

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

STREAMBANK EROSION RATE STUDY
FOR THE PERIOD
21 APRIL, 1978 TO 10 AUGUST, 1985

Prepared For
U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

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I. Purpose. This report is to document the procedures used and the results obtained from the bank erosion study for the Missouri National Recreational River Gavins Point Dam to Ponca, Nebraska. The period studied extends from 21 April, 1978 to 10 August, 1985 or a period of 7.31 years. The study was made for the Omaha District of the U.S. Army Corps of Engineers by River Pro's under Contract No. DACW45-85-D-0084.

II. Objective. The objective of the study was to determine bank erosion rates for the river system noted above for the left bank, right bank, and special identified erosion areas on both the left and right banks of the river reach. As described in the "Scope of Work" presentation furnished by the Omaha District, bank erosion is defined for this analysis as the aerial surface loss in acres of usable or productive land located along the river's banks. This includes land that is considered to be potentially productive.

III. Procedure.

1. Aerial photographs for the base year of 1978 and ending year of 1985 were used to divide the study area of the river reaches into suitable sub-reaches or segments. Segment boundary points on the left and right banks were established by selecting points that could be identified on both the base year and ending year of the photography used for this study; such as, buildings,

fence corners, road intersections, lone single tree or small tree clumps, or small tributary stream confluence points. The points were selected so that they could be identified on the 1978 and 1985 aerial photographs and also on aerial photographs of the area that might be taken in the future should it become necessary to extend the time frame of this erosion study. A brief description of each boundary point and the 1960 mileage location is listed in Table 1. These identifiable points for each segment on both sets of photographs were then connected to form an irregular quadrilateral which outline the river segments with the overall river reach to be evaluated.

2. The photographic reproduction scales of the 1978 and 1985 photographs furnished for the study were at a scale of 1"=2000' and to improve the accuracy of the measurements (both linear and by planimeter) special photographic enlargements to a scale of 1"=1000' were obtained of specified areas of the original photography provided.

a. To determine the approximate area of the original photograph to be enlarged, a preliminary selection was made of the most likely locations of the segment boundary key points on both the 1978 and 1985 photographic series. To insure overlap of the photographic enlargements that would include the approximate location of the key points, templates with a four inch square opening were placed on the 1"=2000' photographs and the area selected to be enlarged was scribed onto the reverse side of the photograph. The original photographs and the corresponding photographic negatives were furnished to the photo laboratory for preparation of the enlargements.

b. The enlarged scale also assisted in more accurately locating the key boundary point's final position on both photographic series.

3. To compute the segment area, the upstream right endpoint of each segment quadrilateral was connected to the downstream left endpoint for the purpose of dividing the quadrilateral into two (2) triangles. The area for each of the triangles formed within the quadrilateral was determined by measuring the length of the three (3) sides of each triangle using the 60 scale on an engineer's scale and applying the following equations:

$$S = \frac{(A+B+C)}{2}$$

where A, B, C are sides of the triangle.

$$\text{Triangle Area} = (S(S-A)(S-B)(S-C))^{0.5}$$

The two triangle areas within each segment were then added together to obtain the total area of each quadrilateral that formed the segment of the sub-reach. The measurements and the areas computed are shown in Table 2 for the 1978 photographs and Table 3 for the 1985 photographs.

4. Scale differences between photographs of the base year series (1978) were corrected using the scale correction factor determined as follows:

- a. Measure the length of the downstream cross-section of the segment using the 60 scale.
- b. Measure the length of the upstream cross-section of the next segment downstream on the next downstream photograph when it was necessary to use the next downstream photograph to locate the segment area.

c. Divide the downstream cross-section distance by the upstream cross-section distance. (This is the photo scale factor for the segment where the upstream measurement was used (see example computation below).)

d. Multiply this photo scale factor by the photo scale factor for the segment upstream and square the product to arrive at the segment scale correction factor.

Note: The scale factor for Segment 1 is used as 1.00.

The segment scale correction factors determined from the 1978 photograph series are presented in tabular format in Table 4. A sample computation showing derivation of the Segment Scale Correction Factor determined for this study is shown on the tabulation page. It is also presented below in generalized form.

$$\frac{\text{D/S X-Section (Seg. X-1)}}{\text{U/S X-Section (Seg. X)}} = \text{Photo Scale Factor (Segment X)}$$

$$((\text{PFS for Seg. X-1}) (\text{PFS for Seg. X}))^2 = \text{Segment Scale Correction Factor for Segment X.}$$

(where X is the segment number for which scale factor is desired)

5. The area distortion factor for the 1985 photographs were determined by dividing the 1978 segment areas by the 1985 segment areas. The area correction factors for the 1985 photographs were then obtained by multiplying the area distortion factor by the scale correction factors determined from the 1978 photograph sets. This computation data is shown in tabular format in Table 6.

The area correction factors for the 1978 photographic set are shown in tabular format in Table 5. The area distortion factor for 1978 is 1.0 as the 1978 photographs were selected as the base year.

6. The area bounded by the upstream and downstream cross-section lines, the river bankline and the right or left boundary line was planimetered on both the 1978 and 1985 photographs. Areas were planimetered at least twice with the left and right areas tabulated separately as shown in tabular format in Table 7. Planimetered areas were multiplied by the appropriate area correction factor to obtain the correlated correct area in square inches. The 1985 corrected areas were subtracted from the 1978 corrected areas to determine the differences in area from 1978 to 1985. Increases in areas are reported as no erosion loss and recorded as negative difference values on the planimeter tabulation and as 0.00 on the Erosion Rate tabulation.

To provide area data for the special identified erosion areas, a perpendicular was constructed (on the 1985 photographs) from the upstream and downstream endpoints of the special erosion area limits to the respective left or right segment boundary line. This allowed for a sub-segment planimeter measurement which could be accumulated with other area measurements to comprise the special erosion site area data. The proportional relationship between the measured length of a segment side on the 1978 and 1985 photographs provided a factorial relationship to set a distance from a key point on the 1978 photograph to establish a similar location point on the 1978 respective segment boundary line from which a perpendicular could be constructed to the 1978 river bankline. This provided the necessary

corresponding sub-segment to be planimetered on the 1978 photography to develop that year's special erosion site area. These areas were designated as "A" and "B" on the photograph overlay and incorporated into the Segment Number on the planimeter data table.

7. The segment cross-sections were located on the August, 1985 aerial mosaic maps using identifiable points between the study aerial photographs and the mosaic maps. The river mileages, shown on the mosaic maps, were used to trace an approximate river thalweg line. From the points where the segment cross-sections intersect the left or right bankline a perpendicular was drawn from the channel thalweg trace. A proportional distance was measured between adjacent mileage points indicated on the mosaic map to establish a river mileage (to the nearest one/hundreth of a mile) for these points which then provided the segment left and right bank limits for determining each left or right segment length. The limit points of the special identified erosion areas were established in the same manner, except for the James River Chute Left and Right Areas where a separate chute thalweg was established for mileage length measurement.

8. A special evaluation was made to determine the reproduction scale of the base year photographs (1978). Specific areas were identified on the photography for which similar areas could be identified on the latest USGS Quadrangle maps of the study area. These areas were measured on both the map and photograph using the 60 scale to determine the surface area values. Seven

of these areas (shown in the table below) were measured over the length of the study reach and an adjustment factor was computed for each site. The largest and the smallest adjustment factor computation was dropped and then an average was computed of the remaining five factors. This "Adjustment Factor" was used to modify the area difference value found for each segment in Table 7 before converting this difference shown in square inches of planimeter measure to acres.

<u>Reference Number</u>	<u>USGS Quadrangle Map Area</u>	<u>1"=1000' Photo Area</u>	<u>Adjustment Factor</u>
1-L-sp	45.0450	180.4955	0.998252
4-L-sp	43.2225	170.2400	1.015566*
13-L-sp	17.7200	35.6200	0.996300
18-L-sp	31.4025	125.7680	0.998744
21-R-sp	31.5218	126.1546	0.999466
45-L-sp	15.8755	65.1462	0.974763*
48-L-sp	15.7605	63.3994	0.994361

$$\text{Adjustment Factor} = 4.9871225/5 = 0.9974245$$

*Largest and smallest values deleted from the computation of average Adjustment Factor.

9. River mileages and area differences were utilized to determine erosion and erosion rates for each segment. Using the scale of 1 inch equal to 1,000 feet, the erosion values in acres were obtained by multiplying the area differences in square inches by the Adjustment Factor noted in paragraph above and then the results multiplied by 22.956841 for conversion to acres.

The erosion values are presented in separate tabular format for the left and right bank for each river segment in Table 8 and 9.

IV. Discussion.

1. As indicated in the "Scope of Work" the definition of bank erosion for this evaluation is the aerial surface loss in acres of useable or productive land, which includes land that is considered to be potentially productive. This classification includes land that is currently being used for agricultural or river front development purposes. It includes land that could be readily converted to agricultural use with a minimum of effort.

2. The majority of the computations for this study were accomplished using computer programs which used values to 8 or 10 decimal places before being rounded-off to the values shown on the tabulations. Therefore, when making check computations of the recorded data it will be necessary to use similar decimal values to simulate study values. This is more relevant where the computation requires several values to be multiplied together or where squares and roots are used.

