from emergency services, and millions in insurance claims. The flood risk problem has been studied previously several times by the U.S. Army Corps of Engineers (USACE) and other agencies dating back to the 1970s. USACE completed a feasibility study and submitted a Chiefs Report in 1994 recommending the construction of the Mahoney Creek Dry Dam upstream of Watertown; however, due to opposition from landowners Congress did not approve the project for construction. Watertown and the surrounding areas experienced the flood of record in 1997 leading the city to request USACE to re-evaluate alternatives with updated hydrology and hydraulic (H&H) models utilizing 1997 flood data as well as impacts to economic land use. USACE completed a re-evaluation report in 2000 that still recommended the Mahoney Creek Dry Dam. Lack of local support for the dry dam alternative still existed which prevented its implementation. USACE conducted additional studies for Watertown and vicinity between 2005 to 2012 which included reviewing additional alternatives, updating H&H modeling, and conducting a value engineering study. No new alternatives were recommended for construction after these studies.

1.1 Study Authority and Scope of Analysis

The Watertown, South Dakota General Investigations (GI) project was authorized under resolutions adopted by the Committee on Public Works, U.S. Senate on May 8, 1964, and March 26, 1968; and a resolution adopted by the Committee on Public Works, U.S. House of Representatives on August 1, 1963, which authorizes the Board of Engineers for Rivers and Harbors to review the reports on the Big Sioux River and its Tributaries, Iowa and South Dakota, published as House Document Numbered 133, Eighty-fourth Congress, and other reports, with a view to determining any modifications should be made in the recommendations therein, with particular reference to utilization of storage reservoirs for flood control and related water problems, including municipal water supply, outdoor recreation, fish and wildlife conservation, irrigation, erosion, and water quality control, in the Big Sioux basin upstream from the mouth of the Rock River but including the Rock River basin.

The Letter of Request, received by USACE on April 7, 2020 was submitted by the City of Watertown and section 201(a)(62) WRDA 2022 authorized the funding for the flood risk management (FRM) along the Big Sioux River in the City of Watertown and vicinity. A feasibility cost sharing agreement (FCSA) was executed between USACE and the City of Watertown, the Non-Federal Sponsor (NFS) on August 19, 2022 officially kicking off the feasibility study. Feasibility study costs are shared 50 percent federal and 50 percent non-federal; and design and implementation costs are shared 65 percent federal and 35 percent non-federal.

The general scope of this Feasibility Report and integrated Environmental Assessment (FR/EA) is to define and quantify flood risks and related problems associated with the Big Sioux River within the vicinity of Watertown and to determine the feasibility of structural and nonstructural solutions to reduce those flood risks. The study results present the economic feasibility of the alternatives evaluated and details any environmental and socioeconomic impacts that could occur along with any associated mitigation. The primary purpose of implementing a FRM project is to reduce the risk of property and infrastructure damages, injury, and possible loss of life due to flooding.

The FR/EA considered FRM alternatives along the Big Sioux River to fully address the study's objectives. The study reviewed existing and future without conditions, developed and evaluated alternatives, compared the costs and benefits of those alternatives, and recommended a FRM. In addition to the City of Watertown, this study has been conducted in coordination with Sisseton Wahpeton Oyate (SWO), South Dakota Department of Game and Fish (SDGF), U.S. Fish and Wildlife Service (USFWS), Environmental Protection Agency (EPA), and the Bureau of Indian Affairs (BIA), as well as other stakeholders and the general public to ensure the study adequately considers and reflects all input.

Consideration of Department of the Army regulatory programs (Section 10 of the River and Harbor Act [RHA] of 1899 and Section 404 of the Clean Water Act [CWA] of 1972) are incorporated into the planning process. Evaluation of the effects of the discharge of dredged or fill material, including consideration of the Section 404(b)(1) Guidelines, is included in the National Environmental Policy Act (NEPA) documentation prepared for all USACE actions in planning, design and construction where the proposed project involves the discharge of dredged or fill material into waters of the United States.

1.2 Purpose of Evaluation

Section 404(b)(1) Guidelines (40 CFR 230) are the substantive criteria used in evaluating discharges of dredged or fill materials in waters of the United States under Section 404 of the CWA. Fundamental to these Guidelines is the precept that dredged or fill materials should not be discharged into an aquatic ecosystem unless it can be demonstrated that such discharges would not have unacceptable adverse impacts either individually or in combination with known or probable impacts of other activities affecting the ecosystem of concern.

The purpose of this analysis is to ensure that the Watertown GI project would not have unacceptable adverse impacts either individually or in combination with known or probable impacts of other activities affecting the aquatic resources in the project area, thus satisfying compliance with Section 404(b)(1) Guidelines.

1.3 Planning Objectives

The Federal objective of water and related land resources project planning is to contribute to National Economic Development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Planning objectives represent desired positive changes to the future without-project conditions. All of the planning objectives focus on activity within the study area and within the 50-year period of analysis. These planning objectives include:

- Reduce the damages and severity of flooding within the vicinity of Watertown.
- Reduce impacts to health and life safety from flooding within the vicinity of Watertown.
- Reduce cost and frequency of deploying emergency response efforts during flood events.

- Provide benefits to and avoid disproportionate impacts to the underserved and disadvantaged communities within the City of Watertown and Lake Traverse Reservation.
- Reduce floodplain requirements within the vicinity of Watertown.
- Increase resiliency of infrastructure to flooding within the vicinity of Watertown.
- Create nature-based features with flood risk management measures.

1.4 Project Area

The proposed project area is located in south-central Codington County, in northeastern South Dakota. The area includes the Big Sioux River and its tributaries, Lake Kampeska, and Pelican Lake within the vicinity of the city of Watertown, SD. The Upper Big Sioux River subbasin watershed covers most of Codington County, and parts of Grant, Roberts, Day, and Hamlin Counties in South Dakota. It drains an area of approximately 1600 square miles. The three major streams draining into the Upper Big Sioux River are Stray Horse Creek, Willow Creek, and Mud Creek. Detention in the upper parts of the basin, structural measures, and nonstructural measures in the lower part of the basin are all being considered in the alternatives analysis, therefore, the project area is consistent with the study area.

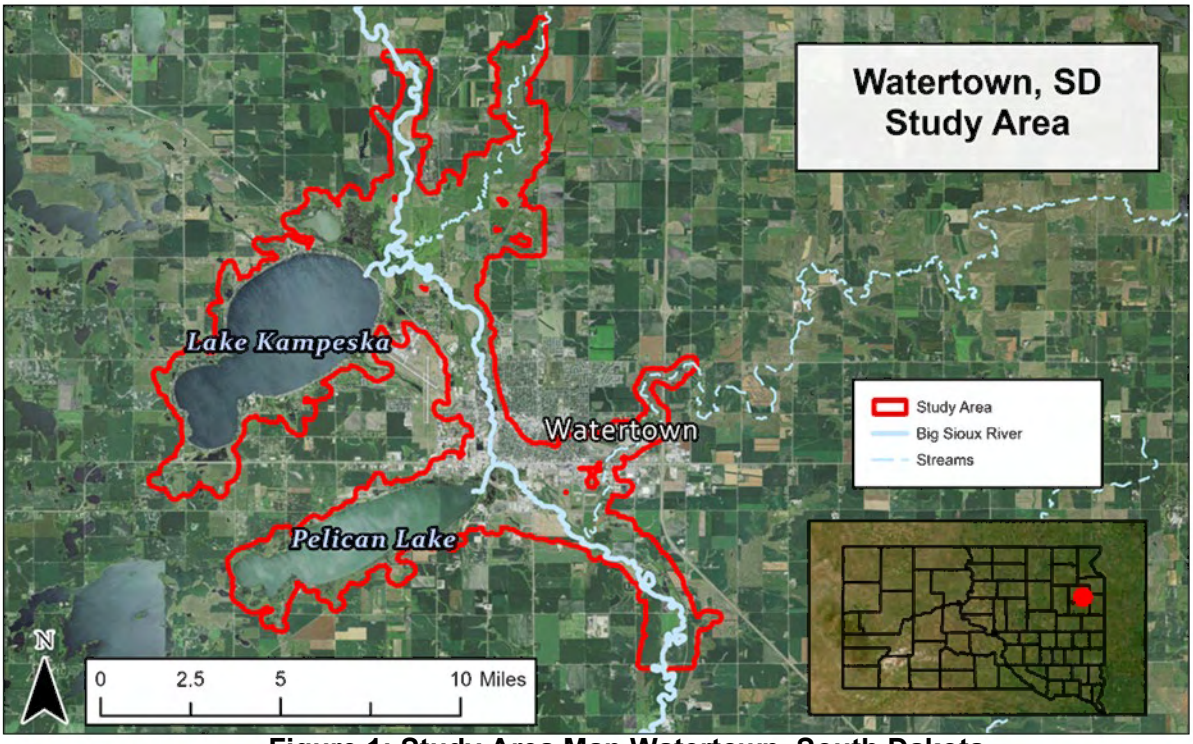


Figure 1: Study Area Map Watertown, South Dakota

1.5 General Description

The City of Watertown has experienced significant flooding events since 1943. These floods have been caused by snowmelt, rain-on-snow, and rainfall events. Recurrent floods present a risk to property and infrastructure within the city of Watertown and its vicinity. This study is being formulated to address flood risk along the Big Sioux River in and around the vicinity of Watertown, South Dakota, consistent with protecting the nation's environment, pursuant to the national environmental statutes, with applicable executive orders and with other Federal planning requirements.

2 Alternatives Considered in the Integrated Environmental Assessment

Section 3 of the main FR/EA describes the alternative formulation process in detail. USACE and the City initially developed 16 separate FRM management measures that would meet the study objectives and avoid any constraints. These measures included lowering Lake Kampeska and/or Pelican Lake, channel widening, different combinations of levee systems, diversion channels, creating a wetland/riparian complex, constructing one or multiple dry dams, and nonstructural options.

These measures were then combined into 13 alternatives. This initial array of alternatives was compared, rated, and screened against the decision criteria that was developed based on federal and study objectives. The decision criteria included constructability and cost, lowering flood risk, induced damages, avoiding adverse environmental and cultural resource impacts, provides benefits to disadvantaged communities, and the ability to acquire land. Based on these decision criteria, 10 alternatives were carried forward for further analysis and comparison.

Preliminary costs and economic benefits were developed for these 10 alternatives and compared to each other. The team further screened this list to remove alternatives 4 more alternatives, due to much high costs and lower economic benefits when compared to the other alternatives. The remaining 6 alternatives were carried into the final array, in addition to the No Action Alternative.

Alternative	Measure	Description
1	A	No Action
2	D, E	Channel Widening + Levee Right/Left Banks
3	D, F	Channel Widening + Levee Left Bank
4	D, G	Channel Widening + Levee Right/Left Banks w/ Closure Structures
5	B, D	Forecasted Weir Operations + Channel Widening
6	B, E	Forecasted Weir Operations + Levee Right/Left Banks
7	C, F	Forecasted Weir Operations + Levee Left Bank
8	C, D, F	Forecasted Weir Operations + Channel Widening + Levee Left Bank
9	C, D, E	Forecasted Weir Operations + Channel Widening + Levee Right/Left Banks
10	C, D, G	Forecasted Weir Operations + Channel Widening + Levee Right/Left Banks w/ Closure Structures
11	C, G	Forecasted Weir Operations + Levee Right/Left Banks w/ Closure Structures
12	N	Nonstructural
13	C	Forecasted Weir Operations

Alternative	Description
1	No Action
3	Channel Widening + Levee Left Bank
6	Forecasted Weir Operations + Levee Right/Left Banks
7	Forecasted Weir Operations + Levee Left Bank
8	Forecasted Weir Operations + Channel Widening + Levee Left Bank
9	Forecasted Weir Operations + Channel Widening + Levee Right/Left Banks
10	Forecasted Weir Operations + Channel Widening + Levee Right/Left Banks w/ Closure Structures
11a	Forecasted Weir Operations + Levee Right/Left Banks w/ All 4ft Closure Structures
11b	Forecasted Weir Operations + Levee Right/Left Banks w/ One 3ft Closure Structures
11c	Forecasted Weir Operations + Levee Right/Left Banks w/ Two 3-4ft Closure Structures
12	Nonstructural

Alternative
1
3
7
8
11b
11c
12

Figure 2. Alternative formulation and final array of alternatives carried forward

2.1 Alternative 1- No Action Alternative

The No Action Alternative is if no flood risk measures were to take place and is considered as a baseline for comparison of other alternatives and fulfills a requirement of NEPA. The USACE planning process also refers to this as the Future Without Project (FWOP) condition. If an action does not occur, the Big Sioux River will continue to flood within the vicinity of Watertown and the risks and damages would remain the same or increase. The City would continue to expend resources flood fighting and re-building damaged infrastructure after each flood event. Flooding will continue to act as a barrier for access to critical facilities such as the hospital during flood events.

2.2 Alternative 3- Channel Widening + Levee Left Bank (no closures)

Alternative 3 would include channel widening and a left bank levee. The left bank levee, approximately 4,435 ft long (0.84 mile) would start near West Kemp Ave. and extend south where it would tie off just north of US-212. The levee alignment will generally follow the existing flood fight measures in place in order to minimize disturbance. On average, the embankment would be 2-4 ft tall with a twelve-foot-wide gravel surfaced crest and 1:3 side slopes. The left bank levee would require a cut of approximately 9,800 cy to remove the existing discontinuous embankments and then would be mixed with approximately 4,000 cy of clean clay loam from a borrow source to generate the 13,800 cy fill for construction. Clearing and grubbing existing vegetation would occur within the levee footprint, additionally woody vegetation would be removed 15 feet on either side of the levee toe. The area encompassed by the levee footprint and the additional 15 feet on either side would perpetually inhibit the growth and establishment of woody vegetation in accordance with ER-1110-2-1913. Nature and natural based features (NNBF) that would be incorporated as part of levee construction would include native herbaceous plantings within the levee footprint and 15 feet of either side and establishment of emergent wetland vegetation along 70.2 acres of the newly widened channel right of way (ROW).

A flood wall segment would be built to align with center of the levee alignment to avoid the Watertown Iron and Metal facility which is documented as a recognized environmental condition (REC) under the phase I HTRW assessment (USACE, 2023). The flood wall will be 1,287 ft in length, 2 ft in height, and 1 ft wide. The wall will be cast in place reinforced concrete T shape wall and will be designed to resist the hydrostatic and dynamic flood pressure. The foundation of the wall will extend 4.5 ft below grade for protection from frost heave. Waterstops will be provided between wall segments. Additionally, all six storm sewer crossings on the left bank are planned to be replaced with a 36-inch pipe and a gatewell.

The channel widening component consist of widening the Big Sioux River starting just north of 14th Ave. and continuing south past US-212, where it crosses both 5th St. and 20th Ave and ends approximately 1,600 ft south of the 20th Ave. bridge. The channel would be widened approximately 50 feet to the east and west and would start approximately 3-3.5 ft above the invert of the existing channel. The existing channel bed would be retained to approximately 50-ft wide and 3-ft deep low flow channel which would allow for better fish passage and assist with limiting sedimentation. The total length of the BSR that would be widened is approximately 24,366 ft (4.6 miles) and require the excavation of approximately 296,100 cy of material. It is anticipated the excavated material will be disposed at a disposal site owned by City of Watertown. Additionally, all six storm sewer outfalls on the left bank are planned to be replaced with 36-inch pipes.

2.2.1 Mitigation of Alternative 3

Mitigation of Alternative 3 would require the replacement of 1.32 Average Annual Habitat Units (AAHUs), as described in Appendix G2. The potential compensatory mitigation site on Mud Creek, upstream of the City of Watertown, would therefore necessitate 17 acres of construction of wetland/riparian habitat. See Appendix G1 for a full discussion on the quantitative assessment utilized to determine impacts to habitat function from Alternative 3 and Appendix G2 for additional discussion on mitigation planning.

2.3 Alternative 7 – Weir Operations + Levee Left Bank (No Closures)

Alternative 7 (Figure 3) includes a combination of forecasted weir operations and constructing an earthen levee with a floodwall along the left bank. This alternative would examine altering the existing operations of the Big Sioux River channel weir north of Watertown to gain approximately 3,300 acre-feet of additional flood storage. The measure includes removing one stop log from the weir which lowers the inlet elevation and inadvertently lowering the water surface elevation of Lake Kampeska to elevation 1718 feet NAVD88. Full pool for Lake Kampeska is 1718.8 feet NAVD88, so this measure could lower the lake by 0.8 feet depending on current lake levels and predicted snowmelt or rainfalll. Removing the stop log from the weir in the fall between September and October would allow storage to be available for spring runoff. To draw the pool down 0.8 feet is estimated to take approximately 80 days with a discharge of 22 cfs. This would lessen downstream impacts by avoiding higher winter releases. It would also assist with diverting the initial flush from flood events to go downstream with the stop log removed instead of directly into Lake Kampeska. The full pool elevation would return to 1718.8 feet NAVD88 during the late spring, and summer lake levels would be expected to be similar to current conditions. This alternative would utilize the existing low-flow gates to lower Lake Kampeska.

