

III. Sample Cases

Sample Case #1: All Mitigation On-Site

This project will involve permanent fill of 30 linear feet of first order perennial stream in a tertiary priority category for construction of a dam, thus impounding 500 linear feet of this stream. Existing condition of the stream is entrenched banks with moderately vegetated buffer and an impoundment occurs 0.25 miles upstream (somewhat impaired). In addition, this project contains a residential development that involves permanent piping of 150 feet of a perennial stream in a tertiary priority category that has not channelization or contains rip rap within 0.5 miles (fully-functional).

Proposed mitigation includes riparian buffer mitigation that will consist of enhancement of a single side of 2,000 feet of Reach 1 and both sides of 1,000 feet of Reach 2. The buffers to be enhanced are adjacent to a perennial stream of the same order as the impact stream. The buffer proposed will be 100 feet in width, have a 6% slope, require 50% of the area to be re-vegetated (to be performed concurrent with the adverse impacts), are located in a tertiary priority category, and will be protected by deed restrictions overseen by a property owners association.

Included with the proposed will be stream mitigation that will remove 350 linear feet of piping on-site, restore the stream to a “day-lighted” condition and establish appropriate geomorphology based on a referenced, stable channel. The piped stream to be restored is perennial, in a tertiary priority category, and will be restored prior to the adverse impacts and subsequently protected by deed restrictions overseen by a property owners association. The stream restoration plan was coordinated with appropriate resource and regulatory agencies and deemed acceptable.

Adverse Impact (debit) worksheet: Work sheet example for Area 1 of this sample case.

Table I1 Adverse Impacts (debit) Factors and Worksheet. (Factors are defined in Section II)

FACTORS	MULTIPLIERS									
Stream Type (Pg18)	Ephemeral 0.2		Intermittent 0.3		>2 nd Order Perennial 0.6			1 st or 2 nd Order Perennial 0.8		
Stream Status (Pg18)	Tertiary 0.1			Secondary 0.3				Primary 0.6		
Existing Condition (Pg19)	Impaired 0.1			Somewhat Impaired 0.75				Fully Functional 1.5		
Duration (Pg19)	Temporary (<12 months) 0.0			Short Term (12-24 months) 0.1				Permanent (>24 months) 0.3		
Dominant Impact (Pg20)	Shade Clear 0.05	Utility Crossing 0.15	Bank Stabilization* See table I.2 below	Culvert 0.3	Detention /Weir 0.75	Morphologic 1.5	Impound 2.0	Pipe 2.2	Fill 2.5	
Collective Impact (Pg21)	0.0005 x linear feet of stream impacted by this dominant impact 30 linear feet x 0.0005 = 0.015									

$$SF_i = 0.8 + 0.1 + 0.75 + 0.3 + 2.5 + 0.015 = 4.465$$

$$LF_i = 30 \text{ linear feet}$$

$$SF_i \times LF_i = 4.465 \times 30 = 133.95$$

DEBITS:	Impact Area 1 (Dam)	Impact Area 2 (Impoundment)	Impact Area 3 (Piping)
Stream Type	0.8	0.8	0.8
Stream Status	0.1	0.1	0.1
Existing Condition	0.75	0.75	1.5
Duration	0.3	0.3	0.3
Dominant Impact	2.5	2.0	2.2
Collective Impact	0.015	0.25	0.1
Sum of Factors (SF _i)	4.465	4.2	5.0
Linear Feet Impact (LF _i)	30	500	150
SF _i X LF _i	133.95	2,100.0	750

$$\text{Total Debits} = \Sigma (SF_i \times LF_i) = \underline{\underline{2,984.0}}$$

Proposed mitigation (credit) worksheets

Minimum buffer width for the mitigation area is calculated by multiplying the minimum width for residential (50 feet) by 2 to account for a 6% slope, yielding a minimum of a 100-foot wide riparian buffer to attain mitigation credit. Thus, the proposed 100-foot buffers satisfy the minimum buffer width.

Work sheet example for Reach 1 of this sample case.

