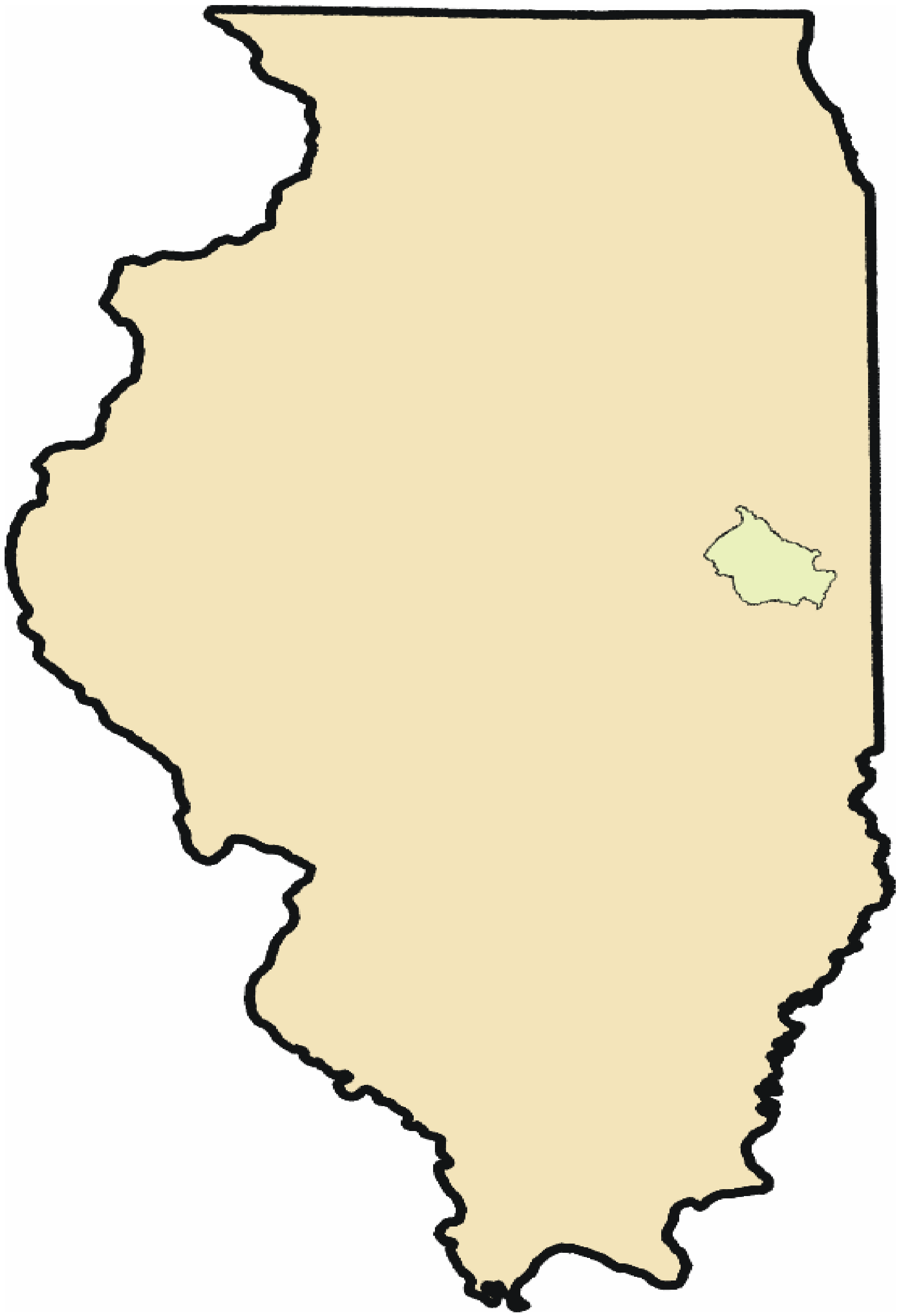


AERIAL ASSESSMENT REPORT FOR SALT FORK OF THE VERMILLION RIVER

CHAMPAIGN AND VERMILLION COUNTIES

AUGUST 2005

PREPARED BY WAYNE KINNEY, FOR IL. DEPARTMENT OF AGRICULTURE

The Illinois Environmental Protection Agency has identified the Salt Fork Vermillion River Watershed as an impaired water. Many of the 303(d) listings for this watershed are for parameters without numeric water quality standards and therefore TMDLs will not be developed for those parameters. The only impairment with sufficient data to allow for TMDL development in the Salt Fork Vermillion River are Nitrates.

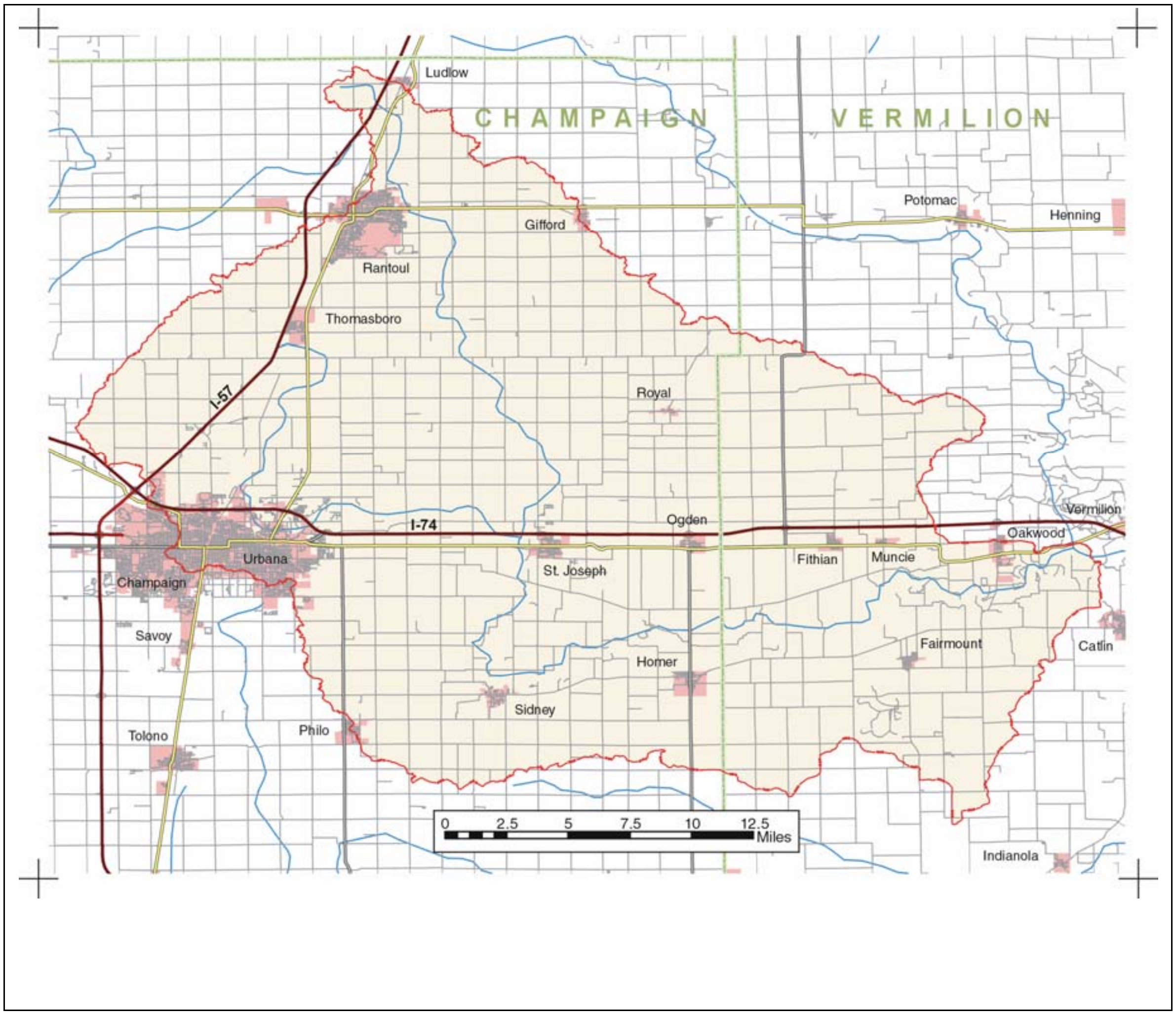


Figure 1 Watershed Area of Salt Fork Vermillion River

Assessment Procedure

Low level geo-referenced video was taken of the Salt Fork of the Vermillion River in March, 2004. Video taping was completed by Fostaire Helicopters, Sauget, IL, using a camera mounted beneath a helicopter to record data from just above tree top level in DVD format for further evaluation and assessment. Video mapping began at the I-74 bridge over the Vermillion River near Batestown and progressed upstream to approx. 2.5 miles above the I-74 bridge over the Salt Fork near St. Joseph, Illinois. Aerial video of tributaries was not part of the project, regardless of the stream size or vegetation.

After videotaping the stream, the DVD tapes were processed by USGS to produce a geo-referenced DVD showing flight data and location. Next, USGS identified features from the video and created shapefiles containing the GPS location, type of feature identified, and the time on the DVD to allow cross referencing. The shape-files along with the DVD were then used to identify and locate the points where ground investigations were needed to verify aerial assessment assumptions and gather additional data.

The ground investigations or "ground truthing" is intended to accomplish two primary functions. First, it provides those viewing videos the opportunity to verify the correct interpretation of the video. Second, the video allows the user to identify and gather field data at the most appropriate locations to more closely represent the entire study portion of the stream.

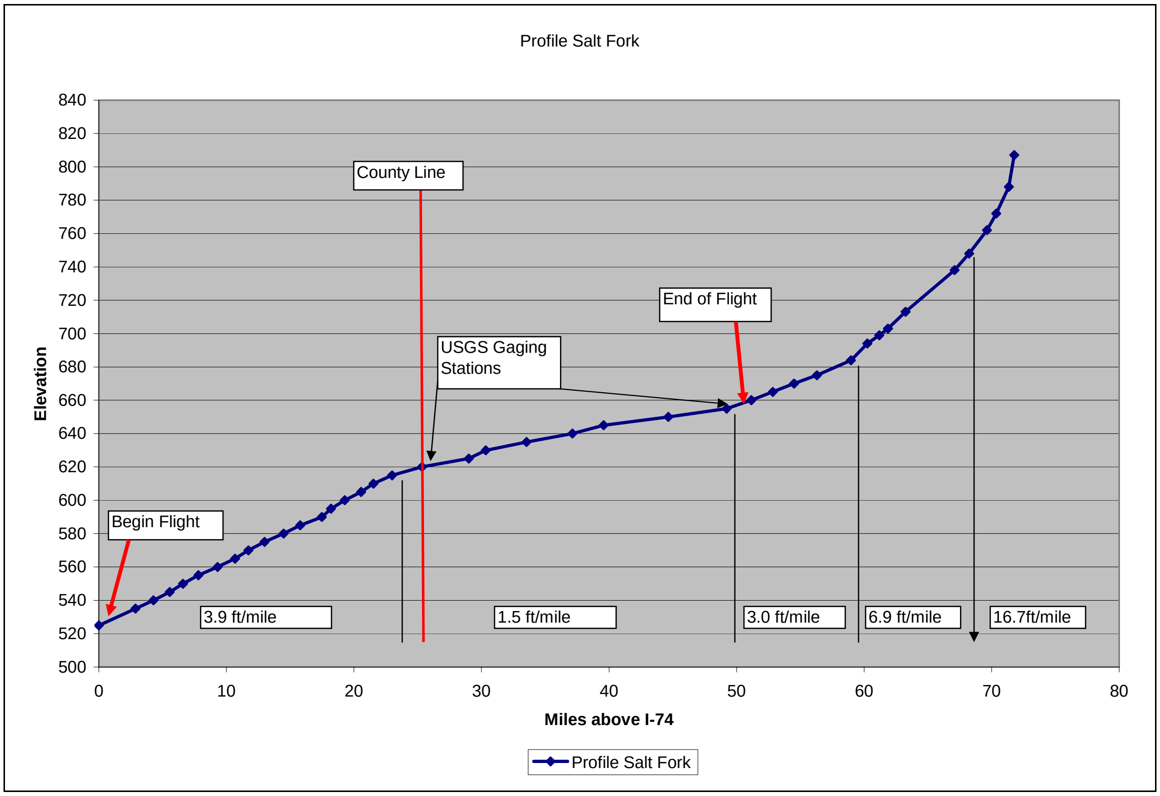


Figure 2 Channel Profile of Salt Fork Vermillion River

Detailed elevation data is not available; therefore the channel slope is calculated from USGS topo maps by measuring the channel length between contour lines. The report refers to this as "valley profile" although a true valley profile would use a straight line distance down the floodplain rather than channel length. However, this method is used because it incorporates sinuosity into the calculation and allows the channel slope to be assume equal to "valley slope" in order to estimate channel capacity, velocity, etc., although there are short segments where the channel slope may differ significantly near roads, logjams, knickpoints, etc.