A levee with a floodwall would be constructed on the left bank, as described in Alternative 3 above.

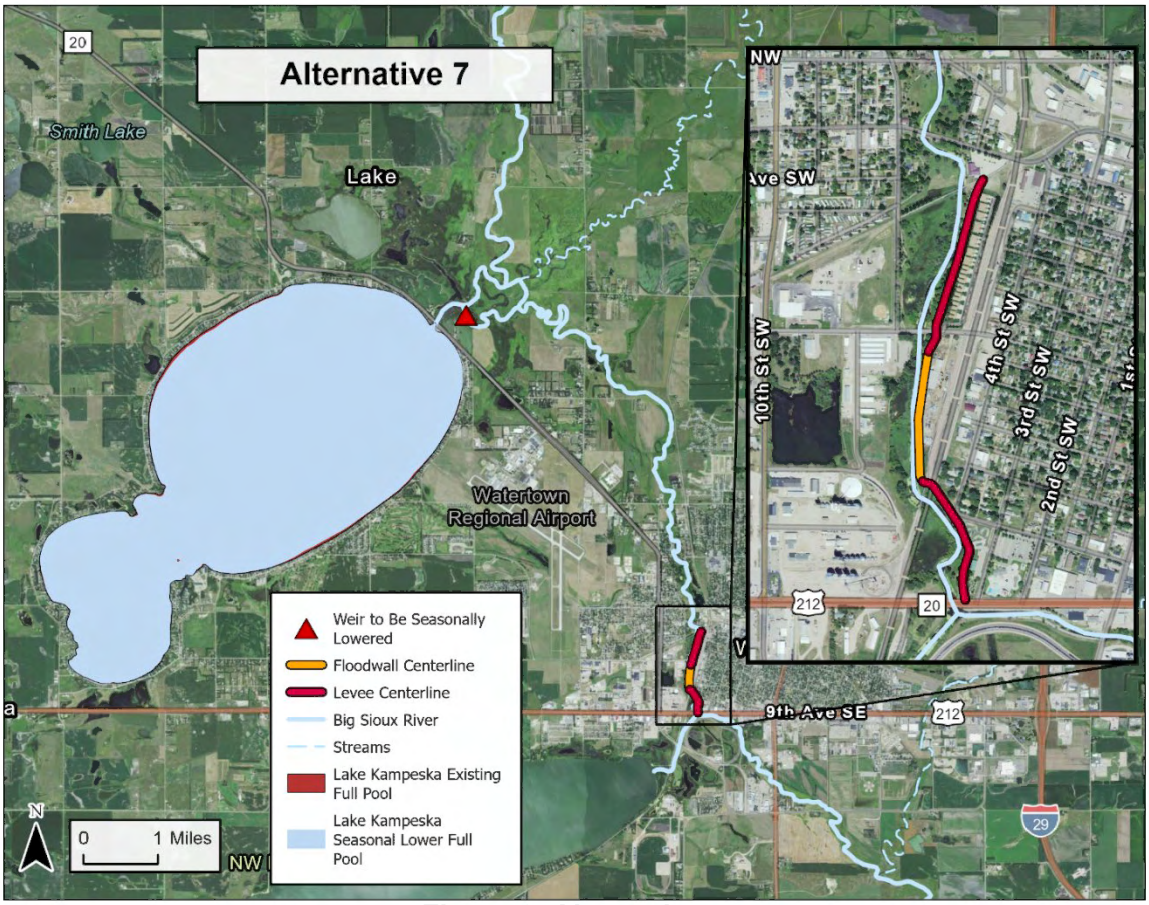


Figure 3. Alternative 7

2.3.1 Mitigation of Alternative 7

Mitigation of Alternative 7 would require the replacement of 2.16 AAHUs, as described in Appendix G2. The potential mitigation site on Mud Creek, upstream of the City of Watertown, would therefore necessitate 27.5 acres of construction of wetland/riparian habitat. See Appendix G1 for a full discussion on the quantitative assessment utilized to determine impacts to habitat function from Alternative 7 and Appendix G2 for additional discussion on mitigation planning.

2.4 Alternative 8 – Weir Operations + Channel Widening + Levee Left Bank (no closures)

Alternative 8 would be similar to Alternative 7 as it would include forecasted weir operations, and construction of a left-bank levee with an integrated floodwall, but would also include the addition of channel widening as described in Alternative 3 above.

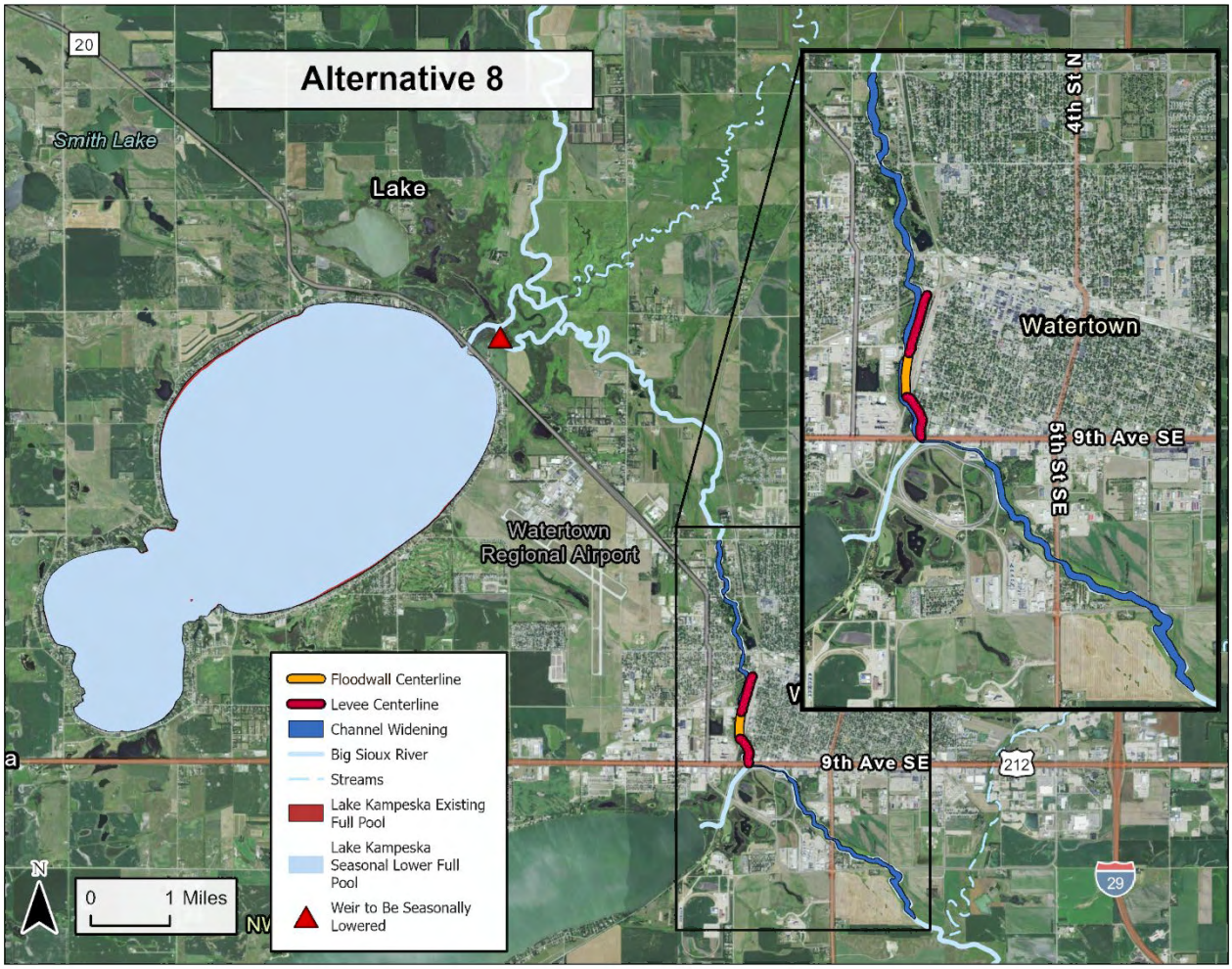


Figure 4: Alternative 8

2.4.1 Mitigation of Alternative 8

Mitigation of Alternative 8 would require the replacement of 1.43 AAHUs, as described in Appendix G2. The potential mitigation site on Mud Creek, upstream of the City of Watertown, would therefore necessitate 18 acres of construction of wetland/riparian habitat. See Appendix

G1 for a full discussion on the quantitative assessment utilized to determine impacts to habitat function from Alternative 8 and Appendix G2 for additional discussion on mitigation planning.

2.5 Alternative 11B – Weir Operations + Levee Right/Left Bank (one 3ft closure structure)

Alternative 11B is an optimized version of constructing earthen levees along both the left and right banks of the Big Sioux River combined with seasonally lowering Lake Kampeska to an elevation of 1718. The left bank levee and floodwall would be constructed the same as described above for alternatives 7 and 8. The right bank levee, approximately 14,208 ft (2.7 miles) long would start just north of 14th Ave. and extend south until tying off before the BNSF railroad crossing. On average, the embankment would be 5-7 ft tall with a twelve-foot-wide gravel surfaced crest and 1:3 side slopes. A right bank levee would require a cut of approximately 46,000 cy to remove the existing discontinuous embankments and require approximately 96,700 cy of fill for construction.

A T-shaped flood wall would be constructed around a mobile housing community. The flood wall will be 300 ft in length, 5.25 ft in height, and 1 ft wide. The wall will be cast in place reinforced concrete T shape wall and will be designed to resist the hydrostatic and dynamic flood pressure. The foundation of the wall will extend 4.5 ft below grade for protection from frost heave. Waterstops will be provided between wall segments. Additionally, all six storm sewer crossings on the left bank and 17 crossings on the right bank are planned to be replaced with a 36 inch pipe and a gatewell until more information on existing structures is gathered and the proposed plan can be optimized.

Due to the height of the levee, one permanent post and panel closure structure would be installed at 3rd Avenue. This closure structure would be 3 ft tall by 45 ft wide by 63 ft long. The remaining roadway crossings would utilize hesco barriers set to a height of 3 ft or shorter.

Forecasted weir operations, as described in Alternative 7 above, would also be included.

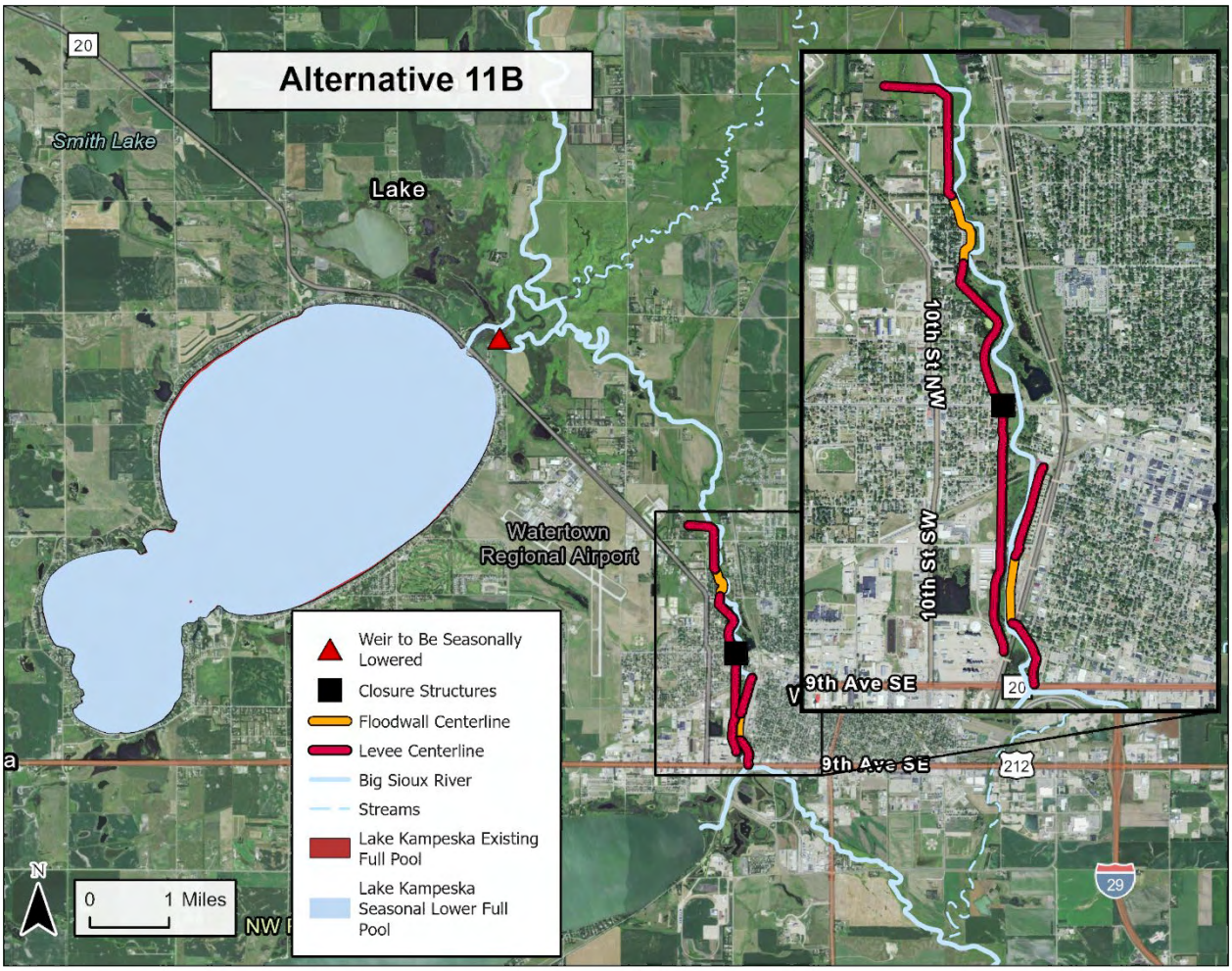


Figure 5: Alternative 11B

2.5.1 Mitigation of Alternative 11B

Mitigation of Alternative 11B would require the replacement of 3.97 AAHUs, as described in Appendix G2. The potential mitigation site on Mud Creek, upstream of the City of Watertown, would therefore necessitate 50 acres of construction of wetland/riparian habitat. See Appendix G1 for a full discussion on the quantitative assessment utilized to determine impacts to habitat function from Alternative 11B and Appendix G2 for additional discussion on mitigation planning.

2.6 Alternative 11C – Weir Operations + Levee Right/Left Bank (two 3-4ft closure structure)

Alternative 11C is very similar to 11B except the levees would be constructed one foot higher and would require closure structures at West Kemp Ave. and 3rd Ave. along the right bank levee alignment. This right bank levee configuration would require a cut of approximately 46,000 cy to remove the existing discontinuous embankments and require approximately 116,700 cy of fill for construction.

Forecasted weir operations, as described in Alternative 7 above, would also be included.