MISSOURI NATIONAL RECREATIONAL RIVER
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TABLE 1

KEY POINT IDENTIFICATION DESCRIPTION

<u>RIVER MILEAGE LOCATION</u>	<u>KEY POINT DESCRIPTION</u>
810.35 L	Intersection centerline of dam and outlet
810.23 R	Intersection centerline of highway and drive
809.40 L	Engine on irrigation system
809.06 R	Center of house
807.80 L	Engine on irrigation system
808.64 R	Intersection centerline of highway and drive
806.84 L	Center of garage on North side of house
807.69 R	Intersection of fence lines
805.67 L	Intersection of street centerlines
805.80 R	Northeast corner of building
804.89 L	Centerline of centerline of drives
804.66 R	Center of pivot pad of irrigation system
802.10 L	Intersection of field drives
803.37 R	Intersection of field lines
801.40 L	Intersection of field drives
802.17 R	Center of shed
800.62 L	Intersection of field lines
799.97 R	Field corner
799.32 L	Fence corner
799.05 R	Center pivot pad of irrigation system
797.95 L	Center of shed
797.10 R	Center of pivot pad of irrigation system
796.93 L	Intersection of field drives
797.10 R	Fence corner

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TABLE 1

KEY POINT IDENTIFICATION DESCRIPTION

<u>RIVER MILEAGE</u> <u>LOCATION</u>	<u>KEY POINT DESCRIPTION</u>
795.68 L	Intersection of field drives
794.90 R	Intersection of field drives and field line
794.39 L	Intersection of centerline of road and feince line
793.94 R	Intersection of field line and tree line
792.08 L	Center of shed
793.0 R	Intersection of farm drives
790.95 L	Center of shed
791.60 R	Center of pivot pad of irrigation system
789.88 L	Single tree
789.38 R	Engine on irrigation system
787.24 L	Center of shed
787.54 R	Tree on edge of clearing
785.60 L	Single tree
786.07 R	Center of building
783.83 L	Field corner
784.17 R	Intersection of centerline of road and fence line
782.75 L	Northwest corner of building
782.90 R	Northwest corner of farm field fence line
781.60 L	Centerline of farm road and alignment turn
779.79 L	Cener of center-pivot
780.38 R	Northeast corner of farm field
779.05 L	Southeast corner of farm field at true line
778.95 R	Northwest corner of farm field

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TABLE 1

KEY POINT IDENTIFICATION DESCRIPTION

<u>RIVER MILEAGE LOCATION</u>	<u>KEY POINT DESCRIPTION</u>
778.08 L	Northwest corner of farm building
778.60 R	Northwest corner of farm building
777.29 L	Southwest corner of farm field
777.60 R	Ditch on fence line
777.22 L	Point at road intersection
776.57 R	Intersection of drainage ditches
775.80 L	Road intersection at Northwest corner of farm field
776.26 R	Northwest corner of building
775.08 L	Road intersection at center of Northwest edge farm field
775.20 R	Large lone tree in bluffs area
774.57 L	Lone tree on fence line
774.13 R	Northwest corner of small triangular field
773.19 L	Northwest corner of irrigation pump house
773.69 R	Point of land along left bank of old dry chute channel
772.45 R	Point along center-pivot access road at field edge line
772.14 L	Northwest corner of farm pond
771.09 L	Road intersection - South side of East-West road
770.60 R	East-West road extended to intersection with North-South field road
769.78 L	Center of center-pivot irrigation system
769.38 R	Lone tree on fence line
768.95 L	At bend in field road that runs along tree line
768.97 R	Right bank end of drainage crossing
767.56 L	Intersection of North-South field road with East-West field road running along North side of tree line
768.05 R	At point where field road running along right bank of drainage way bends to the right at about a 30-degree angle

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TABLE 1

KEY POINT IDENTIFICATION DESCRIPTION

<u>RIVER MILEAGE LOCATION</u>	<u>KEY POINT DESCRIPTION</u>
766.45 L	Center of building
765.63 R	Lone tree located along field road
765.80 L	County road intersection next to farmstead
767.45 R	Intersection of field roads
765.0 L	Center of irrigation pivot
764.65 R	Intersection of driveway from group of buildings with road.
763.55 L	County road intersection - The East-West road extends East from the river and intersects the North-South road a short distance (about 200 to 250 feet) South from a clump of trees
764.17 R	Small building located in tree clearing
762.76 L	Intersection of North-South field line with Northeast-Southwest road running along tree line
762.66 R	This is a manufactured point. It was determined by extrapolating the North-South field line through point 7L across the river. Maps for segments 6 and 7 were matched and a line was drawn connecting the key points 6R and 8R. The intersection of this line with the extrapolated line from across the river defines the key point.
761.74 L	Center point of pivot irrigation installation
761.96 R	Midpoint of rectangular building
760.31 L	On a North-South county road at point where an East-West road intersects the county road. The East-West road is believed to be a borrow pit intersects the county road.
760.67 R	On an East-West county road at point where a field road intersects the county road.

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TABLE 1

KEY POINT IDENTIFICATION DESCRIPTION

<u>RIVER MILEAGE LOCATION</u>	<u>KEY POINT DESCRIPTION</u>
759.98 L	At a point where a field road from the West intersects another field road running in a North-South direction.
759.46 R	This is a manufactured point. It lies on the same East-West county road as point 9R. It was located by using point 9R as the midpoint between a North-South county road lying West of point 9R and point 10R. Point 10R is therefore the same distance (14.95 units on 50 scale) from point 9R as point 9R is from the North-South county road.
758.48 L	At the intersection of North-South field line with East-West field line.
758.84 R	At the intersection of a line extrapolating an East-West county road with a field road running along the East side of a tree line.
757.54 L	Small building (appears to be a grain bin) located along North-South county road about 1000 feet North of farmstead buildings.
758.84 R	Same as 11R
757.0 L	Intersection of field road which is an extension of North-South county road with East-West field line. Point is located about one-half mile South of farmstead buildings showing on segment 12 photo.
756.38 R	Intersection of East-West county road with North-South field road. Point is located on county road about 200 feet East of field road by segment 12 photo of county road. (Shows more clearly on '85 photo.)
755.96 L	Intersection of North-South county road with East-West half-section road.
755.70 R	This is a manufactured point. It lies on a well defined land line that runs in a general Northeast-Southwest direction. The key point is located at the intersection of this land line with a line extrapolated South from what appears to be a North-South center pivot maintenance road.

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TABLE 1

KEY POINT IDENTIFICATION DESCRIPTION

<u>RIVER MILEAGE LOCATION</u>	<u>KEY POINT DESCRIPTION</u>
755.11 L	Intersection of East-West county road with North-South field road. Key point is located at beginning of driveway into farmstead.
754.58 R	This is a manufactured point. It lies on a line that was developed by matching the maps for segments 14 and 15 and drawing a line connecting points 14R and 16R. The key point was then located at the intersection of this line with an extrapolation along the East-West county road through point 15L and across the river.
753.43 L	At intersection of East-West county road with driveway to farmstead.
754.0 R	At "Y" intersection of bluff road located about 1000 feet East of circle road.
751.94 L	At intersection of North-South county road and driveway to farmstead located East of county road.
752.63 R	At intersection North-South road with dead-end road entering from West.

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TABLE 2

1978 TRIANGULAR AND SEGMENT AREAS FOR DISTORTION CORRECTION

<u>SEGMENT NUMBER</u>	<u>LEFT BANK DISTANCE</u>	<u>UPSTREAM X-SECTION</u>	<u>DIAGONAL U/R TO D/L</u>	<u>DOWNSTREAM X-SECTION</u>	<u>RIGHT BANK DISTANCE</u>	<u>TRIANGLE AREA</u>	<u>SEGMENT AREA</u>
1-L	24.60	10.00	28.80			119.01	
1-R			28.80	27.10	35.60	383.14	502.15
2-L	29.90	27.10	46.70			380.88	
2-R			46.70	39.60	18.00	349.01	729.89
3-L	36.60	39.90	68.70			577.33	
3-R			68.70	41.65	39.50	741.48	1318.81
4-L	44.90	41.85	46.70			851.71	
4-R			46.70	42.10	24.50	513.49	1365.20
5-L	33.00	42.20	67.20			561.70	
5-R			67.20	47.30	40.30	938.95	1500.65
6-L	50.10	47.40	72.00			1182.56	
6-R			72.00	50.70	39.90	978.70	2161.26
7-L	39.40	50.90	73.70			949.58	
7-R			73.70	54.10	51.10	1382.00	2331.58
8-L	39.10	54.20	69.70			1055.08	
8-R			69.70	53.60	35.40	930.90	1985.98
9-L	25.70	53.70	52.50			661.33	
9-R			52.50	52.00	34.80	857.17	1518.50
10-L	48.60	51.80	59.50			1201.20	
10-R			59.50	39.20	33.50	618.53	1819.73
11-L	50.00	39.20	54.30			941.49	
11-P			54.30	40.70	33.50	682.54	1624.03
12-L	45.70	40.60	59.60			926.56	
12-R			59.60	51.35	29.40	754.74	1681.30

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13-L	32.20	51.65	47.40			747.45	
13-R			47.40	46.60	33.50	735.35	1482.80
14-L	41.00	46.80	71.60			906.62	
14-R			71.60	42.45	44.80	892.01	1798.63
15-L	34.50	42.15	71.00			509.69	
15-R			71.00	40.00	45.30	836.82	1346.51
16-L	37.70	40.20	54.70			757.69	
16-R			54.70	48.50	47.50	1078.66	1836.35
17-L	42.40	49.00	61.30			1032.93	
17-R			61.30	45.30	50.00	1114.95	2147.88
18-L	48.90	45.15	67.50			1103.46	
18-R			67.50	40.60	51.10	1034.67	2138.14
19-L	48.20	40.60	68.40			962.37	
19-R			68.40	45.45	47.70	1080.69	2043.06
20-L	33.60	45.25	56.40			760.20	
20-R			56.40	36.00	31.80	529.08	1289.28
21-L	40.10	36.13	57.43			717.99	
21-R			57.43	32.45	42.97	690.02	1408.01
22-L	41.15	34.07	65.00			611.49	
22-R			65.00	49.40	38.43	946.10	1557.59
23-L	38.80	49.35	59.33			951.59	
23-R			59.33	25.53	40.35	411.31	1362.90
24-L	51.65	25.65	55.15			658.59	
24-R			55.15	53.93	15.57	418.95	1077.54