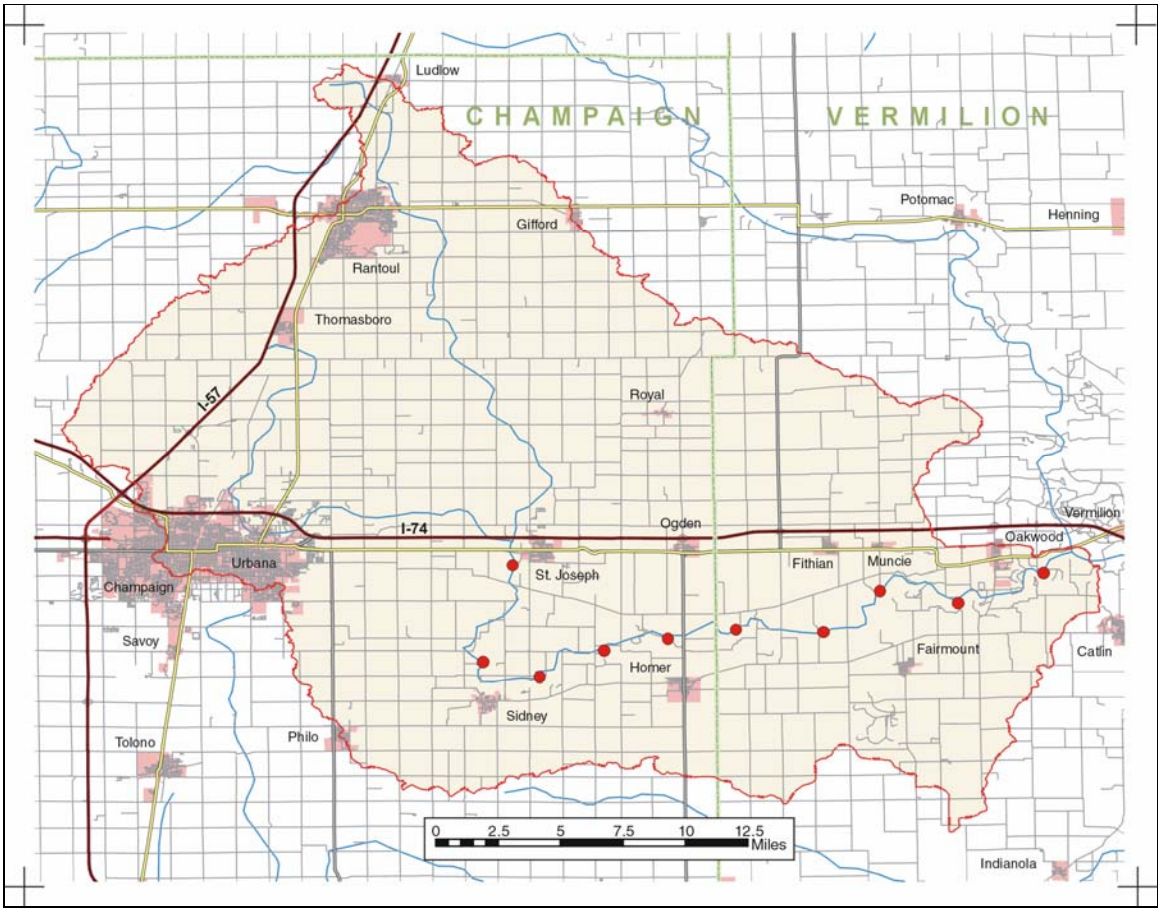


Figure 3 Study Reach with Chapter Divisions

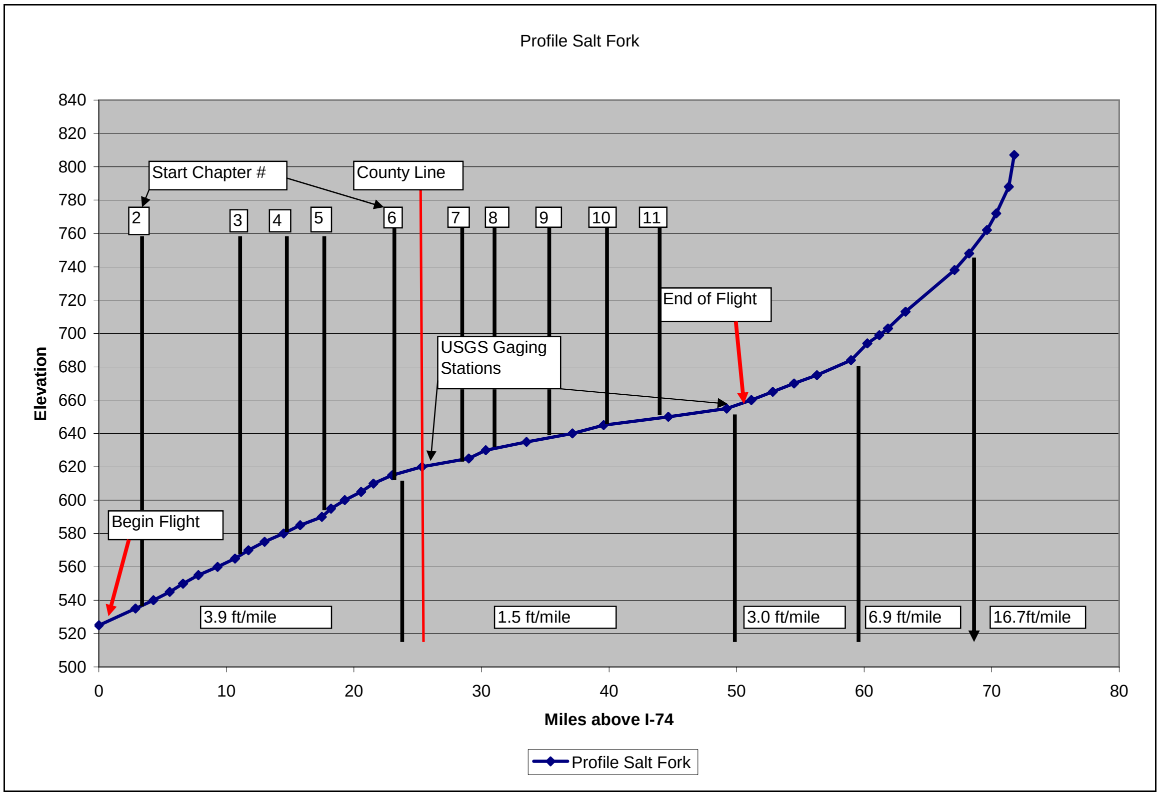


Figure 4. Profile Salt Fork with Approximate Chapter Divisions

The DVD has been divided in "chapters" of approximately five minutes of video (Fig. 3) to enhance the ability to navigate within the flight video and provide a simple way to identify and discuss different stream segments. Although the report will begin with a broader more general assessment of the entire study reach, it will also provide an assessment and treatment recommendations by chapter. The chapter divisions are clearly arbitrary and do not reflect "change points" in the stream characteristics or treatment recommendations. For clarity the conclusions and recommendations are presented for each stream "chapter".

The major factors indicating channel condition identified from the aerial assessment have been totaled by DVD chapter in Table 1 below. This tabulation allows a general comparison of the relative dominance of features found in each chapter and provides a means of comparing stream characteristic between chapters. A discussion of the major differences will follow later in this report.

FEATURES IDENTIFIED BY CHAPTER --SALT FORK VERMILLION RIVER							
Chapter	Log Jam	Erosion	Severe Erosion	Geotech Failure	Breakpoint	Bank Control	Deposition
1	0	27	0	5	0	2	2
2	0	11	0	10	5	0	4
3	0	14	0	1	1	1	4
4	0	25	2	1	4	0	3
5	1	16	1	4	4	3	1
6	1	18	0	6	2	0	1
7	2	25	0	3	1	0	1
8	1	15	0	5	0	0	2
9	2	23	0	11	0	0	0
10	1	32	0	2	0	0	1
11	0	15	0	0	0	1	6
Totals	8	221	3	48	17	7	25

Table 1. Features by Chapter identified by Aerial Assessment

Six cross sections were taken at selected locations on Salt Fork after viewing the DVD's. The cross sections are located at "riffle" locations to best represent the channel characteristics and to allow for comparison of width, depth, x-sec. area, etc. along the channel at similar geometric locations. The result of the hydraulic analysis at each site is presented in summary form in Table 2 and the approximate location of each cross section along the channel profile is found in Fig. 5. Aerial views of cross sections locations are shown in Figs. 10 thru 21. Exact locations as Eastings and Northings and more detail can be found in Appendix A

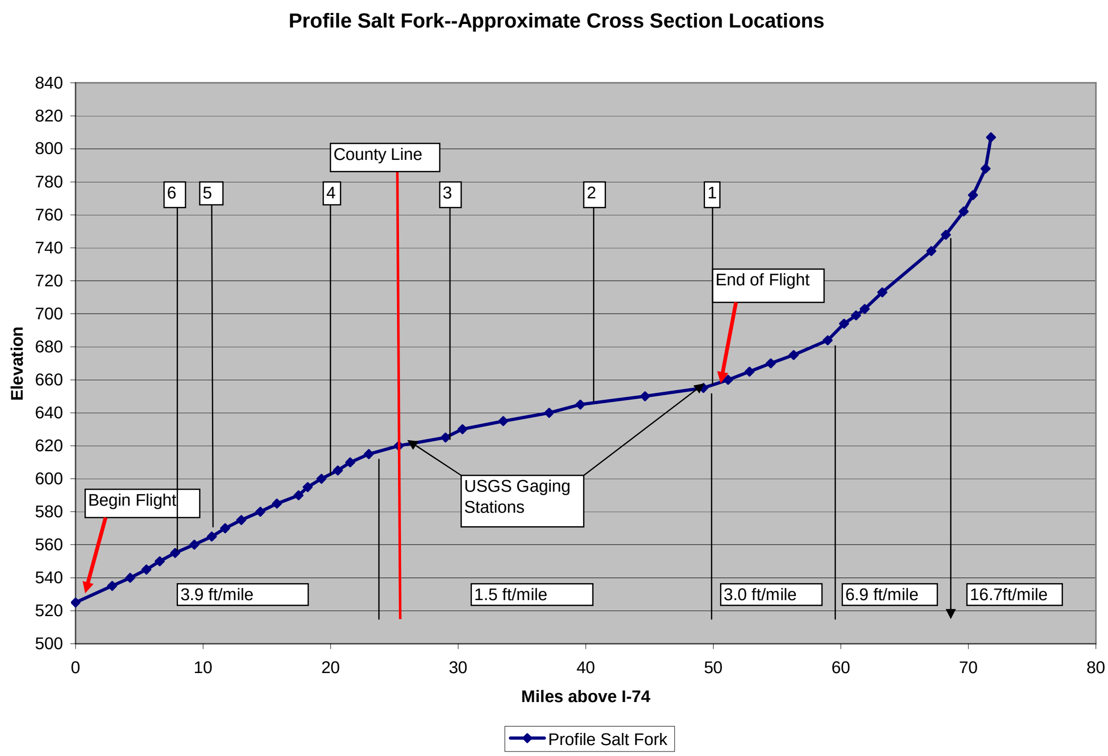


Figure 5 Cross section locations along channel profile (approximate)

CROSS SECTION SUMMARY --SALT FORK VERMILLION RIVER																
X-sec	Valley Slope	ADA	Q2 cfs	BKF Depth	BKF Width	BKF cfs	W/D	Max D	BKF/sq.mi.	Vel. FPS	BKF cfs/ Q2 cfs	BKF X- Area	Top Bk X- Area	Top Bk/ BKF area	Top Bk. Depth	Top Bk. D/ Max D
1	5.5	134	2507	8.17	70	1364	8.57	9.4	10.18	2.4	0.54	572	762	1.33	11.6	1.23
2	5.5	237	3939	9.72	100	2630	10.29	10.5	11.08	2.7	0.67	972	1168	1.20	12.3	1.17
3	2.8	312	3404	7.83	85	1572	10.86	9.1	4.92	2.4	0.46	665	665	1.00	9.1	1.00
4	2.5	369	3436	5.57	111	1940	19.93	7	5.26	3.1	0.56	619	700	1.13	7.7	1.10
5	2.6	457	4143	5.82	134	2541	23.02	7.5	5.56	3.3	0.61	780	1102	1.41	9.8	1.31
6	2.6	473	4258	5.76	141	2614	24.48	7	5.52	3.2	0.61	813	1383	1.70	8.3	1.19

Table 2 Cross Section Summary

A plot of the discharge probability curve from USGS Gage # 3336900 over the last 24 yrs. of continuous record (1967-1991) in Fig. 6 indicates the 2 yr. discharge (50% probability) at approx. 2125 cfs and the 1.5 yr. discharge (67% probability) at approx. 1975 cfs. The drainage area at Gage # 3336900 near St. Joseph is 134 sq. miles; therefore the discharge per sq. mile is 15.9 and 14.7 cfs per sq. mile respectively for the 2 yr. and the 1.5 yr. R.I. discharge. The field determined "bankfull" discharge in the study area ranges from 11.08 to 5.04 cfs/sq. mile. Referring to the gage data this discharge represents a Return Interval (R.I.) of approx. 1.1 yrs at cross sections 1 and 2 near the gage site and a R.I. of less than 1.0 at cross sections 3 thru 6 downstream. While it is expected that the cfs/sq. mile discharge would decrease as the drainage area increases, at first glance this appears to be a rather dramatic and sudden decrease between x-sec 2 and x-sec 3. It should be noted however that the 5.04 cfs/sq. mi. discharge at the field determined bankfull conditions found at x-sec 3 are actually at the top bank elevation and therefore, by definition, cannot be any higher. Additional support for the lower R.I. discharge is found at X-sec. 4, 5 and 6 where the bankfull indicators all yield a discharge per sq. mi. between 5.2 and 5.6 cfs.