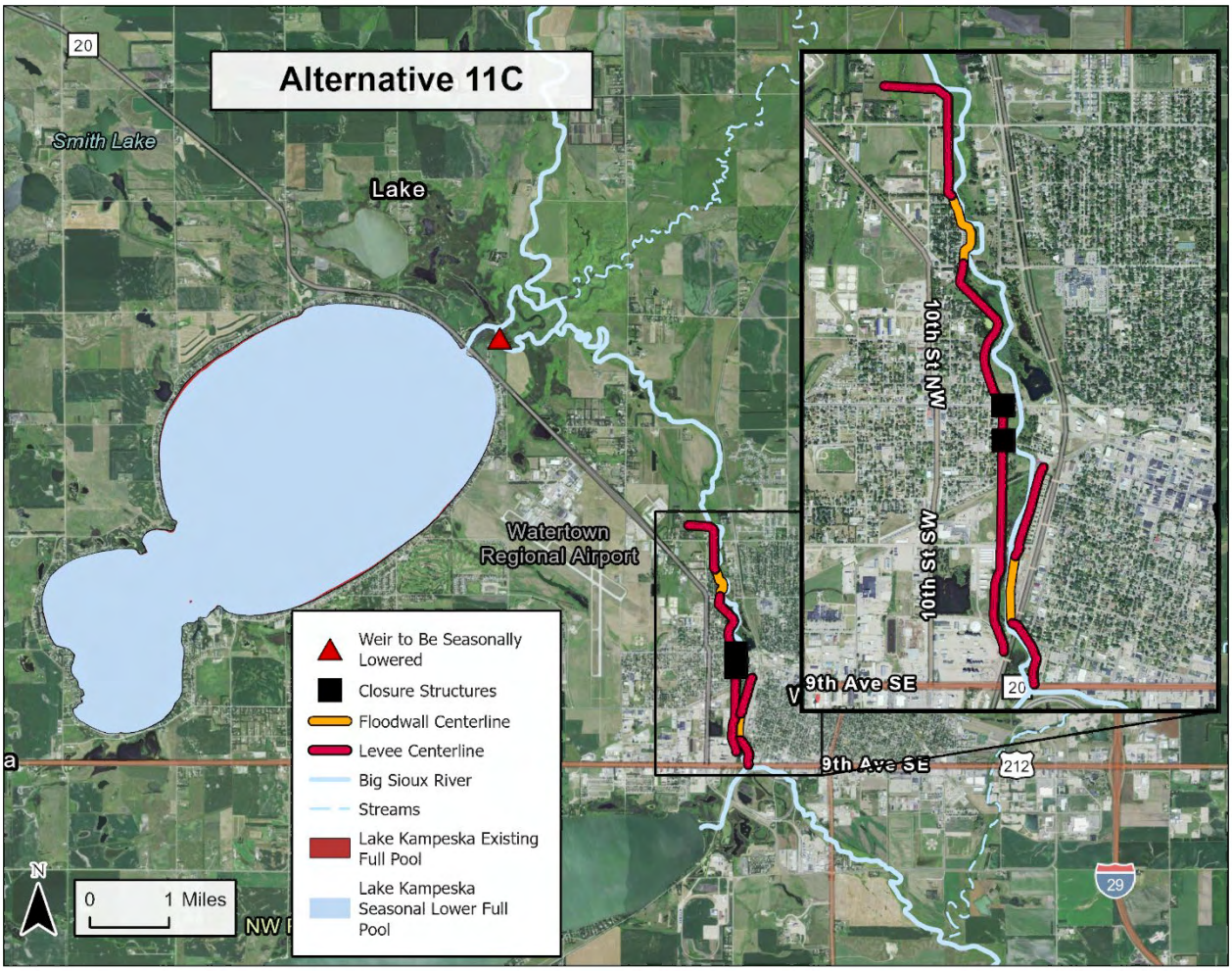


Figure 6: Alternative 11C

2.6.1 Mitigation of Alternative 11C

Mitigation of Alternative 11C would require the replacement of 4.23 AAHUs, as described in Appendix G2. The potential mitigation site on Mud Creek, upstream of the City of Watertown, would therefore necessitate 53.5 acres of construction of wetland/riparian habitat. See Appendix G1 for a full discussion on the quantitative assessment utilized to determine impacts to habitat function from Alternative 11C and Appendix G2 for additional discussion on mitigation planning.

2.7 Alternative 12 - Nonstructural

Alternative 12 is an optimized nonstructural standalone alternative which analyzed elevation, dry floodproofing, wet floodproofing, and buyouts/relocations throughout the study area. The damage reaches were constructed so that each reflected a logical aggregation of structures based on flooding source and political boundaries with the different flood plains being used to find the optimized aggregation within the reach based on flooding characteristics. Critical infrastructure facilities were considered, but none ended up in the final array.

Due to the results of the standalone alternative, no other alternatives have nonstructural measures currently included. However, nonstructural measures will be considered during optimization to potentially address residual damages and/or disadvantaged communities.

3 Section 404(b)(1) Evaluation

This evaluation is based on the regulations found at 40 CFR 230, Section 404(b)(1): Guidelines for Specifical of Disposal Sites for Dredged and Fill Material. The Economic and Environmental Principals and Guidelines for Water and Related Land Resources Implementation Studies (P&Gs) (U.S. Water Resources Council 1983) establish the standards and procedures that USACE and other Federal agencies use for planning and evaluating the merits of a water project. The FR/EA identifies alternatives, compares effects of alternatives, and selects the best alternative plans for flood risk management in the project area based on Engineering Regulation (ER) 1105-2-103 and ER 200-2-2.

USACE must evaluate alternatives that are practicable and reasonable. In accordance with the Guidelines at 40 CFR 230.10(a), a 404 permit cannot be issued if a practicable alternative exists that would have less adverse impact on the aquatic ecosystem (known as the Least Environmentally Damaging Practicable Alternative [LEDPA]), provided that the LEDPA does not have other significant adverse environmental consequences to other natural ecosystem components. See Section 5 for discussion on how the LEDPA is determined for Civil Works projects authorized under 33 USC 2231.

Appendix G5a provides a detailed description of the methodology used and results of a desktop delineation. Table 3 of Section 4.4 in this 404(b)1 depicts the direct fill, isolation, conversion, and temporary disturbance of wetland habitat by type for each alternative.

3.1 Alternative 3 – Channel Widening + Levee Left Bank (no closures)

To accomplish the activities listed in Section 2.2:

- Approximately 9,800 cy of material from the existing discontinuous embankment would be excavated, mixed with the material excavated from the mitigation site, and shaped and graded to construct the levee alignment.
- Approximately 4,000 cy of borrow material would be excavated from the wetland/habitat mitigation site at Mud Creek and used to construct the proposed earthen left bank levee.
- Approximately 296,100 cy of material would be excavated from the Big Sioux River, hauled offsite, and disposed of at an upland location.
- The six existing storm sewer outfalls would be removed and replaced with six 36-inch pipes and gatewells.
- A reinforced concrete floodwall segment would be placed to align with the center of the levee alignment. The flood wall will be 1,287 ft in length, 2 ft in height, and 1 ft wide. The foundation of the wall will extend 4.5 ft below grade for protection from frost heave.
- All proposed construction associated with Alternative 3 would occur above the OHWM.
- Seeding of the levee and all disturbed areas using native seed mixes.
- Wetland/riparian vegetation will be established/re-established within the widened channel area.

3.1.1 General Description of Dredged or Fill Material

Discharge associated with the construction of the left bank levee would include clean, clay loam borrow material excavated from the site designated for wetland/habitat mitigation on Mud Creek mixed with material obtained from degrading the existing embankment along the left bank within the project footprint. The existing embankment is made of 2-5 feet of lean clay below natural ground surface and 6-15 feet of poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay); this material will be suitable to utilize for the new embankment.

Discharge associated with the construction of the floodwall would include reinforced concrete. Additional discharge will include replacing the six existing storm sewer outfalls on the left bank with six 36-inch pipes and a gatewell. There will be no discharge of dredged or fill material associated with seasonally lowering Lake Kampeska.

3.1.2 Description of the Proposed Discharge Site

The proposed discharge site of the borrow material would be along the left bank of the Big Sioux River. Some portions along the left bank consist of an existing embankment. For the segments of the proposed left bank levee that will be constructed within the footprint of an existing embankment, material from the existing embankment will be utilized to construct the new embankment. For the segments of the proposed left bank levee that will be constructed outside of the footprint of an existing embankment, borrow material will be discharged in mostly upland areas that are routinely manicured. Reinforced concrete for the floodwall will be discharged along the existing embankment that currently abuts the Watertown Iron and Metal Facility. The six new storm sewer pipes will be replaced within the proposed left bank levee.

3.1.3 Factual Determinations

3.1.3.1 Physical Substrate Determinations

3.1.3.1.1 *Substrate Elevation and Slope*

Placement of 4,000 cubic yards of borrow material and 9,800 cubic yards of material form the existing embankment will be used to construct the proposed earthen left bank levee. The levee alignment will generally follow the existing flood fight measures in place in order to minimize disturbance. On average, the proposed fill to make up the embankment would be 2-4 ft tall with a twelve-foot-wide gravel surfaced crest and 1:3 side slopes. The reinforced concrete flood wall will be 1,287 ft in length, 2ft in height, and 1 ft wide. The wall will extend 4.5 ft below grade. Placement of the proposed embankment and floodwall would directly fill 0.02 acre of PEM wetlands and 0.10 acre of PSS wetlands. Approximately 0.84 acres of unconsolidated bottom (PUB), 3.24 acres of scrub-shrub (PSS), 0.34 acres of forested bottomlands (PFO), and 24.7 acres of upland habitat types within the floodplain would be excavated to accommodate the newly widened channel cross section. It is anticipated the widened benches of this channel would convey spring flows between March and May, prior to the primary growing season in South Dakota, and as such these benches would be permanently converted to 29.1 acres of PEM wetlands. Another 41.12 acres of existing PEM wetlands temporarily disturbed from construction of channel widening would be restored back to PEM upon completion of construction.

USACE has incorporated measures into the design to adequately minimize adverse effects to the substrate elevation and slope.

3.1.3.1.2 *Sediment Type*

The sediment types of the existing embankment consist of lean clay, poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay). The borrow material sediment types consist of clay loam material.

3.1.3.1.3 *Dredged/Fill Material Movement*

Up to 4,000 cubic yards of borrow material, 9,800 cubic yards of material from the existing embankments, 1,287 square feet of reinforced concrete, and materials for additional structures required for the levee (six storm sewer pipes, gatewell, waterstops, etc.) would be placed along

the left bank of the Big Sioux River. The new embankment would then be graded and seeded with a native upland seed mix to stabilize the fill material. Erosion control best management practices (BMPs), such as silt fencing and erosion control blankets would be utilized during construction. Utilizing erosion control to prevent sediment from entering existing wetlands and preventing deleterious material from entering the Big Sioux River are examples of BMPs that would be used to reduce the amount of potential pollutants that reach the water resources adjacent to or downstream of the proposed project area.

3.1.3.1.4 *Physical Effects on Benthos*

Physical effects on benthos would consist of the direct placement of 0.12 acre of fill into wetland habitat. No permanent discharge in the channel below OHWM is anticipated. Placement of these materials into wetlands would bury immobile biota and displace those that are mobile. Direct impacts to benthos from the direct placement of fill are expected to be minor due to the minimal amount of area to be filled. Indirect impacts to wetlands expected to be isolated would be short-term and minor. All placement of fill associated with construction of the left bank levee and disposal of excavated material will occur above the OHWM; however, it is reasonable to assume that a temporary increase in turbidity within the Big Sioux River and directly abutting wetlands near the construction zone could result in minor, temporary disturbances to benthos in the Big Sioux River and abutting wetlands.

3.1.3.2 Water Circulation, Fluctuation, and Salinity Determinations

3.1.3.2.1 *Salinity*

Not Applicable.

3.1.3.2.2 *Water Chemistry*

Minor, temporary, and localized effects to water chemistry (see below) would primarily include an increase in turbidity due to construction activities. Silt curtains would be used to surround the area where fill is being placed to contain turbidity to the area inside the curtains. Other common water quality BMPs would be utilized as appropriate.

3.1.3.2.3 *Clarity*

A temporary increase in turbidity may occur within the immediate area surrounding the construction area. As described in paragraph 3.2.3.1.4 above, these effects would be minor, temporary, and localized.

3.1.3.2.4 *Color*

A minor, temporary change in color is possible due to the potential increased turbidity during construction. As discussed directly above, these effects would be minor, temporary, and localized.

3.1.3.2.5 *Odor*

No impacts are anticipated.

3.1.3.2.6 *Taste*

Not applicable.

3.1.3.2.7 *Dissolved Gas Levels*

No changes to dissolved gas levels are anticipated.

3.1.3.2.8 *Nutrients*
The placement of fill material would result in the loss of 0.12 acre of wetlands. A decrease in wetlands would result in decreasing opportunities for filtering excess nutrients before flows enter the Big Sioux River. However, this decrease would be minor due to the minimal area of wetlands proposed to be directly impacted. However, it is anticipated the widened benches of this channel would convey spring flows between March and May, prior to the primary growing season in South Dakota, and as such these benches, currently a mix of uplands and wetlands, would be permanently converted to 29.1 acres of PEM wetlands. Another 41.12 acres of existing PEM wetlands temporarily disturbed from construction of channel widening would be restored back to PEM upon completion of construction so no net loss to wetland habitat would occur under this alternative.

All fill material for the levee embankment will be placed and stabilized with native upland vegetation to keep the material in place, so it would not actively mix with water in the Big Sioux River or any components (hydric soils, hydrophytic vegetation, hydrology) within wetlands abutting the levee or floodplain wall.

3.1.3.2.9 *Current Patterns and Circulation*
The Big Sioux River would continue to function as a flowing stream during normal flows. However, during higher runoff events due to precipitation or snowmelt, the water along the areas of the channel with the constructed levee and/or floodwall would not overtop the bank and flood as often as it currently does in some locations. The restriction of bank overtopping could increase velocities during high flow events.

3.1.3.2.10 *Normal Water Level Fluctuations*
Normal water fluctuations would not change as a result of the placement of fill for the left bank levee.

3.1.3.2.11 *Salinity Gradients*
Not Applicable.

3.1.3.2.12 *Actions to Minimize Impacts*
USACE would take steps to minimize impacts that include implementation of project appropriate construction BMPs. Several measures would be implemented during construction to minimize water quality impacts that would include both structural and non-structural BMPs. Structural BMPs may include: perimeter controls such as straw bales, silt fencing and/or earthen berms around petroleum products and stock-piles materials. Nonstructural BMPs would include: keeping heavy construction equipment out of the waterway whenever possible, protecting construction materials from precipitation/flooding, and stabilizing bare soil by re-vegetating exposed soil.

3.1.3.3 Suspended Particulate/Turbidity Determination

3.1.3.3.1 *Change at Placement Site*
Minor, temporary, and localized increases in turbidity may occur as a result of construction activities. Appropriate construction BMPs, descripted in 3.1.3.2.12 would be implemented. Once construction has been completed and necessary stabilization measures have been implemented such as seeding the embankments with native upland vegetation, localized reductions in turbidity would be expected.

3.1.3.3.2 *Effects on Chemical and Physical Properties of the Water Column*

Fill material proposed to be placed in wetlands would not violate any water quality standards criteria for South Dakota, Chapter 74:51:01 of the Administrative Rules for South Dakota. No significant adverse impacts to the chemical and physical properties of the water column are expected.

3.1.3.3.3 *Effects on Biota*

Suspended particulates and turbidity may increase slightly within wetlands and the Big Sioux River during construction activities; however, these effects would be minor, temporary, and localized. Appropriate construction BMPs, described in 3.1.3.2.12 would be implemented to ensure that any increased turbidity level during construction would be confined to the immediate construction area.

3.1.4 Contaminant Determination

Only non-contaminated fill material would be placed into wetlands. The borrow site would be clean soil excavated along Mud Creek within the watershed. There is no evidence of any contamination in the borrow site. Additionally, there is no evidence of contamination within the reinforced concrete proposed for the floodwall and any of the structures proposed to be placed within the levee for its utility within the city (storm sewer pipes, gatewell, waterstops, etc.).

3.1.5 Aquatic Ecosystem and Organisms Determination

Majority of the proposed construction site along the left bank of the Big Sioux River is along an already existing embankment throughout the City of Watertown. While these embankments are not classified, operated, or maintained as levees, they do cause isolation of the ecological floodplain. Construction of the left bank levee using the existing embankment alignment will minimize overall impacts to the aquatic ecosystem and organisms. The majority of impacts would be indirect, minor, and/or localized. Permanent impacts to wetlands and organisms in the footprint would be minimal as there would be a loss of 0.12 acres of wetlands through direct fill activities, but the widened channel floodplain benches would be permanently converted to 29.1 acres of PEM wetlands. Another 41.12 acres of existing PEM wetlands temporarily disturbed from construction of channel widening would be restored back to PEM upon completion of construction.

3.1.6 Proposed Disposal Site Determination

The discharge site would include the existing channel of the Big Sioux River (to be developed into a low flow channel), the left bank of the Big Sioux River along the existing embankment alignment, adjacent wetlands, and the upland areas slightly outside of the alignment to the north and south. The discharge of fill will be directly placed in 0.12 acre of wetlands. The excavated material from channel floodplain bench widening will be disposed at an upland location owned by the City of Watertown.

3.1.7 Determination of Cumulative Effects on the Aquatic Ecosystem

No significant negative cumulative effects would be anticipated as a result of Alternative 3. Alternative 3 would have beneficial impacts on aquatic habitat from the incidental conversion of 24.7 acres of upland herbaceous habitat into PEM. Other wetland types would be temporarily impacted or converted, resulting in a total of up to 70.2 acres of PEM wetlands constructed or restored.

3.1.8 Determination of Secondary Effects on the Aquatic Ecosystem

The proposed project woould not result in significant secondary effects on the aquatic ecosystem.

The Corps has taken appropriate steps to avoid and minimize potential secondary effects or indirect effects by implementing BMPs during construction.

3.2 Alternative 7- Weir Operations +Levee Left Bank (No Closures)

To accomplish the activities listed in Section 2.3:

- Approximately 9,800 cy of material from the existing discontinuous embankment would be excavated, mixed with the material excavated from the mitigation site, and shaped and graded to construct the levee alignment.
- Approximately 4,000 cy of borrow material will be excavated from the mitigation site at Mud Creek and used to construct the proposed earthen left bank levee.
- The six existing storm sewer crossings will be removed and replaced with six 36-inch pipes and a gatewell.
- The reinforced concrete floodwall would be placed within the center of the levee alignment.
- All proposed construction associated with Alternative 7 would occur above the ordinary high-water mark (OHWM).
- Seeding of the levee and all disturbed areas using native seed mixes

3.2.1 General Description of Dredged or Fill Material

Discharge associated with the construction of the left bank levee would include clean, clay loam borrow material excavated from the site designated for mitigation on Mud Creek. The existing embankment is made of 2-5 feet of lean clay below natural ground surface and 6-15 feet of poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay); this material will be suitable to utilize for the new embankment. Discharge associated with the construction of the floodwall would include reinforced concrete. Additional discharge will include replacing the six existing storm sewer crossings on the left bank with six 36-inch pipes and a gatewell. There will be no discharge of dredged or fill material associated with seasonally lowering Lake Kampeska.