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25-L	39.55	53.93	44.30			862.29	
25-R			44.30	32.65	18.63	271.36	1133.65
26-L	9.83	32.05	41.85			14.05	
26-R			41.85	58.43	45.75	951.25	965.30
27-L	18.15	58.43	44.90			307.66	
27-R			44.90	21.70	31.55	313.52	621.18
28-L	14.67	21.83	35.10			68.01	
28-R			35.10	46.55	46.90	759.94	845.95
29-L	11.60	46.55	47.57			269.82	
29-R			47.57	38.37	31.73	606.34	876.16
30-L	48.13	38.75	48.87			861.29	
30-R			48.87	46.95	13.03	305.86	1167.15
31-L	31.25	47.10	49.53			712.19	
31-R			49.53	41.73	14.55	276.64	988.83
32-L	46.45	42.17	64.20			978.30	
32-R			64.20	45.55	49.95	1132.08	2110.38
33-L	36.20	44.97	47.00			763.94	
33-R			47.00	37.85	25.55	482.55	1246.48
34-L	30.13	37.85	32.10			466.77	
34-R			32.10	31.33	18.27	277.19	743.97
35-L	30.35	32.00	54.40			414.14	
35-R			54.40	45.00	31.55	700.71	1122.85
36-L	38.90	44.35	63.40			852.00	
36-R			63.40	38.15	35.10	580.83	1432.83

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<u>SEGMENT NUMBER</u>	<u>LEFT BANK DISTANCE</u>	<u>UPSTREAM X-SECTION</u>	<u>DIAGONAL U/R TO D/L</u>	<u>DOWNSTREAM X-SECTION</u>	<u>RIGHT BANK DISTANCE</u>	<u>TRIANGLE AREA</u>	<u>SEGMENT AREA</u>
37-L	32.70	38.35	43.40			605.16	
37-R			43.40	43.85	7.75	168.09	773.25
38-L	23.45	43.90	38.20			447.43	
38-R			38.20	32.20	27.20	430.67	878.10
39-L	23.90	32.15	39.25			383.86	
39-R			39.25	28.30	22.80	317.90	701.76
40-L	24.55	28.30	50.65			190.55	
40-R			50.65	23.35	54.00	589.33	779.88
41-L	28.75	23.45	41.45			326.09	
41-R			41.45	41.90	31.60	609.25	935.34
42-L	37.00	42.05	56.15			777.92	
42-R			56.15	38.60	38.00	731.36	1509.28
43-L	23.60	38.70	49.20			447.40	
43-R			49.20	44.30	17.95	396.14	843.54
44-L	41.45	44.60	55.15			909.23	
44-R			55.15	46.45	23.75	545.77	1455.00
45-L	47.90	46.40	50.65			1006.77	1006.77
45-R							
46-L	24.80	50.70	55.20			627.73	
46-R			55.20	51.20	22.70	580.69	1208.41
47-L	38.60	51.25	43.30			815.05	
47-R			43.30	46.00	28.10	715.17	1350.22
48-L	22.60	46.40	42.40			477.54	
48-R			42.40	35.10	33.25	567.72	1045.26

MISSOURI NATIONAL RECREATIONAL RIVER
 GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 2

1978 TRIANGULAR AND SEGMENT AREAS FOR DISTORTION CORRECTION

<u>SEGMENT NUMBER</u>	<u>LEFT BANK DISTANCE</u>	<u>UPSTREAM X-SECTION</u>	<u>DIAGONAL U/R TO D/L</u>	<u>DOWNSTREAM X-SECTION</u>	<u>RIGHT BANK DISTANCE</u>	<u>TRIANGLE AREA</u>	<u>SEGMENT AREA</u>
49-L	31.85	35.10	47.45			558.97	
49-R			47.45	42.55	31.25	651.22	1210.19
50-L	27.10	42.70	63.05			457.34	
50-R			63.05	42.55	40.20	844.18	1301.52

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 3

1985 TRIANGULAR AND SEGMENT AREAS FOR DISTORTION CORRECTION

<u>SEGMENT NUMBER</u>	<u>LEFT BANK DISTANCE</u>	<u>UPSTREAM X-SECTION</u>	<u>DIAGONAL U/R TO D/L</u>	<u>DOWNSTREAM X-SECTION</u>	<u>RIGHT BANK DISTANCE</u>	<u>TRIANGLE AREA</u>	<u>SEGMENT AREA</u>
1-L	23.90	9.60	27.90			111.06	
1-R			27.90	25.90	34.50	355.46	466.52
2-L	29.10	25.90	45.00			354.86	
2-R			45.00	38.00	17.40	323.20	678.06
3-L	36.20	38.10	66.60			548.20	
3-R			66.60	40.90	37.60	691.02	1239.22
4-L	44.00	40.90	45.40			812.37	
4-R			45.40	40.60	23.80	481.61	1293.98
5-L	32.10	40.60	65.00			524.59	
5-R			65.00	46.80	38.90	900.87	1425.46
6-L	49.20	46.90	70.40			1150.68	
6-R			70.40	49.20	38.00	894.08	2044.76
7-L	38.50	49.30	73.60			871.34	
7-R			73.60	52.60	49.10	1289.94	2161.28
8-L	38.20	52.60	67.80			1000.37	
8-R			67.80	52.20	33.90	866.14	1866.51
9-L	24.90	52.00	50.70			619.39	
9-R			50.70	50.20	33.40	794.93	1414.32
10-L	46.80	50.20	57.70			1122.80	
10-R			57.70	38.30	32.20	581.06	1703.86
11-L	48.70	38.30	52.30			890.88	
11-R			52.30	30.30	32.30	631.89	1522.77
12-L	44.60	39.50	57.90			879.47	
12-R			57.90	49.90	28.60	713.48	1592.96

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 3

1985 TRIANGULAR AND SEGMENT AREAS FOR DISTORTION CORRECTION

<u>SEGMENT NUMBER</u>	<u>LEFT BANK DISTANCE</u>	<u>UPSTREAM X-SECTION</u>	<u>DIAGONAL U/R TO D/L</u>	<u>DOWNSTREAM X-SECTION</u>	<u>RIGHT BANK DISTANCE</u>	<u>TRIANGLE AREA</u>	<u>SEGMENT AREA</u>
13-L	30.90	49.80	45.30			687.38	
13-R			45.30	44.70	31.70	667.42	1354.80
14-L	39.60	44.70	68.70			836.77	
14-R			68.70	40.80	43.00	823.75	1660.52
15-L	33.30	40.90	68.80			475.04	
15-R			68.80	39.20	42.70	763.23	1238.27
16-L	36.00	39.10	53.80			703.58	
16-R			53.80	46.70	36.90	846.25	1549.83
17-L	40.90	46.90	58.60			952.82	
17-R			58.60	43.40	48.10	1026.18	1979.00
18-L	47.60	42.80	64.40			1018.56	
18-R			64.40	38.90	48.70	944.94	1963.50
19-L	47.00	38.80	66.50			894.46	
19-R			66.50	44.50	46.10	1022.66	1917.12
20-L	33.40	44.40	55.60			741.48	
20-R			55.60	35.70	30.80	505.12	1246.60
21-L	39.05	35.07	55.73			679.10	
21-R			55.73	32.37	41.10	658.78	1337.88
22-L	39.83	32.25	62.20			562.17	
22-R			62.20	48.00	36.87	883.39	1445.56
23-L	37.00	46.90	56.47			862.44	
23-R			56.47	24.50	28.27	788.87	1651.31
24-L	49.90	24.65	53.23			611.46	
24-R			53.23	51.97	14.75	382.69	994.15

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 3

1985 TRIANGULAR AND SEGMENT AREAS FOR DISTORTION CORRECTION

<u>SEGMENT NUMBER</u>	<u>LEFT BANK DISTANCE</u>	<u>UPSTREAM X-SECTION</u>	<u>DIAGONAL U/R TO D/L</u>	<u>DOWNSTREAM X-SECTION</u>	<u>RIGHT BANK DISTANCE</u>	<u>TRIANGLE AREA</u>	<u>SEGMENT AREA</u>
25-L	38.30	51.97	42.73			804.79	
25-R			42.73	31.45	17.87	249.46	1054.25
26-L	9.75	31.23	40.90			22.27	
26-R			40.90	56.63	44.53	903.70	925.97
27-L	18.20	56.63	42.93			293.19	
27-R			42.93	20.95	30.10	289.67	582.86
28-L	14.45	20.93	34.03			80.85	
28-R			34.03	45.40	45.67	718.63	799.48
29-L	11.35	45.40	46.65			257.62	
29-R			46.65	37.85	31.23	588.18	845.80
30-L	46.10	37.35	47.23			798.28	
30-R			47.23	45.53	12.55	285.70	1083.98
31-L	30.23	45.55	47.93			666.44	
31-R			47.93	40.35	14.03	257.25	923.69
32-L	44.35	40.00	61.15			885.95	
32-R			61.15	43.30	47.80	1029.52	1915.47
33-L	34.93	43.45	45.23			710.87	
33-R			45.23	36.57	24.35	444.30	1155.17
34-L	29.20	36.60	31.05			437.35	
34-R			31.05	30.25	17.47	256.36	693.71
35-L	29.00	30.20	51.80			371.05	
35-R			51.80	42.00	26.00		
36-L	38.00	43.15	61.45			811.38	
36-R			61.45	37.25	33.50	537.66	1349.04