Table 1.4 Minimum Stream Riparian Zone widths for Mitigation

Land Use (in feet)	Less than 5% slope (1x)	5% - 20% slope (2x)	21% - 40% slope (3x)	Greater than 40% slope (4x)
Residential	50	100	150	200
Agricultural - Grazing lands/ non cultivated	50	100	150	200
Recreational	75	150	225	300
Institutional / Agricultural-cultivated	75	150	225	300
Industrial	100	200	300	400
Landfill	100	200	300	400
Other Categories (including use of reference reach data)	Case-by-case	Case-by-case	Case-by-case	Case-by-case

Note: Slope is measured from top of bank perpendicular away from the stream for a distance of 200 feet. In most instances slope may be averaged for the length of stream to be buffered. However, in situations where stream segments have definitively different slopes it may be appropriate to calculate average slopes for each stream segment.

Table 1.5 NET IMPROVEMENT FOR RIPARIAN BUFFERS

Stream Status (Pg 18)	Buffer Width (Isile)	91-100% Area to be restored	61-90% Area to be restored	33-60% Area to be Restored	1-32% Area to be restored	No Restoration Needed *
Primary	4x min width	1.0	0.9	0.8	0.7	0.6
	3x min width	0.8	0.7	0.6	0.5	0.4
	2x min width	0.6	0.55	0.5	0.4	0.3
	Minimum Width	0.4	0.3	0.25	0.2	0.15
Secondary	4x min width	0.95	0.85	0.75	0.65	0.55
	3x min width	0.75	0.65	0.55	0.45	0.35
	2x min width	0.55	0.45	0.4	0.35	0.25
	Minimum Width	0.3	0.25	0.2	0.15	0.1
Tertiary	4x min width	0.8	0.7	0.6	0.5	0.4
	3x min width	0.65	0.6	0.5	0.4	0.3
	2x min width	0.5	0.45	0.4	0.3	0.2
	Minimum Width	0.25	0.2	0.15	0.1	0.05

As mentioned in the proposed mitigation – “50% of the area to be re-vegetated (to be performed concurrent with the adverse impacts), are located in a tertiary priority category, and will be protected by deed restrictions overseen by a property owners association.”

Table 1.6 Riparian Credit Factors Worksheet

FACTORS	MULTIPLIERS				
Net Improvement (Pg 21)	Riparian Buffer Enhancement (step 5) (Calculate value from above Net Improvement table) 0.15 0.05 - 1.0				
Type of Protection (Pg 22)	Permit Condition 0.03	Covenants 0.05	Deed Restriction 0.12	Conservation Easement 0.15	Fee Title 0.2
Mitigation Timing (Pg 23)	Schedule 5* 0.0	Schedule 4 0.02	Schedule 3 0.05	Schedule 2 0.08	Schedule 1 0.1
Comparative Stream Order (Pg 18)	Same Order 0.2	1 Order Difference 0.01		2 or more Order Difference 0.0	
Location (Pg 23)	On-site 0.2	Off-site 0.1		Outside 0.0	

Schedule 3: Mitigation will be completed concurrent with impacts

*Use this option to calculate credits when no restoration of buffer necessary

$$SF_m = 0.15 + 0.12 + 0.05 + 0.2 + 0.2 = 0.72$$

$$LF_m = 2,000 \text{ ft in Reach 1}$$

$$RM = [\text{buffer 1 side} = 0.75]$$

$$SF_m \times LF_m \times RM = 0.72 \times 2,000 \times 0.75 = 1,080$$

(Reach 1 data on next page)

Table 1.7 Total Riparian Credits Worksheet

FACTORS		Mitigation Reach 1	Mitigation Reach 2	Mitigation Reach 3	Mitigation Reach 4	Mitigation Reach 5
Net Improvement	Stream Side A	0.15	0.15			
Net Improvement	Stream Side B	NA	0.15			
Type of Protection		0.12	0.12			
Mitigation Timing		0.05	0.05			
Comparative Stream Order		0.2	0.2			
Location		0.2	0.2			
Sum of Factors (SF _i)		0.72	0.87			
Linear Feet Impact* (LF _i)		2,000.0	1,000			
Reach Multiplier (RM) Buffer 1 side = 0.75 Buffer both sides = 1.25		0.75	1.25			
SF _m x LF _m x RM		1,080	1,087.5			

Total Riparian Credits = $\Sigma (SF_m \times LF_m \times RM) = \underline{2,167.5}$