3.2.2 Description of the Proposed Discharge Site

The proposed discharge site of the borrow material would be along the left bank of the Big Sioux River. Some portions along the left bank consist of an existing embankment. For the segments of the proposed left bank levee that will be constructed within the footprint of an existing embankment, material from the existing embankment will be utilized to construct the new embankment. For the segments of the proposed left bank levee that will be constructed outside of the footprint of an existing embankment, borrow material will be discharged in mostly upland areas that are routinely manicured. Reinforced concrete for the floodwall will be discharged along the existing embankment that currently abuts the Watertown Iron and Metal Facility. The six new storm sewer pipes will be replaced within the proposed left bank levee.

3.2.3 Factual Determinations

3.2.3.1 Physical Substrate Determinations

3.2.3.1.1 *Substrate Elevation and Slope*

Placement of 4,000 cubic yards of borrow material and 9,800 cubic yards of material form the existing embankment will be used to construct the proposed earthen left bank levee. The levee alignment will generally follow the existing flood fight measures in place in order to minimize disturbance. On average, the proposed fill to make up the embankment would be 2-4 ft tall with a twelve-food-wide gravel surfaced crest and 1:3 side slopes. The reinforced concrete flood wall will be 1,287 ft in length, 2ft in height, and 1 ft wide. The wall will extend 4.5 ft below grade. Placement of the proposed embankment would directly fill 0.02 acre of PEM wetlands and 0.10 acre of PSS wetlands.

3.2.3.1.2 *Sediment Type*

The sediment types of the existing embankment consist of lean clay, poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay). The borrow material sediment types consist of clay loam material.

3.2.3.1.3 *Dredged/Fill Material Movement*

Up to 4,000 cubic yards of borrow material, 9,800 cubic yards of material from the existing embankments, 1,287 square feet of reinforced concrete, and materials for additional structures required for the levee (six storm sewer pipes, gatewell, waterstops, etc.) would be placed along the left bank of the Big Sioux River. The new embankment would then be graded and seeded with a native upland seed mix to stabilize the fill material. Erosion control best management practices (BMPs), such as silt fencing and erosion control blankets would be utilized during construction. Utilizing erosion control to prevent sediment from entering existing wetlands and preventing deleterious material from entering the Big Sioux River are examples of BMPs that would be used to reduce the amount of potential pollutants that reach the water resources adjacent to or downstream of the proposed project area.

3.2.3.1.4 *Physical Effects on Benthos*

Physical effects on benthos would consist of the direct placement of 0.02 acre of fill into PEM wetlands and 0.10 acre of PSS wetlands. Placement of these materials into wetlands would bury immobile biota and displace those that are mobile in wetlands. Direct impacts to benthos from the direct placement of fill into 0.12 acre of wetland habitat are expected to be minor due to the minimal amount of area to be impacted. Indirect impacts to wetlands expected to be isolated would be minor. All placement of fill will occur above the OHWM; however, it is reasonable to assume that a temporary increase in turbidity within the Big Sioux River and directly abutting wetlands near the construction zone could result in minor, temporary disturbances to benthos in the Big Sioux River and abutting wetlands.

3.2.3.2 Water Circulation, Fluctuation, and Salinity Determinations

3.2.3.2.1 *Salinity*

Not Applicable

3.2.3.2.2 *Water Chemistry*

Minor, temporary, and localized effects to water chemistry (see below) would primarily include an increase in turbidity due to construction activities. If the river is actively flowing during construction, floating silt curtains would be used to surround the area where fill is being placed

to contain turbidity to the area inside the curtains. Other common water quality BMPs would be utilized as appropriate.

3.2.3.2.3 *Clarity*
A temporary increase in turbidity may occur within the immediate area surrounding the construction area. As described in paragraph 3.2.3.1.4 above, these effects would be minor, temporary, and localized.

3.2.3.2.4 *Color*
A minor, temporary change in color is possible due to the potential increased turbidity during construction. As discussed directly above, these effects would be minor, temporary, and localized.

3.2.3.2.5 *Odor*
No impacts are anticipated.

3.2.3.2.6 *Taste*
Not applicable.

3.2.3.2.7 *Dissolved Gas Levels*
No changes to dissolved gas levels are anticipated.

3.2.3.2.8 *Nutrients*
The placement of fill material would result in the loss of 0.12 acre of wetland habitat. A decrease in wetlands would result in decreasing opportunities for filtering excess nutrients before flows enter the Big Sioux River. However, this decrease would be minor due to the minimal area of wetlands proposed to be directly impacted.

All fill material for the levee embankment will be placed and stabilized with native upland vegetation to keep the material in place, so it would not actively mix with water in the Big Sioux River or any components (hydric soils, hydrophytic vegetation, hydrology) within wetlands abutting the levee or floodplain wall.

3.2.3.2.9 *Current Patterns and Circulation*
The Big Sioux River would continue to function as a flowing stream during normal flows. However, during higher runoff events due to precipitation or snowmelt, the water along the areas of the channel with the constructed levee and/or floodwall would not overtop the bank and flood as often as it currently does in some locations. The restriction of bank overtopping could increase velocities during high flow events.

3.2.3.2.10 *Normal Water Level Fluctuations*
Normal water fluctuations would not change as a result of this alternative.

3.2.3.2.11 *Salinity Gradients*
Not Applicable.

3.2.3.2.12 *Actions to Minimize Impacts*
The Corps would take steps to minimize impacts that include implementation of project appropriate construction BMPs. Several measures would be implemented during construction to minimize water quality impacts that would include both structural and non-structural BMPs. Structural BMPs may include: perimeter controls such as straw bales, silt fencing and/or earthen berms around petroleum products and stock-piles materials. Non-structural BMPs would

include: keeping heavy construction equipment out of the waterway whenever possible, protecting construction materials from precipitation/flooding, and stabilizing bare soil by re-vegetating exposed soil.

3.2.3.3 Suspended Particulate/Turbidity Determination

3.2.3.3.1 *Change at Placement Site*

Minor, temporary, and localized increases in turbidity may occur as a result of construction activities. Appropriate construction BMPs, descripted in 3.2.3.2.12 would be implemented. Once construction has been completed and necessary stabilization measures have been implemented such as seeding the embankments with native upland vegetation, localized reductions in turbidity would be expected.

3.2.3.3.2 *Effects on Chemical and Physical Properties of the Water Column*

There is no evidence of any contamination in the borrow material, material in the existing embankment, and reinforced concrete. The clean borrow material, existing embankment material, and reinforced concrete placed in wetlands would not violate any water quality standards criteria for South Dakota, Chapter 74:51:01 of the Administrative Rules for South Dakota. No significant adverse impacts to the chemical and physical properties of the water column are expected.

3.2.3.3.3 *Effects on Biota*

Suspended particulates and turbidity may increase slightly within wetlands and the Big Sioux River during construction activities; however, these effects would be minor, temporary, and localized. Appropriate construction BMPs, descripted in 9.3.2.5 would be implemented to ensure that any increased turbidity level during construction would be confined to the immediate construction area.

3.2.4 Contaminant Determination

Only non-contaminated fill material would be placed into wetlands. The borrow site would be clean soil excavated along Mud Creek within the watershed. There is no evidence of any contamination in the borrow site or in the material, making up the existing embankments. Additionally, there is no evidence of contamination within the reinforced concrete proposed for the floodwall and any of the structures proposed to be placed within the levee for its utility within the city (storm sewer pipes, gatewell, waterstops, etc.).

3.2.5 Aquatic Ecosystem and Organisms Determination

Majority of the proposed construction site along the left bank of the Big Sioux River is along an already existing embankment throughout the City of Watertown. While these embankments are not classified, operated, or maintained as levees, they do cause isolation of the ecological floodplain. Construction of the left bank levee using the existing embankment alignment will minimize overall impacts to the aquatic ecosystem and organisms. The majority of impacts would be indirect, minor, and/or localized. Permanent impacts to wetlands and organisms in the footprint would be minimal as there will be a loss of only 0.12 acre of wetland habitat.

3.2.6 Proposed Disposal Site Determination

The discharge site would include the left bank of the Big Sioux River along the existing embankment alignment and adjacent wetlands and slightly outside of the alignment to the north and south in upland areas. The discharge of fill will be directly placed in 0.12 acre of wetland habitat along the project footprint for Alternative 7.

3.2.7 Determination of Cumulative Effects on the Aquatic Ecosystem

No significant negative cumulative effects would be anticipated as a result of Alternative 7.

3.2.8 Determination of Secondary Effects on the Aquatic Ecosystem

The proposed project should not result in significant secondary effects on the aquatic ecosystem.

The Corps has taken appropriate steps to avoid and minimize potential secondary effects or indirect effects by implementing BMPs during construction.

3.3 Alternative 8 – Weir Operations + Channel Widening + Levee Left Bank (no closures)

To accomplish the activities listed in Section 2.3:

- Approximately 9,800 cy of material from the existing discontinuous embankment would be excavated, mixed with the material excavated from the mitigation site, and shaped and graded to construct the levee alignment.
- Approximately 4,000 cy of borrow material would be excavated from the mitigation site at Mud Creek and used to construct the proposed earthen left bank levee.
- Approximately 296,100 cy of material would be excavated from the Big Sioux River, hauled offsite, and disposed of at an approved upland location
- The six existing storm sewer crossings would be removed and replaced with six 36-inch pipes and a gatewell.
- The reinforced concrete floodwall would be placed within the center of the levee alignment.
- All proposed construction associated with Alternative 8 would occur above the OHWM.
- Seeding of the levee and all disturbed areas using native seed mixes
- Seasonal lowering of Lake Kampeska

3.3.1 General Description of Dredged or Fill Material

Discharge associated with the construction of the left bank levee would include clean, clay loam borrow material excavated from the site designated for mitigation on Mud Creek mixed with material obtained from degrading the existing embankment along the left bank within the project footprint. The existing embankment is made of 2-5 feet of lean clay below natural ground surface and 6-15 feet of poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay); this material will be suitable to utilize for the new embankment. Discharge associated with the construction of the floodwall would include reinforced concrete. Additional discharge will include replacing the six existing storm sewer crossings on the left bank with six 36-inch pipes and a gatewell. There will be no discharge of dredged or fill material associated with seasonally lowering Lake Kampeska.

3.3.2 Description of the Proposed Discharge Site

The proposed discharge site of the borrow material would be along the left bank of the Big Sioux River. Some portions along the left bank consist of an existing embankment. For the segments of the proposed left bank levee that will be constructed within the footprint of an existing embankment, material from the existing embankment will be utilized to construct the new embankment. For the segments of the proposed left bank levee that will be constructed outside of the footprint of an existing embankment, borrow material will be discharged in mostly upland areas that are routinely manicured. Reinforced concrete for the floodwall will be

discharged along the existing embankment that currently abuts the Watertown Iron and Metal Facility. The six new storm sewer pipes will be replaced within the proposed left bank levee.

3.3.3 Factual Determinations

3.3.3.1 Physical Substrate Determinations

3.3.3.1.1 *Substrate Elevation and Slope*

Placement of 4,000 cubic yards of borrow material and 9,800 cubic yards of material form the existing embankment will be used to construct the proposed earthen left bank levee. The levee alignmenwill generally follow the existing flood fight measures in place in order to minimize disturbance. On average, the proposed fill to make up the embankment would be 2-4 ft tall with a twelve-food-wide gravel surfaced crest and 1:3 side slopes. The reinforced concrete flood wall will be 1,287 ft in length, 2ft in height, and 1 ft wide. The wall will extend 4.5 ft below grade. Placement of the proposed embankment would directly fill 0.02 acre of PEM wetlands and 0.10 acre of PSS wetlands. Approximately 0.84 acres of unconsolidated bottom (PUB), 3.24 acres of scrub-shrub (PSS), 0.34 acres of forested bottomlands (PFO), and 24.7 acres of upland habitat types within the floodplain would be excavated to accommodate the newly widened channel cross section. It is anticipated the widened benches of this channel would convey spring flows between March and May, prior to the primary growing season in South Dakota, and as such these side benches would be permanently converted to 29.1 acres of PEM wetlands. Another 41.12 acres of existing PEM wetlands temporarily disturbed from construction of channel widening would be restored back to PEM upon completion of construction.

The Corps has incorporated measures into the design to adequately minimize adverse effects to the substrate elevation and slope. This alternative is in compliance with 404(b)(1) guidelines.

3.3.3.1.2 *Sediment Type*

The sediment types of the existing embankment consist of lean clay, poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay). The borrow material sediment types consist of clay loam material.

3.3.3.1.3 *Dredged/Fill Material Movement*

Up to 4,000 cubic yards of borrow material, 9,800 cubic yards of material from the existing embankments, 1,287 square feet of reinforced concrete, and materials for additional structures required for the levee (six storm sewer pipes, gatewell, waterstops, etc.) would be placed along the left bank of the Big Sioux River. The new embankment would then be graded and seeded with a native upland seed mix to stabilize the fill material. Erosion control best management practices (BMPs), such as silt fencing and erosion control blankets would be utilized during construction. Utilizing erosion control to prevent sediment from entering existing wetlands and preventing deleterious material from entering the Big Sioux River are examples of BMPs that would be used to reduce the amount of potential pollutants that reach the water resources adjacent to or downstream of the proposed project area.

3.3.3.1.4 *Physical Effects on Benthos*

Physical effects on benthos would consist of the direct placement of 01.2 acre of fill into wetland habitat. Approximately 0.84 acres of unconsolidated bottom (PUB), 3.24 acres of scrub-shrub (PSS), 0.34 acres of forested bottomlands (PFO), and 24.7 acres of upland habitat types within the floodplain would be excavated to accommodate the newly widened channel cross section. It is anticipated the widened benches of this channel would convey spring flows between March

and May, prior to the primary growing season in South Dakota, and as such these side benches would be permanently converted to 29.1 acres of PEM wetlands. Another 41.12 acres of existing PEM wetlands temporarily disturbed from construction of channel widening would be restored back to PEM upon completion of construction. Placement of these materials into wetlands and channel would bury immobile biota and displace those that are mobile. Direct impacts to benthos from the direct placement of fill into 0.05 acre of PEM wetlands and 0.14 acre of channel are expected to be minor due to the minimal amount of area to be filled. Indirect impacts to wetlands expected to be isolated would be short-term and minor. All placement of fill associated with construction of the left bank levee will occur above the OHWM; however, it is reasonable to assume that a temporary increase in turbidity within the Big Sioux River and directly abutting wetlands near the construction zone could result in minor, temporary disturbances to benthos in the Big Sioux River and abutting wetlands.

3.3.3.2 Water Circulation, Fluctuation, and Salinity Determinations

3.3.3.2.1 *Salinity*
Not Applicable

3.3.3.2.2 *Water Chemistry*
Minor, temporary, and localized effects to water chemistry (see below) would primarily include an increase in turbidity due to construction activities. If the river is actively flowing during construction, floating silt curtains would be used to surround the area where fill is being placed to contain turbidity to the area inside the curtains. Other common water quality BMPs would be utilized as appropriate.

3.3.3.2.3 *Clarity*
A temporary increase in turbidity may occur within the immediate area surrounding the construction area. As described in paragraph 3.3.3.1.4 above, these effects would be minor, temporary, and localized.

3.3.3.2.4 *Color*
A minor, temporary change in color is possible due to the potential increased turbidity during construction. As discussed directly above, these effects would be minor, temporary, and localized.

3.3.3.2.5 *Odor*
No impacts are anticipated.

3.3.3.2.6 *Taste*
Not applicable.

3.3.3.2.7 *Dissolved Gas Levels*
No changes to dissolved gas levels are anticipated..

3.3.3.2.8 *Nutrients*
The placement of fill material would result in the loss of 0.12 acres of wetland habitat. Approximately 0.84 acres of unconsolidated bottom (PUB), 3.24 acres of scrub-shrub (PSS), 0.34 acres of forested bottomlands (PFO), and 24.7 acres of upland habitat types within the floodplain would be excavated to accommodate the newly widened channel cross section. A decrease in wetlands would result in decreasing opportunities for filtering excess nutrients before flows enter the Big Sioux River. However, it is anticipated the widened benches of this channel would convey spring flows between March and May, prior to the primary growing

season in South Dakota, and as such these side benches would be permanently converted to 29.1 acres of PEM wetlands. Another 41.12 acres of existing PEM wetlands temporarily disturbed from construction of channel widening would be restored back to PEM upon completion of construction.

All fill material for the levee embankment will be placed and stabilized with native upland vegetation to keep the material in place, so it would not actively mix with water in the Big Sioux River or any components (hydric soils, hydrophytic vegetation, hydrology) within wetlands abutting the levee or floodplain wall.