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 3

1985 TRIANGULAR AND SEGMENT AREAS FOR DISTORTION CORRECTION

<u>SEGMENT NUMBER</u>	<u>LEFT BANK DISTANCE</u>	<u>UPSTREAM X-SECTION</u>	<u>DIAGONAL U/R TO D/L</u>	<u>DOWNSTREAM X-SECTION</u>	<u>RIGHT BANK DISTANCE</u>	<u>TRIANGLE AREA</u>	<u>SEGMENT AREA</u>
37-L	31.70	37.10	41.65			565.38	
37-R			41.65	42.10	7.30	151.97	717.35
38-L	22.70	42.20	36.55			414.47	
38-R			36.55	30.50	25.75	387.38	801.85
39-L	23.00	30.65	37.50			352.13	
39-R			37.50	26.95	21.85	290.04	642.17
40-L	23.45	27.00	48.30			175.47	
40-R			48.30	22.20	51.20	533.69	709.16
41-L	27.55	22.30	39.40			298.13	
41-R			39.40	39.60	29.75	544.30	842.43
42-L	35.45	40.45	54.10			716.93	
42-R			54.10	37.45	36.45	680.77	1397.70
43-L	23.30	37.50	48.20			426.75	
43-R			48.20	43.45	17.35	375.43	802.18
44-L	39.70	43.10	52.90			840.66	
44-R			52.90	44.80	23.10	513.41	1354.07
45-L	46.55	44.70		48.80	0	940.00	940.00
45-R							
46-L	23.90	48.80	52.75			581.61	
46-R			52.75	49.20	21.80	535.53	1117.14
47-L	37.20	49.45	41.65			736.18	
47-R			41.65	45.05	19.50	405.72	1161.70
48-L	21.80	45.10	41.35			449.13	
48-R			41.35	34.55	22.15	510.11	989.24

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 3

1985 TRIANGULAR AND SEGMENT AREAS FOR DISTORTION CORRECTION

<u>SEGMENT NUMBER</u>	<u>LEFT BANK DISTANCE</u>	<u>UPSTREAM X-SECTION</u>	<u>DIAGONAL U/R TO D/L</u>	<u>DOWNSTREAM X-SECTION</u>	<u>RIGHT BANK DISTANCE</u>	<u>TRIANGLE AREA</u>	<u>SEGMENT AREA</u>
49-L	31.00	34.60	46.55			536.30	
49-R			46.55	41.80	30.90	631.80	1168.10
50-L	25.85	41.90	61.25			427.91	
50-R			61.25	40.90	39.25	791.31	1219.22

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 4

SCALE CORRECTION FACTORS (1978)

<u>SEGMENT</u>	<u>1978 UPSTREAM X-SECTION</u>	<u>1978 DOWNSTREAM X-SECTION</u>	<u>PHOTO SCALE FACTOR (DS/US)</u>	<u>SEGMENT SCALE FACTOR</u>
1	10.00	27.10	1.0000	1.0000
2	27.10	39.60	1.0000	1.0000
3	39.90	41.65	0.9925	0.9850
4	41.85	42.10	0.9952	0.9756
5	42.20	47.30	0.9976	0.9858
6	47.40	50.70	0.9979	0.9911
7	50.90	54.10	0.9961	0.9880
8	54.20	53.60	0.9982	0.9885
9	53.70	52.00	0.9981	0.9926
10	51.80	39.20	1.0039	1.0040
11	39.20	40.70	1.0000	1.0077
12	40.60	51.35	1.0025	1.0049
13	51.65	46.60	0.9942	0.9933
14	46.80	42.45	0.9957	0.9800
15	42.15	40.00	1.0071	1.0056
16	40.20	48.50	0.9950	1.0042
17	49.00	45.30	0.9898	0.9700
18	45.15	40.60	1.0033	0.9862
19	40.60	45.45	1.0000	1.0067
20	45.25	56.00	1.0044	1.0089

Segment 1 - assumed to be 1.0000

Segment 4 - $41.65/41.85 = 0.9952 = \text{Photo Scale Factor (Segment 4)}$
 $[(0.9925)(0.9952)]^2 = 0.9756 = \text{Segment Scale Factor (Segment 4)}$

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 4

SCALE CORRECTION FACTORS (1978)

<u>SEGMENT</u>	<u>1978 UPSTREAM X-SECTION</u>	<u>1978 DOWNSTREAM X-SECTION</u>	<u>PHOTO SCALE FACTOR (DS/US)</u>	<u>SEGMENT SCALE FACTOR</u>
21	36.13	32.45	0.9964	1.0016
22	34.07	49.40	0.9525	0.9006
23	49.35	25.53	1.0010	0.9090
24	25.65	53.93	0.9953	0.9927
25	53.93	32.65	1.0000	0.9907
26	32.05	58.43	1.0187	1.0378
27	58.43	21.70	1.0000	1.0378
28	21.83	46.55	0.9940	0.9981
29	46.55	38.37	1.0000	0.9881
30	38.75	46.95	0.9902	0.9805
31	47.10	41.73	0.9968	0.9742
32	42.17	45.55	0.9896	0.9730
33	44.97	37.85	1.0129	1.0047
34	37.85	31.33	1.0000	1.0260
35	32.00	45.00	0.9791	0.9586
36	44.35	38.15	1.0147	0.9869
37	38.35	43.85	0.9948	1.0188
38	43.90	32.20	0.9989	0.9873
39	32.15	28.30	1.0016	1.0008
40	20.00	23.35	1.0000	1.0031

MISSOURI NATIONAL RECREATIONAL RIVER
 GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 4

SCALE CORRECTION FACTORS (1978)

<u>SEGMENT</u>	<u>1978 UPSTREAM X-SECTION</u>	<u>1978 DOWNSTREAM X-SECTION</u>	<u>PHOTO SCALE FACTOR (DS/US)</u>	<u>SEGMENT SCALE FACTOR</u>
41	23.45	41.90	0.9957	0.9915
42	42.05	38.60	0.9964	0.9844
43	38.70	44.30	0.9974	0.9878
44	44.60	46.45	0.9933	0.9815
45	46.40	50.65	1.0011	0.9887
46	50.70	51.20	0.9990	1.0002
47	51.25	46.90	0.9990	0.9961
48	46.40	35.10	1.0108	1.0197
49	35.10	42.55	1.0000	1.0217
50	42.70	42.55	0.9965	0.9930

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 5

1978 AREA CORRECTION FACTORS

<u>SEGMENT</u>	(1) <u>1978 AREA</u>	(2) <u>1978 AREA</u>	(3) DISTORTION FACTOR <u>(1)/(2)</u>	(4) 1978 SCALE FACTOR	(5) AREA CORRECTION FACTOR <u>(3) x (4)</u>
1	502.147	502.147	1.0000	1.0000	1.0000
2	729.889	729.889	1.0000	1.0000	1.0000
3	1318.808	1318.808	1.0000	0.9850	0.9850
4	1365.197	1365.197	1.0000	0.9756	0.9756
5	1500.641	1500.641	1.0000	0.9858	0.9858
6	2161.252	2161.252	1.0000	0.9911	0.9911
7	2331.578	2331.578	1.0000	0.9880	0.9880
8	1985.981	1985.981	1.0000	0.9885	0.9885
9	1518.501	1518.501	1.0000	0.9926	0.9926
10	1819.721	1819.721	1.0000	1.0040	1.0040
11	1624.030	1624.030	1.0000	1.0077	1.0077
12	1681.298	1681.298	1.0000	1.0049	1.0049
13	1482.796	1482.796	1.0000	0.9933	0.9933
14	1798.630	1798.630	1.0000	0.9800	0.9800
15	1346.508	1346.508	1.0000	1.0056	1.0056
16	1836.350	1836.350	1.0000	1.0042	1.0042
17	2147.881	2147.881	1.0000	0.9700	0.9700
18	2138.139	2138.139	1.0000	0.9862	0.9862
19	2043.058	2043.058	1.0000	1.0067	1.0067
20	1289.283	1289.283	1.0000	1.0089	1.0089
21	1408.810	1408.810	1.0000	1.0000	1.0000
22	1557.591	1557.591	1.0000	0.9006	0.9006

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 5

1978 AREA CORRECTION FACTORS

<u>SEGMENT</u>	(1) <u>1978 AREA</u>	(2) <u>1978 AREA</u>	(3) DISTORTION FACTOR <u>(1)/(2)</u>	(4) 1978 SCALE FACTOR	(5) AREA CORRECTION FACTOR <u>(3) x (4)</u>
23	1362.898	1362.898	1.0000	0.9090	0.9090
24	1077.546	1077.546	1.0000	0.9927	0.9927
25	1133.645	1133.645	1.0000	0.9907	0.9907
26	965.304	965.304	1.0000	1.0378	1.0378
27	621.182	621.182	1.0000	1.0378	1.0378
28	845.953	845.953	1.0000	0.9881	0.9881
29	876.155	876.155	1.0000	0.9881	0.9881
30	1167.151	1167.151	1.0000	0.9805	0.9805
31	988.835	988.835	1.0000	0.9742	0.9742
32	2110.377	2110.377	1.0000	0.9730	0.9730
33	1246.484	1246.484	1.0000	1.0047	1.0047
34	743.967	743.967	1.0000	1.0260	1.0260
35	1123.855	1123.855	1.0000	0.9586	0.9586
36	1432.831	1432.831	1.0000	0.9867	0.9867
37	773.259	773.259	1.0000	1.0188	1.0188
38	878.096	878.096	1.0000	0.9873	0.9873
39	701.761	701.761	1.0000	1.0008	1.0008
40	779.883	779.883	1.0000	1.0031	1.0031
41	935.340	935.340	1.0000	0.9915	0.9915
42	1509.271	1509.271	1.0000	0.9844	0.9844
43	843.537	843.537	1.0000	0.9878	0.9878
44	1454.994	1454.994	1.0000	0.9815	0.9815