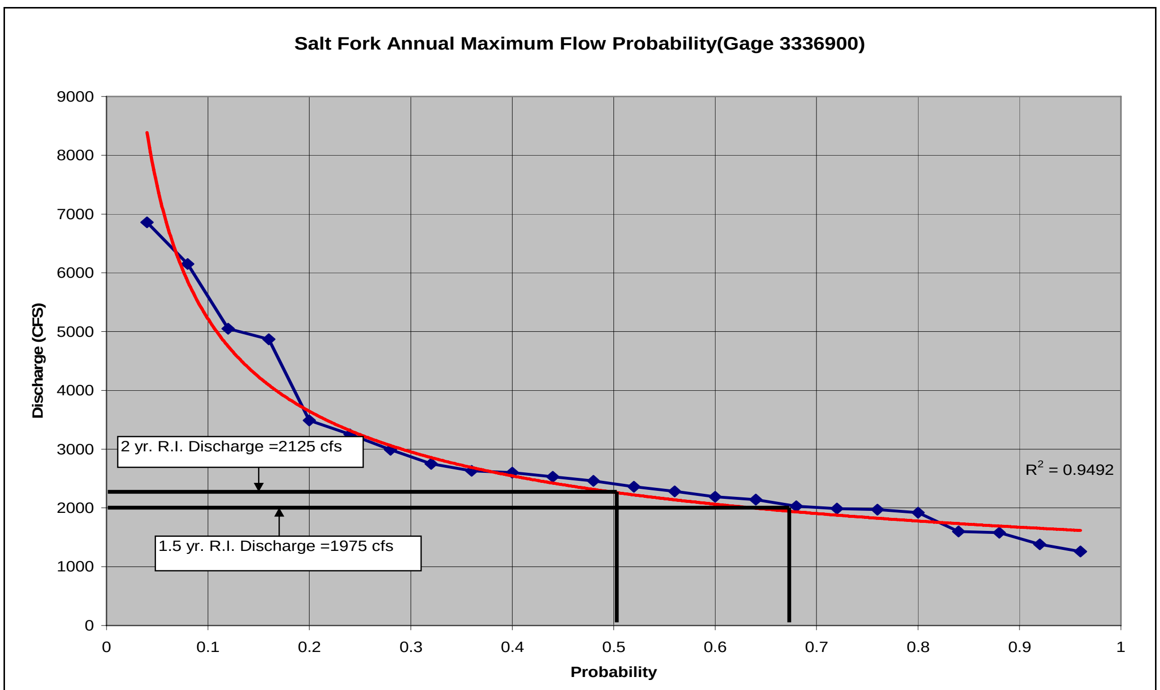
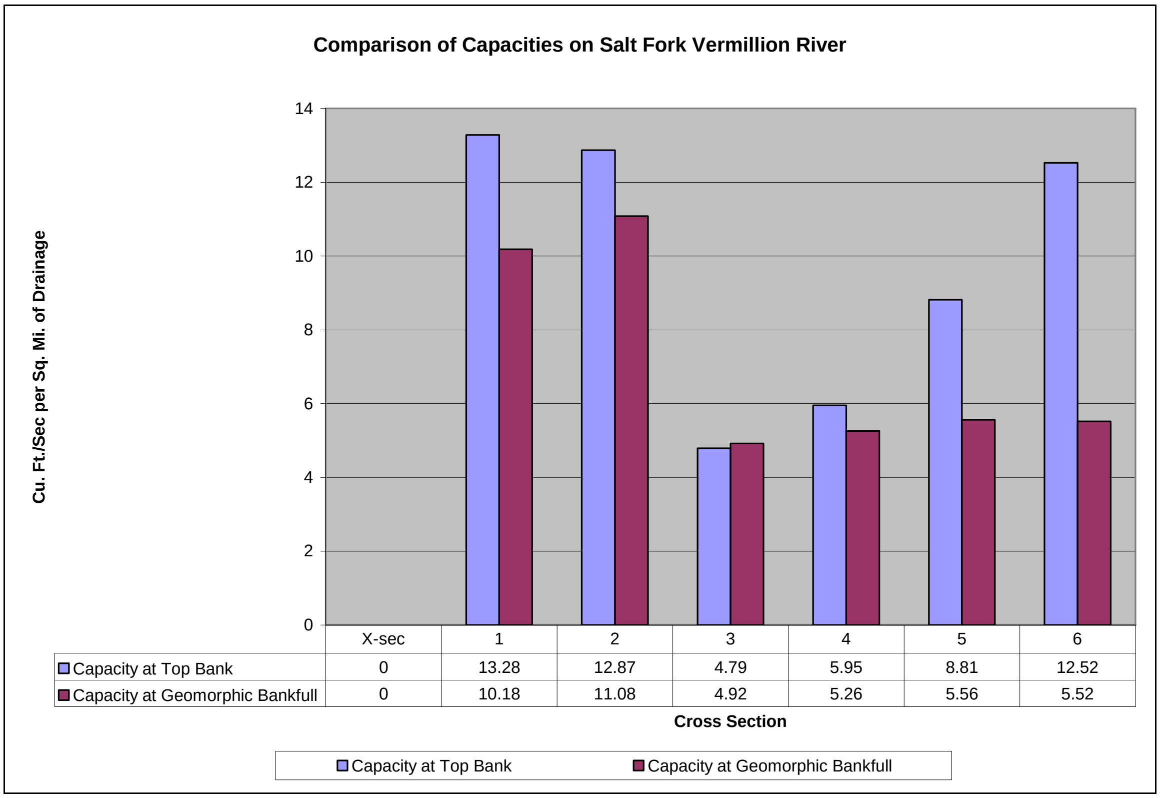


Figure 5. Annual Maximum Peak Discharge Probability at St. Joseph Gage (1968-1991)

The proposed reason for this change in R.I. discharge is related more to the channel modifications made at X-sec. 1 and 2 during channelization and building of levees that prevent out-of-bank flow at low R.I. rather than dramatic changes in watershed discharge. Even at the field determined discharge rate of 10-11 cfs/sq. mile at cross sections 1 and 2 the top bank (floodplain elevation) is approx. 2 ft. above the field determined bankfull elevation. The data suggests that the channel has been enlarged in the channelized section to increase its capacity and improve drainage of the upper Salt Fork so that the capacity per sq. mile of drainage is more than twice that of the natural channel at X-sec 3.



	X-sec	1	2	3	4	5	6
Capacity at Top Bank	0	13.28	12.87	4.79	5.95	8.81	12.52
Capacity at Geomorphic Bankfull	0	10.18	11.08	4.92	5.26	5.56	5.52

Fig. 6 Capacity at Top Bank Compared to Geomorphic Bankfull Capacity

Another analysis of the Annual Maximum Peak Discharges recorded at Gage # 03336900 indicates that there is no trend toward increased runoff in this watershed between 1959 and 1991 when the gage was discontinued. In fact the data indicates a very slight decrease of 2% in maximum annual peaks over this period.

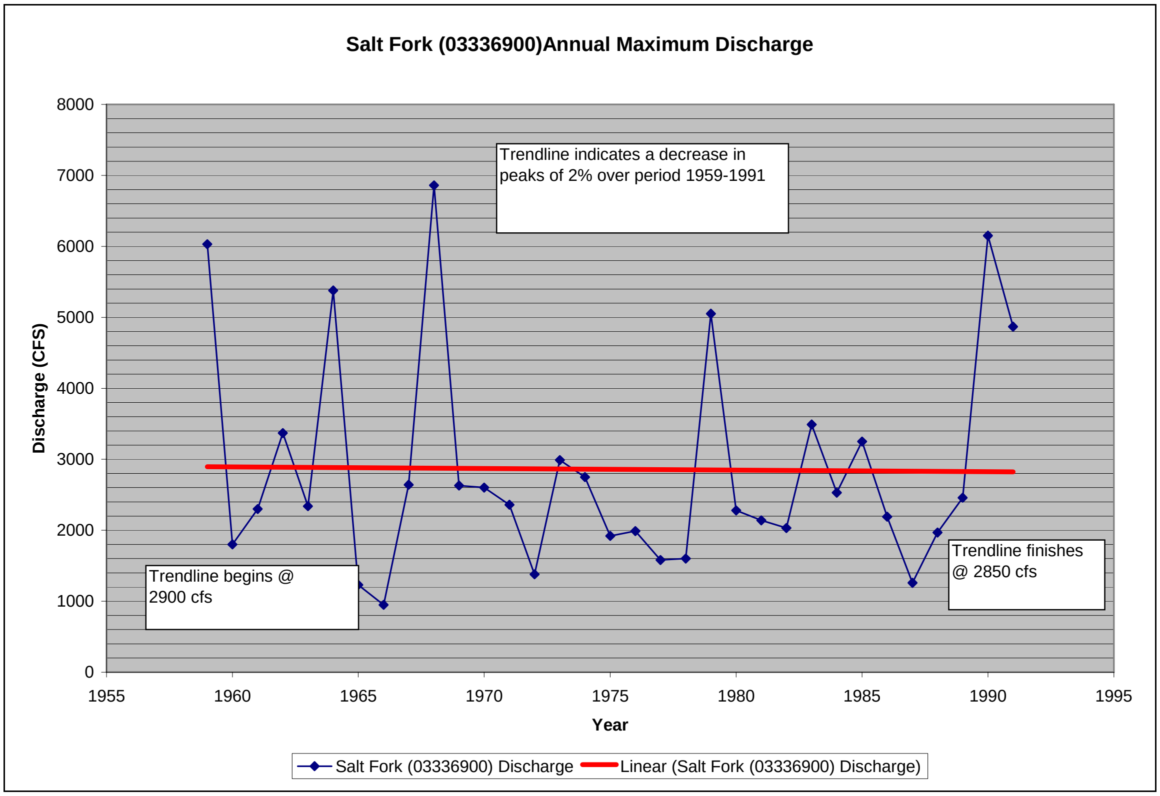


Figure 7. Trendline for Maximum Annual Peak Discharges from 1959 thru 1991

General Observations

1. Aerial assessment indicates streambank erosion is generally occurring throughout the study reach with no obvious reaches of concentrated or severe erosion that may indicate a need for special attention.
2. There is no apparent increase in watershed runoff from available Annual maximum Peak Discharge data. (1959-1991).
3. The upper portion of the study area has been highly modified and has a much larger capacity per unit of drainage area than the middle section between Homer and the confluence of Feather Creek.
4. There is a 25 plus mile reach of Salt Fork, from approx. 2.5 miles above St. Joseph down to near the Champaign County line, with approx. 50% or less of the gradient found in the upper 20 miles or the lower 20 miles of the watershed.
5. The lower 20 plus miles of the Salt Fork are dominated by a rocky substrate and are generally thought to be vertically stable.
6. The steeper gradient reach in the upper end of Salt Fork was not a part of the study reach flown for aerial assessment; therefore no information is presented regarding the vertical or lateral stability above the USGS Gage # 03336900.
7. Preliminary calculations indicate that riffle-pool sequences with heights of up to 5 ft. in the low gradient section around St. Joseph would produce no net increase in the flood stage or backwater. Installation of riffle-pool sequences could have a beneficial impact on nitrates, improved DO, increased bank stability and

improved aquatic habitat. A more thorough study would need to be completed to determine the impact on tile outlets and other drainage structures.

8. A more thorough study of the impacts of a riffle-pool sequence near St.Joseph could also determine if there is a positive impact on sediment transport in this reach due to creation of a riffle pool sequence which could reduce potential flooding and maintenance cost.

Recommendations

Chapter 1 through 5

These chapters are located from the beginning of the flight at the I-74 bridge up to about 2 or 3 miles below the Vermillion-Champaign County line. Although this reach has a steeper gradient than the reach above at 3.9 ft/mile, a rocky substrate provides vertical stability. As a result of the vertical stability, cross sections 4, 5 and 6 in this reach have been determined to be near equilibrium with Channel Evolution Stages of 5 or 6. The width depth ratios found at each x-sec are from 20 to 25 with bedload materials of 3 to 4 inch diameter. There is at least a narrow mature woody riparian corridor on nearly all of this reach. Where the riparian area is only one row of trees or less the threat of accelerated erosion rates are high. An example is found at 23:18 and 23:22 on the DVD and Fig.8 and Fig. 9 show the increased erosion and scalloping of the banks. These areas are recommended for additional riparian establishment.
Given these findings the only structural treatment recommended would be to stabilize the eroding bends with the use of Stone Toe Protection, Stream Barbs or Bendway Weirs. The selection of the most appropriate technique would be determined on a case by case basis to include a cost analysis.
There are 114 identified erosion sites in these six chapters, excluding the 27 areas of geotechnical failure. For this report the geotechnical failures are assumed to be cost prohibitive to treat successfully. The 114 sites deemed to be economically and technically treatable will average 500 ft. each in length. A summary of treatment length and cost by chapter is provided in Table 3.

TREATMENT --CHAPTERS 1 THRU 5					
Chapter	**Erosion Sites**	**Average Length**	**Total Length**	**Average Cost/foot**	**Total Cost**
1	27	500	13500	$30.00	$405,000.00
2	11	500	5500	$30.00	$165,000.00
3	14	500	7000	$30.00	$210,000.00
4	27	500	13500	$30.00	$405,000.00
5	17	500	8500	$30.00	$255,000.00
Total	96		48000		$1,440,000.00

Table 3

Fig. 8 DVD 23:18---Scalloped bank between mature trees

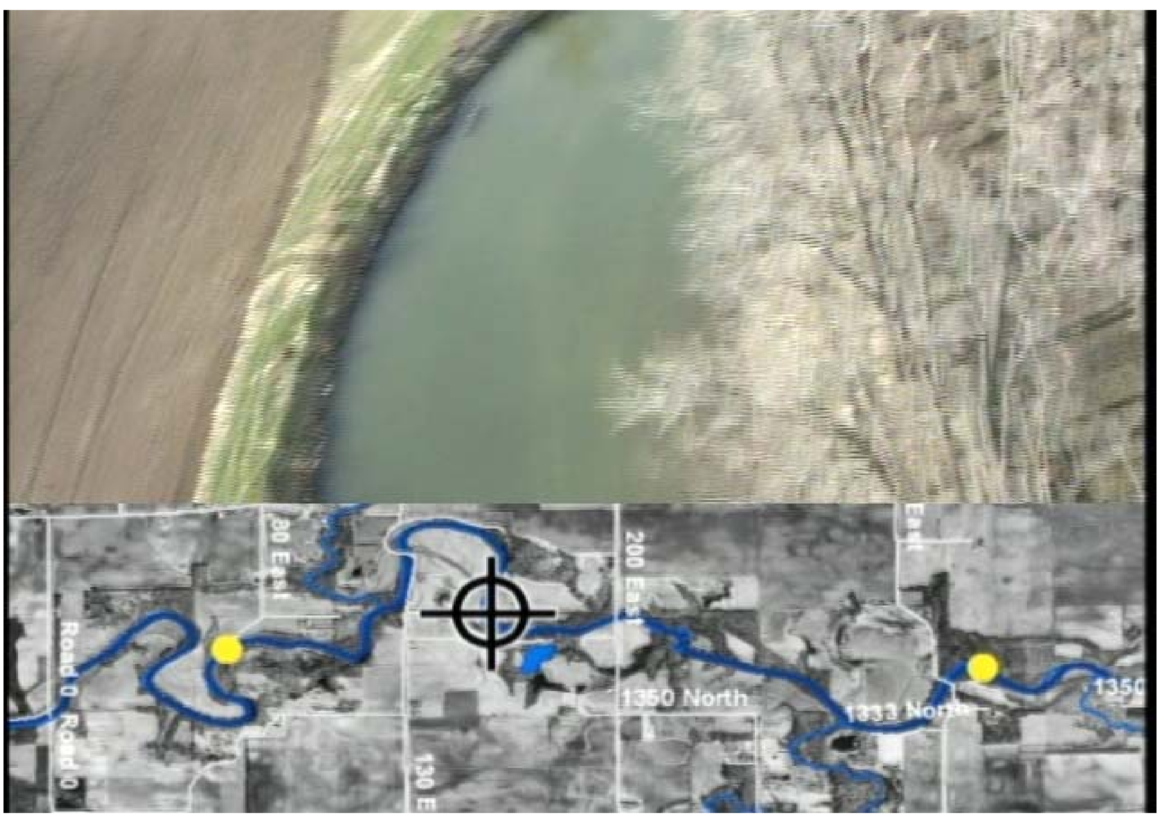


Fig. 9 Erosion where there is no riparian corridor (DVD 23:22)