3.3.3.2.9 *Current Patterns and Circulation*
The Big Sioux River would continue to function as a flowing stream during normal flows. However, during higher runoff events due to precipitation or snowmelt, the water along the areas of the channel with the constructed levee and/or floodwall would not overtop the bank and flood as often as it currently does in some locations. The restriction of bank overtopping could increase velocities during high flow events.

3.3.3.2.10 *Normal Water Level Fluctuations*
Normal water fluctuations would not change as a result of the placement of fill for the left bank levee. The placement of boulders may have the potential to increase the current water level.

3.3.3.2.11 *Salinity Gradients*
Not Applicable.

3.3.3.2.12 *Actions to Minimize Impacts*
The Corps would take steps to minimize impacts that include implementation of project appropriate construction BMPs. Several measures would be implemented during construction to minimize water quality impacts that would include both structural and non-structural BMPs. Structural BMPs may include: perimeter controls such as straw bales, silt fencing and/or earthen berms around petroleum products and stock-piles materials. Non-structural BMPs would include: keeping heavy construction equipment out of the waterway whenever possible, protecting construction materials from precipitation/flooding, and stabilizing bare soil by re-vegetating exposed soil.

3.3.3.3 Suspended Particulate/Turbidity Determination

3.3.3.3.1 *Change at Placement Site*
Minor, temporary, and localized increases in turbidity may occur as a result of construction activities. Appropriate construction BMPs, descripted in 3.3.3.2.12 would be implemented. Once construction has been completed and necessary stabilization measures have been implemented such as seeding the embankments with native upland vegetation, localized reductions in turbidity would be expected.

3.3.3.3.2 *Effects on Chemical and Physical Properties of the Water Column*
Fill material proposed to be placed in wetlands and the channel would not violate any water quality standards criteria for South Dakota, Chapter 74:51:01 of the Administrative Rules for South Dakota. No significant adverse impacts to the chemical and physical properties of the water column are expected.

3.3.3.3.3 *Effects on Biota*

Suspended particulates and turbidity may increase slightly within wetlands and the Big Sioux River during construction activities; however, these effects would be minor, temporary, and localized. Appropriate construction BMPs, described in 3.3.3.2.12 would be implemented to ensure that any increased turbidity level during construction would be confined to the immediate construction area.

3.3.4 Contaminant Determination

Only non-contaminated fill material would be placed into wetlands. The borrow site would be clean soil excavated along Mud Creek within the watershed. There is no evidence of any contamination in the borrow site. Additionally, there is no evidence of contamination within the reinforced concrete proposed for the floodwall and any of the structures proposed to be placed within the levee for its utility within the city (storm sewer pipes, gatewell, waterstops, etc.).

3.3.5 Aquatic Ecosystem and Organisms Determination

Majority of the proposed construction site along the left bank of the Big Sioux River is along an already existing embankment throughout the City of Watertown. While these embankments are not classified, operated, or maintained as levees, they do cause isolation of the ecological floodplain. Construction of the left bank levee using the existing embankment alignment will minimize overall impacts to the aquatic ecosystem and organisms. The majority of impacts would be indirect, minor, and/or localized. Permanent impacts to wetlands and organisms in the footprint would be minimal as there will be a fill of only 0.12 acre of wetland habitat and the newly widened channel benches would be planted with emergent wetland vegetation, incidentally constructing or converting approximately 70.2 acres of PEM.

3.3.6 Proposed Disposal Site Determination

The discharge site would include the existing channel of the Big Sioux River (to be developed into a low flow channel), the left bank of the Big Sioux River along the existing embankment alignment, adjacent wetlands, and the upland areas slightly outside of the alignment to the north and south. The discharge of fill will be directly placed in 0.12 acre of wetland habitat.

3.3.7 Determination of Cumulative Effects on the Aquatic Ecosystem

No significant negative cumulative effects would be anticipated as a result of Alternative 8. Alternative 8 would have beneficial impacts on aquatic habitat from the incidental conversion of 24.7 acres of upland herbaceous habitat into PEM. Other wetland types would be temporarily impacted or converted, resulting in a total of up to 70.2 acres of PEM wetlands constructed or restored.

3.3.8 Determination of Secondary Effects on the Aquatic Ecosystem

The proposed project should not result in significant secondary effects on the aquatic ecosystem.

The Corps has taken appropriate steps to avoid and minimize potential secondary effects or indirect effects by implementing BMPs during construction.

3.4 Alternative 11B – Weir Operations + Levee Right/Left Bank (one 3ft closure structure)

To accomplish the activities listed in Section 2.4:

- Approximately 9,800 cy of material from the existing discontinuous embankment would be excavated, mixed with the 4,000 cy of material excavated from the mitigation site, and shaped and graded to construct the left bank levee alignment.
- Approximately 4,000 cy of borrow material would be excavated from the mitigation site at Mud Creek and used to construct the proposed earthen left bank levee.
- Approximately 96,800 cy of material would be excavated from the mitigation site at Mud Creek and used to construct the proposed earthen right bank levee.
- Approximately 46,000 cy of material would be excavated from the existing discontinuous embankment on the right bank and hauled off site to an approved upland location
- The six existing storm sewer crossings would be removed and replaced with six 36-inch pipes and a gatewell on the left bank levee.
- The 17 existing storm sewer crossings would be removed and replaced with 17 36-inch pipes and a gatewell on the left bank levee.
- The reinforced concrete floodwall would be placed within the center of the left bank levee alignment.
- All proposed construction associated with Alternative 11B would occur above the OHWM.

3.4.1 General Description of Dredged or Fill Material

Discharge associated with the construction of the left and right bank levees would include clean, clay loam borrow material excavated from the site designated for Mitigation on Mud Creek mixed with material obtained from degrading the existing embankment along the left and right banks within the project footprint. The existing embankment is made of 2-5 feet of lean clay below natural ground surface and 6-15 feet of poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay); this material will be suitable to utilize for the new embankment. Discharge associated with the construction of the floodwalls would include reinforced concrete. Additional discharge will include replacing the 22 existing storm sewer crossings on the left and right banks with six 36-inch pipes, the gatewell, and 3-foot closure structure. There will be no discharge of dredged or fill material associated with seasonally lowering Lake Kampeska.

3.4.2 Description of the Proposed Discharge Site

The proposed discharge site of the borrow material would be along the left and right bank of the Big Sioux River. Some portions along the left and right banks consist of an existing embankment. For the segments of the proposed levee that will be constructed within the footprint of an existing embankment, material from the existing embankment will be utilized to construct the new embankment. Some segments of the proposed levee that will be constructed outside of the footprint of an existing embankment. Reinforced concrete for the floodwall will be discharged along the left embankment that currently abuts the Watertown Iron and Metal Facility and the right embankment that currently abuts a mobile housing community. The six new storm sewer pipes will be replaced within the proposed left bank levee and 17 storm sewer pipes will be replaced within the proposed right bank levee.

3.4.3 Factual Determinations

3.4.3.1 Physical Substrate Determinations

3.4.3.1.1 *Substrate Elevation and Slope*

Placement of 4,000 cubic yards of borrow material and 46,000 cubic yards of material excavated from the existing embankment will be used to construct the proposed earthen left and

right bank levees. The levee alignments will generally follow the existing flood fight measures in place in order to minimize disturbance. For the left bank levee, the proposed fill to make up the embankment would be 2-4 ft tall with a twelve-food-wide gravel surfaced crest and 1:3 side slopes. The reinforced concrete flood wall on the left bank will be 1,287 ft in length, 2ft in height, and 1 ft wide. The wall will extend 4.5 ft below grade. For the right bank levee, the proposed fill to make up the embankment would be 5-7 ft tall with a twelve-foot-wide gravel surfaced crest and 1:3 side slopes. The flood wall on the right bank will be 300 ft in length, 5.25 ft in height, and 1 ft wide. Placement of the left and right bank levees would directly fill 1.26 acre of PEM wetlands, 0.39 acre of PSS, and 0.24 acre of PFO for a total of 1.89 acres of wetland habitat directly filled. Additionally, 0.63 acre of PUB, 0.05 acre of PEM, 0.07 acre of PSS, and 0.5 acre of PFO for a total of 1.25 acres of wetland habitat would be indirectly impacted (isolated). The Corps has incorporated measures into the design to adequately minimize adverse effects to the substrate elevation and slope.

3.4.3.1.2 *Sediment Type*

The sediment types of the existing embankment consist of lean clay, poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay). The borrow material sediment types consist of clay loam material.

3.4.3.1.3 *Dredged/Fill Material Movement*

Up to 4,000 cubic yards of borrow material, 46,000 cubic yards of material from the existing embankments, 1,287 square feet of reinforced concrete on the left bank, 300 square feet of reinforced concrete on the right bank, and materials for additional structures required for the levees (storm sewer pipes, gatewell, waterstops, closures etc.) would be placed along the banks of the Big Sioux River. The new embankments would then be graded and seeded with a native upland seed mix to stabilize the fill material. Erosion control best management practices (BMPs), such as silt fencing and erosion control blankets would be utilized during construction. Utilizing erosion control to prevent sediment from entering existing wetlands and preventing deleterious material from entering the Big Sioux River are examples of BMPs that would be used to reduce the amount of potential pollutants that reach the water resources adjacent to or downstream of the proposed project area.

3.4.3.1.4 *Physical Effects on Benthos*

Physical effects on benthos would consist of the direct placement of 1.89 acres of fill into wetland habitat, and the indirect effect of fill placement, resulting in the isolation of 1.25 acres of wetland habitat. Placement of these materials into wetlands would bury immobile biota and displace those that are mobile. Direct impacts to benthos from the direct placement of fill into wetlands are expected to result in moderate impacts due to the amount of area to be filled. Indirect impacts to wetlands expected to be isolated would be short-term and moderate. All placement of fill associated with construction of the left and right bank levees will occur above the OHWM; however, it is reasonable to assume that a temporary increase in turbidity within the Big Sioux River and directly abutting wetlands near the construction zone could result in minor, temporary disturbances to benthos in the Big Sioux River.

3.4.3.2 Water Circulation, Fluctuation, and Salinity Determinations

3.4.3.2.1 *Salinity*

Not Applicable

3.4.3.2.2 *Water Chemistry*
Minor, temporary, and localized effects to water chemistry (see below) would primarily include an increase in turbidity due to construction activities. If the river is actively flowing during construction, floating silt curtains would be used to surround the area where fill is being placed to contain turbidity to the area inside the curtains. Other common water quality BMPs would be utilized as appropriate.

3.4.3.2.3 *Clarity*
A temporary increase in turbidity may occur within the immediate area surrounding the construction area. As described in paragraph 3.3.2.1.2 above, these effects would be minor, temporary, and localized.

3.4.3.2.4 *Color*
A minor, temporary change in color is possible due to the potential increased turbidity during construction. As discussed directly above, these effects would be minor, temporary, and localized.

3.4.3.2.5 *Odor*
No impacts are anticipated.

3.4.3.2.6 *Taste*
Not applicable.

3.4.3.2.7 *Dissolved Gas Levels*
No changes to dissolved gas levels are anticipated.

3.4.3.2.8 *Nutrients*
The placement of fill material would result in the loss of 1.89 acres of wetland habitat and the indirect isolation of 1.25 acres of wetland habitat. A decrease in wetlands would result in decreasing opportunities for filtering excess nutrients before flows enter the Big Sioux River.

3.4.3.2.9 *Current Patterns and Circulation*
The Big Sioux River would continue to function as a flowing stream during normal flows. However, during higher runoff events due to precipitation or snowmelt, the water along the areas of the channel with the constructed levee and/or floodwall would not overtop the bank and flood as often as it currently does in some locations. The restriction of bank overtopping could increase velocities during high flow events.

3.4.3.2.10 *Normal Water Level Fluctuations*
Normal water fluctuations would not change as a result of this alternative.

3.4.3.2.11 *Salinity Gradients*
Not Applicable.

3.4.3.2.12 *Actions to Minimize Impacts*
The Corps would take steps to minimize impacts that include implementation of project appropriate construction BMPs. Several measures would be implemented during construction to minimize water quality impacts that would include both structural and non-structural BMPs. Structural BMPs may include: perimeter controls such as straw bales, silt fencing and/or earthen berms around petroleum products and stock-piles materials. Non-structural BMPs would include: keeping heavy construction equipment out of the waterway whenever possible,

protecting construction materials from precipitation/flooding, and stabilizing bare soil by re-vegetating exposed soil.

3.4.3.3 Suspended Particulate/Turbidity Determination

3.4.3.3.1 *Change at Placement Site*

Minor, temporary, and localized increases in turbidity may occur as a result of construction activities. Appropriate construction BMPs, described in 3.4.3.2.12 would be implemented. Once construction has been completed and necessary stabilization measures have been implemented such as seeding the embankments with native upland vegetation, localized reductions in turbidity would be expected.

3.4.3.3.2 *Effects on Chemical and Physical Properties of the Water Column*

Fill material proposed to be placed in wetlands and the channel would not violate any water quality standards criteria for South Dakota, Chapter 74:51:01 of the Administrative Rules for South Dakota. No significant adverse impacts to the chemical and physical properties of the water column are expected.

3.4.3.3.3 *Effects on Biota*

Suspended particulates and turbidity may increase slightly within wetlands and the Big Sioux River during construction activities; however, these effects would be minor, temporary, and localized. Appropriate construction BMPs, descripted in 3.4.3.2.12 would be implemented to ensure that any increased turbidity level during construction would be confined to the immediate construction area.

3.4.4 Contaminant Determination

Only non-contaminated fill material would be placed into wetlands. The borrow site would be clean soil excavated along Mud Creek within the watershed. There is no evidence of any contamination in the borrow site. Additionally, there is no evidence of contamination within the reinforced concrete proposed for the floodwall and any of the structures proposed to be placed within the levee for its utility within the city (storm sewer pipes, gatewell, waterstops, closures etc.).

3.4.5 Aquatic Ecosystem and Organisms Determination

Majority of the proposed construction site along the left and rank bank of the Big Sioux River is along an already existing embankment throughout the City of Watertown. While these embankments are not classified, operated, or maintained as levees, they do cause isolation of the ecological floodplain. Construction of the left and right bank levees using the existing embankment alignments will minimize overall impacts to the aquatic ecosystem and organisms. Due to the amount of wetlands proposed to be filled under this alternative, impacts to the aquatic ecosystem are expected to be higher under this alternative compared to alternatives 3, 7, and 8.

3.4.6 Proposed Disposal Site Determination

The discharge site would include the left and right banks of the Big Sioux River along the existing embankment alignment and adjacent wetlands and slightly outside of the alignment to the north and south in upland areas. The discharge of fill will be directly placed in 1.89 acres of wetland habitat along the project footprint for Alternative 11B. Additionally, 1.25 acres of wetland habitat would be indirectly impacted (isolated) as a result of the implementation of this alternative.

3.4.7 Determination of Cumulative Effects on the Aquatic Ecosystem

No significant negative cumulative effects would be anticipated as a result of Alternative 11B.

3.4.8 Determination of Secondary Effects on the Aquatic Ecosystem

The proposed project should not result in significant secondary effects on the aquatic ecosystem. The Corps has taken appropriate steps to avoid and minimize potential secondary effects or indirect effects by implementing BMPs during construction.

3.5 Alternative 11C – Weir Operations + Levee Right/Left Bank (Two 3- to 4ft closure structure)

To accomplish the activities listed in Section 2.5:

- Approximately 4,000 cy of borrow material would be excavated from the mitigation site at Mud Creek and used to construct the proposed earthen left bank levee.
- Approximately 9,800 cy of material from the existing discontinuous embankment would be excavated, mixed with the 4,000 cy of material excavated from the mitigation site, and shaped and graded to construct the left bank levee alignment.
- Approximately 116,700 cy of material would be excavated from the mitigation site at Mud Creek and used to construct the proposed earthen right bank levee.
- Approximately 46,000 cy of material would be excavated from the existing discontinuous embankment on the right bank and hauled off site to an approved upland location
- The six existing storm sewer crossings would be removed and replaced with six 36-inch pipes and a gatewell on the left bank levee.
- The 17 existing storm sewer crossings would be removed and replaced with 17 36-inch pipes and a gatewell on the left bank levee.
- The reinforced concrete floodwall would be placed within the center of the left bank levee alignment.
- All proposed construction associated with Alternative 11C would occur above the OHWM.

3.5.1 General Description of Dredged or Fill Material

Discharge associated with the construction of the left and right bank levees would include clean, clay loam borrow material excavated from the site designated for Mitigation on Mud Creek mixed with material obtained from degrading the existing embankment along the left and right banks within the project footprint. The existing embankment is made of 2-5 feet of lean clay below natural ground surface and 6-15 feet of poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay); this material will be suitable to utilize for the new embankment. Discharge associated with the construction of the floodwalls would include reinforced concrete. Additional discharge will include replacing the 22 existing storm sewer crossings on the left and right banks with six 36-inch pipes, the gatewell, and 3-foot closure structure. There will be no discharge of dredged or fill material associated with seasonally lowering Lake Kampeska.