MISSOURI NATIONAL RECREATIONAL RIVER
 GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 5

1978 AREA CORRECTION FACTORS

<u>SEGMENT</u>	(1) <u>1978 AREA</u>	(2) <u>1978 AREA</u>	(3) DISTORTION FACTOR <u>(1) / (2)</u>	(4) 1978 SCALE FACTOR	(5) AREA CORRECTION FACTOR <u>(3) x (4)</u>
45	1006.770	1006.770	1.0000	0.9887	0.9887
46	1208.413	1208.413	1.0000	1.0002	1.0002
47	1256.121	1256.121	1.0000	0.9961	0.9961
48	1045.257	1045.257	1.0000	1.0197	1.0197
49	1210.188	1210.188	1.0000	1.0217	1.0217
50	1301.521	1301.521	1.0000	0.9930	0.9930

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 6

1985 AREA CORRECTION FACTORS

<u>SEGMENT</u>	(1) <u>1978 AREA</u>	(2) <u>1985 AREA</u>	(3) DISTORTION FACTOR <u>(1)/(2)</u>	(4) 1978 SCALE FACTOR	(5) AREA CORRECTION FACTOR <u>(3) x (4)</u>
1	502.147	466.513	1.0764	1.0000	1.0764
2	729.889	678.055	1.0764	1.0000	1.0764
3	1318.808	1239.214	1.0642	0.9850	1.0483
4	1365.197	1293.977	1.0550	0.9756	1.0293
5	1500.641	1425.463	1.0527	0.9858	1.0378
6	2161.252	2044.764	1.0570	0.9911	1.0475
7	2331.578	2161.281	1.0788	0.9880	1.0658
8	1985.981	1866.515	1.0640	0.9885	1.0518
9	1518.501	1414.314	1.0737	0.9926	1.0657
10	1819.721	1703.863	1.0680	1.0040	1.0723
11	1624.030	1522.771	1.0665	1.0077	1.0747
12	1681.298	1592.956	1.0554	1.0049	1.0607
13	1482.796	1354.802	1.0945	0.9933	1.0871
14	1798.630	1660.521	1.0832	0.9800	1.0615
15	1346.508	1238.271	1.0874	1.0056	1.0935
16	1836.350	1549.830	1.1849	1.0042	1.1899
17	2147.881	1979.003	1.0853	0.9700	1.0527
18	2138.139	1963.504	1.0889	0.9862	1.0739
19	2043.058	1917.128	1.0657	1.0067	1.0728
20	1289.283	1246.597	1.0342	1.0089	1.0434
21	1408.013	1337.878	1.0521	1.0013	1.0541
22	1557.591	1445.555	1.0775	0.9006	0.9704

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 6

1985 AREA CORRECTION FACTORS

<u>SEGMENT</u>	(1) <u>1985 AREA</u>	(2) <u>1978 AREA</u>	(3) DISTORTION FACTOR <u>(1)/(2)</u>	(4) 1978 SCALE FACTOR	(5) AREA CORRECTION FACTOR <u>(3) x (4)</u>
23	1362.898	1240.647	1.0985	0.9090	0.9986
24	1077.546	994.150	1.0839	0.9927	1.0759
25	1133.645	1054.254	1.0753	0.9907	1.0653
26	965.304	925.971	1.0425	1.0378	1.0819
27	621.182	582.856	1.0658	1.0378	1.1060
28	845.953	799.479	1.0581	0.9881	1.0456
29	876.155	845.804	1.0359	0.9881	1.0236
30	1167.151	1083.976	1.0767	0.9805	1.0557
31	988.835	923.689	1.0705	0.9742	1.0430
32	2110.377	1915.471	1.1018	0.9730	1.0720
33	1246.484	1155.173	1.0790	1.0047	1.0841
34	743.967	693.708	1.0724	1.0260	1.1003
35	1123.855	1014.390	1.1079	0.9586	1.0620
36	1432.831	1349.041	1.0621	0.9869	1.0482
37	773.260	717.354	1.0779	1.0188	1.0982
38	878.096	801.848	1.0951	0.9873	1.0812
39	701.761	642.175	1.0928	1.0008	1.0937
40	779.883	709.160	1.0997	1.0031	1.1032
41	935.340	842.428	1.1103	0.9915	1.1008
42	1509.271	1397.697	1.0798	0.9844	1.0630
43	843.537	802.177	1.0516	0.9876	1.0387
44	1454.994	1354.076	1.0745	0.9815	1.0547

MISSOURI NATIONAL RECREATIONAL RIVER
 GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 6

1985 AREA CORRECTION FACTORS

<u>SEGMENT</u>	(1) <u>1985 AREA</u>	(2) <u>1978 AREA</u>	(3) DISTORTION FACTOR <u>(1)/(2)</u>	(4) 1978 SCALE FACTOR	(5) AREA CORRECTION FACTOR <u>(3) x (4)</u>
45	1006.770	940.000	1.0710	0.9887	1.0590
46	1208.413	1117.139	1.0817	1.0002	1.0819
47	1256.121	1161.709	1.0813	0.9961	1.0770
48	1045.257	989.243	1.0566	1.0197	1.0774
49	1210.188	1168.096	1.0360	1.0217	1.0585
50	1301.521	1219.213	1.0675	0.9930	1.0600

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
LEFT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
1-L	6.54	1.0000	6.540	5.98	1.0764	6.437	0.103
2-L	11.47	1.0000	11.470	10.58	1.0764	11.389	0.081
3-L	11.94	0.9850	11.761	11.43	1.0483	11.982	-0.221
4-L	9.80	0.9756	9.561	9.37	1.0293	9.645	-0.084
5-L	11.93	0.9858	11.760	11.24	1.0378	11.664	0.096
6-L	34.24	0.9911	33.934	32.44	1.0475	33.983	-0.048
7-L	27.45	0.9880	27.120	25.62	1.0658	27.306	-0.186
8-L	14.82	0.9885	14.650	14.01	1.0518	14.735	-0.086
9-L	9.64	0.9926	9.569	9.03	1.0658	9.624	-0.055
10-L	12.15	1.0040	12.198	11.40	1.0723	12.224	-0.025
11-L	10.14	1.0077	10.218	9.96	1.0747	10.704	-0.486
12-L	12.33	1.0049	12.390	11.85	1.0607	12.569	-0.178
13-L	18.16	0.9933	18.038	16.54	1.0871	17.981	0.057
14-L	27.00	0.9800	26.460	24.00	1.0615	25.476	0.984
15-L	9.34	1.0056	9.393	8.45	1.0935	9.240	0.152

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
LEFT BANK AREAS

<u>SEGMENT</u>	(1) 1978 <u>PLANIMETERED AREA (IN)²</u>	(2) 1978 <u>AREA CORRECT. FACTOR</u>	(3) 1978 <u>CORRECTED AREA (IN)²</u>	(4) 1985 <u>PLANIMETERED AREA (IN)²</u>	(5) 1985 <u>AREA CORRECT. FACTOR</u>	(6) 1985 <u>CORRECTED AREA (IN)²</u>	(7) 1978 TO 1985 <u>DIFFERENCE IN AREA (IN)²</u>
10-L	6.07	1.0042	6.096	5.45	1.1899	6.485	-0.389
11-L	13.68	0.9700	13.269	12.84	1.0527	13.517	-0.248
12-L	35.42	0.9862	34.932	32.16	1.0739	34.538	0.394
13-L	15.80	1.0067	15.905	14.74	1.0727	15.813	0.092
20-L	4.47	1.0089	4.510	4.08	1.0434	4.257	0.253
21-L	4.752	1.0016	4.760	4.384	1.0541	4.621	0.138
22-L	7.696	0.9006	6.931	7.072	0.9704	6.863	0.068
23-L	13.520	0.9090	12.290	12.720	0.9986	12.702	-0.412
24-L	9.600	0.9927	9.530	8.704	1.0759	9.365	0.165
25-L	9.792	0.9907	9.701	10.096	1.0653	10.755	-1.054
26-L	1.488	1.0378	1.544	1.408	1.0819	1.523	0.210
27-L	3.584	1.0378	3.719	3.656	1.1060	2.938	0.782
28-L	3.408	0.9881	3.368	7.584	1.0456	7.930	-4.562
29-L	4.144	0.9881	4.095	5.344	1.0236	5.470	-1.375
30-L	9.424	0.9805	9.240	8.656	1.0557	9.138	0.102

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
LEFT BANK AREAS

<u>SEGMENT</u>	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
30-L	8.896	0.9742	8.667	8.080	1.0430	8.427	0.240
31-L	17.040	0.9730	16.580	15.104	1.0720	16.192	0.388
32-L	4.832	1.0047	4.855	6.512	1.0841	7.060	-2.205
33-L	4.896	1.0260	5.023	4.496	1.1003	4.947	0.076
34-L	5.120	0.9586	4.908	3.856	1.0620	4.095	0.813
35-L	6.699	0.9869	6.611	6.309	1.0482	6.613	-0.002
36-L	12.550	1.0188	12.786	9.211	1.0982	10.116	2.670
37-L	10.880	0.9873	10.742	10.080	1.0812	10.899	-0.156
38-L	8.261	1.0008	8.268	6.528	1.0937	7.140	1.128
40-L	10.320	1.0031	10.352	8.299	1.1032	9.155	1.197
41-L	12.624	0.9915	12.517	10.608	1.1008	11.678	0.839
42-L	18.213	0.9844	17.929	16.512	1.0630	17.552	0.377
43-L	9.152	0.9878	9.040	9.048	1.0387	9.398	-0.358
44-L	14.181	0.9815	13.919	16.827	1.0547	17.747	-3.828
45-L	14.584	0.9887	14.419	13.520	1.0590	14.317	0.102