Table L8 Stream Restoration Credit Factors Worksheet

FACTORS	MULTIPLIERS				
Net Improvement (Pg21)	Minimal 1.2	Moderate 1.8		Substantial 2.5	
Stream Status (Pg 18)	Tertiary 0.05	Secondary 0.2		Primary 0.3	
Type of Protection (Pg22)	Permit Condition 0.03	Covenants 0.05	Deed Restriction 0.1	Conservation Easement 0.15	Fee Title 0.2
Mitigation Timing (Pg23)	Schedule 5* 0.0	Schedule 4 0.02	Schedule 3 0.05	Schedule 2 0.08	Schedule 1 0.1
Comparative Stream Order (Pg18)	Same Order 0.2	1 Order Difference 0.01		2 or more Order Difference 0.0	
Location (Pg23)	On-site 0.2	Off-site 0.1		Outside 0.0	

Schedule 1:
All mitigation will be completed prior to the adverse impacts

$$SF_m = 2.5 + 0.05 + 0.1 + 0.1 + 0.2 + 0.2 = 3.15$$

$$LF_m = 350 \text{ ft}$$

$$SF_m \times LF_m = 3.15 \times 350 = 1,102.5$$

Table L9 Stream Restoration Credit Worksheet

Factors	Mitigation Reach 1	Mitigation Reach 2	Mitigation Reach 3	Mitigation Reach 4	Mitigation Reach 5
Net Improvement	2.5				
Stream Status	0.05				
Type of Protection	0.1				
Mitigation Timing	0.1				
Comparative Stream Order	0.2				
Location	0.2				
Sum of Factors: SF _m =	3.15				
Linear Feet: LF _m =	350				
SF _m x LF _m =	1,102.5				

Total Stream Credits = $\Sigma (SF_m \times LF_m) = \underline{1,102.5}$

SUMMARY OF MITIGATION CREDITS


Category	Credits
Riparian Buffer Enhancement	2,167.5
Stream Restoration	1,102.5

Total Credits = 3,270.0

PMC \geq Debits: (3,270.0 \geq 2,984.0)

The Total Proposed Mitigation Credits (3,270.0) are greater than the Debits (2,984.0). Therefore, the quantity and mix of mitigation is acceptable. The Project Manager must also review the other aspects of the mitigation plan to assure that it is generally in compliance with the policies and guidelines for mitigation.

End of Sample case #1



Sample Case #2: On-site Mitigation Combined With Mitigation Bank Credits

For this sample case, let us assume that the impacts are the same as in the previous case sample. Thus, we need 2,984.0 mitigation credits. Also, assume the same riparian buffer enhancement that generates a total of 2,167.5 credits. However, instead of 350 linear feet of stream restoration, assume only 150 linear feet of stream restoration are proposed and the remaining credits will be obtained from a Mitigation Bank. Similar to the previous example we can calculate the following:

Proposed Riparian Buffer Enhancement = 2,167.5

Proposed Stream Restoration ($SF_m \times LF_m$)

= 3.15 X 150 = 472.5

Total Proposed Non-Bank Mitigation Credits = 2,640.0

The additional credits needed are:

Total Mitigation Credits Required = 2,984.0

Total Proposed Non-Bank Credits = 2,640

Additional Credits Needed = 344.0

In order for the credits to be equal to or greater than debits, the applicant must obtain at least 344.0 credits from a mitigation bank.

The number of linear feet required from the bank to obtain these credits will depend on the approved banking documents and must be calculated by the bank operator. The calculation of bank linear feet used should be submitted with both the project mitigation proposal and the regular accounting summary for the Mitigation Bank.

Date: March 17, 2010

Investigators: Klynn Ward

Project Name: Sample 3 - Bank Stabilization Corps file No# _____

Brief Project Description:

A continuous 2,400 linear feet bank stabilization to protect a residence, outbuildings, and valuable irrigated cropland

- * 375 linear feet of rock riprap revetment up to the high bank elevation along the bank in front of the residence and outbuildings;
- * 525 linear feet of rock toe up to the ordinary high water mark (OHWM) with bank sloping & vegetation above the OHWM;
- * 1,200 linear feet of bank protected by nothing but a series of 11 rock barbs on 100-foot spacing. Each rock barb is 40 feet long, angles 25 degrees upstream, and is submerged at normal and high flows; and
- * 300 linear feet of bank sloping and heavy riparian plantings with no rock.

Stream is a large 3rd order perennial stream and a Primary water (outstanding fisheries resource). Existing condition is fully functional. Work occurs along the left bank only. Duration: this is intended to be a permanent bank stabilization project.

Mitigation Debit Tables

Adverse Impacts (debit) Factors and Worksheet. Factors are defined in Section II of the MTSMP.

FACTORS	MULTIPLIERS									
Stream Type (Pg 18)	Ephemeral 0.2		Intermittent 0.3		>2nd Order Perennial 0.6			1 st or 2 nd Order Perennial 0.8		
Stream Status (Pg 18)	Tertiary 0.1			Secondary 0.3				Primary 0.6		
Existing Condition (Pg 19)	Impaired 0.1			Somewhat Impaired 0.75				Fully Functional 1.5		
Duration (Pg 19)	Temporary (<12 months) 0.0			Short Term (12-24 months) 0.1				Permanent (>24 months) 0.3		
Dominant Impact (Pg 20)	Shade Clear 0.05	Utility Crossing 0.15	Bank Stabilization* See table I.2 below	Culvert 0.3	Detention /Weir 0.75	Morphologic 1.5	Impound 2.0	Pipe 2.2	Fill 2.5	
Collective Impact (Pg 21)	0.0005 x linear feet of stream impacted by this dominant impact (see chart for each reach's numbers)									

Note: The cumulative impact factor for the overall project must be used in each reach column on the Total Debits Worksheet below.

Table I.2 Bank Stabilization Multipliers

Multiplier	Description For Bank Stabilization (Dominant Impact)
0.1	Vegetation only. (End result is a living herbaceous, woody, or mixed plant community. Coir logs, fabric, or other soft temporary protection is acceptable with no additional debits needed.)
0.2	Vegetation combined with dead woody material. (End result is a living herbaceous, woody, or mixed plant community with a less than 50% dead wood component in the toe and/or bank. Coir logs, fabric, or other soft temporary protection is acceptable with no additional debits needed.)
0.3	Vegetation above the Ordinary High Water Mark (OHWM) combined with either a rock Toe or 50%+ dead wood at or below OHWM. (End result is a living herbaceous, woody, or mixed plant community above the OHWM and rock or dead wood at or below the OHWM. Coir logs, fabric, or other soft temporary protection is acceptable with no additional debits needed.)
0.4	Rock riprap above and below the OHWM, and any type of vanes/barbs/weirs/hard points that project into the channel. (End result is little or no vegetation on bank for rock riprap revetments, or an eroding bankline protected by one or more vanes/barbs/weirs/hard points/etc.)
0.5	Log Cribs, or combinations of bank riprap with vanes/barbs/weirs/hard points. (Log crib structures filled with soil, plants, and/or rock extending below and/or above the OHWM, or projects using vanes/barbs/weirs/hard points that also include a rock riprap revetment or toe along the bank)
0.7	Retaining Walls. (Vertical or nearly vertical retaining walls constructed of gabion baskets, hand-placed stone, masonry, concrete, steel, wood, or other materials.)

Total Debits Worksheet

Factor	Impact Area 1 riprap	Impact Area 2 – Rock toe	Impact Area 3- Barbs	Impact Area 4- plantings	Impact Area 5	Impact Area 6
Stream Type	0.6	0.6	0.6	0.6		
Stream Status	0.6	0.6	0.6	0.6		
Existing Condition	1.5	1.5	1.5	1.5		
Duration	0.3	0.3	0.3	0.3		
Dominant Impact	0.4	0.3	0.4	0.1		
Collective Impact	0.2	0.3	0.6	0.2		
Sum of Factors (SF _i)	3.6	3.6	4.0	3.3		
Linear Feet Impact* (LF _i)	375.0	525.0	1,200.0	300.0		
SF _i X LF _i	1,350.0	1,890.0	4,800.0	990.0		

Note: Some projects (including maintenance) that are less than 300 ft in length may not require compensatory mitigation.

Total Debits = Σ (SF_i X LF_i) = 9,030.0