3.5.2 Description of the Proposed Discharge Site

The proposed discharge site of the borrow material would be along the left and right bank of the Big Sioux River. Some portions along the left and right banks consist of an existing embankment. For the segments of the proposed levee that will be constructed within the footprint of an existing embankment, material from the existing embankment will be utilized to construct the new embankment. Some segments of the proposed levee that will be constructed outside of the footprint of an existing embankment. Reinforced concrete for the floodwall will be

discharged along the left embankment that currently abuts the Watertown Iron and Metal Facility and the right embankment that currently abuts a mobile housing community. The six new storm sewer pipes will be replaced within the proposed left bank levee and 17 storm sewer pipes will be replaced within the proposed right bank levee.

3.5.3 Factual Determinations

3.5.3.1 Physical Substrate Determinations

3.5.3.1.1 *Substrate Elevation and Slope*

Placement of 4,000 cubic yards of borrow material and 9,800 cubic yards of material excavated from the existing embankment will be used to construct the proposed earthen left bank levee and placement of 116,700 cy for the right bank levee. The levee alignments will generally follow the existing flood fight measures in place in order to minimize disturbance. For the left bank levee, the proposed fill to make up the embankment would be 2-4 ft tall with a twelve-food-wide gravel surfaced crest and 1:3 side slopes. The reinforced concrete flood wall on the left bank will be 1,287 ft in length, 2ft in height, and 1 ft wide. The wall will extend 4.5 ft below grade. For the right bank levee, the proposed fill to make up the embankment would be 5-7 ft tall with a twelve-foot-wide gravel surfaced crest and 1:3 side slopes. The flood wall on the right bank will be 300 ft in length, 5.25 ft in height, and 1 ft wide. Placement of the left and right bank levees would directly fill 1.43 acre of PEM wetlands, 0.44 acre of PSS, and 0.26 acre of PFO for a total of 2.12 acres of wetland habitat directly filled. Additionally, 0.63 acre of PUB, 0.04 acre of PEM, 0.06 acre of PSS, and 0.48 acre of PFO for a total of 1.22 acres of wetland habitat would be indirectly impacted (isolated). The Corps has incorporated measures into the design to adequately minimize adverse effects to the substrate elevation and slope.

3.5.3.1.2 *Sediment Type*

The sediment types of the existing embankment consist of lean clay, poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay). The borrow material sediment types consist of clay loam material.

3.5.3.1.3 *Dredged/Fill Material Movement*

Up to 4,000 cubic yards of borrow material and 9,800 cy of material for the left bank levee and 116,700 cy of material for the right bank levee, 1,287 square feet of reinforced concrete on the left bank, 300 square feet of reinforced concrete on the right bank, and materials for additional structures required for the levees (storm sewer pipes, gatewell, waterstops, closures etc.) would be placed along the banks of the Big Sioux River. The new embankments would then be graded and seeded with a native upland seed mix to stabilize the fill material. Erosion control BMPs, such as silt fencing and erosion control blankets would be utilized during construction. Utilizing erosion control to prevent sediment from entering existing wetlands and preventing deleterious material from entering the Big Sioux River are examples of BMPs that would be used to reduce the amount of potential pollutants that reach the water resources adjacent to or downstream of the proposed project area.

3.5.3.1.4 *Physical Effects on Benthos*

Physical effects on benthos would consist of the direct placement of 2.12 acres of wetland habitat, and the indirect effect of fill placement, resulting in the isolation of 1.22 acre of wetland habitat. Placement of these materials into wetlands would bury immobile biota and displace those that are mobile. Direct impacts to benthos from the direct placement of fill into wetlands are expected to result in moderate impacts due to the amount of area to be filled. Indirect impacts to wetlands expected to be isolated would be short-term and moderate. All placement

of fill associated with construction of the left and right bank levees will occur above the OHWM; however, it is reasonable to assume that a temporary increase in turbidity within the Big Sioux River and directly abutting wetlands near the construction zone could result in minor, temporary disturbances to benthos in the Big Sioux River.

3.5.3.2 Water Circulation, Fluctuation, and Salinity Determinations

3.5.3.2.1 *Salinity*
Not Applicable

3.5.3.2.2 *Water Chemistry*
Minor, temporary, and localized effects to water chemistry (see below) would primarily include an increase in turbidity due to construction activities. If the river is actively flowing during construction, floating silt curtains would be used to surround the area where fill is being placed to contain turbidity to the area inside the curtains. Other common water quality BMPs would be utilized as appropriate.

3.5.3.2.3 *Clarity*
A temporary increase in turbidity may occur within the immediate area surrounding the construction area. As described in paragraph 3.3.2.1.2 above, these effects would be minor, temporary, and localized.

3.5.3.2.4 *Color*
A minor, temporary change in color is possible due to the potential increased turbidity during construction. As discussed directly above, these effects would be minor, temporary, and localized.

3.5.3.2.5 *Odor*
No impacts are anticipated.

3.5.3.2.6 *Taste*
Not applicable.

3.5.3.2.7 *Dissolved Gas Levels*
No changes to dissolved gas levels are anticipated.

3.5.3.2.8 *Nutrients*
The placement of fill material would result in the loss of wetlands from the direct placement of fill in 2.12 acres of wetland habitat, and the indirect effect of fill placement, resulting in the isolation of 1.22 acre of wetland habitat. A reduction in wetlands would result in decreasing opportunities for filtering excess nutrients before flows enter the Big Sioux River.

3.5.3.2.9 *Current Patterns and Circulation*
The Big Sioux River would continue to function as a flowing stream during normal flows. However, during higher runoff events due to precipitation or snowmelt, the water along the areas of the channel with the constructed levee and/or floodwall would not overtop the bank and flood as often as it currently does in some locations. The restriction of bank overtopping could increase velocities during high flow events.

3.5.3.2.10 *Normal Water Level Fluctuations*
Normal water fluctuations would not change as a result of this alternative.

3.5.3.2.11 *Salinity Gradients*
Not Applicable.

3.5.3.2.12 *Actions to Minimize Impacts*
The Corps would take steps to minimize impacts that include implementation of project appropriate construction BMPs. Several measures would be implemented during construction to minimize water quality impacts that would include both structural and non-structural BMPs. Structural BMPs may include: perimeter controls such as straw bales, silt fencing and/or earthen berms around petroleum products and stock-piles materials. Non-structural BMPs would include: keeping heavy construction equipment out of the waterway whenever possible, protecting construction materials from precipitation/flooding, and stabilizing bare soil by re-vegetating exposed soil.

3.5.3.3 Suspended Particulate/Turbidity Determination

3.5.3.3.1 *Change at Placement Site*
Minor, temporary, and localized increases in turbidity may occur as a result of construction activities. Appropriate construction BMPs, described in 3.5.3.2.12 would be implemented. Once construction has been completed and necessary stabilization measures have been implemented such as seeding the embankments with native upland vegetation, localized reductions in turbidity would be expected.

3.5.3.3.2 *Effects on Chemical and Physical Properties of the Water Column*
Fill material proposed to be placed in wetlands and the channel would not violate any water quality standards criteria for South Dakota, Chapter 74:51:01 of the Administrative Rules for South Dakota. No significant adverse impacts to the chemical and physical properties of the water column are expected.

3.5.3.3.3 *Effects on Biota*
Suspended particulates and turbidity may increase slightly within wetlands and the Big Sioux River during construction activities; however, these effects would be minor, temporary, and localized. Appropriate construction BMPs, descripted in 3.5.3.2.12 would be implemented to ensure that any increased turbidity level during construction would be confined to the immediate construction area.

3.5.4 Contaminant Determination
Only non-contaminated fill material would be placed into wetlands. The borrow site would be clean soil excavated along Mud Creek within the watershed. There is no evidence of any contamination in the borrow site. Additionally, there is no evidence of contamination within the reinforced concrete proposed for the floodwall and any of the structures proposed to be placed within the levee for its utility within the city (storm sewer pipes, gatewell, waterstops, closures etc.).

3.5.5 Aquatic Ecosystem and Organisms Determination
Majority of the proposed construction site along the left and rank bank of the Big Sioux River is along an already existing embankment throughout the City of Watertown. While these embankments are not classified, operated, or maintained as levees, they do cause isolation of the ecological floodplain. Construction of the left and right bank levees using the existing embankment alignments will minimize overall impacts to the aquatic ecosystem and organisms. Due to the amount of wetlands proposed to be filled (2.12 acres) under this alternative, impacts

to the aquatic ecosystem are expected to be higher under this alternative compared to alternatives 3, 7, and 8, and 11B.

3.5.6 Proposed Disposal Site Determination

The discharge site would include the left and right banks of the Big Sioux River along the existing embankment alignment and adjacent wetlands and slightly outside of the alignment to the north and south in upland areas. The discharge of fill will be directly placed in 2.12 acres of wetland habitat, and the indirect effect of fill placement, resulting in the isolation of 1.22 acre of wetland habitat along the project footprint for Alternative 11C.

3.5.7 Determination of Cumulative Effects on the Aquatic Ecosystem

No significant negative cumulative effects would be anticipated as a result of Alternative 11C.

3.5.8 Determination of Secondary Effects on the Aquatic Ecosystem

The proposed project should not result in significant secondary effects on the aquatic ecosystem. The Corps has taken appropriate steps to avoid and minimize potential secondary effects or indirect effects by implementing BMPs during construction.

3.6 Alternative 12 – Nonstructural

Nonstructural alternatives are not expected to result in impacts to wetlands or WOTUS because floodproofing measures would be applied to existing structures and within an already developed area. If specific nonstructural alternatives are considered during optimization, potential impacts to wetlands and WOTUS will be assessed.

4 Biological Characteristics

The Functional Assessment of Colorado Streams (FACStream) Method (Version 1.0, 2016) was selected to assess the existing habitat conditions within the study area, as well as Future with Project (FWP) and Future without Project (FWOP) conditions. The FACStream method is a reach-scale functional assessment tool that rates functional condition based on the degree of impairment in comparison to a reference standard condition. FACStream is a weight-of-evidence approach that utilizes the best evidence available through desktop analysis and field verification within a rapid assessment timeframe to develop and support ratings for 10 variables and their associated sub-variables (Johnson et al., 2016). FACStream received regional approval use from the ECO-PCX on 28 July 2023 within the Omaha and Kansas City District Civil Works boundaries (see sub-appendix G1a).

Model outputs, specifically the composite FCI, were utilized to qualitatively assess the existing condition, the FWOP condition and the FWP condition. This qualitative output was then multiplied by the AA, measured in acres. This value is a quantified measure of environmental output, known as a habitat unit (HU), where the difference between future habitat units without management measures (future without project) and future habitat units with management measurements (future with project) equals the habitat units produced by the alternative (USACE, 1995). The HUs are then annualized throughout the 50-year study period to provide an overall average annual HU, or AAHU. This value represents an average environmental functional output that the subject area contributes to in any given year for any FWP condition.

The Table below provides a summary of the AAHUs of each alternative. Reference Appendix G1 for a full discussion the environmental modeling effort and Appendix G2 for discussion on mitigation.

Table 1. AAHUs of Alternatives

Reach	Acres	Existing/FWOP	FWP					
		Alt 1	Alt 3	Alt 7	Alt 8	Alt 11b	Alt 11c	Alt 12
		AAHUs						
1	560	401.93	401.93	401.95	401.95	401.95	401.95	Nonstructural
2	238	166.07	163.00	163.87	163.76	162.06	161.81	
3	296	212.45	212.45	212.46	213.31	212.46	212.46	
Study Area Total AAHUs		780.45	779.12	778.28	779.01	776.47	776.22	
Net Difference FWP-FWOP AAHUs			-1.32	-2.16	-1.43	-3.97	-4.22	

4.1 Threatened and Endangered Species

An official list of federally listed threatened and endangered species was obtained through the USFWS Information for Planning and Conservation (IPaC) tool on February 5, 2025 (See Appendix G3 for the Biological Assessment). The endangered Topeka shiner (*Notropis topeka*), threatened rufa red knot (*Calidris canutus rufa*), threatened Dakota skipper (*Hesperia dacotae*), proposed threatened western regal fritillary (*Argynnis idalia occidentalis*), proposed threatened monarch butterfly (*Danaus plexippus*), and proposed endangered Suckley's cuckoo bumble bee (*Bombus suckleyi)* were included in the list generated from IPaC. In coordination with USFWS, it was recommended that USACE consider the endangered northern long-eared bat (*Myotis septentrionalis*) and the proposed endangered tricolored bat (*Permimyotis subflavus*) due to the amount of tree removal anticipated under the proposed action even though they did not populate under IPaC's list. It is recognized that proposed species under the ESA currently do not have statutory protection, however, USACE considers the proposed species for this project in case their listing status should change for one or all proposed species in the near future.

USACE submitted the Biological Assessment to USFWS on May 7, 2025, to initiate informal consultation under Section 7 of the Endangered Species Act (ESA). Concurrence on effect determinations was received in a letter dated November 21, 2025. See Appendix G3 for the Biological Assessment.

Table 2. Federally listed species with potential to occur in the study area

Common Name	Scientific Name	ESA Listing
Topeka Shiner	*Notropis topeka*	Endangered
Rufa Red Knot	*Calidris canutus rufa*	Threatened
Dakota Skipper	*Hesperia dacotae*	Threatened
Western Regal Fritillary	*Argynnis idalia occidentalis*	Proposed Threatened
Monarch Butterfly	*Danaus plexippus*	Proposed Threatened

Suckley's Cuckoo Bumble Bee	*Bombus Suckleyi*	Proposed Endangered
Northern Long-eared Bat	*Myotis septentrionalis*	Endangered
Tricolored Bat	*Perimyotis subflavus*	Proposed Endangered

4.1.1 No Action Alternative (Alternative 1)

Under the No Action Alternative, no construction/demolition, staging, or land use changes would occur from a federally funded project, therefore, no direct impacts to any specially listed species within the study area would occur. However, these types of activities may occur indirectly as the City of Watertown would continue to conduct flood fighting, cleanup activities from flood damage, and seek other sources of funding to construct a FRM project. The Sponsor would be required to comply with the provisions of the ESA. The No Action Alternative would not meet the project purpose and need

4.1.2 All Structural Alternatives (Alternative 3, 8, 7, 11B, 11C)

Topeka Shiner: Topeka shiner have not been observed within the study area. However, through coordination with USFWS, USACE was informed that it is possible for Topeka shiner to use habitat in the Big Sioux River within the study area during low flow years. The most recent captures of Topeka shiner near the study area have occurred above and below Watertown in other tributaries. More specifically, a recent capture occurred in Willow Creek. Using best available information, Topeka shiner are not known to be present within Mud Creek, located along the proposed mitigation area. Construction activities associated with all structural alternatives have the potential to cause temporary sedimentation impacts downstream of the Big Sioux River, temporarily impacting water quality and resulting in minor short-term impacts to Topeka shiner. It is not anticipated that in-channel work would be necessary, but if in-channel work occurs for channel widening construction proposed under alternatives 3 and 8 within the Topeka shiner spawning period from May 15 to July 31, construction could result in moderate short-term adverse impacts to Topeka shiner if they are found to be present.

Rufa Red Knot: Red knots may use the lakeshores and prairie potholes within Codington County as stopover habitat or resting habitat during their long migrations. However, red knots prefer migration corridors along the entire Atlantic coast and are faithful to those specific routes. Thus, red knots would be considered extremely rare visitors to the proposed project area. The portion of the project along the Big Sioux River and proposed mitigation site along Mud Creek lacks suitable stopover habitat., as there are no desirable habitat features (e.g. sandbars, shoals, sand spits, etc. present. Additionally, the majority of the Big Sioux River within the project area is surrounded by human development from both the east and west, further limiting the location's ability to provide suitable habitat for the rufa red knot. While unlikely, if the rufa red knot were to use the project area as a stopover location, the lowering of Lake Kampeska (Alternative 7, 8, 11b, and 11c) could offer the potential for suitable habitat during migratory periods due to more sandy areas being exposed within the fall and spring. Under alternative 7, 8, 11b, and 11c, the proposed project may indirectly benefit the rufa red knot; however, the benefit would be negligible. Adverse impacts to the rufa red knot would not be anticipated under all structural alternatives.

Dakota Skipper: Given that Dakota skipper is an obligate resident of undisturbed (remnant, untilled) high-quality prairie, ranging from wet-mesic tallgrass prairie to dry-mesic mixed-grass prairie habitat, habitat along the Big Sioux River throughout the City of Watertown is likely not

considered suitable for the Dakota skipper. Additionally, there are no recorded occurrences of Dakota skipper along the Big Sioux River and within the proposed mitigation site (See Section 2.3.4.1 of the main report). While there are no recorded occurrences of the Dakota Skipper within the study area, the proposed mitigation site along Mud Creek may potentially provide suitable habitat as these areas contain grasslands and fall within potentially undisturbed areas, designated within the South Dakota Environmental Review Tool. No adverse impacts to the Dakota skipper would be anticipated under all structural alternatives. Construction of the mitigation site may result in minor short-term adverse impacts to the Dakota skipper.