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
LEFT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
Special Identified Erosion Areas Along the Left Bank							
Site #2: <u>James River Area</u>							
7-B-L	9.69	0.9880	9.573	8.85	1.0658	9.433	0.141
8-A-L	3.77	0.9885	3.727	3.35	1.0518	3.523	0.203
8-I-R	0.75	0.9885	0.741	0.55	1.0518	0.578	0.163
9-IA-R	1.24	0.9926	1.231	1.15	1.0657	1.226	0.005
Totals	15.45		15.272	13.90		14.760	0.512
<u>James River Chute - Left Bank</u>							
9-B-L	9.04	0.9926	8.973	8.36	1.0657	8.909	0.064
10-A-L	9.12	1.0040	9.156	8.80	1.0723	9.436	-0.279
Totals	18.16		18.130	17.16		18.345	0.064*
<u>James River Chute - Right Bank</u>							
8-IB-L	1.83	0.9885	1.809	1.70	1.0518	1.788	0.021
9-I-L	9.00	0.9926	8.933	8.53	1.0657	9.091	-0.157
10-IA-L	9.24	1.0040	9.277	8.31	1.0723	8.910	0.366
Totals	20.07		20.019	18.54		19.789	0.387*

*Total difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
LEFT BANK AREAS

<u>SEGMENT</u>	(1) 1978 <u>PLANIMETERED AREA (IN)²</u>	(2) 1978 <u>AREA CORRECT. FACTOR</u>	(3) 1978 <u>CORRECTED AREA (IN)²</u>	(4) 1985 <u>PLANIMETERED AREA (IN)²</u>	(5) 1985 <u>AREA CORRECT. FACTOR</u>	(6) 1985 <u>CORRECTED AREA (IN)²</u>	(7) 1978 TO 1985 <u>DIFFERENCE IN AREA (IN)²</u>
46-L	10.811	1.0002	10.813	10.069	1.0819	10.894	-0.081
47-L	15.648	0.9961	15.587	13.616	1.0770	14.665	0.922
48-L	8.213	1.0197	8.375	7.568	1.0774	8.154	0.221
49-L	11.024	1.0217	11.263	10.392	1.0585	11.000	0.263
50-L	8.912	0.9930	8.849	8.112	1.0600	8.599	0.251
<u>James River Island</u>							
8-I-L	2.95	0.9885	2.916	2.75	1.0518	2.892	0.024
8-I-R	0.77	0.9885	0.761	0.60	1.0518	0.631	0.130
9-I-L	9.39	0.9926	9.321	8.55	1.0657	9.112	0.209
9-I-R	5.14	0.9926	5.102	4.52	1.0657	4.817	0.285
10-I-L	10.50	1.0040	10.542	9.42	1.0747	10.124	0.418
10-I-R	4.62	1.0040	4.638	4.75	1.0747	5.105	-0.467
Totals	33.37		33.280		32.682		1.065*

*Total of Difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
LEFT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
<u>Site #2B</u>							
12-B-L	1 872	1.0049	1.881	1.792	1.0607	1.901	-0.020
13-L	18.160	0.9933	18.038	16.544	1.0871	17.986	0.052
14-A-L	3 600	0.9800	3.528	2.784	1.0615	2.955	0.573
Totals	23 632		23.447	21.120		22.842	0.625*
<u>Site #4A</u>							
17-B-L	8 03	0.9700	7.789	7.60	1.0527	8.001	-0.212
<u>Site #3 Highline Area</u>							
17-C-L	4.730	0.9700	4.588	4.330	1.0527	4.558	0.030
18-A-L	25.696	0.9862	25.342	23.632	1.0739	25.379	-0.037
Totals	30.426		29.930	27.962		29.937	0.030*
<u>Site #4 Clay County Park Area</u>							
21-B-L	2 928	1.0016	2.933	2.688	1.0541	2.833	0.100
22-B-L	7 696	0.9006	6.931	7.072	0.9704	6.863	0.068
23-B-L	2.736	0.9090	2.487	2.992	0.9986	2.988	-0.501
Totals	13.360		12.351	12.752		12.684	0.168*

*Total of Difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
LEFT BANK AREAS

SEGMENT	(1) 1978 PLAN METERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
<u>Site #6 - Mulberry Point Area</u>							
25-B-L	3.184	0.9907	3.154	3.040	1.0653	3.238	-0.084
26-L	1.488	1.0378	1.544	1.408	1.0819	1.523	0.021
27-L	3.584	1.0378	3.719	2.656	1.1060	2.938	0.782
28-A-L	1.792	0.9881	1.771	2.000	1.0456	2.091	-0.320
Totals	0.048		10.189	9.104		9.790	0.803*
<u>Site #7 - Fairview Area</u>							
30-B-L	3.136	0.9805	3.075	2.848	1.0557	3.007	0.068
31-L	8.896	0.9742	8.667	8.080	1.0430	8.427	0.240
32-A-L	2.896	0.9730	2.818	2.400	1.0720	2.573	0.245
Totals	14.928		14.560	13.328		14.007	0.553
<u>Site #8 - Burbank Area</u>							
34-B-L	0.256	1.0260	0.263	0.224	1.1003	0.246	0.016
35-L	5.120	0.9586	4.908	3.856	1.0620	4.095	0.813
36-A-L	3.504	0.9869	3.458	3.528	1.0482	3.698	-0.240
Totals	8.880		8.628	7.608		8.039	0.829*
<u>Site #7A</u>							
36-B-L	2.28	0.9869	2.250	1.992	1.0482	2.088	0.162
37-L	12.55	1.0188	12.786	9.211	1.0982	10.116	2.670
38-L	10.88	0.9873	10.742	10.869	1.0812	11.752	-1.010
Totals	25.71		25.779	22.072		23.955	2.832*

*Total of Difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
LEFT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
<u>Site #1 Bolson Bend Area</u>							
38-B-L	.880	0.9873	10.742	10.080	1.0812	10.898	-0.156
39-L	.261	1.0008	8.268	6.528	1.0937	7.140	1.128
40-A-L	.680	1.0031	3.691	2.568	1.1032	2.833	0.858
Totals	.821		22.701	19.176		20.871	1.986*
<u>Site #11A</u>							
49-B-L	.744	1.0217	1.782	1.600	1.0585	1.694	0.088
50-A-L	.008	0.9930	2.987	2.752	1.0600	2.917	0.070
Totals	.752		4.769	4.352		4.611	0.158

*Total of Difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
RIGHT BANK AREAS

<u>SEGMENT</u>	(1) 1978 <u>PLANIMETERED AREA (IN)²</u>	(2) 1978 <u>AREA CORRECT. FACTOR</u>	(3) 1978 <u>CORRECTED AREA (IN)²</u>	(4) 1985 <u>PLANIMETERED AREA (IN)²</u>	(5) 1985 <u>AREA CORRECT. FACTOR</u>	(6) 1985 <u>CORRECTED AREA (IN)²</u>	(7) 1978 TO 1985 <u>DIFFERENCE IN AREA (IN)²</u>
1-R	1.82	1.0000	1.82	1.65	1.0764	1.776	0.044
2-R	4.56	1.0000	4.56	4.17	1.0764	4.489	0.071
3-R	11.86	0.9850	11.682	10.95	1.0483	11.479	0.204
4-R	14.70	0.9756	14.342	13.94	1.0293	14.349	-0.007
5-R	20.55	0.9858	20.258	19.69	1.0378	20.434	-0.176
6-R	6.15	0.9911	6.095	5.90	1.0475	6.180	-0.085
7-R	15.51	0.9880	15.323	13.67	1.0658	14.570	0.754
8-R	17.95	0.9885	17.744	16.30	1.0518	17.143	0.600
9-R	4.82	0.9926	4.784	4.69	1.0657	4.998	-0.214
10-R	6.99	1.0040	7.018	6.25	1.0723	6.702	0.316
11-R	16.46	1.0077	16.587	15.19	1.0747	16.325	0.262
12-R	15.40	1.0049	15.476	13.89	1.0607	14.732	0.743
13-R	4.14	0.9933	4.112	3.53	1.0871	3.838	0.275
14-R	7.67	0.9800	7.517	6.94	1.0615	7.367	0.150
15-R	14.99	1.0056	15.074	13.35	1.0935	14.599	0.476

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
RIGHT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
16-R	25.43	1.0042	25.537	22.76	1.1899	27.081	-1.544
17-R	11.88	0.9700	11.523	10.74	1.0527	11.306	0.217
18-R	8.24	0.9862	8.126	6.95	1.0739	7.464	0.663
19-R	4.80	1.0067	4.832	4.27	1.0728	4.581	0.251
20-R	2.960	1.0089	2.986	2.67	1.0434	2.786	0.200
21-R	10.96	1.0016	10.978	10.192	1.0541	10.744	0.234
22-R	10.336	0.9006	9.309	8.544	0.9704	8.292	1.018
23-R	9.952	0.9090	9.046	6.432	0.9986	6.423	2.624
24-R	1.296	0.9927	1.287	1.104	1.0759	1.188	0.099
25-R	4.320	0.9907	4.280	3.904	1.0653	4.159	0.121
26-R	10.656	1.0378	11.059	10.272	1.0819	11.113	-0.054
27-R	5.024	1.0378	5.214	4.88	1.1060	5.397	-0.184
28-R	6.096	0.9881	6.024	5.792	1.0456	6.056	-0.032
29-R	10.736	0.9881	10.609	10.048	1.0236	10.285	0.324
30-R	18.368	0.9805	8.205	7.024	1.0557	7.415	0.789

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
RIGHT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
31-R	6.368	0.9742	6.204	6.272	1.0430	6.541	-0.337
32-R	10.640	0.9730	10.353	11.856	1.0720	12.710	-2.357
33-R	11.744	1.0047	11.799	3.968	1.0841	4.302	7.497
34-R	11.392	1.0260	11.688	10.288	1.1003	11.320	0.370
35-R	10.085	0.9586	9.667	8.875	1.0620	9.425	0.242
36-R	17.696	0.9869	17.464	16.176	1.0482	16.955	0.509
37-R	2.613	1.0188	2.662	2.960	1.0982	3.251	-0.589
38-R	3.312	0.9873	3.270	2.208	1.0812	2.387	0.883
39-R	2.027	1.0008	2.029	1.173	1.0937	1.283	0.746
40-R	1.061	1.0031	1.064	1.307	1.1032	1.442	-0.378
41-R	4.841	0.9915	4.800	4.283	1.1008	4.715	0.085
42-R	12.752	0.9844	12.553	11.477	1.0630	12.200	0.353
43-R	6.896	0.9876	6.812	6.336	1.0387	6.581	0.230
44-R	5.936	0.9815	5.826	5.291	1.0547	5.580	0.246
45-R	0.571	0.9887	0.565	0.459	1.0590	0.486	0.079

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
RIGHT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
46-R	6.667	1.0002	6.668	4.885	1.0819	5.285	1.383
47-R	11.536	0.9961	11.491	10.315	1.0770	11.110	0.381
48-R	7.461	1.0197	7.608	10.347	1.0774	11.148	-3.540
49-R	8.293	1.0217	8.473	11.355	1.0585	12.019	-3.546
50-R	17.413	0.9930	17.291	16.651	1.0600	17.650	-0.360
<u>Goat Island</u>							
18-I-L	0.31	0.9862	0.306	0.18	1.0739	0.193	0.112
18-I-R	1.00	0.9862	0.986	0.74	1.0739	0.795	0.192
19-I-L	6.95	1.0067	6.996	5.9	1.0728	6.329	0.667
19-I-R	5.00	1.0067	5.033	4.47	1.0728	4.795	0.238
20-I-L	6.40	1.0089	6.457	6.23	1.0434	6.500	-0.044
20-I-R	7.13	1.0089	7.193	6.20	1.0434	6.469	0.724
21-I-L	0.848	1.0016	0.849	0.592	1.0541	0.624	0.225
21-I-R	1.648	1.0016	1.651	1.488	1.0541	1.569	0.082
Totals	29.286		29.471	25.80		27.275	2.240*

*Total of Difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
RIGHT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
Special Identified Erosion Areas along the Right Bank							
<u>Site #1 - Yawton Reach Area</u>							
5-B-R	12.10	0.9858	11.928	11.58	1.0378	12.017	-0.089
6-R	6.15	0.9911	6.095	5.90	1.0475	6.180	-0.085
7-A-R	15.03	0.9880	14.849	13.22	1.0658	14.090	0.759
Totals	33.28		32.872	30.70		32.288	0.759*
<u>Site #2A</u>							
11-B-R	9.73	1.0077	9.805	8.73	1.0747	9.383	0.423
12-A-R	12.19	1.0049	12.250	11.08	1.0607	11.752	0.498
Totals	21.92		22.055	19.81		21.135	0.921
<u>Site #3A</u>							
11-B-R	1.57	0.9800	1.539	1.35	1.0615	1.433	0.106
12-P	14.99	1.0056	15.074	13.35	1.0935	14.599	0.476
13-B-R	7.87	1.0042	7.913	15.36	1.1899	18.276	-0.331
Totals	24.43		24.526	30.06		34.308	0.582*

*total of Difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
RIGHT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
<u>Site #5 - North Alabama Area</u>							
29-B-R	6.096	0.9700	5.913	4.880	1.0527	5.137	0.776
29-R	9.952	0.9862	9.815	6.432	1.0739	6.908	2.907
29-R	1.296	1.0067	1.304	1.104	1.0728	1.184	0.120
29-R	4.320	1.0089	4.358	3.904	1.0434	4.073	0.285
29-A-R	2.064	1.0016	2.067	1.856	1.0541	1.956	0.111
Totals	23.728		23.458	18.176		19.259	4.199
<u>Site #5A</u>							
29-B-R	3.376	0.9881	3.336	2.928	1.0236	2.997	0.339
30-R	8.368	0.9805	8.205	7.024	1.0557	7.415	0.789
31-A+R	1.744	0.9742	1.699	1.584	1.0430	1.652	0.047
Totals	13.49		13.240	11.536		12.064	1.175
<u>Site #6A</u>							
32-B-R	5.520	0.9730	5.371	5.968	1.0720	6.398	-1.027
33-R	11.744	1.0047	11.799	3.968	1.0841	4.302	7.497
34-A-R	3.184	1.0260	3.267	2.800	1.1003	3.081	0.186
Totals	20.448		20.436	12.736		13.780	7.683*

*Total of Difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 7

PLANIMETERED AREAS
RIGHT BANK AREAS

SEGMENT	(1) 1978 PLANIMETERED AREA (IN) ²	(2) 1978 AREA CORRECT. FACTOR	(3) 1978 CORRECTED AREA (IN) ²	(4) 1985 PLANIMETERED AREA (IN) ²	(5) 1985 AREA CORRECT. FACTOR	(6) 1985 CORRECTED AREA (IN) ²	(7) 1978 TO 1985 DIFFERENCE IN AREA (IN) ²
<u>Site #9 - Volcano Hill Area</u>							
37-R	2.613	1.0188	2.662	2.960	1.0982	3.2507	-0.589
38-R	3.312	0.9873	3.270	2.208	1.0812	2.3874	0.883
39-R	0.027	1.0008	2.029	1.173	1.0937	1.283	0.746
Totals	952		7.961	6.341		6.921	1.629*
<u>Site #8</u>							
44-B-R	192	0.9815	2.151	1.904	1.0547	2.008	0.143
45-R	571	0.9887	0.565	0.459	1.0590	0.486	0.079
46-R	667	1.0002	6.668	4.885	1.0819	5.285	1.383
47-A-R	472	0.9961	4.454	3.552	1.0770	3.826	0.629
Totals	1,902		13.839	10.800		11.605	2.234
<u>Site #7</u>							
48-R	7,461	1.0197	7.608	10.347	1.0774	11.148	-3.504
<u>Site #10</u>							
49-B-	6,904	1.0217	7.054	7.264	1.0585	7.689	-0.635
50-A-	3,872	0.9930	3.845	3.616	1.0600	3.833	0.012
Totals	10,776		10.898	10.880		11.522	0.012*

*Total of Difference values does not include negative values for accretion.

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 8

LEFT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

<u>1960 RIVER MILE</u>	<u>SEGMENT NO.</u>	<u>PERIOD OF RECORD (YEARS)</u>	<u>LENGTH OF SEGMENT (MILES)</u>	<u>ACRES LOST IN SEGMENT REACH</u>	<u>SEGMENT EROSION RATE (AC/YR)</u>	<u>SEGMENT EROSION RATE (AC/MI/YR)</u>
810.32	1-L	7.31	1.20	2.36	0.32	0.27
809.12	2-L	7.31	0.82	1.85	0.25	0.31
808.30	3-L	7.31	1.41	0	0	0
806.89	4-L	7.31	1.18	0	0	0
805.71	5-L	7.31	0.91	2.20	0.30	0.33
804.80	6-L	7.31	1.54	0	0	0
803.26	7-L	7.31	1.81	0	0	0
801.45	8-L	7.31	1.14	0	0	0
800.31	9-L	7.31	1.16	0	0	0
799.15	10-L	7.31	1.13	0	0	0
798.02	11-L	7.31	1.07	0	0	0
796.95	12-L	7.31	1.69	0	0	0
795.26	13-L	7.31	0.95	1.31	0.18	0.19
794.31	14-L	7.31	1.96	22.53	3.08	1.57
792.35	15-L	7.31	1.01	0.10	0.10	0.36
791.04	16-L	7.31	1.16	0	0	0
789.88						

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 8

LEFT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

<u>1960 RIVER MILE</u>	<u>SEGMENT NO.</u>	<u>PERIOD OF RECORD (YEARS)</u>	<u>LENGTH OF SEGMENT (MILES)</u>	<u>ACRES LOST IN SEGMENT REACH</u>	<u>SEGMENT EROSION RATE (AC/YR)</u>	<u>SEGMENT EROSION RATE (AC/MI/YR)</u>
789.88	17-L	7.31	2.44	0	0	0
787.44	18-L	7.31	1.56	9.02	1.23	0.79
785.88	19-L	7.31	2.00	2.11	0.29	0.14
783.88	20-L	7.31	1.12	5.79	0.79	0.71
782.76	21-L	7.31	1.18	3.16	0.43	0.37
781.58	22-L	7.31	1.58	1.56	0.21	0.13
780.0	23-L	7.31	0.97	0	0	0
779.03	24-L	7.31	0.78	3.78	0.52	0.66
778.25	25-L	7.31	0.98	0	0	0
777.27	26-L	7.31	0.07	0.48	0.07	0.94
777.20	27-L	7.31	0.98	17.91	2.45	2.50
776.22	28-L	7.31	1.11	0	0	0
775.11	29-L	7.31	0.69	0	0	0
774.42	30-L	7.31	1.19	2.34	0.32	0.27
773.23	31-L	7.31	0.85	5.50	0.75	3.68
772.38	32-L	7.31	1.38	8.88	1.22	0.88
771.0						

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 8

LEFT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

<u>1960 RIVER MILE</u>	<u>SEGMENT NO.</u>	<u>PERIOD OF RECORD (YEARS)</u>	<u>LENGTH OF SEGMENT (MILES)</u>	<u>ACRES LOST IN SEGMENT REACH</u>	<u>SEGMENT EROSION RATE (AC/YR)</u>	<u>SEGMENT EROSION RATE (AC/MI/YR)</u>
771.0	33-L	7.31	1.23	0	0	0
769.77	34-L	7.31	0.83	1.74	0.24	0.29
768.94	35-L	7.31	1.21	18.62	2.55	2.10
767.73	36-L	7.31	1.33	0	0	0
766.40	37-L	7.31	0.80	61.14	8.36	10.45
765.60	38-L	7.31	0.73	0	0	0
764.87	39-L	7.31	1.22	25.83	3.53	2.90
763.65	40-L	7.31	0.93	27.41	3.75	4.03
762.72	41-L	7.31	0.90	19.21	2.63	2.92
761.82	42-L	7.31	1.38	8.63	1.18	0.86
760.44	43-L	7.31	0.54	0	0	0
759.90	44-L	7.31	1.34	0	0	0
758.56	45-L	7.31	0.94	2.34	0.32	0.34
757.62	46-L	7.31	0.76	0	0	0
756.86						1.05
755.88	48-L	7.31	0.88	5.06	0.69	0.79
755.0						

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 8

LEFT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

1960 RIVER MILE	SEGMENT NO.	PERIOD OF RECORD (YEARS)	LENGTH OF SEGMENT (MILES)	ACRES LOST IN SEGMENT REACH	SEGMENT EROSION RATE (AC/YR)	SEGMENT EROSION RATE (AC/MI/YR)
755.0	49-L	7.31	1.44	6.02	0.82	0.57
753.56	50-L	7.31	1.39	5.75	0.79	0.57
752.17						
TOTALS**	L.B.	7.31	58.15	297.10	40.64	0.70

** Totals are values for the entire left bank reach of 58.15 miles.

James River Island - Left Bank

800.72	L.B.	7.31	2.58	14.91	2.04	0.79
798.14						

James River Island - Right Bank

800.72	R.B.	7.31	2.58	9.39	1.28	0.50
798.14						

Special Identified Erosion Areas along the Left Bank

801.99	James River	7.31	1.95	11.72	1.60	0.82
800.04						

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 8

LEFT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

<u>1960</u> <u>RIVER MILE</u>	<u>SEGMENT</u> <u>NO.</u>	<u>PERIOD OF</u> <u>RECORD</u> <u>(YEARS)</u>	<u>LENGTH OF</u> <u>SEGMENT</u> <u>(MILES)</u>	<u>ACRES LOST</u> <u>IN SEGMENT</u> <u>REACH</u>	<u>SEGMENT</u> <u>EROSION</u> <u>RATE</u> <u>(AC/YR)</u>	<u>SEGMENT</u> <u>EROSION</u> <u>RATE</u> <u>(AC/MI/YR)</u>
<u>James River Chute (J.R.C.)</u>						
2.36	J.R.C.L.B.	7.31	2.14	1.47	0.20	0.09
0.22						
2.47	J.R.C.R.B.	7.31	2.04	8.86	1.21	0.59
0.43						
795.42	Site #2B	7.31	1.61	14.31	1.96	1.22
793.81						
789.63	Site #4A	7.31	0.95	0	0	0
788.68						
788.68	Site #3	7.31	2.3	0.69	0.09	0.04
786.38						
782.23	Site #4	7.31	2.39	3.85	0.53	0.22
779.84						
777.92	Site #6	7.31	1.89	18.59	2.52	1.33
776.03						

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 8

LEFT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

<u>1960 RIVER MILE</u>	<u>SEGMENT NO.</u>	<u>PERIOD OF RECORD (YEARS)</u>	<u>LENGTH OF SEGMENT (MILES)</u>	<u>ACRES LOST IN SEGMENT REACH</u>	<u>SEGMENT EROSION RATE (AC/YR)</u>	<u>SEGMENT EROSION RATE (AC/MI/YR)</u>
773.57	Site #7	7.31	1.50	12.66	1.73	1.15
772.07						
769.19	Site #8	7.31	2.17	18.98	2.60	1.20
767.02						
766.77	Site #7A	7.31	1.28	64.87	8.87	6.93
765.49						
765.49	Site #10	7.31	2.18	45.50	6.22	2.86
763.31						
753.76	Site #11A	7.31	0.82	3.62	0.49	0.60
752.94						

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 9

RIGHT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

<u>1960 RIVER MILE</u>	<u>SEGMENT NO.</u>	<u>PERIOD OF RECORD (YEARS)</u>	<u>LENGTH OF SEGMENT (MILES)</u>	<u>ACRES LOST IN SEGMENT REACH</u>	<u>SEGMENT EROSION RATE (AC/YR)</u>	<u>SEGMENT EROSION RATE (AC/MI/YR)</u>
810.26	1-R	7.31	1.18	1.01	0.14	0.12
809.08	2-R	7.31	0.61	1.63	0.22	0.36
808.47	3-R	7.31	1.01	4.67	0.64	0.63
807.46	4-R	7.31	1.71	0	0	0
805.75	5-R	7.31	1.03	0	0	0
804.72	6-R	7.31	1.39	0	0	0
803.33	7-R	7.31	1.63	17.26	2.36	1.45
801.70	8-R	7.31	1.55	12.82	1.75	1.13
800.15	9-R	7.31	1.06	0	0	0
799.09	10-R	7.31	0.95	7.24	0.99	1.04
798.14	11-R	7.31	1.24	6.00	0.82	0.66
796.90	12-R	7.31	1.87	17.01	2.33	1.24
795.03	13-R	7.31	1.01	6.30	0.86	0.85
794.02						
792.75						
791.25						
789.73	16-R	7.31	1.52	0	0	0

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 9

RIGHT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

<u>1960 RIVER MILE</u>	<u>SEGMENT NO.</u>	<u>PERIOD OF RECORD (YEARS)</u>	<u>LENGTH OF SEGMENT (MILES)</u>	<u>ACRES LOST IN SEGMENT REACH</u>	<u>SEGMENT EROSION RATE (AC/YR)</u>	<u>SEGMENT EROSION RATE (AC/MI/YR)</u>
789.73	17-R	7.31	2.22	4.97	0.68	0.31
787.51	18-R	7.31	1.46	15.18	2.08	1.42
786.05	19-R	7.31	1.92	5.75	0.79	0.41
784.13	20-R	7.31	1.24	4.58	0.63	0.51
782.89	21-R	7.31	1.37	5.36	0.73	0.54
781.52	22-R	7.31	1.20	23.31	3.19	2.66
780.32	23-R	7.31	1.36	60.08	8.22	6.04
778.96	24-R	7.31	0.42	2.27	0.31	0.74
778.54	25-R	7.31	0.94	2.77	0.38	0.40
777.60	26-R	7.31	0.94	0	0	0
776.66	27-R	7.31	0.41	0	0	0
776.25	28-R	7.31	1.09	0	0	0
775.16	29-R	7.31	0.91	7.42	1.01	1.12
774.25						
773.33	31-R					
772.31	32-R	7.31	1.67	0	0	0
770.64						

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 9

RIGHT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

1960 RIVER MILE	SEGMENT NO.	PERIOD OF RECORD (YEARS)	LENGTH OF SEGMENT (MILES)	ACRES LOST IN SEGMENT REACH	SEGMENT EROSION RATE (AC/YR)	SEGMENT EROSION RATE (AC/MI/YR)
770.64	33-R	7.31	0.91	171.66	23.48	25.81
769.73	34-R	7.31	0.78	8.43	1.15	1.48
768.95	35-R	7.31	1.03	5.54	0.76	0.74
767.92	36-R	7.31	1.78	11.65	1.59	0.90
766.14	37-R	7.31	0.64	0	0	0
765.50	38-R	7.31	0.80	20.22	2.77	3.46
764.70	39-R	7.31	0.56	17.08	2.34	4.17
764.14	40-R	7.31	1.47	0	0	0
762.67	41-R	7.31	0.75	1.95	0.27	0.36
761.92	42-R	7.31	1.38	8.08	1.11	0.80
760.54	43-R	7.31	0.90	5.27	0.72	0.80
759.64	44-R	7.31	0.91	5.63	0.77	0.85
758.73	45-R	7.31	0.27	1.81	0.25	0.92
758.46					4.33	2.33
756.60	47-R	7.31	0.73	8.12	1.11	1.53
755.32	48-R	7.31	0.99	0	0	0
754.83						

MISSOURI NATIONAL RECREATIONAL RIVER
GAVINS POINT DAM TO PONCA, NEBRASKA

TABLE 9

RIGHT BANK EROSION RATES: 21 APRIL 1978 TO 10 AUGUST 1985
BASE YEAR ADJUSTMENT FACTOR = 0.9974245

1960 RIVER MILE	SEGMENT NO.	PERIOD OF RECORD (YEARS)	LENGTH OF SEGMENT (MILES)	ACRES LOST IN SEGMENT REACH	SEGMENT EROSION RATE (AC/YR)	SEGMENT EROSION RATE (AC/MI/YR)
754.83	49-R	7.31	0.98	0	0	0
753.85	50-R	7.31	1.51	0	0	0
752.34						
TOTALS**	R.B.	7.31	57.92	535.74	73.29	1.27

**Totals are values for the entire right bank reach of 57.92 miles.

Goat Island

786.4	Goat Island L.B.	7.31	4.04	22.99	3.14	0.78
782.36						
786.4	Goat Island R.B.	7.31	4.04	28.30	3.87	0.96
782.36						

Special Identified Erosion Areas

805.46	Site #1	7.31	3.72	17.38	2.38	0.64
801.74						
797.34	Site #2A	7.31	2.15	21.09	2.88	1.34
795.37						