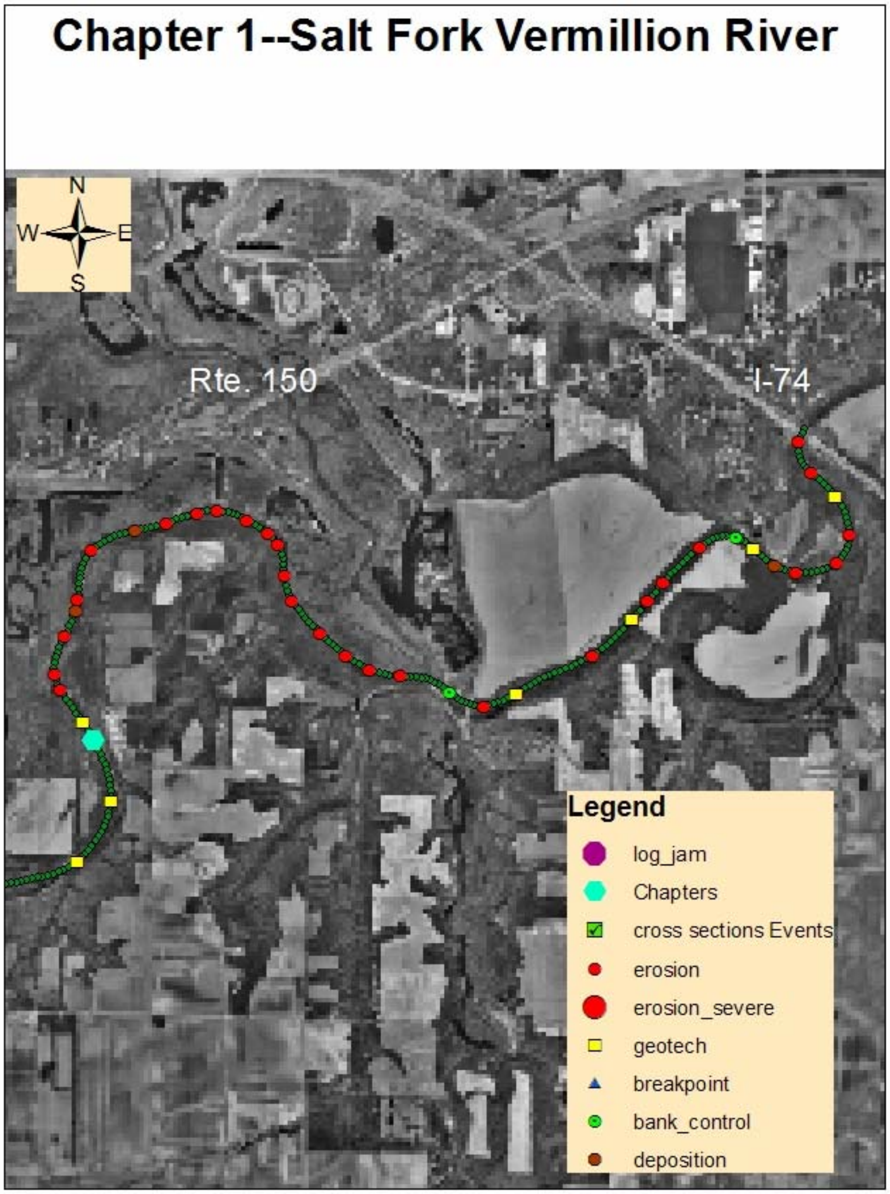


Fig. 10 Chapter 1 Salt Fork

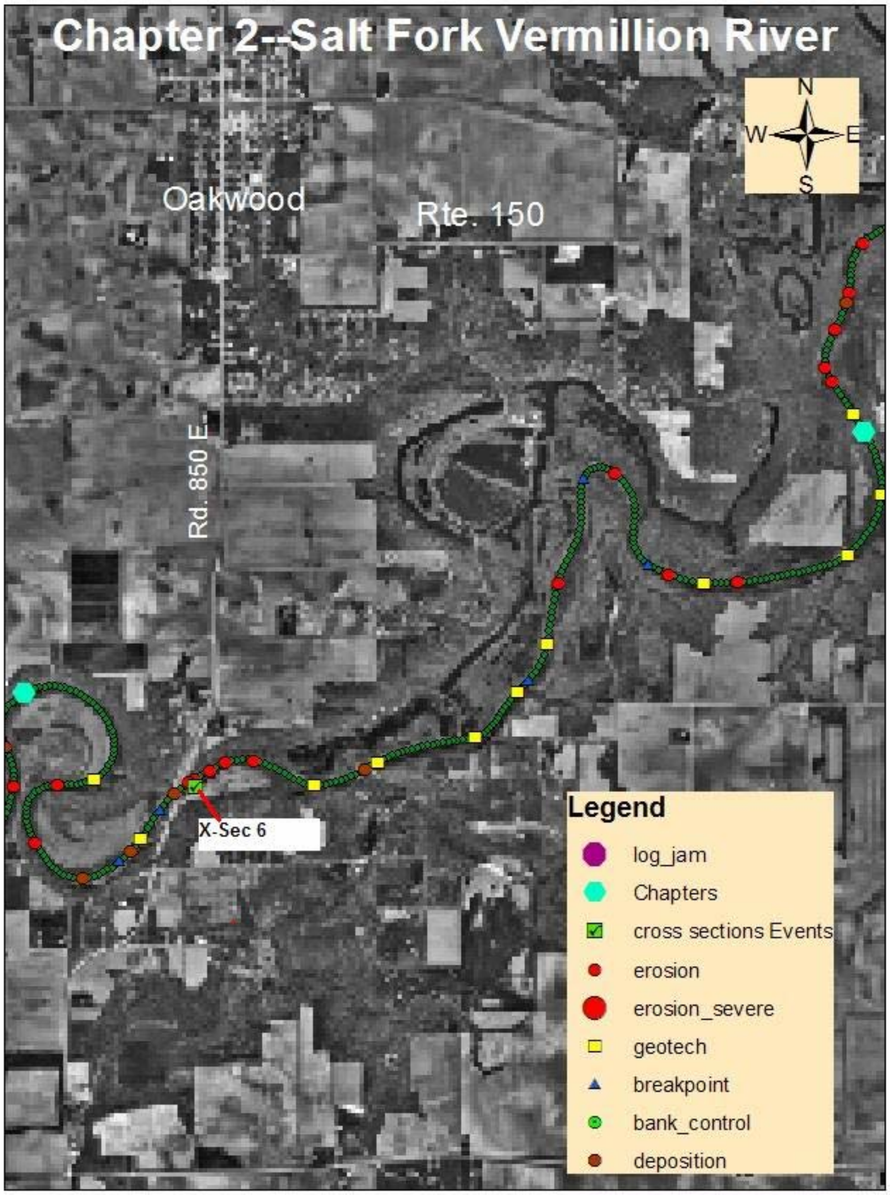


Fig.11 Chapter 2 Salt Fork

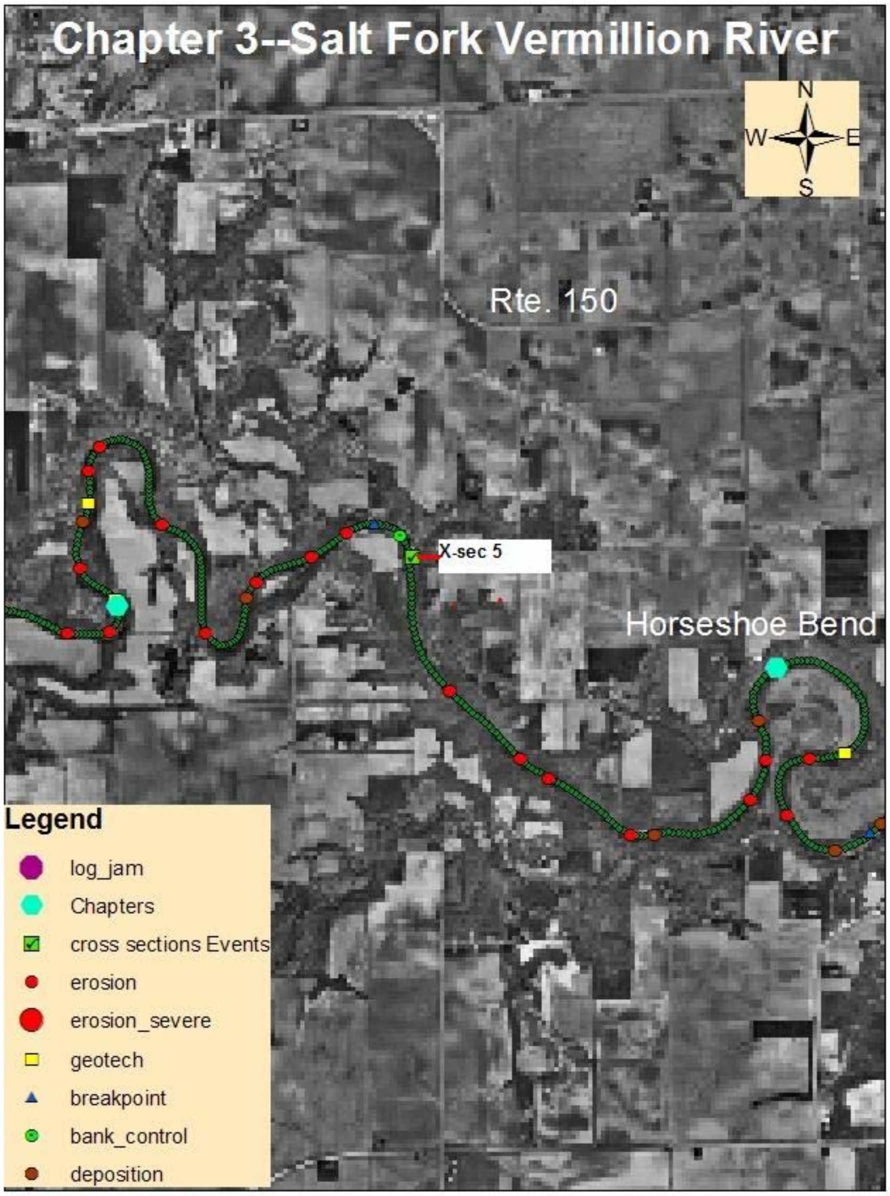


Fig. 12 Chapter 3 Salt Fork

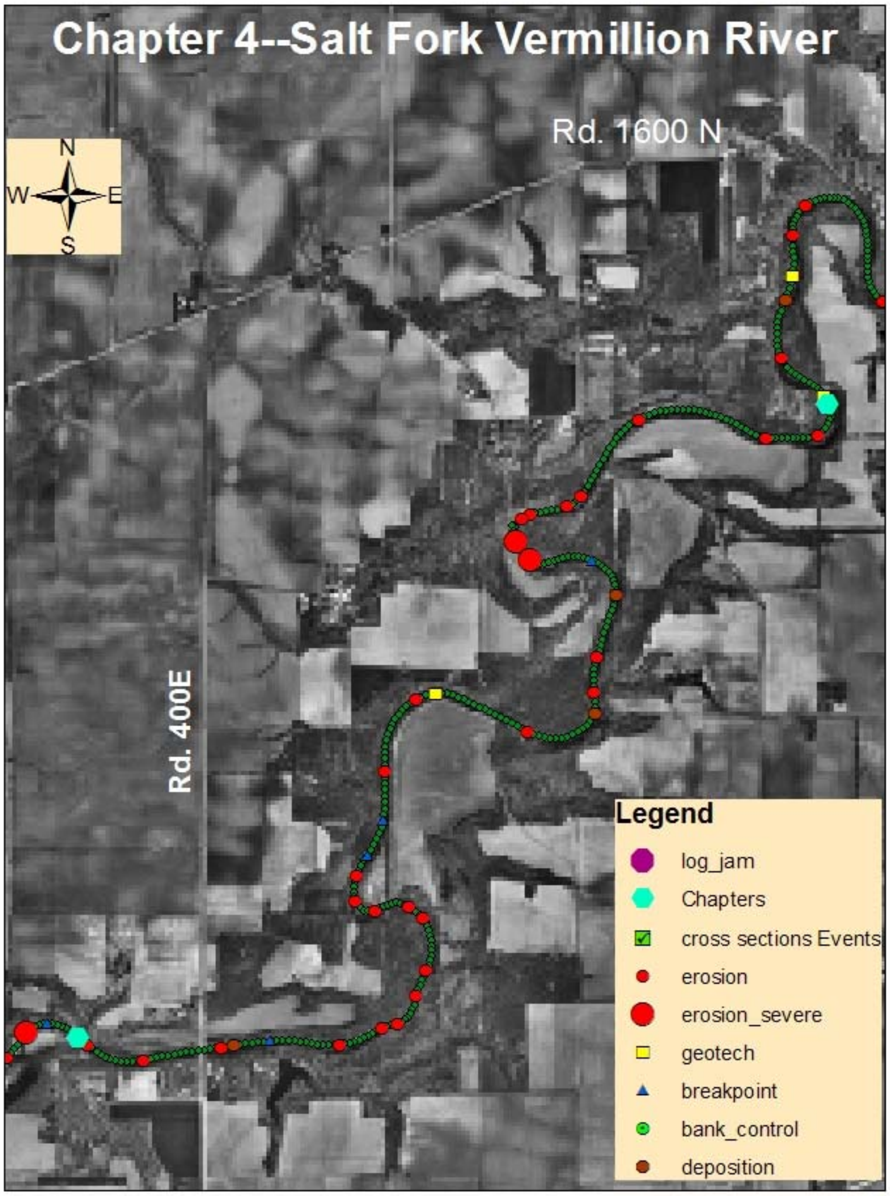


Fig. 13 Chapter 4 Salt Fork

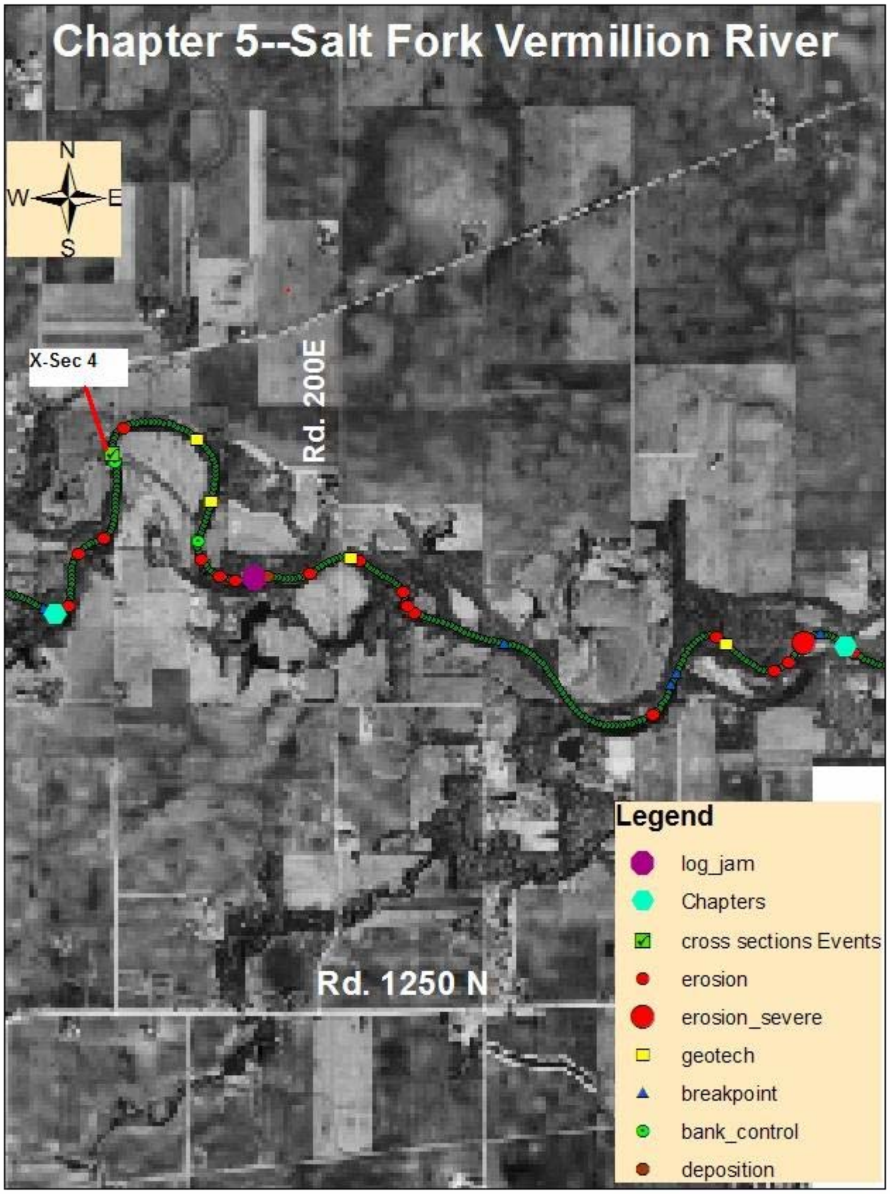


Fig. 14 Chapter 5 Salt Fork

Chapter 6 through 9

This reach represents the lower 60% of the flattest gradient section on Salt Fork and is approximately 16 miles in length. The gradient in this reach is approximately 1.5 ft/mile compared to 3.9 ft/mile downstream and from 3 ft. to 16 ft/mile upstream. Cross section 3, located in the lower half of this reach, shows a change in stream characters from the downstream reach. The width depth ratio drops from 20 to 11 at this site and the bedload is smaller at 2 inches in diameter with no residual rocky substrate. The field determined bankfull discharge is also located at the top bank elevation and is down slightly to 4.92 cfs/sq. mile from 5.26 cfs/sq. mile at x-sec 4. However the top bank height has increased 1.4 ft. and continues to increase in height upstream from this point.
At DVD times 34:32 there are the remnants of a large logjam. (Fig. 15) The logjam is indicative of failing banks creating an abundance of trees entering the channel and forming logjams. There are a total of 6 logjams identified in this reach. In this section particularly, logjams can create major problems as any blockage will tend to impede flow, increase out of bank flow and encourage the channel to scour around the blockage. At DVD time 35:58 and 37:06 there are channel cutoffs developing that do not appear to be the result of logjams. These cutoffs are near sharp bends and probably represent the natural process of channel adjustment to watershed conditions. One possible explanation for this is the reduction in gradient in this section and the fact that this reach has not