Western Regal Fritillary: Western Regal Fritillary have not been observed and/or data has not been collected for Western Regal Fritillary presence within the study area, according to the South Dakota National Heritage Program database (SDGFP, 2023). Areas where project activities are proposed near the Big Sioux River do not offer suitable habitat for the Western Regal Fritillary, as these areas are heavily disturbed and do not consist of large native prairie habitat nor remnants within the bounds of native prairie habitat. There is potential for suitable habitat to be present within the proposed mitigation area on Mud Creek. Although crop fields are found within parts of the proposed mitigation site, other areas contain grasslands and fall within potentially undisturbed areas, connected to a larger section of undisturbed land, designated within the South Dakota Environmental Review Tool. No adverse impacts to the western regal fritillary would be anticipated under all structural alternatives. Construction of the mitigation site may result in minor short-term adverse impacts to the western regal fritillary.

Monarch Butterfly: Monarch butterflies range throughout the entire study area. Common milkweed (*Asclepias syriaca*) and flowering plants were found to be present throughout the study area along the Big Sioux River and are likely to be present within the proposed mitigation area along Mud Creek. Construction activities under all structural alternatives have the potential to directly result in minor, short-term adverse impacts as a result of clearing and grubbing activities; however, minor long-term beneficial impacts to monarch butterfly may occur through the incorporation of native plantings, including milkweed species. Due to the high likelihood of suitable habitat present within the proposed mitigation site along Mud Creek, minor, short-term adverse impacts may occur as a result of mitigation construction.

Suckley's Cuckoo Bumble Bee: The Suckley's cuckoo bumble ranges throughout the entire study area; however, because this species has not been caught in South Dakota since 1969 nor seen in the United States since around 2018, it is unlikely they would be present in or near areas impacted by implementation of this project under all structural alternatives and proposed mitigation activities. Due to the minimal likelihood of the Suckley's cuckoo bumble bee to be present within the study area, adverse impacts to the Suckley's cuckoo bumble bee would not be anticipated under all structural alternatives.

Tricolored Bat: Tree removal and perpetual inhibition of woody growth would occur under all structural alternatives. See Section 4.2.2.2 of the main report for acreages of vegetation impacts under each structural alternative. Any clearing of trees and vegetation for construction while bats are roosting and rearing young has the potential to directly disrupt the females and their young if present. Clearing of vegetation of trees also has the potential to reduce the amount of foraging and roosting habitat available to bats present at the time or in the future. Noise and other physical disturbance would be temporary and localized and would not affect the availability of roosting areas or foraging opportunities for the tricolored bat. Alternative 7 would require significantly less tree removal and lead to significantly less perpetual inhibition of woody growth compared to other structural alternatives. Overall, Alternative 7 could have a minor long-

term adverse impact on tri-colored bats and all other structural alternatives could have a moderate long-term adverse impact on tri-colored bats. Proposed conservation measures would minimize these impacts.

Northern Long-eared Bat: Tree removal and perpetual inhibition of woody growth would occur under all structural alternatives. See Section 4.2.2.2 of the main report for acreages of vegetation impacts under each structural alternative. Any clearing of trees and vegetation for construction while bats are roosting and rearing young has the potential to directly disrupt the females and their young if present. Clearing of vegetation of trees also has the potential to reduce the amount of foraging and roosting habitat available to bats present at the time or in the future. Noise and other physical disturbance would be temporary and localized and would not affect the availability of roosting areas or foraging opportunities for the tricolored bat. Alternative 7 would require significantly less tree removal and lead to significantly less perpetual inhibition of woody growth compared to other structural alternatives. Overall, Alternative 7 would have a minor long-term adverse impact on northern long-eared bat and all other structural alternatives would have a moderate long-term adverse impact on northern long-eared bats. Proposed conservation measures would minimize these impacts.

4.1.3 Nonstructural Alternative (Alternative 12)

Alternative 12 would see floodproofing measures applied to 1,003 existing structures. As floodproofing measures would be applied to existing structures and within an already developed area, no effects to threatened and endangered species would be anticipated from Alternative 12.

4.2 Fish and Aquatic Organisms

Of the 48 species found in the Big Sioux River, fathead minnow (*Pimephales promelas*), black bullhead (*Ameiurus melas*), sand shiner (*Notropis ludibundus*), white sucker (*Catostomus commersoni*), red shiner (*Cyprinella lutrensis*), common shiner (*Luxilus comutus*), Johnny darter (*Etheostoma nigrum*), channel catfish (*Ictalurus punctatus*), and creek chub (*Semotilus atromaculatus*) were recorded as the most abundant species (Dieterman & Berry Jr, 1998). Sections of the Upper Big Sioux River within the project area are designated as having biological use for warmwater semipermanent fish (SDANR, 2024). The hydrologic characteristics of the stream (shallow, intermittent flows) do not allow most game fishes to grow into catchable sizes, except for the black bullhead (*Ameiurus melas*).

The SDGFP lists smallmouth bass (*Micropterus dolomieu*) and walleye (*Sander vitreus*) as the primary fish species occurring in Lake Kampeska. The walleye population in Lake Kampeska is supported by both natural reproduction and fry stocking. Other species occurring in Lake Kampeska include black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), channel catfish, northern pike (*Esox Lucius*), white bass (*Morone chrysops*), and yellow perch (*Perca flavescens*) (SDGFP, 2015).

4.3 Other Wildlife

General quality of upland habitat for fish and wildlife within the study area is relatively poor in proximity to the City, with some areas of moderate quality for game production. Diversity and interspersion of cover types, which is an essential condition to the establishment of optimum productivity of both game and non-game populations, has been greatly diminished because of intensive agricultural activities. Intensive cultivation and pasturing of wetlands along the Big Sioux River flood plains have limited wildlife production potential. Lack of winter cover types, especially in close association with food, after crop harvest is judged to be a major limiting factor

in assuring survival of local game species. The riparian zone, a habitat area that is extremely important to many forms of wildlife, is lacking in quantity and quality and is of little wildlife significance in the study area.

Large mammal species that are likely to be found in the study area include white- tailed deer (*Odocoileus virginianus*) and mule deer (*Odocoileus hemionus*). Smaller mammals likely to use the study area include the white-tailed jackrabbit (*Lepus townsendii*), which inhabits croplands and grasslands, the eastern cottontail (*Sylvilagus floridanus*), and the Virginia opossum (*Didelphis virginiana*),

Although semi-aquatic furbearers such as the beaver, mink, weasel, and muskrat can be found adjacent to the project they are uncommon in the study area due to the lack of suitable habitat. The eroding banks of Lake Kampeska and Pelican Lake are steep and devoid of vegetation, and the near-shore area lacks vegetation and wetlands due to the constant wave-action, high turbidity, and unstable substrate. Each of these semi-aquatic species relies on wetland vegetation and/or riparian forest for survival.

Bats species potentially within and adjacent to the study area include the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and the northern long-eared bat (*Myotis septentrionalis*). Common rodents include the Richardson's ground squirrel (*Urocitellus richardsonii*), thirteen-lined ground squirrel (*Ictidomys tridecemlineatus*), Franklin's ground squirrel (*Poliocitellus franklinii*), pocket gopher (*Microtus ochrogaster*), voles, and various mice.

Area bird counts by Audubon Society members have shown that over 215 species of birds utilize local habitats, including eagles, hawks, owls, warblers, sparrows, shorebirds, and waterfowl. Pair counts from area Waterfowl Production Areas, as well as information gathered from field visits, indicate that the following species may use study area wetlands: mallard, widgeon, blue-winged teal, pintail, redhead, lesser scaup, ring necked duck, American egret, white pelican, gadwall, green-winged teal, shoveler, wood duck, canvasback, ruddy duck, Canada geese, and black cormorant. Information from the SDGFP indicates that the Still Lake basin generally attracts from 400 to 500 canvasbacks during spring and fall migrations.

Nesting opportunities for migratory waterfowl and upland game birds, such as pheasant and Hungarian (gray) partridge, are limited to occasional narrow strips of grassland cover. This situation normally subjects game birds to high predation. Shelterbelts provide excellent nesting, feeding, and escape cover. In the study area, however, this cover type is also quite limited and generally quite narrow, providing limited wildlife benefits. Persistent, emergent cover, such as cattail, bulrush, or phragmites, were absent along the Big Sioux River within the study area. This type of cover is essential to the survival of young broods of migratory waterfowl through the flight stage, as it provides optimum feeding opportunities and valuable escape cover. The relative absence of migratory waterfowl broods was noted during a July reconnaissance of the riverine area by USFWS personnel. One brood of blue-wing teal was observed on an excavated pond within the Mahoney Creek drainage (FWS Coordination Report, 1989).

4.4 Special Aquatic Sites

Formal wetland delineations were not conducted as part of the field data collection, nor are formal wetland delineations required to be conducted to utilize FACStream. Desktop analyses utilized include NWI, the Natural Resources Conservation Services Websoil Survey tool, and Coefficient of Conservation values in accordance with the Coefficients of Conservatism for the

Vascular Flora of the Dakotas and Adjacent Grasslands (USGS, 2001) to understand the functional quality index of the present vegetation communities. USACE recognizes NWI as a limited dataset and supplemented the findings of its FACStream field surveys by conducting additional analysis to further refine wetlands present in the assessment area through a more in-depth review of historical aerial imagery, digital elevation model (DEM) mapping, normalized difference vegetation index (NDVI), and normalized difference water index (NDWI) to provide a more tailored estimate during alternative optimization. Utilizing these analysis, permanent impacts to wetlands would occur under all action alternatives. Construction of the left bank levee, associated with all action alternatives, and the right bank levee, associated with alternatives 11b and 11c, would require the placement of fill in areas that have wetlands and result in the isolation of wetlands on the landward side of the proposed levee alignments. See Appendix G5a for more detail of aquatic sites within the study area.

Table 3 below provides a summary of permanent and temporary aquatic habitat effects associated with each alternative. Permanent effects include direct fill, indirect impacts associated with isolating the aquatic habitat from the floodplain, and conversion of one habitat type to another. Temporary effects are those disturbances associated with construction activities. Alternatives 3, 7, and 8 all result in the same amount of direct fill by wetland habitat type as a result of the left bank levee/floodwall component associated with those alternatives. Alternatives 11B and 11C have greater direct wetland impacts, as well as indirect isolating impacts, as compared to Alternatives 3, 7, and 8 due to the addition of a right bank levee. Alterantives 3 and 8 additionally result in habitat conversion due to channel widening effects; however, these alternatives would net an incidental overall positive impact to wetlands as a result of converting approximately 24.7 acres of upland habitat to a palustrine wetland habitat.

Table 3. Wetland and WOTUS Impacts

Alternative	Wetland Impacts (ac)															
	Levee/Floodwall Impacts										Channel Widening Impacts					
	Direct Fill					Isolated					Conversion				Temporary Disturbance	
	PUB	PEM	PSS	PFO	***Total***	PUB	PEM	PSS	PFO	***Total***	PUB to PEM	PSS to PEM	PFO to PEM	Upland to PEM	PEM to PEM	Riverine to Riverine
1																
3	0	0.02	0.10	0	***0.12***	0	0	0	0	***0***	0.84	3.24	0.34	24.70	41.12	31.32
7	0	0.02	0.10	0	***0.12***	0	0	0	0	***0***						
8	0	0.02	0.10	0	***0.12***	0	0	0	0	***0***	0.84	3.24	0.34	24.70	41.12	31.32
11b	0	1.26	0.39	0.24	***1.89***	0.63	0.05	0.07	0.50	***1.25***						
11c	0	1.43	0.44	0.26	***2.12***	0.63	0.04	0.06	0.48	***1.22***						
12																

5 Selection of the Least Environmentally Damaging, Practicable Alternative

In consideration of applying the 404(b)1 Guidelines to determine the LEDPA, the first screening criteria an array of alternatives undergoes is to determine the environmental impact so as to assess the “least environmentally damaging” component of the final alternatives. For Civil Works projects, ER 1105-2-103 dictates the process for evaluation of environmental impacts among alternatives for Civil Works water resource development projects. It provides guidance on applying environmental evaluation procedures to planning water resource projects while at

the same time fulfilling the requirements of compliance with all applicable federal laws. In accordance with the Fish and Wildlife Coordination Act; Section 906 WRDA of 1986; the Principals, Requirements, and Guidelines for Federal Investments in Water Resources (PR&Gs); ER 1105-2-103; and E.O. 11990, water resource development projects consider effects to all habitat types— not only aquatic habitats or jurisdictional waters of the U.S.— when evaluating environmental impacts among alternatives and developing compensatory mitigation plans (see Appendix G2). The FR/EA utilized FACStream to assess the existing habitat conditions within the study area and evaluate environmental impacts to all aquatic and terrestrial habitat types among alternatives (see Appendix G1). Table 4 below describes environmental impacts, in AAHUs for each alternative.

Table 4. AAHUs associated with each alternative

Alternative	AAHUs
1	*No Action*
3	-1.32
7	-2.16
8	-1.43
11b	-3.97
11c	-4.23
12	*Nonstructual*

It is this net loss in AAHUs of an alternative from the existing condition that determines the necessary compensatory mitigation equivalent to habitat loss. FACStream was the tool utilized to determine the “least environmentally damaging” alternative across all habitat types, aquatic and terrestrial, within the impact area. Of the structural alternatives, Alternative 3 has the least environmental impact with a net loss of 1.32 AAHUs. Alternative 7 has the lowest acreage of wetlands impacted from the left bank levee construction while Alternatives 3 and 8 result in permanent habitat type conversion from channel widening. The variations of Alternative 11 both have greater direct fill impacts than Alternatives 3, 7, and 8 due to the right bank levee (Table 3).

Civil Works projects authorized under 33 USC 2231 are governed by the PR&Gs. The “four accounts”, which include National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE), provide a structured planning framework for evaluating and comparing alternatives while also leaving sufficient flexibility to adapt water resource recommendations to federal priorities and needs of tribes, partners, stakeholders, and communities.

The application of the PR&Gs, and as defined in ER 1105-2-103, is the process utilized to determine the practicability of the alternatives through “maximizing public benefits, with appropriate consideration of costs”. Public benefits encompass the environmental, economic, and social goals, to include monetary and non-monetary effects. In addressing complex water resource problems with conflicting needs of the present and future, solutions may produce varying degrees of effects relative to environmental, economic, and social goals. No hierarchal relationship exists among these three goals, and, as a result, tradeoffs are assessed throughout

the decision-making process. The Recommended Plan, Alternative 3, was selected as the "practicable" alternative through application of the PR&Gs.

The selected TSP in Fall of 2024 was Alternative 8 and was identified as such in the Draft FR/EA that was released for public and agency review in September 2024.Following the release of the Draft EA, the South Dakota Department of Agriculture and Natural Resources (SDDANR), the certifying authority for a Section 401 Water Quality Certificate (WQC), provided comments stating that the weir operations associated with the TSP that would lower Lake Kampeska could adversely impact water quality and efforts the State has conducted to date to bring water quality in compliance with the TMDLs, as well as cause an adverse impact on existing water rights. Subsequent coordination resulted in the State concluding that a 401 WQC could not be obtained for any plan including weir operations unless USACE could demonstrate no adverse impact to the TMDL. As such, Alternative 3 was the only structural action alternative that did not include weir operations and thus was determined to be the only implementable plan. See Section 5 for Plan Comparison and Section 6 for Plan Optimization within the FR/EA.

The Recommended Plan, which is the Comprehensive Benefits Plan, results in a total of $780,000 in annual flood damage reduction, 93% of these benefits are realized by economically disadvantaged communities. The Recommended Plan reduces flood risk by lowering depths and damages to 948 structures at the 1% AEP and removes 398 structures from the 1% AEP. Nearly all (393) structures removed from the 1% AEP are within economically disadvantaged communities. At the 0.2% AEP event, the Recommended Plan would reduce average life loss down from 1 to 0 during a daytime event and reduce average life loss down from 5 to 2 during a nighttime event. See Section 7.1 within the FR/EA for a full discussion on Recommended Plan accomplishments.

6 Findings of Compliance or Non-compliance

a) Our review of water quality standards established by the State of South Dakota indicates that the proposed discharge would not violate any applicable state water quality standards
b) None of the Alternatives would result in significant adverse impacts to human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, or special aquatic sites
c) All appropriate steps to minimize adverse environmental impacts have been taken
d) None of the Alternatives would jeopardize the existence of federally listed threatened or endangered species or their habitat
e) No significant adaptions of the guidelines were made relative to this evaluation

7 Conclusions

Based on all of the above, Alternative 3, the Recommended Plan, is determined to be in compliance with the 404(b)1 guidelines. With the least environmental damage occurring under Alternative 3 with the loss of 1.32 AAHUs, the incidental conversion of 24.7 acres of upland habitat to wetland habitat through channel widening, and Alternative 3 being found as the practicable alternative through the assessment of the four planning accounts, the Recommended Plan is the LEDPA.