been extensively channelized as it has been above this point. It is therefore possible that the channel is naturally adjusting to the relative loss of sediment transport capacity and is therefore aggrading. As the channel aggrades it loses even more gradient and then begins to form “cutoffs” in order to shorten its length and increase its gradient and therefore its sediment transport capacity. This appears to be a situation where the cutoffs should be allowed to continue developing.

Fig. 15 Remnants of a large logjam (DVD 34:32)

It may be worth investigating the sediment (silt/sand/gravel) accumulations in this reach to determine if aggradation is occurring. If so, channel modification or structural means to narrow the channel may be recommended to gradually increase sediment transport in this reach. It appears that the lower reach (chapters 1 through 5) will easily transport any additional sediment transported from upstream, eliminating the normal concern of "moving the problem" from one reach to the next.

The first logical step is to reduce the amount of sediment required for transport by stabilizing the banks in this reach and upstream to reduce sediment generation. The recommended method for this reach is Stone Toe Protection with possible use of Bendway Weirs and or Stream Barbs in selected location after a more thorough study of sediment transport.

This reach has 81 erosion sites that can be successfully treated with the recommended methods. Each site is again estimated to be an average of 500 ft. in length and the cost per foot is estimated at $30.00. Table 4 shows a summary of treatment needs and cost.

TREATMENT --CHAPTERS 6 THRU 9					
Chapter	**Erosion Sites**	**Average Length**	**Total Length**	**Average Cost/foot**	**Total Cost**
6	18	500	9000	$30.00	$270,000.00
7	25	500	12500	$30.00	$375,000.00
8	15	500	7500	$30.00	$225,000.00
9	23	500	11500	$30.00	$345,000.00
Total	**81**		**40500**		**$1,215,000.00**

Table 4

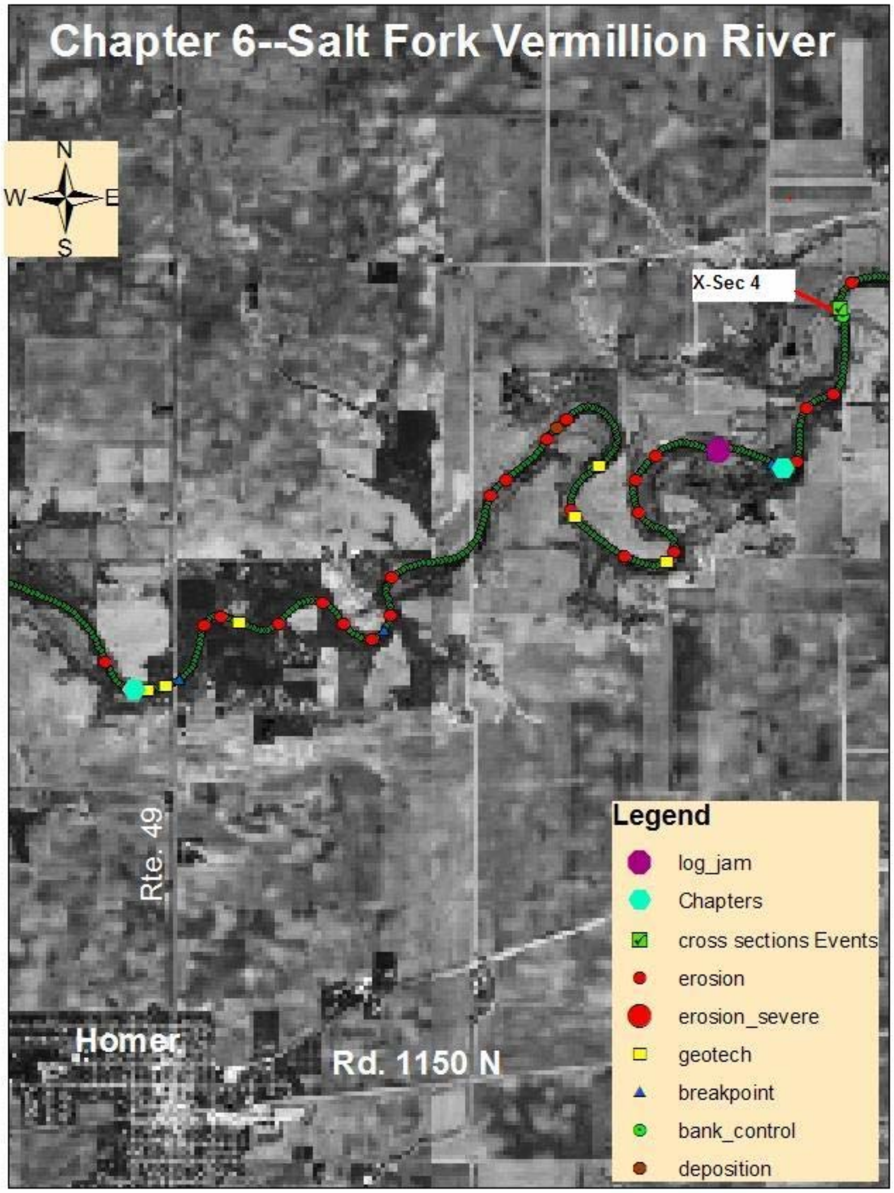


Fig. 16 Chapter 6 Salt Fork

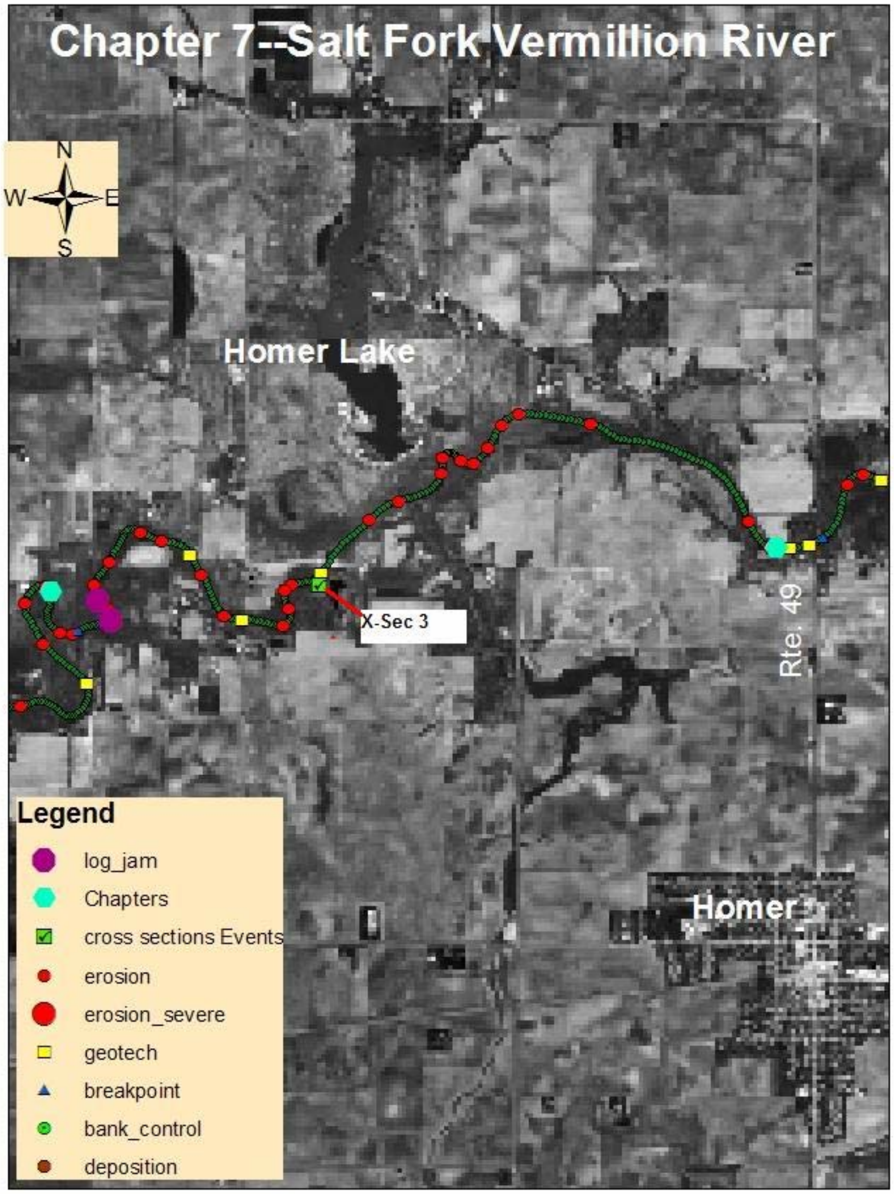


Fig. 17 Chapter 7 Salt Fork

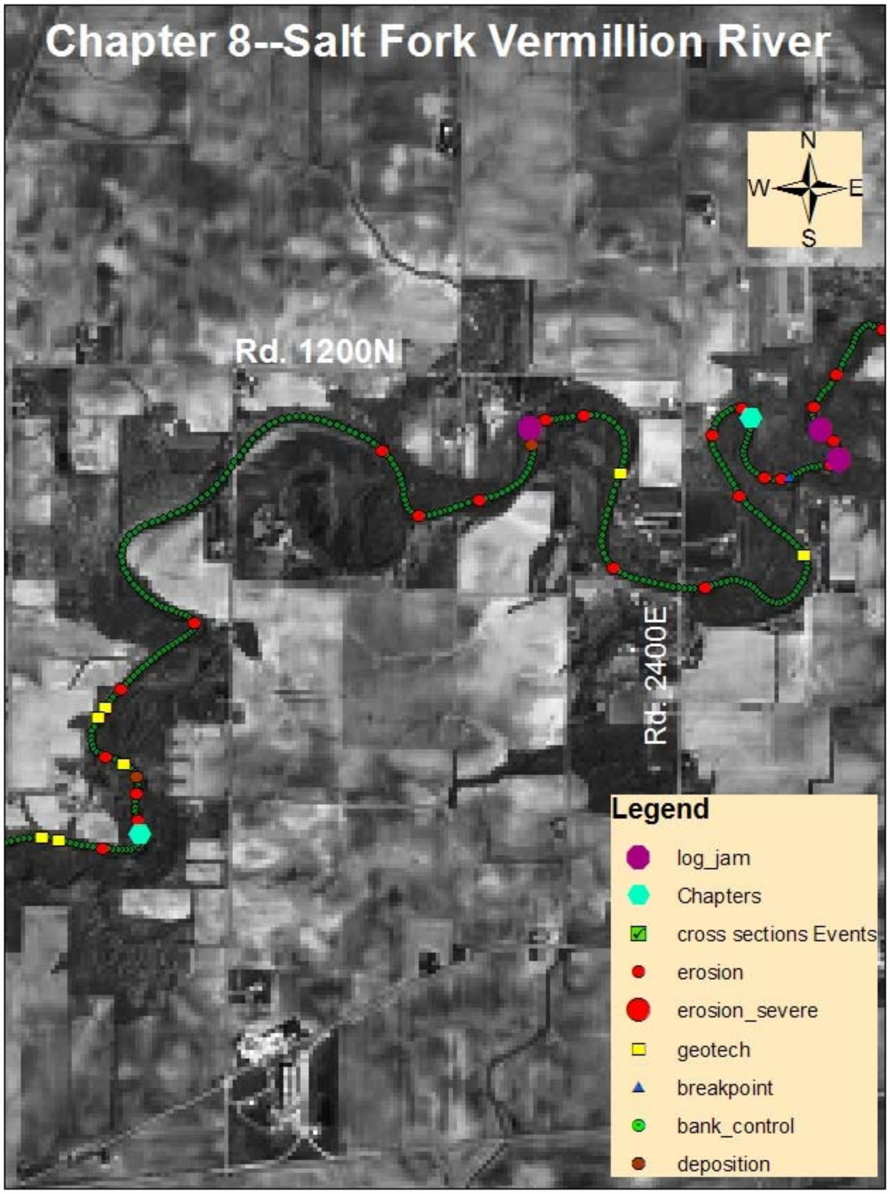


Fig. 18 Chapter 8 Salt Fork

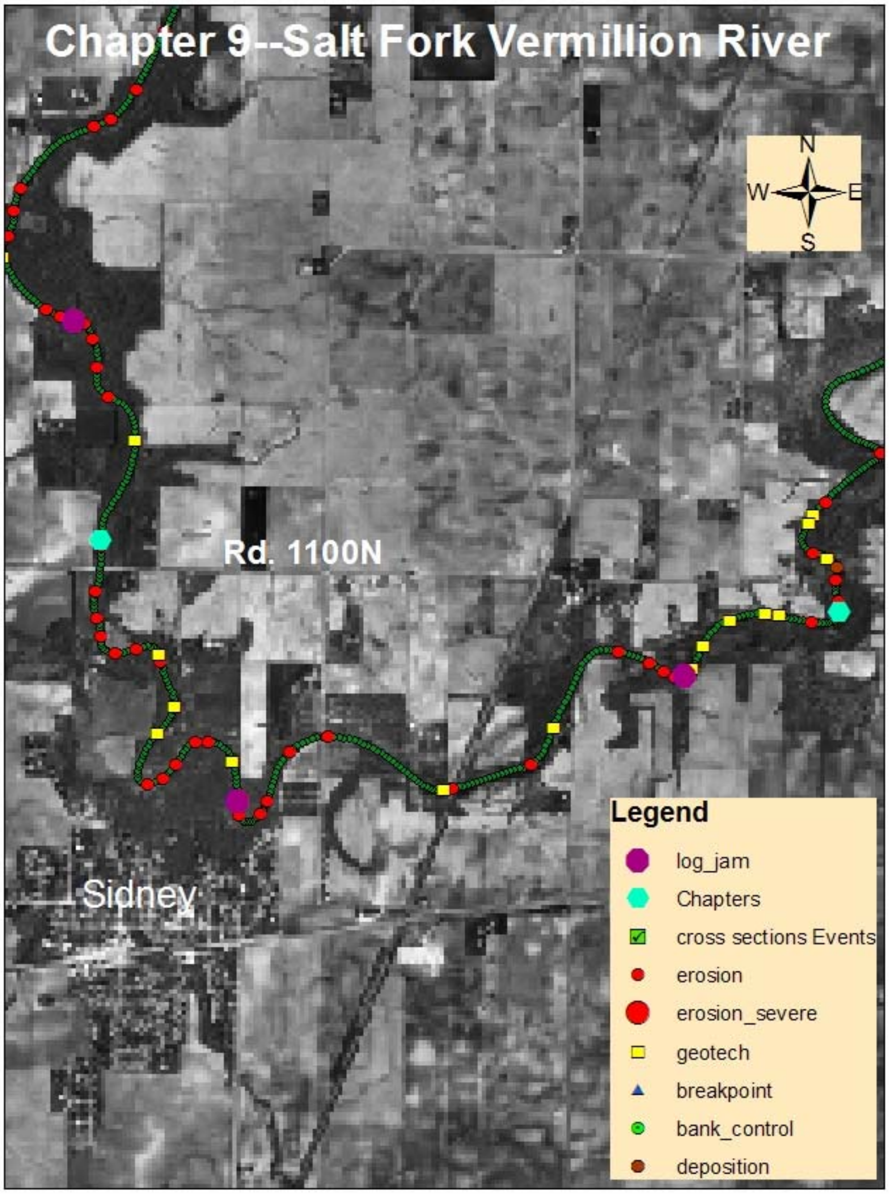


Fig. 19 Chapter 9 Salt Fork

Chapter 10 and 11

This reach represents the upper 12 miles of the aerial assessment and the upper 40% of the flat (1.5 ft/mile) section of Salt Fork. This reach has been extensively channelized and cross sections 1 and 2 show a channel capacity of approximately 10 to 11 cfs/sq. mile of drainage at field determined bankfull as compared to 5 to 6 cfs/sq. mile in chapters 1 thru 9. The top bank is still approximately 2 ft. above the field determined bankfull and represents 20 to 30 percent additional area before out of bank flow occurs. The bedload in this reach is less than 1 inch in diameter (silt and sand). There are still significant bank erosion areas with 47 identified sites in this reach that contribute sediment to the downstream reaches. To reduce sediment contributions these sites should be stabilized.

As stated in the general observations, a preliminary analysis of this reach near St. Joseph indicates that due to the low gradient, a riffle-pool sequence could be installed with riffle height up to 5 ft. in height with no increase in backwater or out of bank flow. This could be significant, both in terms of reducing sediment and increasing sediment transport capacity through this flat gradient reach, as well as for aquatic habitat improvement.

The recommended treatment for this reach is then to explore the feasibility of creating a riff-pool sequence in this 12 mile reach. The bankfull width is from 70 to 100 ft. therefore the appropriate riffle spacing would be from 420 to 600 ft. For a preliminary estimate an average of 500 ft. will be assumed at an average height of 3 ft. These are very preliminary figures and a complete channel profile and determination of impact on drainage structures would be needed as well as confirmation of the backwater and out of bank flow predictions prior to proceeding with a design recommendation. However, for planning purposes, the assumptions made by this report would indicate the following treatment needs and cost estimates.

TREATMENT --CHAPTERS 10 and 11 (option 1)					
Chapter	**Number Riffles**	**Average Tons Stone**	**Total Tons Stone**	**Average Cost/ton**	**Total Cost**
10	60	850	51,000	$30.00	$1,530,000.00
11	60	1200	72,000	$30.00	$2,160,000.00
Total	**120**	**1025**	**123000**		**$3,690,000.00**

Table 5

An alternative means of controlling bank erosion would be to use Stone Toe Protection or Stream Barbs in the eroding sections. This option would be less expensive, but would sacrifice the added benefits of aquatic habitat and sediment transport, at least in the early life of the project, although over time the channel near the Stone Toe Protection will likely deepen and narrow creating improved habitat and sediment transport provided the channel is not artificially widened during maintenance operations.

TREATMENT --CHAPTERS 10 and 11 (option 2)					
Chapter	**Erosion Sites**	**Average Length**	**Total Length**	**Average Cost/foot**	**Total Cost**
10	18	800	14400	$30.00	$432,000.00
11	25	800	20,000	$30.00	$600,000.00
Total	**43**		**34400**		**$1,032,000.00**