US Army Corps of Engineers®

WATERTOWN, SOUTH DAKOTA FLOOD RISK MANAGEMENT GENERAL INVESTIGATIONS STUDY

INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX G5A: DESKTOP DELINEATION

OMAHA DISTRICT
NORTHWESTERN DIVISION



March 2026

Purpose

The purpose of this report is to describe the methods and results of a desktop delineation conducted to estimate the aquatic resources present along the main reach of the Big Sioux River (BSR) within the assessment area and the proposed mitigation site along Mud Creek, a tributary to the BSR. Information obtained from this desktop delineation helped inform on-the-ground conditions to estimate potential impacts and opportunities for avoidance, minimization, and mitigation of impacts to aquatic resources under each proposed alternative for the Watertown General Investigations Study.

Assessment Area

Main Reach (BSR): The main reach of the BSR within the assessment area encompasses Reach 2 and Reach 3 identified in The Functional Assessment of Colorado Streams (FACStream) completed for this study (See Appendix G1 for more information). The width of the ecological floodplain was determined using the 20-year Annual Exceedance Probability (AEP). Using this inundation area, an approximate average total width of an 880-foot buffer was applied along the main reach for the desktop delineation to form the assessment area for FACStream. This is the same area which was also utilized as the assessment area for this desktop delineation. The main reach begins at the north end of Watertown, north of 14th Ave NW, and extends southeast through town for approximately 6 miles along the BSR before terminating in a rural setting. The main reach also incorporates the entire stretch of the Pelican Lake inlet/outlet channel and adjacent wetlands up to the point of confluence with the BSR.

Proposed Mitigation Site (166th Ave and Sioux Conifer Road): The proposed mitigation site area is located near 166th Avenue and Sioux Conifer, north of the City of Watertown along Mud Creek. The proposed mitigation site is a mixture of pasture and agricultural fields. Mud Creek flows northeast to southeast for approximately 4 river miles across the site.

Sources and Methods Used

To delineate the presence and classification of wetlands within the assessment area, a collection of data sources was used to determine potential presence of hydrophytic vegetation, hydric soils, and hydrology under typical conditions. The sources used for this desktop delineation are described below.

Elevation Data

- U.S. Geological Survey (USGS) 3D Elevation Program (3DEP) Bare Earth Digital Elevation Model (DEM) Dynamic Service: 3DEP is based on multi-resolution USGS DEM sources. 3DEP was referenced to obtain information on elevation changes throughout the assessment area. This source was heavily relied upon for the delineation of areas where clear assumptions to hydric soil, hydrology, and hydrophytic vegetation could not be made alone through utilization of other data sources explained below. 3DEP makes low spots and depressions easily visible; therefore, it was also utilized as a source to cross-check conclusions drawn from other data sources.

Aerial Imagery

Historic and recent aerial imagery was used to compare conditions within the assessment area between years.

- National Agriculture Imagery Program (NAIP) Aerial Imagery from August 22, 2016; August 30, 2018 and October 15, 2018; August 31, 2020; and October 10, 2023.
- 1991-2024 Google Earth Aerial Imagery and Google Earth Street View
- 1953 South Dakota State University Historic Aerial Imagery

Soil Data

- U.S. Department of Agriculture and Natural Resources Conservation Gridded Service Soil Survey Geographic Database (gSSURGO): The gSSURGO provides information regarding the type and distribution of soils on the landscape, based on soil surveys conducted by the National Cooperative Soil Survey. This data was used to determine the soil hydric rating throughout the assessment area. The soil hydric rating indicates whether a map unit component may be classified as a "hydric soil."
- USGS Web Soil Survey: The USGS web soil survey provides information regarding the soil types and characteristics for an area of analysis. The web soil survey was referenced to provide information on the hydric soil rating and ecological classifications of specific locations within the assessment area.

Precipitation/Hydrologic Data

- National Oceanic and Atmospheric Administration (NOAA) Precipitation Data: Accumulated precipitation data was referenced to inform conditions observed within NAIP Imagery. Dates of the NAIP imagery were used as inputs to output accumulated precipitation data.
- U.S. Army Corps of Engineers (USACE) 2-year and 4-year Flood Maximum Inundation Extent Data: This data was used to visualize maximum inundation extents for a 2-year and 4-year flood within the assessment area. Inundation areas helped inform where water naturally flows and pools within the assessment area during a 2-year and 4-year flood event.
- Normalized Difference Water Index (NDWI): NDWI is calculated from a multiband raster object that returns a raster object with index values used to differentiate water features from dry land. NDWI calculations were completed using 2022 NAIP imagery.
- National Hydrologic Dataset (NHD): NHD is a geospatial dataset that maps the Nation's surface water network and hydrologic drainage areas. NHD was referenced throughout the assessment area.

Vegetation Data

- Google Earth Street View: Google Earth Street View was only available along main streets within Watertown, SD. Where available within the assessment area, Google Earth Street view was used to identify plant communities within view and to make assumptions for similar, adjacent areas.
- Normalized Difference Vegetation Index (NDVI): NDVI is calculated from a multiband raster object that returns a raster object with index values. NDVI quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). NDVI calculations were

completed using 2022 NAIP imagery. Relative biomass of vegetation was observed throughout the assessment area, utilizing NDVI.

Existing Wetland Data

- U.S. Fish and Wildlife Service National Wetland Inventory (NWI): NWI mapped wetlands are prepared from the analysis of high-altitude imagery. It is likely that mapped features have changed, especially because the imagery used by the NWI in Watertown, SD is from the 1980s. This source was referenced throughout the desktop delineation but held minor influence in comparison with other more-updated sources used.

Results

Classifications of aquatic resources delineated in the assessment area were defined by system and class:

- PEM: Palustrine Emergent
- PFO: Palustrine Forested
- PSS: Palustrine Scrub Shrub
- WIAS: Wetland in an Agricultural Setting
- R2SB: Riverine Lower Perennial Streambed

Table 1. Acreage of Aquatic Resources by Cowardin Classification

Cowardin Classification	Mitigation Area (Acres)	Main Reach (Acres)
PEM	94.76	192.51
PFO	0	2.04
PSS	0	6.73
PUB	1.66	14.80
WIAS	60.88	0
R2SB (Riverine)	6.93	45.22

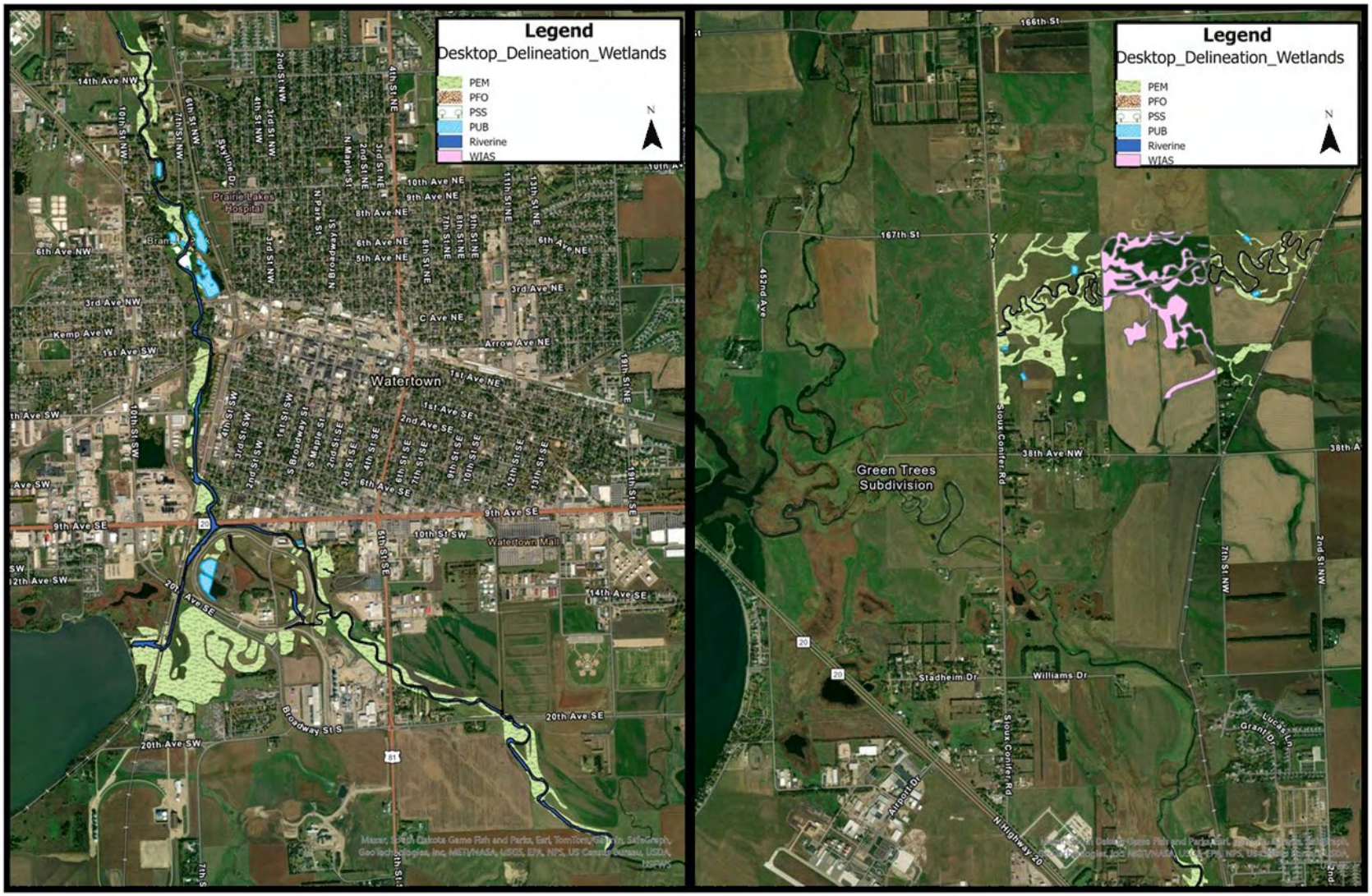


Figure 1. Wetlands within the assessment area determined through desktop methodology

Disclaimer and Assumptions

Utilizing the collection of data sources described above, this desktop delineation was produced using best available information to make the most reasonable estimation of the presence of aquatic resources within the assessment area. The general degree of uncertainty associated with each data source was considered and assumed to be minimized through comparison of multiple data sources.

It is recognized that a desktop delineation may not reflect results that meet the same level of accuracy a field wetland delineation generates. However, using best available information, the collective use of multiple data sources produced results that are reasonable, sound, and commensurate with the level of detail required throughout the planning process of the Watertown General Investigation Study.

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WATERTOWN, SOUTH DAKOTA FLOOD RISK MANAGEMENT GENERAL INVESTIGATIONS STUDY

INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX G6: LAKE KAMPESKA SEDIMENT LOAD ANALYSIS

OMAHA DISTRICT

NORTHWESTERN DIVISION



March 2026

Summary

A conservative analysis of changes in the sediment load entering Lake Kampeska from the Big Sioux River was conducted with existing available data to determine effects to water quality from weir operations associated with Alternatives 7, 8, 11B, and 11C (future with project [FWP] conditions). Due to the limited suspended sediment concentration (SSC) data available at the inflow/outflow structure, data presented in the study: "Upper Big Sioux River Hydrology" (Little, 1998) was used to estimate inflow and outflow SSC. Modeled hourly Lake Kampeska inflow and outflow data for normal and flood control operations presented in Annual Exceedance Probability (AEP) were provided by Omaha District USACE Floodplain Section personnel. The sediment load to Lake Kampeska for normal operations and operations as identified in Alternatives 7, 8, 11B, and 11C was estimated by calculating an hourly flux of suspended sediment entering Lake Kampeska for the modeled period of April 12th through the 24th and then summing the results. Results from this analysis conclude that the modified flows into Lake Kampeska for flood control would result in an increase in sediment load which ranges from 5.4% at the 0.2% AEP to 31.1% at the 25% AEP.

Introduction

Alternatives 7, 8, 11B, and 11C propose altering pool management at Lake Kampeska for potential flood control operations. The proposed changes would slightly lower the lake pool elevation in the late fall to increase storage capacity in the following spring. The additional storage capacity would then be used to impound seasonal inflows or provide additional storage for flood events. To assess the potential water quality impacts of implementing any of the alternatives that included weir operations, the Omaha District USACE Water Control and Water Quality Section was tasked to review pertinent literature and data and conduct a brief evaluation of sediment loading to Lake Kampeska under normal conditions and potential flood control conditions for both the No Action Alternative (future without project [FWOP] conditions) and FWP conditions.

Methods

To assess potential sediment load changes to Lake Kampeska a review of available literature and data was conducted. The literature included documents from the South Dakota Department of Agriculture and Natural Resources (SDDANR) including the approved nutrient and sediment Total Maximum Daily Load (TMDL) for Lake Kampeska (SDDANR, 1994), an analysis of the Hydrology of the Upper Big Sioux River Basin (Little, 1998) which focused on the flood of 1997. Other pertinent literature included a study on

sediment deposition in Lake Kampeska (USGS, 2002) and multiple reports evaluating flood control in the Big Sioux River Basin. A review of pertinent water quality data was conducted by querying the U.S. Environmental Protection Agency's (EPA) Water Quality eXchange (WQX) Database. The EPA's Tools for Automated Data Analysis (TADA) (Mullin, 2025) was used to standardize and evaluate data retrieved via geographic query. The retrieved data contained many samples collected in the Upper Big Sioux Basin and Lake Kampeska, but few analyzed SSC at the inlet/outlet of Lake Kampeska. The SSC data used for analysis was collected in 1997 prior to the construction of the sediment weir. This data was collected in support of the report: "Upper Big Sioux Hydrology" ("Little, 1998).

Estimating the sediment load entering Lake Kampeska during assumed normal conditions and under conditions specified in weir operations under Alternatives 7, 8, 11B, and 11C was done by calculating an hourly suspended sediment (SS) flux entering Lake Kampeska for the period of April 12th through the 24th. Flow data for the normal condition and weir operations scenario was provided by the by Omaha District USACE Floodplain Section. Hourly flow to calculate the SS flux was the only variable that differed between the two scenarios. The hourly flux was calculated assuming a SSC of 98 mg/L for inflows and 14 mg/L for outflows. The SSC samples used for analysis were collected during the 1997 flood event in accordance with USGS standard procedures and then analyzed at a USGS laboratory (Little, 1998). The hourly flux in units of kg/hr was calculated by multiplying the SSC (mg/L) by flow (cms) to yield a flux in units of g/sec, then followed by converting mass and time units to kg/hr. For comparison to previous studies the flux in units of kg/hr was converted to tons/hr and a conversion factor of one ton of sediment is equal to 0.7 cubic yards was used to convert the sediment mass to a volume in cubic yards. The hourly load volumes were then summed over the 12-day period to compare the normal flow and alternative 8 sediment loads.

Results and Discussion

The estimated sediment loads to Lake Kampeska are shown in Table 1-1. The results indicate that alternative 8 would result in an increase in sediment load to Lake Kampeska ranging from 5.4% at the 0.2% AEP to 31.1% at the 25% AEP. To confirm calculation methods the estimated sediment loads from "Upper Big Sioux Hydrology" (Little, 1998) were re-calculated. The results had an absolute mean error of 0.33% which indicates the same methods were used for calculation and is likely a rounding error.

Table 1-1. Comparison of Estimated Sediment Loads to Lake Kampeska.

Alternative 1 (No Action; FWOP)		
AEP %	Approximate Return (1/YR)	Estimated Lake Kampeska Inflow Sediment Volume (yd3)
0.2	500	5053
0.5	200	4011
1	100	3282
2	50	2569
5	20	1731
10	10	1197
25	4	628
50	2	253

Alternatives 7, 8, 11B, 11C (FWP)		
AEP %	Approximate Return (1/YR)	Estimated Lake Kampeska Inflow Sediment Volume (yd3)
0.2	500	5323
0.5	200	4242
1	100	3479
2	50	2734
5	20	1889
10	10	1348
25	4	823
50	2	300

FWP vs FWOP		
AEP %	Approximate Return (1/YR)	Estimated Lake Kampeska Inflow Sediment Volume in yd3 and (percent increase)
0.2	500	270 (+5.4%)
0.5	200	231 (+5.8%)
1	100	198 (+6.0%)
2	50	166 (+6.4%)
5	20	158 (+9.2%)
10	10	150 (+12.5%)
25	4	195 (+31.1%)
50	2	48 (+18.8%)

Using this method to calculate the influent sediment loads for Lake Kampeska under normal operating conditions and conditions as defined in Alternatives 7, 8, 11B, and 11C is for comparison only. This was a simplified, conservative estimate and does not account for the dynamic nature of sediment transport in lake and river systems. To more accurately characterize the sediment load entering Lake Kampeska significantly more data would be required to be collected at the inlet/outlet structure and a dynamic water quality model should be used.