Table 6

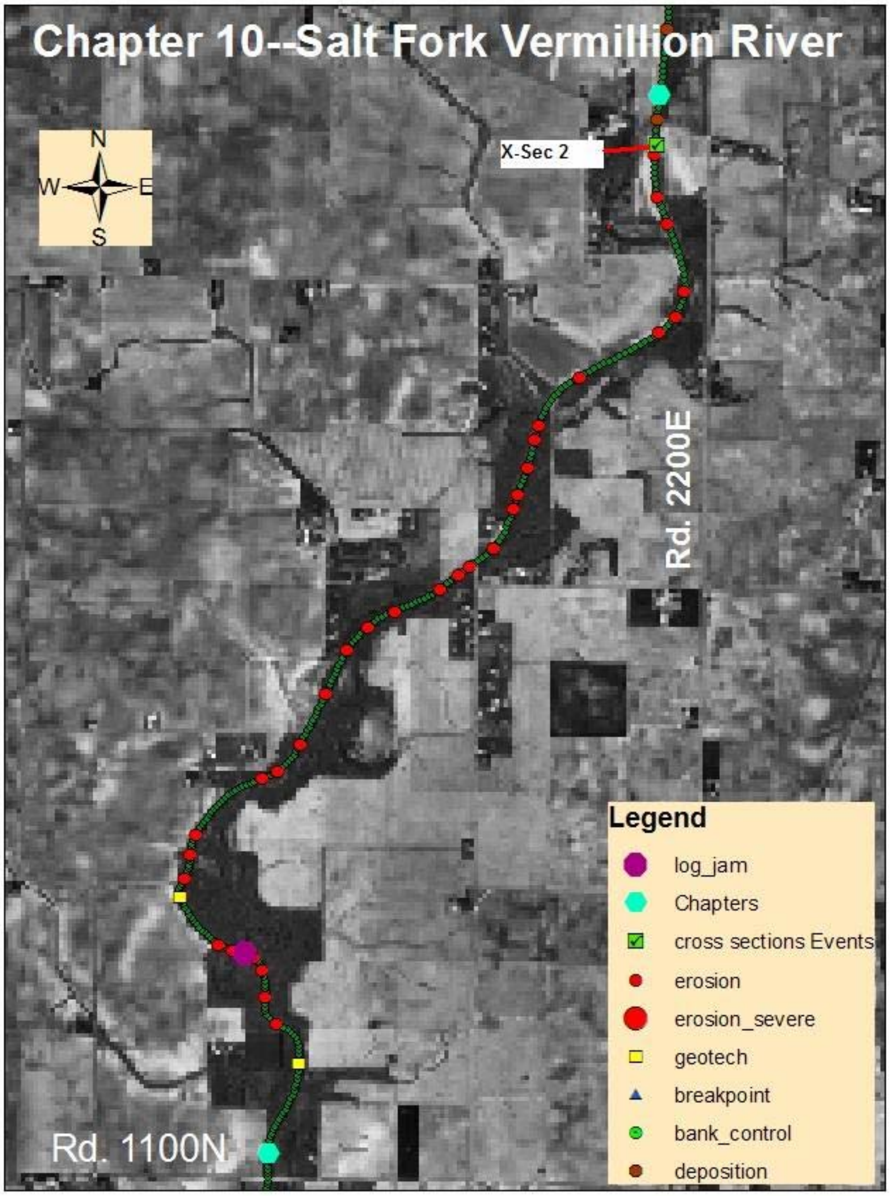


Fig. 20 Chapter 10 Salt Fork

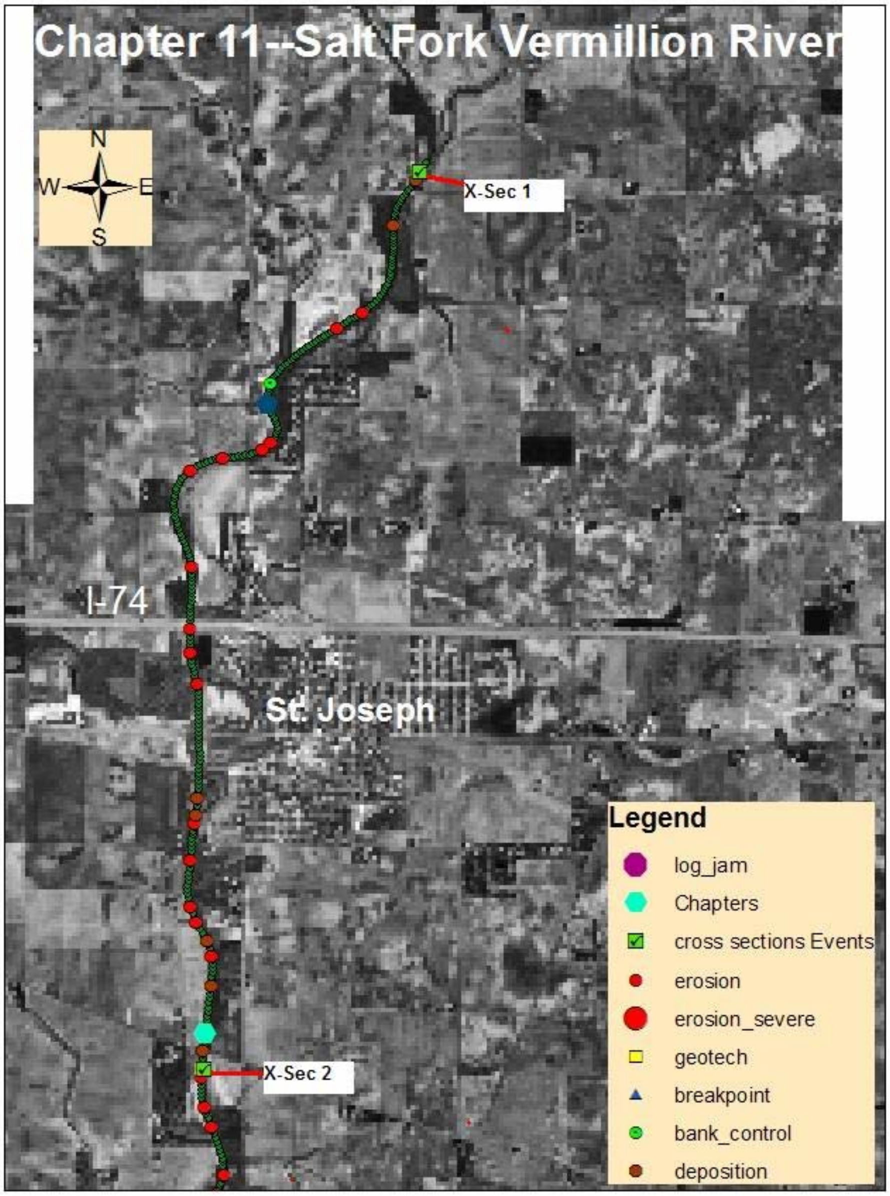


Fig. 21 Chapter 11 Salt Fork

APPENDIX A

CROSS SECTION DATA

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Champaign T. R. Sec.

Date 8/29/2005 By Wayne Kinney

Stream Name Salt Fork UTM Coord. E412026 N4445019

Landowner Name X-sec 1

Drainage Area 134 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	101 ft.	Cross Sectional Area	623 sq. ft.
	Depth	6.2 ft.		

Reference Stream Gage:

Salt Fork near St. Joseph

Champaign County, IL

Station No.	03336900	Gage Q_2	2490 cfs
Drainage Area	134 sq.mi	Regression (	2740 cfs

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope:	5.5	*ft./mi. (user-entered)*	Regression Q_2	2759 cfs
		ft/mi (from worksheet) Rainfall 3.00 in *(2 yr, 24 hr)*	Adjusted Q_2	2507 cfs
	0.0010	*ft./ft.* Regional Factor 1.057	Typical Range for Bankfull Discharge:	1000 to 2010 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

		Stream Length	*ft.*
Basic Field Data:		Valley Length	*ft.*
Bankfull Width	70 *ft.*	Contour Interval	feet
Mean Bankfull Depth	8.17 *ft.*	Estimated Sinuosity	
Width/Depth Ratio	8.57		

		Channel Slope:		Bankfull Q from:	
Max. Bankfull Depth	9.4 *ft.*	Surveyed:	0.000278 *ft./ft.*	Cross-Section	1285 *cfs*
Width at twice max. depth (18.8 ft.)	2000 *ft.*	Estimated:	*ft./ft.*	Basic field data	1442 *cfs*
				Selected Q	1364 *cfs*
Entrenchment Ratio	28.57	Radius of Curvature (Rc)	ft.		
		Rc/Bankfull width:	0.00		

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload: D_{90}	1 *in.*	Velocity required to move D_{90}:	2.1	*ft./sec.*
D_{50}	*in.*	Velocity from Cross-Section data:	2.25	*ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	2.52	*ft./sec.*
velocities from different sources.		Velocity from selected Q:	2.4	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

Bankfull discharge = 10.18 cfs/sq. mile

Natural Open Channel Flow

[back to I&E form]

Project:	X-sec 1
Assisted by:	Wayne Kinney
Date:	8/29/2005
Channel Slope (***S***):	0.000278 *ft/ft*
Manning's ***n*** :	0.040
Flow Depth:	9.4 *ft*

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

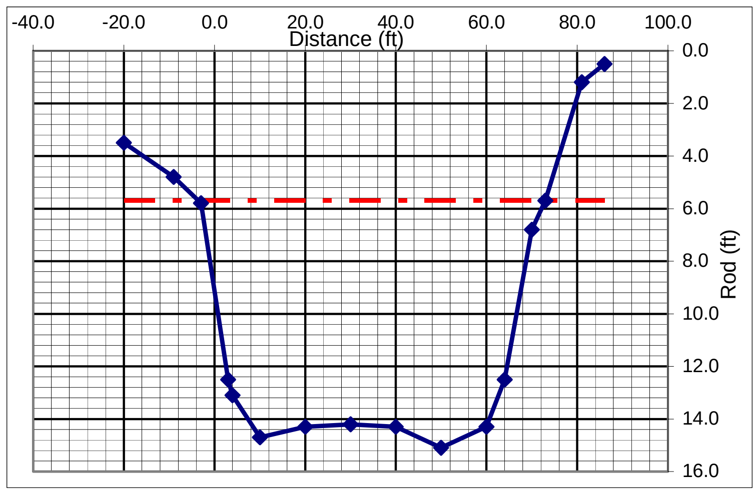
assuming uniform, steady flow

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	9.4 *ft*	11.6	
Channel Flow (***Q***):	1,284.7 *cfs*	1,779.6	
Channel Velocity:	2.2 *ft/sec*	2.3	
Cross-Sectional Area (***A***):	572.2 *sq.ft.*	761.6	
Hydraulic Radius (***R***):	6.9 *ft*	7.3	

Survey Data:

Rod *(ft)*	Distance *(ft)*
3.5	-20.0
4.8	-9.0
5.8	-3.0
12.5	3.0
13.1	4.0
14.7	10.0
14.3	20.0
14.2	30.0
14.3	40.0
15.10	50
14.30	60
12.50	64
6.80	70
5.70	73
1.20	81
0.5	86



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Champaign T. R. Sec.

Date 8/29/2005 By Wayne Kinney

Stream Name Salt Fork UTM Coord. E410420 N4438345

Landowner Name X-sec 2

Drainage Area 237.4 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions Width 126 ft. Cross Sectional Area 918 sq. ft.

Depth 7.3 ft.

Reference Stream Gage:

Salt Fork near St. Joseph Station No. 03336900 Gage Q_2 2490 cfs

Drainage Area 134 sq.mi Regression (2740 cfs

Champaign County, IL **REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope: 5.5 *ft./mi. (user-entered)* Regression Q_2 4335 cfs

ft/mi (from worksheet) Rainfall 3.00 in *(2 yr, 24 hr)* Adjusted Q_2 3939 cfs

0.0010 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge:

1570 to 3160 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

Stream Length *ft.*

Valley Length *ft.*

Contour Interval feet

Estimated Sinuosity

Basic Field Data:

Bankfull Width 100 *ft.*

Mean Bankfull Depth 9.72 *ft.*

Width/Depth Ratio 10.29

Max. Bankfull Depth 10.5 *ft.*

Width at twice max. depth 1200 *ft.*

(21.0 ft.)

Entrenchment Ratio 12.00

Channel Slope:

Surveyed: 0.000278 *ft./ft.*

Estimated: *ft./ft.*

Radius of Curvature (Rc) ft.

Rc/Bankfull width: 0.00

Bankfull Q from:

Cross-Section 2509 *cfs*

Basic field data 2752 *cfs*

Selected Q 2630 *cfs*

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload: D_{90} 1 *in.* Velocity required to move D_{90}: 2.1 *ft./sec.*

D_{50} *in.* Velocity from Cross-Section data: 2.58 *ft./sec.*

GOAL: Develop confidence by matching velocities from different sources.

Velocity from basic field data: 2.83 *ft./sec.*

Velocity from selected Q: 2.7 *ft./sec.*

Channel Evolution Stage II Stream Type (Rosgen)

Notes

Bankfull Discharge = 11.08 cfs/sq. mile

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	X-sec 2	
Assisted by:	Wayne Kinney	
Date:	8/29/2005	
Channel Slope (*S*):	0.000278	*ft/ft*
Manning's *n*:	0.040	
Flow Depth:	10.5	*ft*

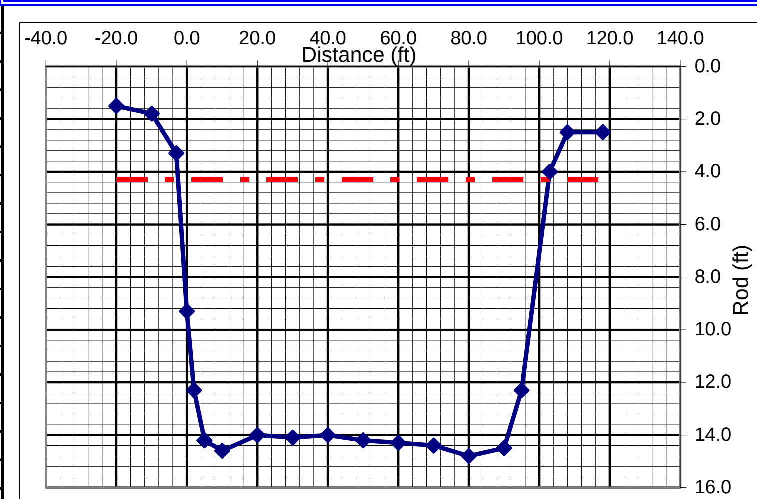
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	10.5 *ft*	12.3	11.5
Channel Flow (*Q*):	2,509.3 *cfs*	3,050.7	2,916.8
Channel Velocity:	2.6 *ft/sec*	2.6	2.7
Cross-Sectional Area (*A*):	972.4 *sq.ft.*	1,168.2	1,079.0
Hydraulic Radius (*R*):	8.5 *ft*	8.7	9.1

Survey Data:

Rod *(ft)*	Distance *(ft)*
1.5	-20.0
1.8	-10.0
3.3	-3.0
9.3	0.0
12.3	2.0
14.2	5.0
14.6	10.0
14.0	20.0
14.1	30.0
14.00	40
14.20	50
14.30	60
14.40	70
14.80	80
14.50	90
12.3	95
4.0	103
2.5	108
2.5	118



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Champaign | T. | R. | Sec.

Date 8/29/2005 | By Wayne Kinney

Stream Name Salt Fork | UTM Coord. E415591 N4434145

Landowner Name Xsec3

Clear Cells

Drainage Area 311.57 sq. mi.

Regional Curve Predictions:

Bankfull dimensions	Width	140 ft.	Cross Sectional Area	1104 sq. ft.
	Depth	7.9 ft.		

Reference Stream Gage:

Salt Fork near Homer	Station No.	03338000	Gage Q_2	3760 cfs
	Drainage Area	344 sq.mi	Regression (	4290 cfs
Champaign County, IL	**REFERENCE STREAM DATA ONLY**			

USGS Flood-Peak Discharge Predictions:

Valley Slope:	2.8	*ft./mi. (user-entered)*			Regression Q_2	3883 cfs
		ft/mi (from worksheet)	Rainfall	3.00 in *(2 yr, 24 hr)*	Adjusted Q_2	3404 cfs
	0.0005	*ft./ft.*	Regional Factor	1.057	Typical Range for Bankfull Discharge:	1360 to 2730 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

			Stream Length		*ft.*
Basic Field Data:			Valley Length		*ft.*
Bankfull Width	85	*ft.*	Contour Interval		feet
Mean Bankfull Depth	7.83	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	10.86				

			Channel Slope:		Bankfull Q from:		
Max. Bankfull Depth	9.1	*ft.*	Surveyed:	0.000284 *ft./ft.*	Cross-Section	1418	*cfs*
Width at twice max. depth		*ft.*	Estimated:	*ft./ft.*	Basic field data	1649	*cfs*
(18.2 ft.)					Selected Q	1572	*cfs*
Entrenchment Ratio	0.00		Radius of Curvature (Rc)	ft.			
			Rc/Bankfull width:	0.00			

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload: D_{90}	2	*in.*	Velocity required to move D_{90}:	2.9 *ft./sec.*
D_{50}		*in.*	Velocity from Cross-Section data:	2.13 *ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.48 *ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.4 *ft./sec.*

Channel Evolution Stage IV | Stream Type (Rosgen)

Notes

5.04 cfs/sq. mi.

Natural Open Channel Flow

[back to I&E form]

Clear Cells

Project:	Xsec3	
Assisted by:	Wayne Kinney	
Date:	8/29/2005	
Channel Slope (***S***):	0.000284	*ft/ft*
Manning's ***n*** :	0.040	
Flow Depth:	9.1	*ft*

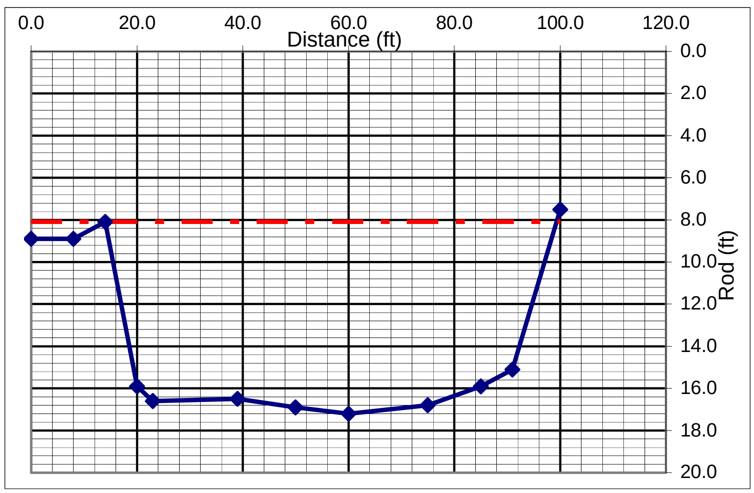
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	9.1 *ft*	9.1	
Channel Flow (***Q***):	1,418.0 *cfs*	1,418.0	
Channel Velocity:	2.1 *ft/sec*	2.1	
Cross-Sectional Area (***A***):	665.4 *sq.ft.*	665.4	
Hydraulic Radius (***R***):	6.3 *ft*	6.3	

Survey Data:

Rod *(ft)*	Distance *(ft)*
8.9	0.0
8.9	8.0
8.1	14.0
15.9	20.0
16.6	23.0
16.5	39.0
16.9	50.0
17.2	60.0
16.8	75.0
15.90	85
15.10	91
7.50	100



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Vermilion | T. | R. | Sec.

Date 8/29/2005 | By Wayne Kinney

Stream Name Salt Fork | UTM Coord. E421884 N4436406

Landowner Name Xsec4

Drainage Area 369.3 sq. mi. | Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	149 ft.	Cross Sectional Area	1238 sq. ft.
	Depth	8.3 ft.		

Reference Stream Gage:

Salt Fork near Homer	Station No.	03338000	Gage Q_2	3760 cfs
	Drainage Area	344 sq.mi	Regression (	4290 cfs
Champaign County, IL	REFERENCE STREAM DATA ONLY			

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.5	*ft./mi. (user-entered)*			Regression Q_2	3920 cfs
	ft/mi (from worksheet)	Rainfall	2.95 in *(2 yr, 24 hr)*	Adjusted Q_2	3436 cfs
0.0005	*ft./ft.*	Regional Factor	1.057	Typical Range for Bankfull Discharge:	1370 to 2750 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

Basic Field Data:		Stream Length	*ft.*
		Valley Length	*ft.*
Bankfull Width	111 *ft.*	Contour Interval	feet
Mean Bankfull Depth	5.57 *ft.*	Estimated Sinuosity	
Width/Depth Ratio	19.93		

		Channel Slope:		Bankfull Q from:	
Max. Bankfull Depth	*ft.*	Surveyed:	0.000739 *ft./ft.*	Cross-Section	1911 *cfs*
Width at twice max. depth	*ft.*	Estimated:	*ft./ft.*	Basic field data	1968 *cfs*
				Selected Q	1940 *cfs*
Entrenchment Ratio	0.00	Radius of Curvature (Rc)	ft.		
		Rc/Bankfull width:	0.00		

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload: D_{90}	3 *in.*	Velocity required to move D_{90}:	3.6 *ft./sec.*
D_{50}	*in.*	Velocity from Cross-Section data:	3.09 *ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	3.18 *ft./sec.*
velocities from different sources.		Velocity from selected Q:	3.1 *ft./sec.*

Channel Evolution Stage VI | Stream Type (Rosgen)

Notes

5.26 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	Xsec4	
Assisted by:	Wayne Kinney	
Date:	8/29/2005	
Channel Slope (***S***):	0.000739	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	7.0	*ft*

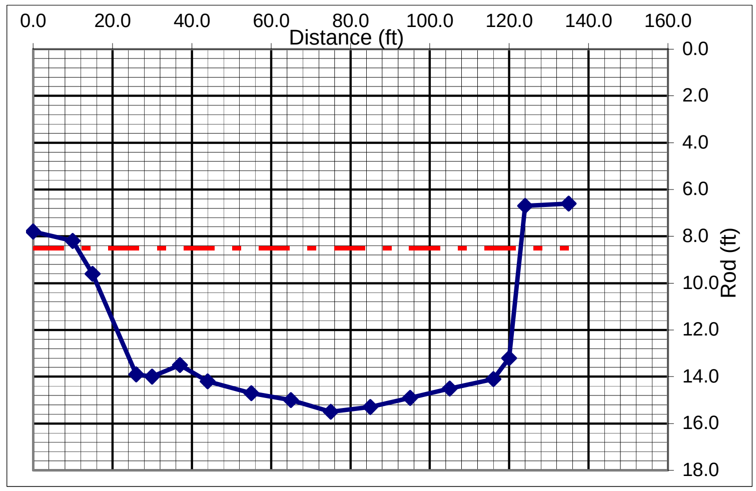
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	7.0 *ft*	7.7	
Channel Flow (***Q***):	1,910.9 *cfs*	2,197.2	
Channel Velocity:	3.1 *ft/sec*	3.1	
Cross-Sectional Area (***A***):	618.6 *sq.ft.*	699.6	
Hydraulic Radius (***R***):	5.4 *ft*	5.5	

Survey Data:

Rod *(ft)*	Distance *(ft)*
7.8	0.0
8.2	10.0
9.6	15.0
13.9	26.0
14.0	30.0
13.5	37.0
14.2	44.0
14.7	55.0
15.0	65.0
15.50	75
15.30	85
14.90	95
14.50	105
14.10	116
13.20	120
6.7	124
6.6	135



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Vermilion T. R. Sec.

Date 8/29/2005 By Wayne Kinney

Stream Name Salt Fork UTM Coord. E430681 N4438368

Landowner Name Xsec5

Drainage Area 456.9 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	162 ft.	Cross Sectional Area	1431 sq. ft.
	Depth	8.8 ft.		

Reference Stream Gage:

Salt Fork near Homer	Station No.	03338000	Gage Q_2	3760 cfs
	Drainage Area	344 sq.mi	Regression	4290 cfs
Champaign County, IL		**REFERENCE STREAM DATA ONLY**		

USGS Flood-Peak Discharge Predictions:

Valley Slope:	2.6	*ft./mi. (user-entered)*		Regression Q_2	4727 cfs
		ft/mi (from worksheet)	Rainfall 2.95 in *(2 yr, 24 hr)*	Adjusted Q_2	4143 cfs
	0.0005	*ft./ft.*	Regional Factor 1.057	Typical Range for Bankfull Discharge:	1650 to 3320 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

Basic Field Data:			Stream Length		*ft.*
			Valley Length		*ft.*
Bankfull Width	134	*ft.*	Contour Interval		feet
Mean Bankfull Depth	5.82	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	23.02				

Channel Slope:

Max. Bankfull Depth		*ft.*	Surveyed:	0.000739 *ft./ft.*	Bankfull Q from: Cross-Section	2526	*cfs*
Width at twice max. depth		*ft.*	Estimated:	*ft./ft.*	Basic field data	2557	*cfs*
					Selected Q	2541	*cfs*
Entrenchment Ratio	0.00		Radius of Curvature (Rc)	ft.			
			Rc/Bankfull width:	0.00			

Bankfull Velocity Check: (typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)

Bedload:	D_{90}	3 *in.*	Velocity required to move D_{90}:	3.6	*ft./sec.*
	D_{50}	*in.*	Velocity from Cross-Section data:	3.24	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	3.28	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	3.3	*ft./sec.*

Channel Evolution Stage v Stream Type (Rosgen)

Notes

5.56 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	Xsec5	
Assisted by:	Wayne Kinney	
Date:	8/29/2005	
Channel Slope (***S***):	0.000739	*ft/ft*
Manning's ***n*** :	0.040	
Flow Depth:	7.5	*ft*

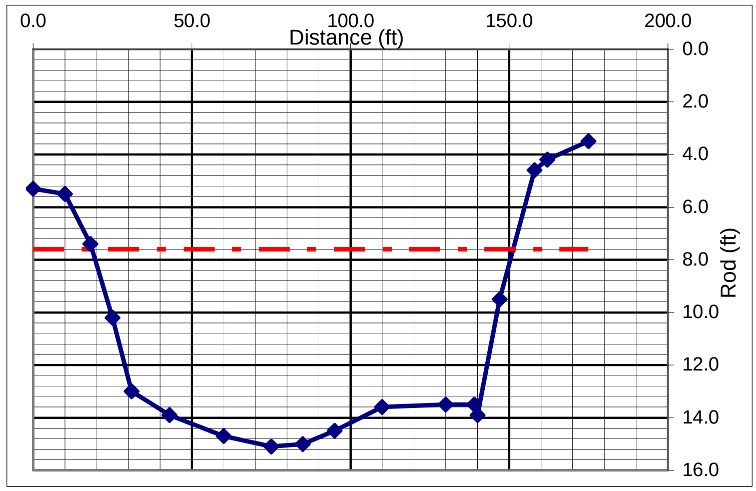
$$Q \cong \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	7.5 *ft*	9.8	
Channel Flow (***Q***):	2,525.9 *cfs*	4,028.4	
Channel Velocity:	3.2 *ft/sec*	3.7	
Cross-Sectional Area (***A***):	779.8 *sq.ft.*	1,102.4	
Hydraulic Radius (***R***):	5.7 *ft*	6.9	

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.3	0.0
5.5	10.0
7.4	18.0
10.2	25.0
13.0	31.0
13.9	43.0
14.7	60.0
15.1	75.0
15.0	85.0
14.50	95
13.60	110
13.50	130
13.50	139
13.90	140
9.50	147
4.6	158
4.2	162
3.5	175



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County	Vermilion	T.		R.	
Date	8/29/2005	By	Wayne Kinney		
Stream Name	Salt Fork		UTM Coord.	E433543 N4437281	
Landowner Name	Xsec6				
Drainage Area	473.1 sq. mi.		Clear Cells		

Sec.

Regional Curve Predictions:

Bankfull dimensions	Width	164 ft.	Cross Sectional Area	1465 sq. ft.
	Depth	8.9 ft.		

Reference Stream Gage:

Salt Fork near Homer	Station No.	03338000	Gage Q_2	3760 cfs
	Drainage Area	344 sq.mi	Regression	4290 cfs
Champaign County, IL		**REFERENCE STREAM DATA ONLY**		

USGS Flood-Peak Discharge Predictions:

Valley Slope:	2.6	*ft./mi. (user-entered)*		Regression Q_2	4859 cfs
		ft/mi (from worksheet)	Rainfall 2.95 in *(2 yr, 24 hr)*	Adjusted Q_2	4258 cfs
	0.0005	*ft./ft.*	Regional Factor 1.057	Typical Range for Bankfull Discharge:	1700 to 3410 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

Basic Field Data:		Stream Length		*ft.*	
		Valley Length		*ft.*	
Bankfull Width	141 *ft.*	Contour Interval		feet	
Mean Bankfull Depth	5.76 *ft.*	Estimated Sinuosity			
Width/Depth Ratio	24.48	*Channel Slope:*		Bankfull Q from:	
Max. Bankfull Depth	*ft.*	Surveyed:	0.000739 *ft./ft.*	Cross-Section	2583 *cfs*
Width at twice max. depth	*ft.*	Estimated:	*ft./ft.*	Basic field data	2644 *cfs*
				Selected Q	2614 *cfs*
Entrenchment Ratio	0.00	Radius of Curvature (Rc)	ft.		
		Rc/Bankfull width:	0.00		

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload: D_{90}	4 *in.*	Velocity required to move D_{90}:	4.2	*ft./sec.*
D_{50}	*in.*	Velocity from Cross-Section data:	3.18	*ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	3.26	*ft./sec.*
velocities from different sources.		Velocity from selected Q:	3.2	*ft./sec.*

Channel Evolution Stage: V   Stream Type (Rosgen)

Notes

5.52 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	Xsec6	
Assisted by:	Wayne Kinney	
Date:	8/29/2005	
Channel Slope (***S***):	0.000739	*ft/ft*
Manning's ***n*** :	0.040	
Flow Depth:	7.0	*ft*

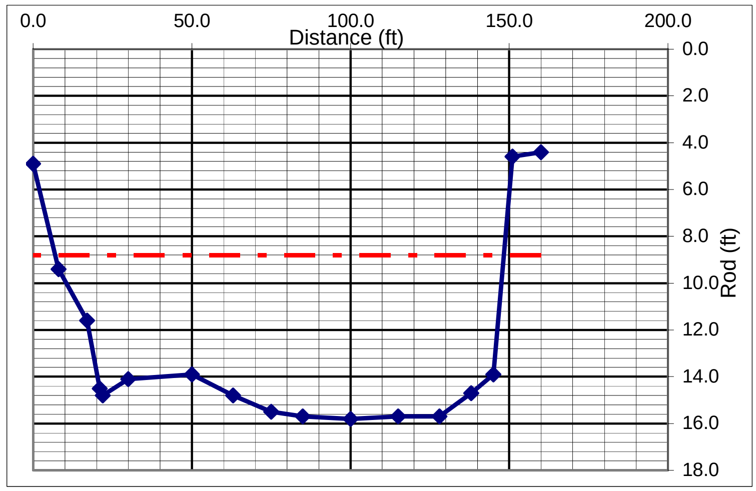
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	7.0 *ft*	10.9	
Channel Flow (***Q***):	2,583.3 *cfs*	5,922.9	
Channel Velocity:	3.2 *ft/sec*	4.3	
Cross-Sectional Area (***A***):	813.1 *sq.ft.*	1,382.8	
Hydraulic Radius (***R***):	5.6 *ft*	8.7	

Survey Data:

Rod *(ft)*	Distance *(ft)*
4.4	160.0
4.6	151.0
13.9	145.0
14.7	138.0
15.7	128.0
15.7	115.0
15.8	100.0
15.7	85.0
15.5	75.0
14.80	63
13.90	50
14.10	30
14.80	22
14.50	21
11.60	17
9.4	8
4.9	0



COMMENTS: