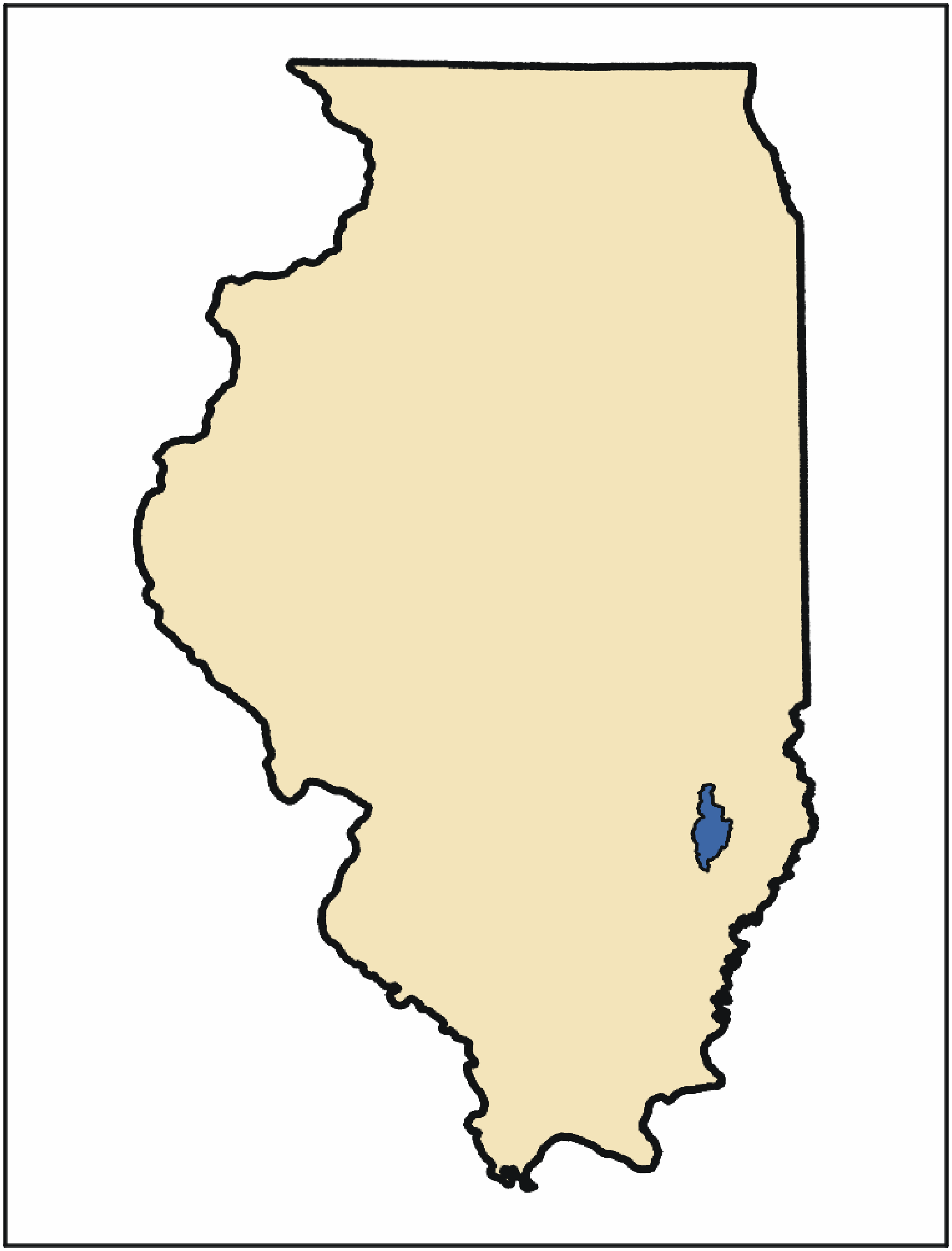

Aerial Assessment of Fox River

Jasper, Richland and Edwards Counties

November 2004

Prepared by Wayne Kinney for the IL. Dept. of Agriculture

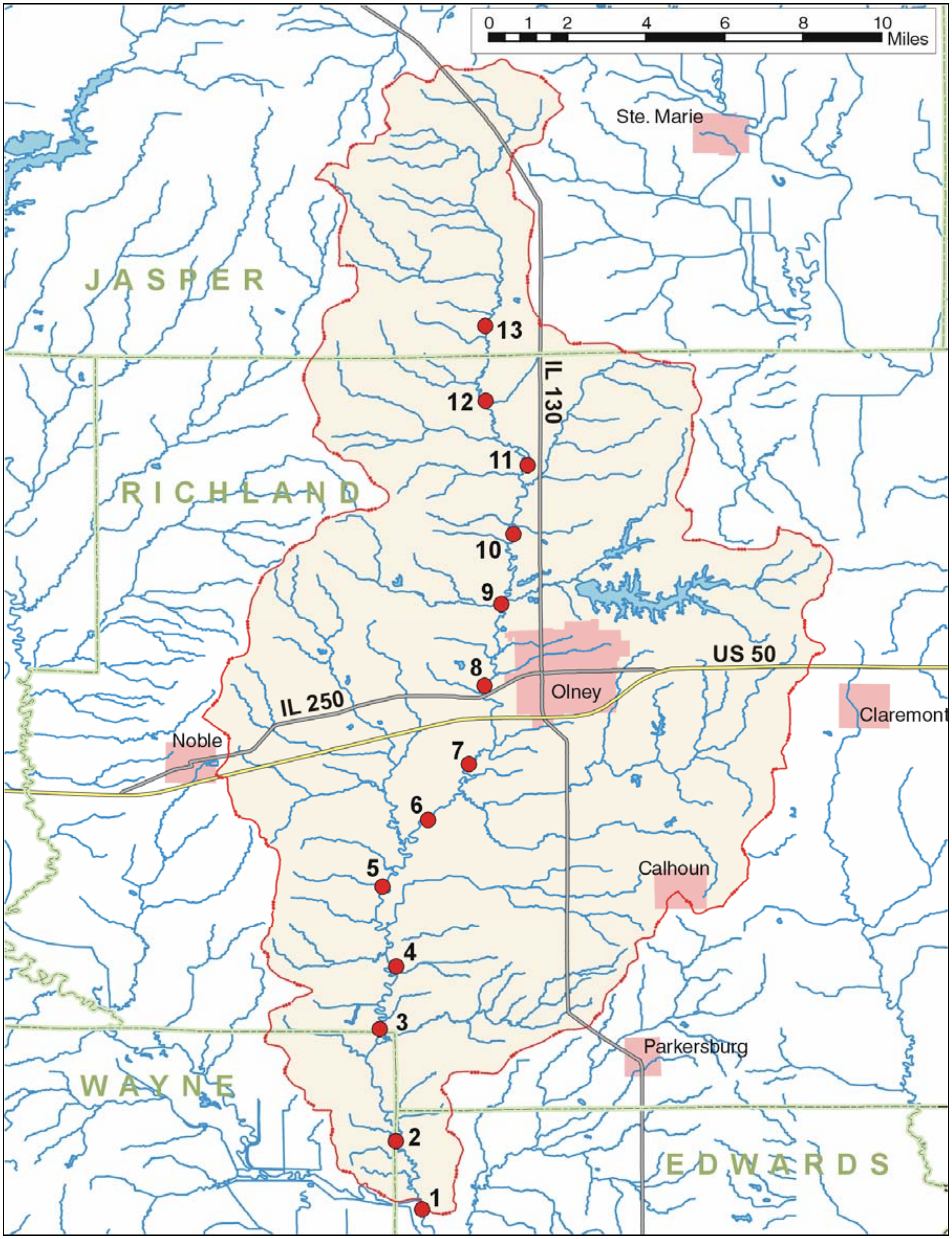

Fig. 1 Aerial Assessment Map of Fox River

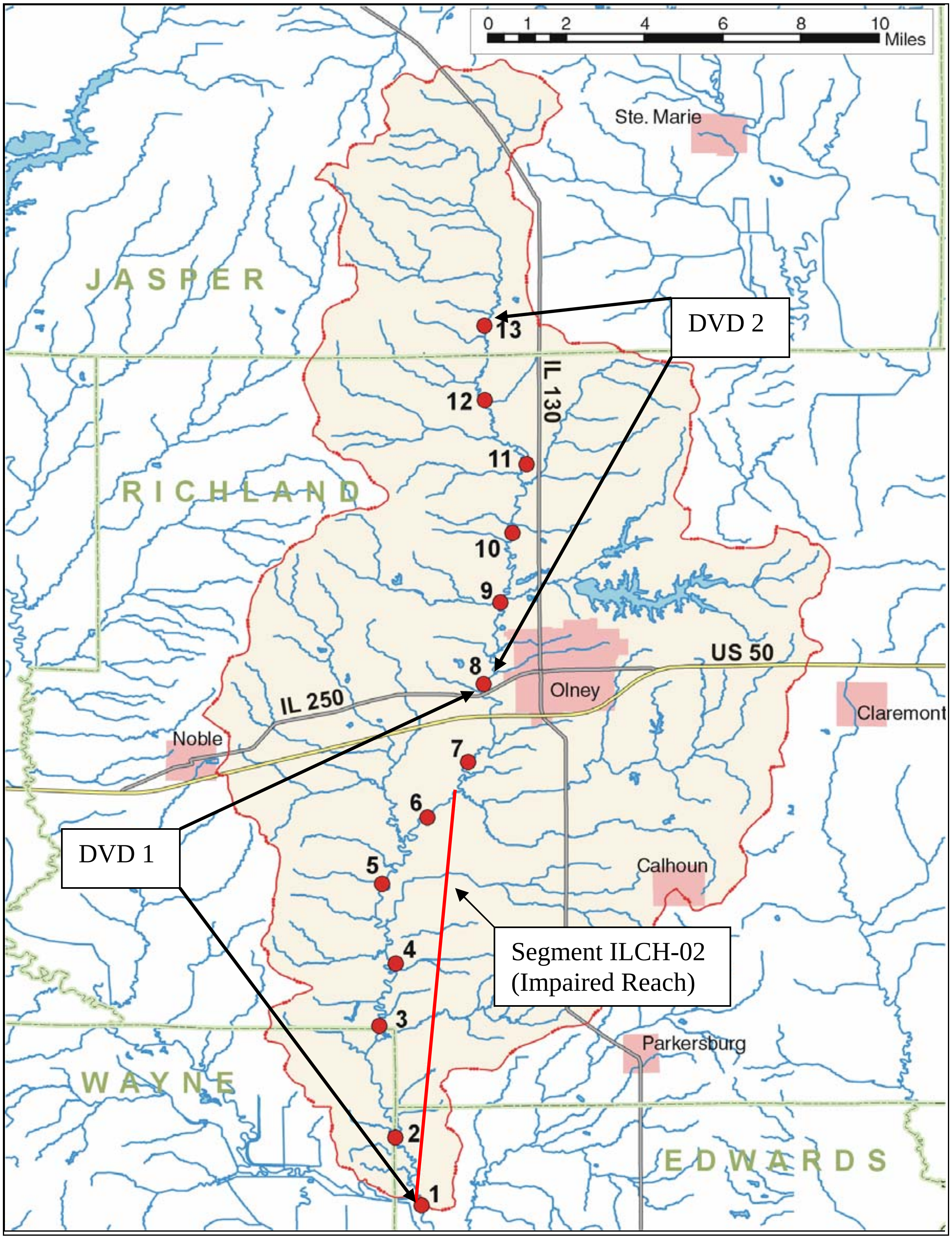

Fig. 2 Fox River DVD Tape Segments and Impaired Reach

Assessment Procedure

Low level geo-referenced video was taken of Fox 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 confluence of the Fox River with the Little Wabash River in Edwards County. The mapping progressed upstream thru Richland County and ended in Jasper County at the confluence with Richland Creek near West Liberty, IL. 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.

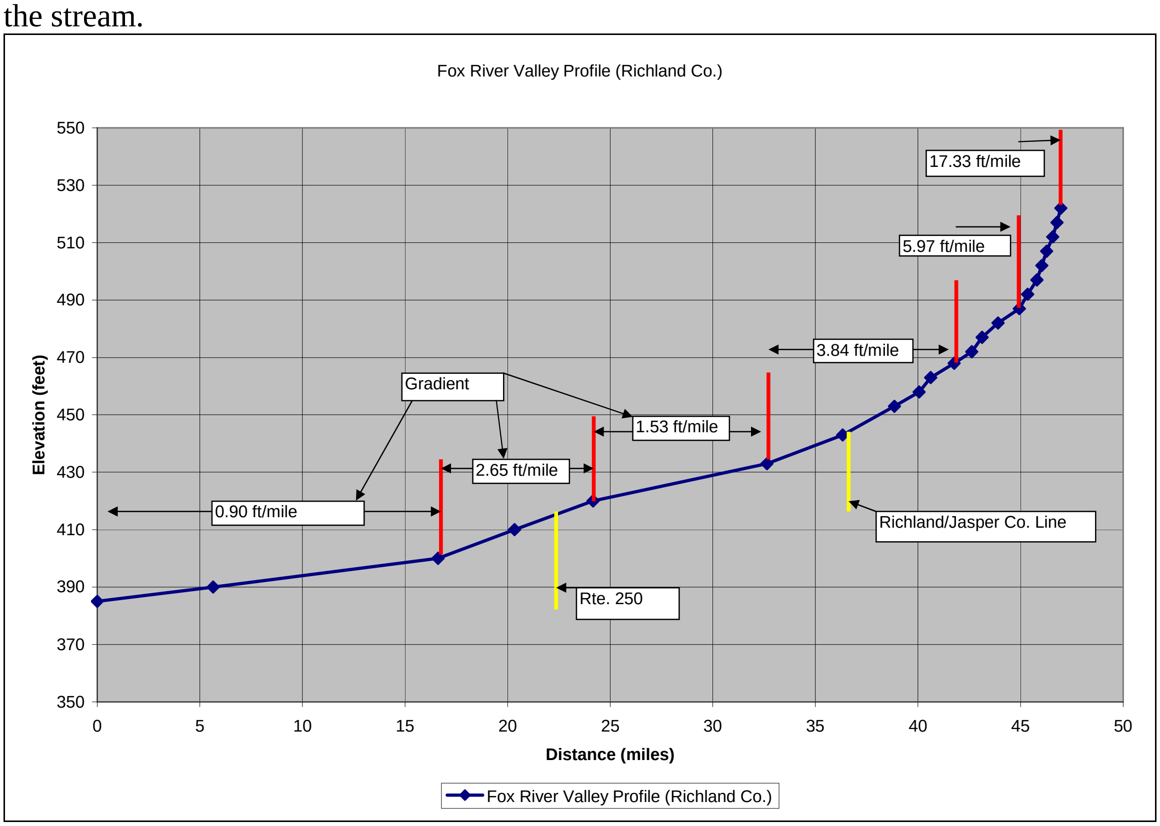

Figure 3 Channel Profile of Fox River

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.

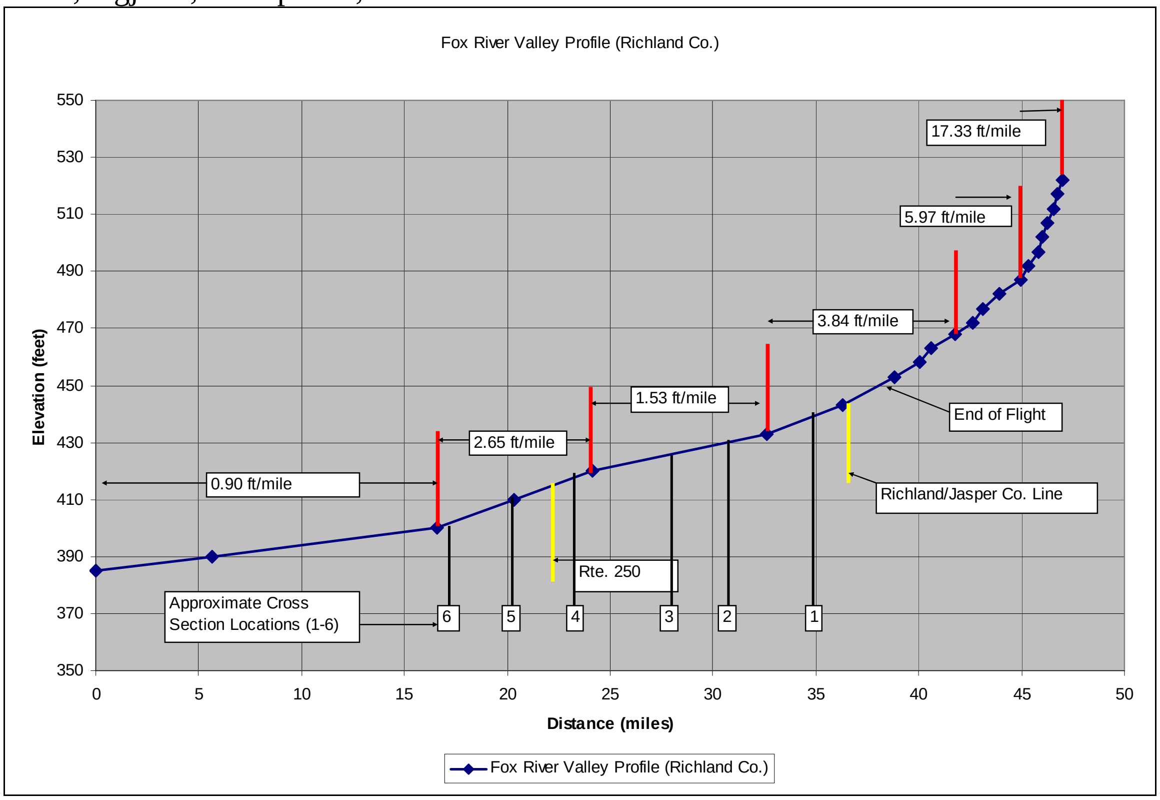

Figure 4 Valley Profile with Cross Section Locations

CHAPTERS ON DVD AND ASSESSMENT REPORT Fox River --Richland County				
DVD Disc	DVD chapter	Beginning Time	Report Chapter	Cross Sections
1	2	5:00	1	
1	3	10:00	2	
1	4	15:00:00	3	
1	5	20:00:00	4	
1	6	25:00:00	5	
1	7	30:00:00	6	6
1	8	35:00:00	7	5
2	2	5:00	8	4
2	3	10:00	9	3
2	4	15:00:00	10	2
2	5	20:00:00	11	
2	6	25:00:00	12	1
2	7	30:00:00	13	

Note: Flight path is from downstream to upstream

Table 1 DVD Chapters and Report Guide

The DVD has been divided into “chapters” of approximately five minutes of video (Table 1) 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 or group of chapters. 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”.

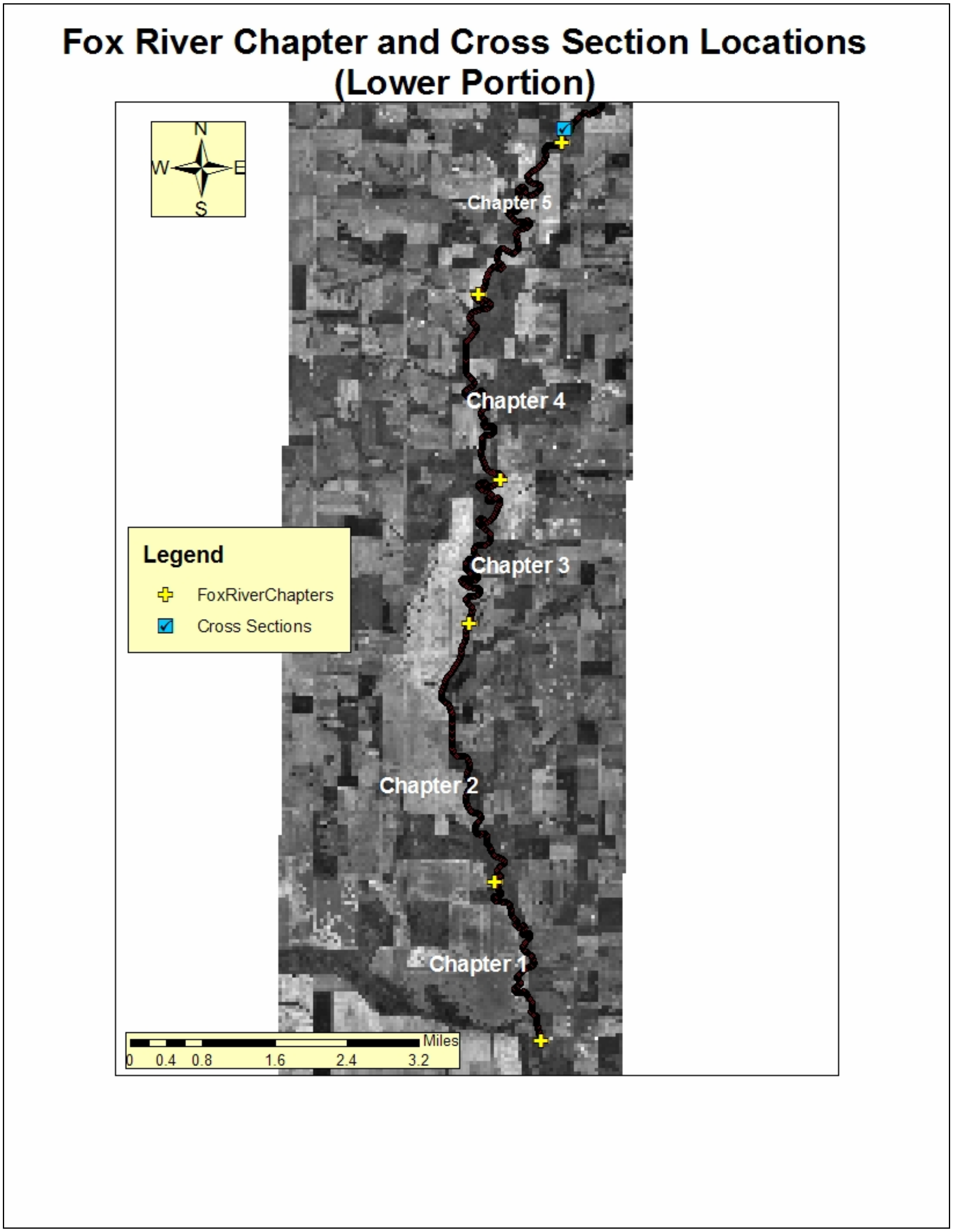

Fig. 5 Chapter Division and Cross Section Locations—Lower Reach

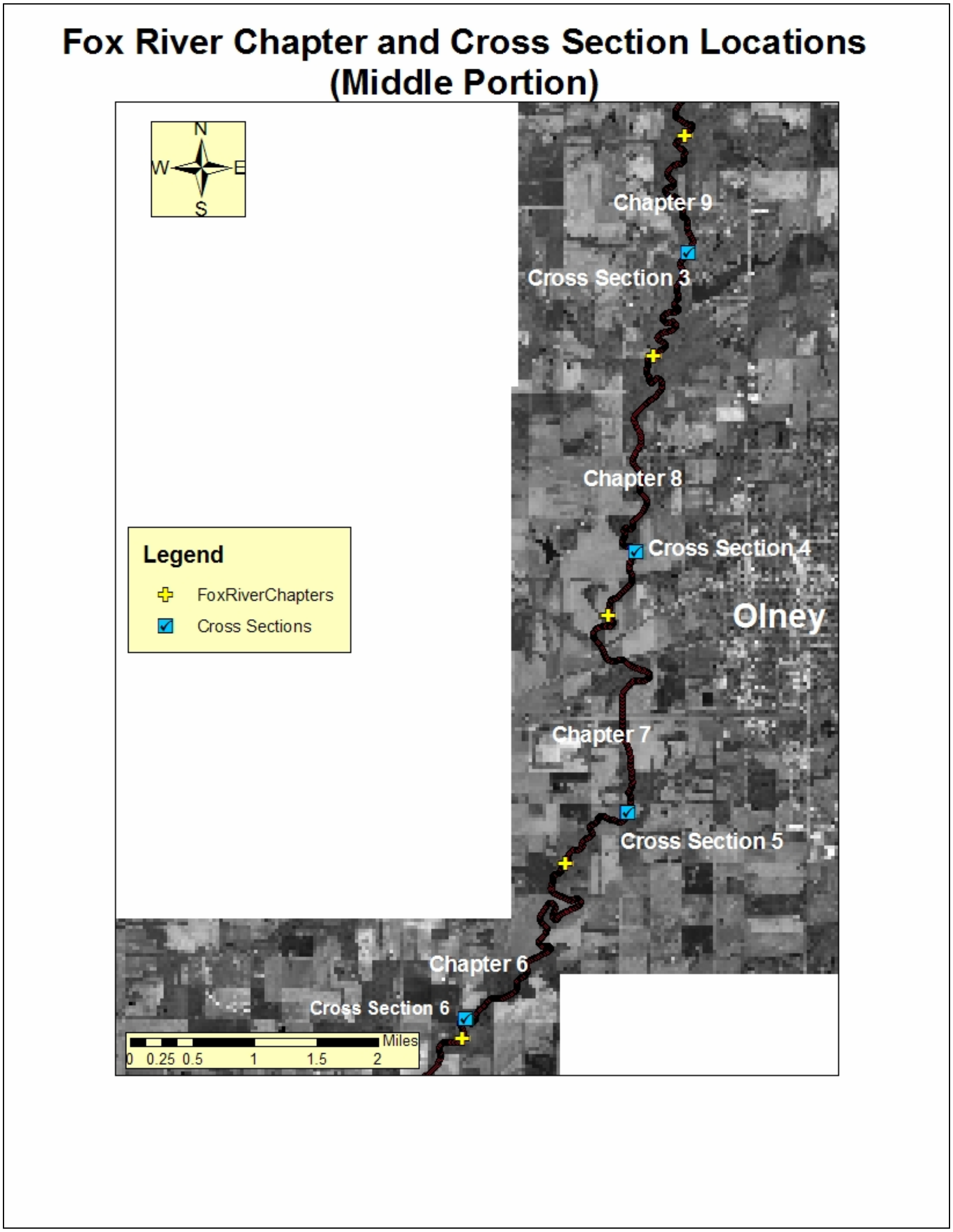

Figure 6 Chapter Division and Cross Section Locations –Middle Reach

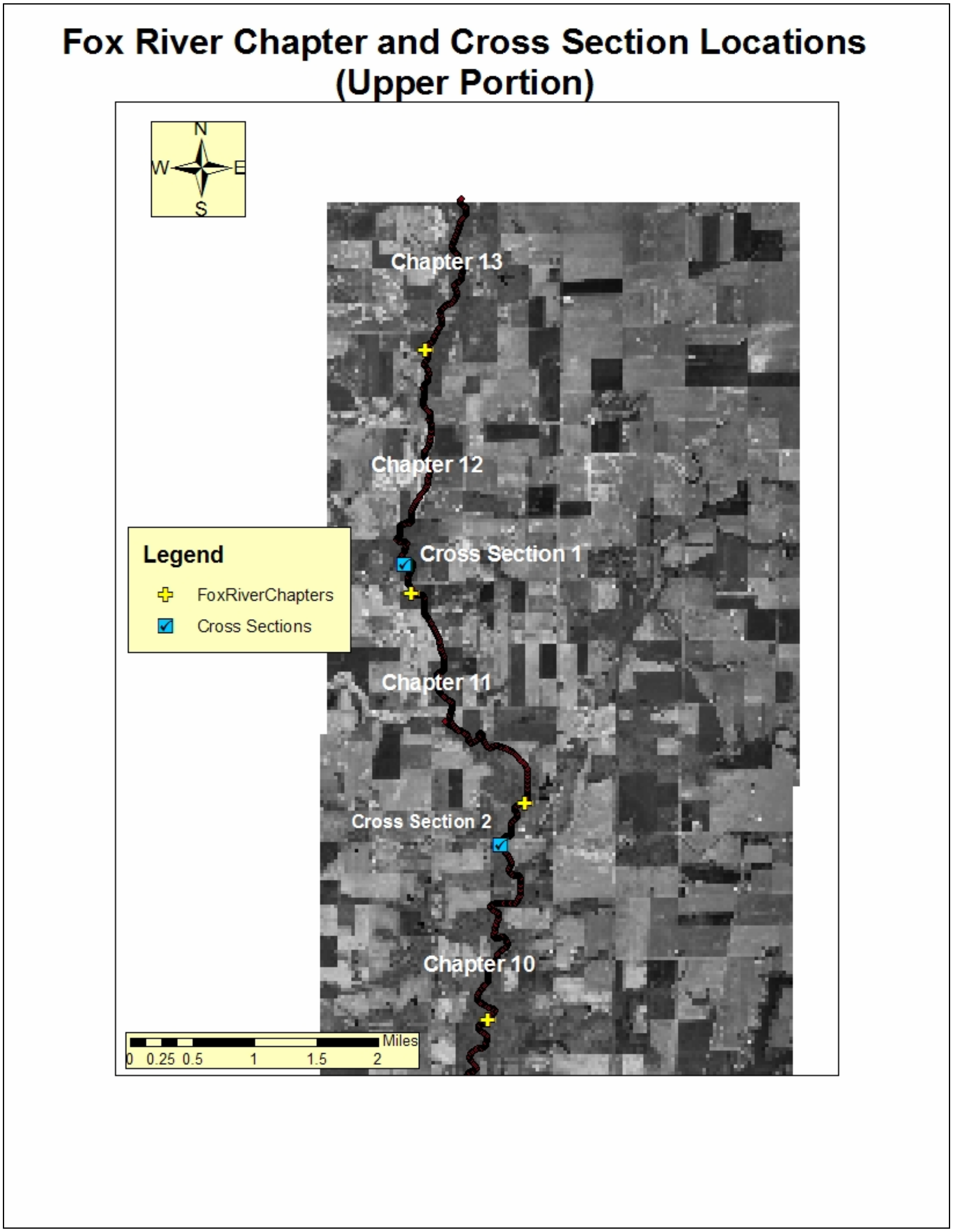

Figure 7 Chapter Division and Cross Section Locations ---Upper Reach

The major factors indicating channel conditions identified from the aerial assessment have been totaled by DVD chapter in Table 3 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								
CHAPTER	ROCK OUTCROP	LOGJAM	GEOTECH FAILURE	DEPOSITION	BED CONTROL	BREAK POINT	EROSION	SEVERE EROSION
1	0	2	0	0	0	0	23	0
2	0	1	0	0	0	0	34	0
3	0	4	1	2	1	0	40	1
4	0	4	0	1	1	0	42	0
5	1	1	2	0	1	0	44	0
6	0	4	1	1	0	0	52	0
7	1	1	1	1	3	0	29	0
8	0	2	0	1	2	0	33	0
9	0	4	0	0	0	0	29	0
10	3	3	0	3	1	0	33	0
11	1	2	1	4	0	1	38	0
12	1	7	0	4	1	1	41	0
13	2	1	0	6	1	3	27	0
TOTALS	9	36	6	23	11	5	465	1

Table 3 Features by Chapter Identified with Aerial Assessment

Six cross sections were taken at selected locations on the Fox River 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 4 and the approximate location of each cross section along the channel profile is found in Fig. 4. Aerial views of cross sections locations are shown in Figs. 5 thru 7. Exact locations as Eastings and Northings and more detail can be found in Appendix A

Cross Section Summary --FOX River														
X-Sec	Easting	Northing	ADA	Valley Slope ft/m	Q2 CFS	BKF CFS	Width	Depth	W/D Ratio	Vel. FPS	Bedload Dia.	CEM Stage	CFS per Sq. Mi.	BKF cfs/ Q2 cfs
1	403011	4299092	28.01	5.2	1052	256	33	3.46	9.54	2.2	1	3	9.14	0.24
2	404256	4295454	41.45	3.7	1175	260	45	3.98	11.31	1.5	1	3	6.27	0.22
3	404132	4291675	58.46	3.7	1541	429	60	4.31	13.92	1.7	1	1	7.34	0.28
4	403456	4287803	65.17	3.1	1542	804	69	4.99	13.83	2.3	1	4	12.34	0.52
5	403346	4284418	72.87	3.1	1685	854	56	5.82	9.62	2.6	1	5	11.72	0.51
6	401250	4281747	103.81	3	2193	1190	63	6.59	9.56	2.9	1	4	11.46	0.54

Table 4 Cross Section Summary

Figure 8 Logjam at 19:34 on DVD Tape 1

Figure 9 Large tree and rootball in channel at 28:24 on DVD tape 1

Figure 10 Erosion on lower reach –note little or no point bar on inside

Figure 11 Riprap bank protection at pipeline crossing – 35:37 on DVD tape 1

Figure 12 Structure below water treatment plant at Olney—7:35 DVD tape 2

Figure 13 Channel segment with riparian border removed—but little or no straightening: DVD Tape 2 at 27:14

Figure 14 Upper reach with sediment slug (deposition) in channel---DVD Tape 2 at 32:35

General Observations

1. The impaired reach on the lower end of Fox River with low DO is the low gradient section with only 0.90 ft/mile valley slope.
2. This reach has very low velocity based on observations and aerial video, although the water depth and access to this reach did not allow any cross section to be gathered.
3. Due to low gradient and low velocity it will be difficult to achieve significant re-aeration in this reach using rock riffle grade controls or stream barbs. Observations made from the aerial assessment show very low turbulence around stream obstructions even though the water levels were somewhat elevated at flight time.
4. The channel throughout the Fox has very little point bar development, especially on the impaired reach. This is due in part to the fine sediment that is easily transported but it also suggests that the lateral bank movement is not rapid.
5. There is no gage data available to calibrate the channel capacity to carry the 1yr. to 1.5 yr. event, however the upper reach will only carry about 25% of the predicted 2 yr. event from the NRCS Streambank I & E calculations using USGS data from the Little Wabash at Clay City. The middle reach has a steeper valley slope and will carry about 50% of the predicted 2 yr. storm. The lower reach cannot be estimated due to lack of cross section data.

6. The bank erosion and loss of mature trees with little bar development may suggest one of two scenarios in the lower impaired reach. First, the flow regime is or has changed to increase the "geomorphic bankfull" discharge and the channel is now adjusting. However, the adjustment seems to be in width rather than depth which would indicate an aggrading system. Second, the channel could be aggrading due to the volume of sediment being produced in the watershed and aggravated by the obstruction created by the logjams.
7. The upper reach represented by cross sections 1 and 2 is definitely downcutting with knickzones present in riffle sections. Cross section 3 is in the flatter middle section and is depositional. Cross sections 4 thru 6 have a steeper channel slope and appear to be transporting sediment from the upper reach to the lower impaired reach.
8. Solutions for the DO levels in the impaired reach may include limited re-aeration in this reach and reductions in BOD and SOD demands thru stabilization of the middle and upper reaches. The recommended solutions for stream stabilization will consider the effect on aeration as well as the reduction of woody debris and sediment generated within the stream system.

Recommendations Chapter 1-6

This reach has low DO and low gradient, but also has 235 erosion sites or over 50% of the total erosion sites identified. This reach also has 16 logjams or almost 50% of all those identified. No cross sections were obtained in this reach, however to achieve the objective of reducing sediment and woody debris from bank erosion the recommended solution is to use Stream Barbs for lateral bank protection due to the increased turbulence created over use of Stone Toe Protection or Bendway Weirs. No grade control structures are recommended as the gradient is very low and riffles would not achieve significant re-aeration. Also, without a more comprehensive study of this reach, riffles can not be recommended as the potential to increase aggradation cannot be overlooked.
Stream Barbs on the other hand will tend to direct flow to the mid channel and by directing flow toward the center have the potential to both limited re-aeration and increase sediment transport by keeping the channel from becoming overwidened which appears to be happening based on the absence of point bars.

`	TREATMENT --CHAPTERS 1 THRU 6				
	Lateral Bank Protection with Stream Barbs				
Chapter	Erosion Sites	Average Length(ft)	Total Length	Average Cost/foot	Total Cost
1	23	350	8050	$25.00	$201,250.00
2	34	350	11900	$25.00	$297,500.00
3	40	350	14000	$25.00	$350,000.00
4	42	350	14700	$25.00	$367,500.00
5	44	350	15400	$25.00	$385,000.00
6	52	350	18200	$25.00	$455,000.00
Total	235		82250		$2,056,250.00

Table 5 Treatment recommendations Chapter 1-6

Recommendations Chapter 7-8

This reach has a gradient almost three times that of the lower reach (2.65 ft/mi. compared to 0.90 ft/mi.) and has only 62 erosion sites and 3 logjams. The recommended treatment for lateral bank migration in this section will include the use of Stone Toe Protection and/or Stream Barbs as dictated by the stream geometry and cross sections at each site. STP will effectively control the bank erosion and should be used where there is no sediment accumulation on the opposite bank, but STP will not produce as much aeration.

	TREATMENT --CHAPTERS 7 and 8				
	Lateral Bank Treatment with Stream Barbs or STP				
Chapter	Erosion Sites	Average Length(ft)	Total Length	Average Cost/foot	Total Cost
7	29	350	10150	$25.00	$253,750.00
8	33	350	11550	$25.00	$288,750.00
Total	**62**		**21700**		**$542,500.00**

Table 6 Treatment Recommendations Chapter 7 and 8

Recommendation Chapter 9-10

This reach is a lower gradient again that the reach immediately above or below and is a depositional reach with a low channel capacity of only about 25% of the 2 yr. storm event. Cross section 3 represents this reach. Although cross section 2 is also in this flatter reach according to the USGS topographic maps and has a low capacity, field checks have identified a hard clay bed and downcutting. Therefore the division between the depositional zone and the downcutting upper reaches need to be better identified with more intense ground truthing.
This report will consider chapters 9 and 10 to be depositional and recommend only treatment with STP given the low width/depth ratios and apparent frequent out of bank flows.

	TREATMENT --CHAPTERS 9 and 10				
	Lateral Bank Treatment with STP				
Chapter	Erosion Sites	Average Length(ft)	Total Length	Average Cost/foot	Total Cost
9	29	300	8700	$25.00	$217,500.00
10	33	300	9900	$25.00	$247,500.00
Total	**62**		**18600**		**$465,000.00**

Table 7 Treatment Recommendations Chapter 9 and 10

Recommendation Chapter 11-13

This reach is the upper end of the aerial assessment and represents the highest concentration of depositional features and logjams in spite of the increased gradient. Field observations suggest these features are likely the result of heavy sediment contributions from an actively downcutting system over loading the channels transport capacity. Therefore the recommendation is to extend the information upstream beyond the aerial assessment to determine the exact location and extent of the downcutting.

Preliminary calculations show that Rock Riffle Grade Controls can be built in this reach to a height of 1.7 ft. above the flowline with no increase in out of bank flow or backwater. This report will recommend use of Rock Riffle Grade Control Structures at a height of 1.5 ft. and STP in chapters 11-13 with the recommendation that no implementation be planned until a better understanding of the need to extend these practices to the upstream channel is obtained.

	TREATMENT --CHAPTERS 11 through 13				
	Lateral Bank Treatment				
Chapter	**Erosion Sites**	**Average Length(ft)**	**Total Length**	**Average Cost/foot**	**Total Cost**
11	38	200	7600	$25.00	$190,000.00
12	41	200	8200	$25.00	$205,000.00
13	27	200	5400	$25.00	$135,000.00
Total	**106**		**21200**		**$530,000.00**

	Rock Riffle Grade Control				
Chapter	**Number Riffles**	**Average Tons Stone**	**Total Tons Stone**	**Average Cost/ton**	**Total Cost**
11	65	120	7800	$30.00	$234,000.00
12	55	120	6600	$30.00	$198,000.00
13	36	100	3600	$30.00	$108,000.00
Total	**156**		**18000**		**$540,000.00**

Table 8 Treatment Recommendations Chapter 11 through 13

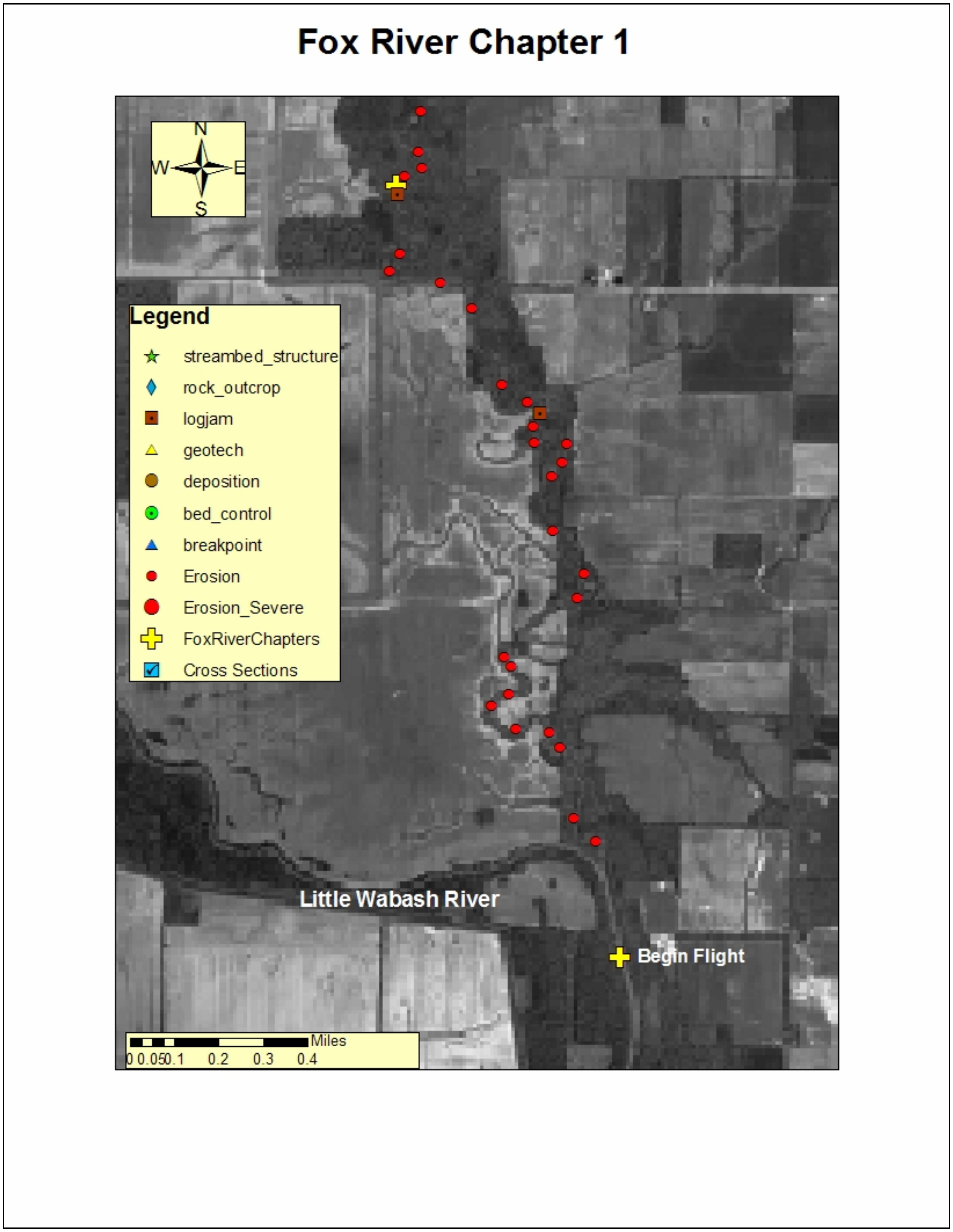

Figure 15 Chapter 1

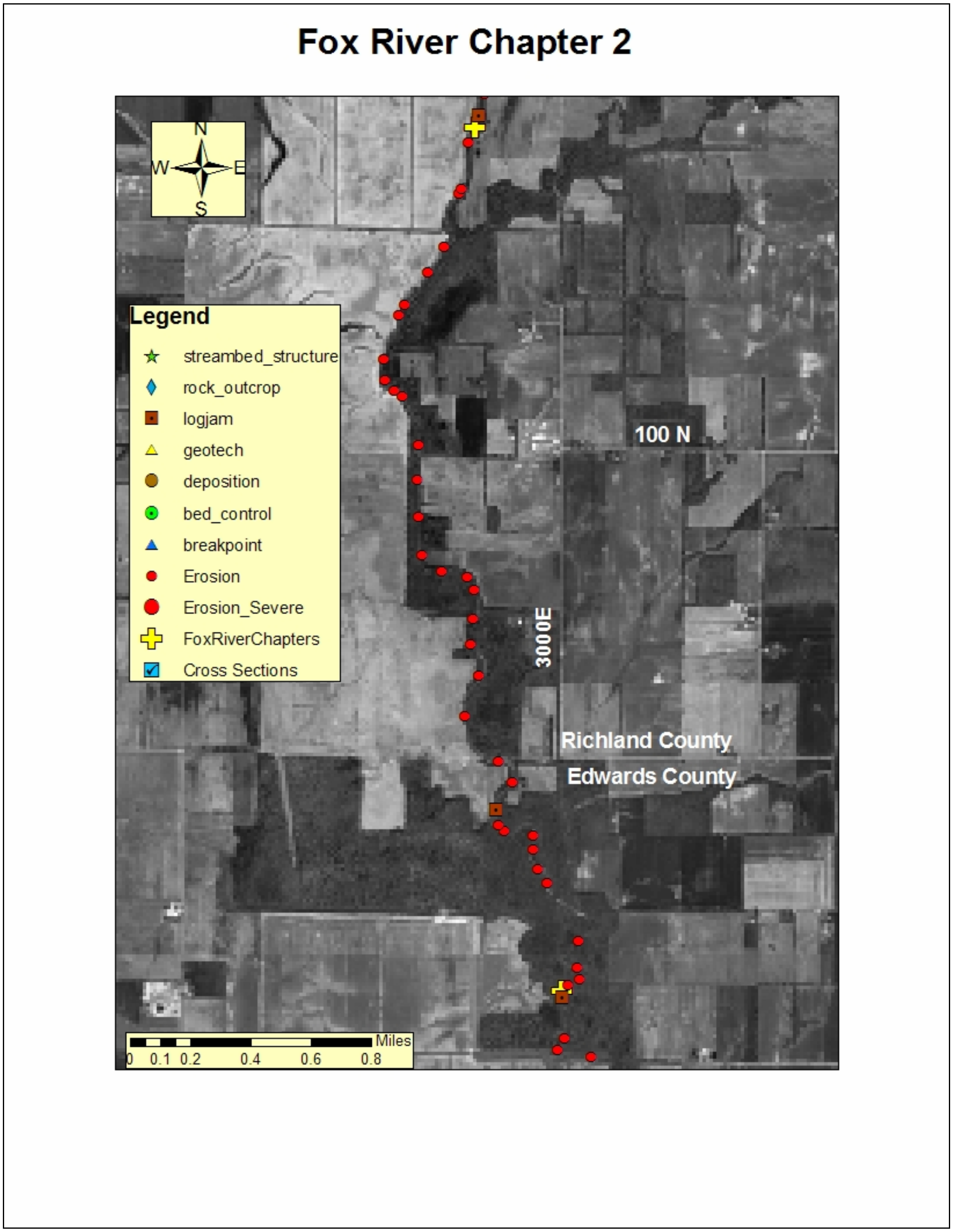

Figure 16 Chapter 2

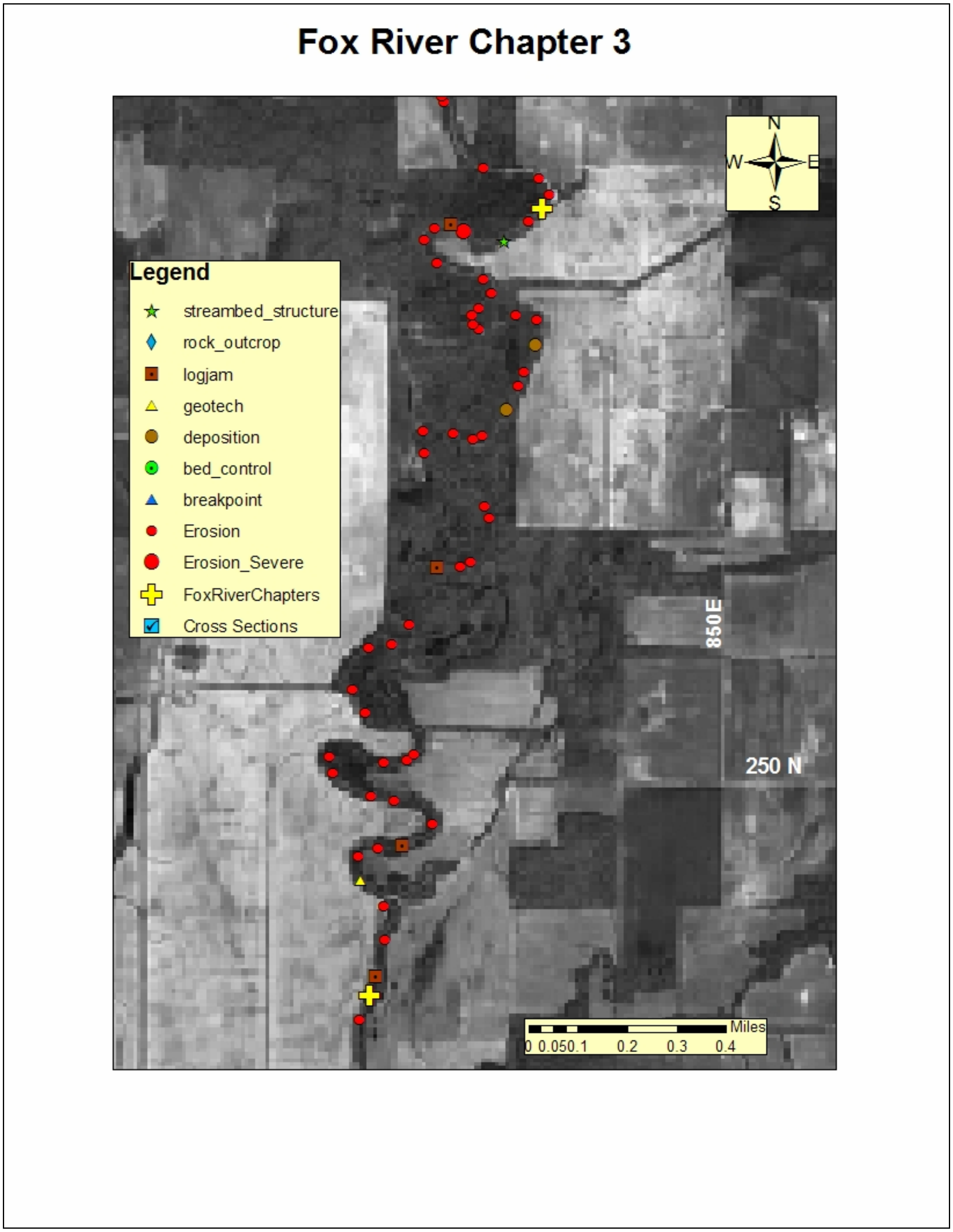

Figure 17 Chapter 3

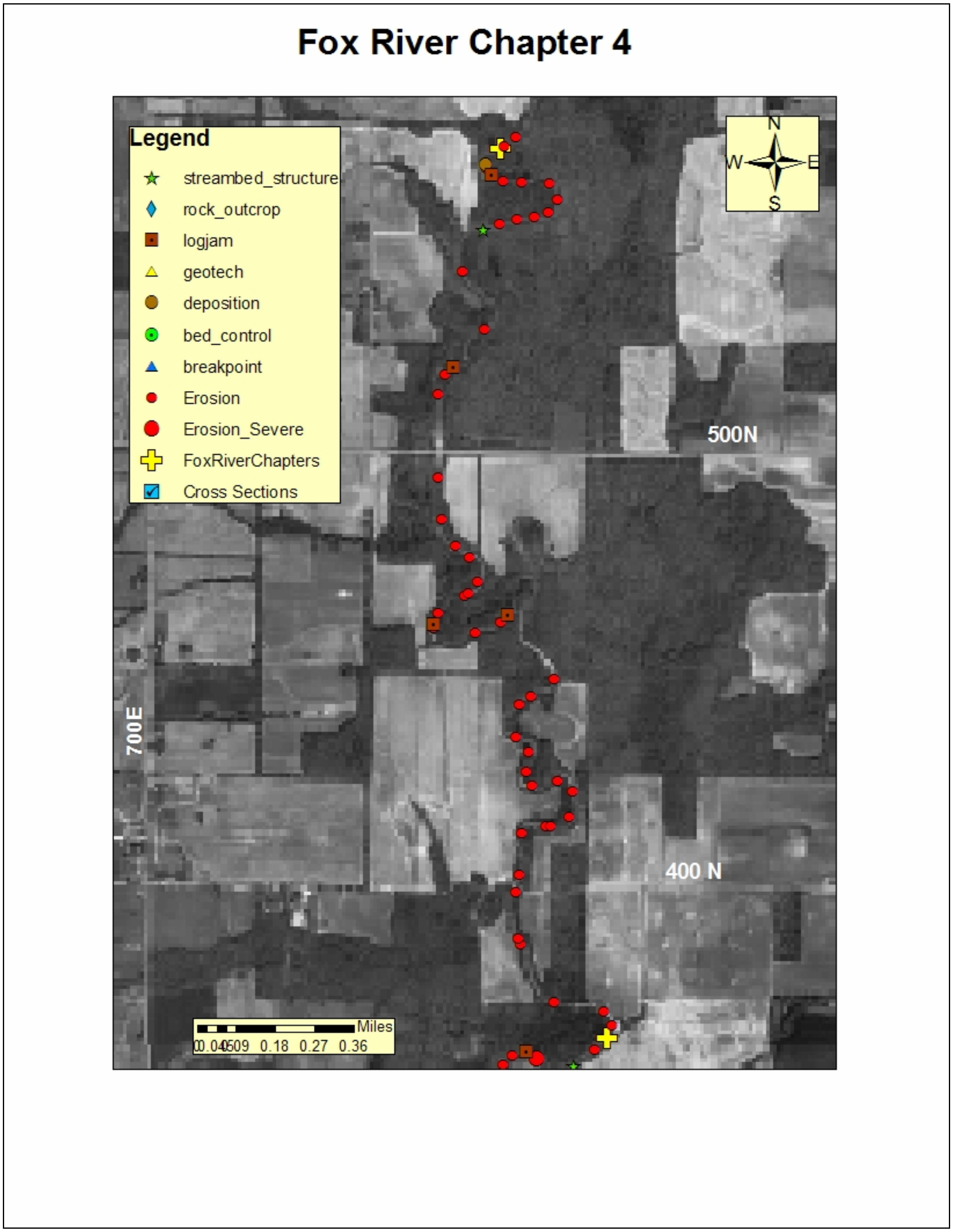

Figure 18 Chapter 4

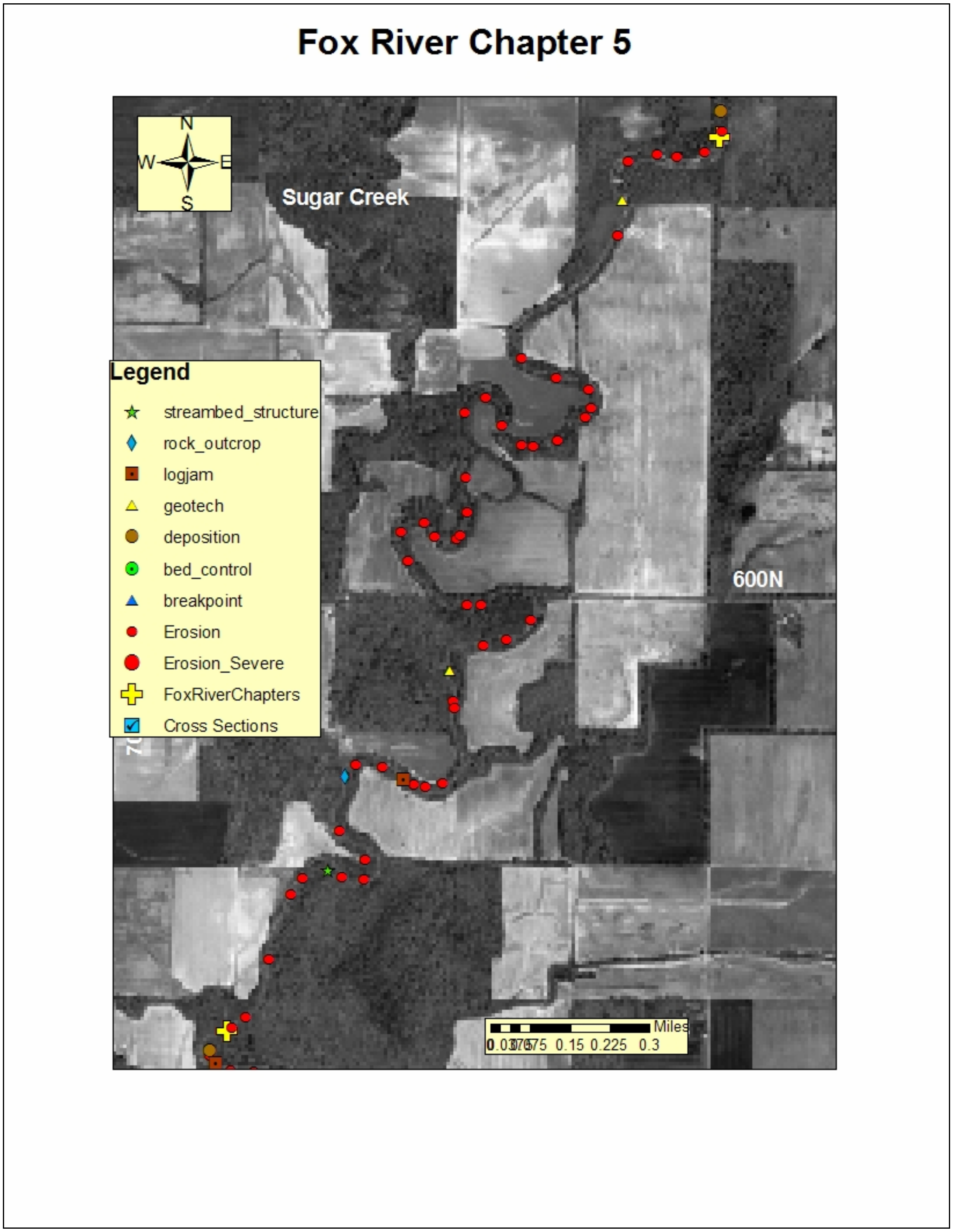

Figure 19 Chapter 5

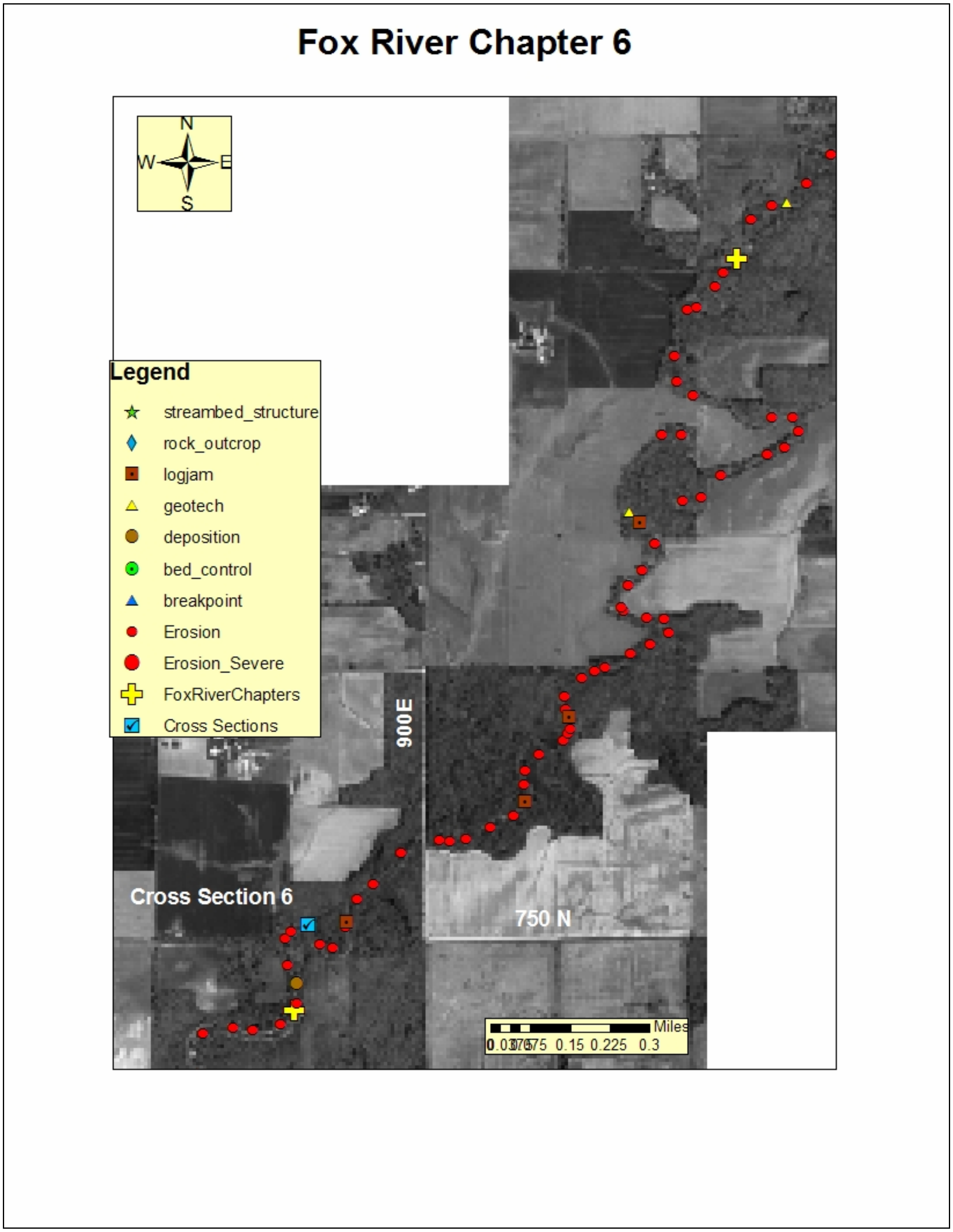

Figure 20 Chapter 6

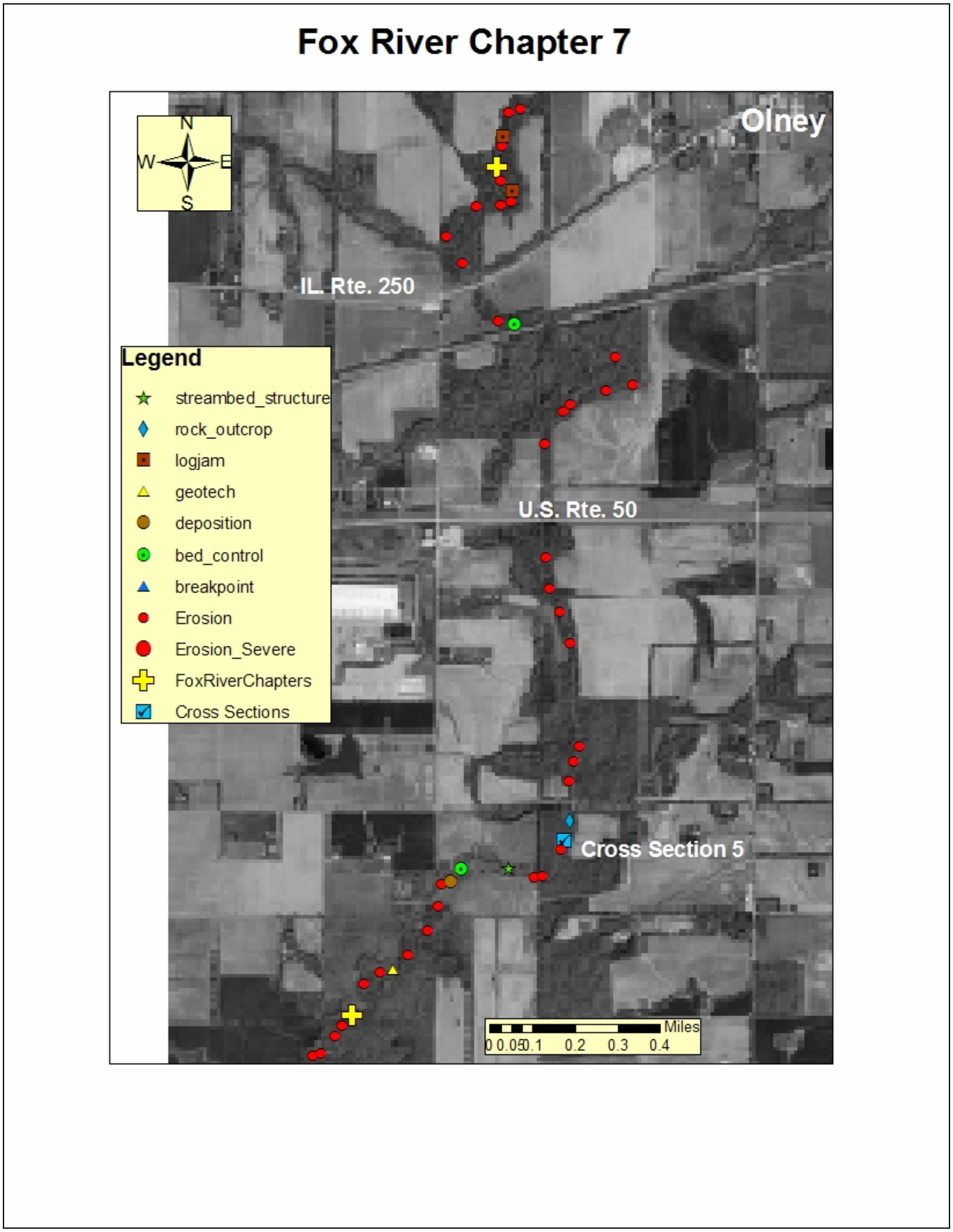

Figure 21 Chapter 7

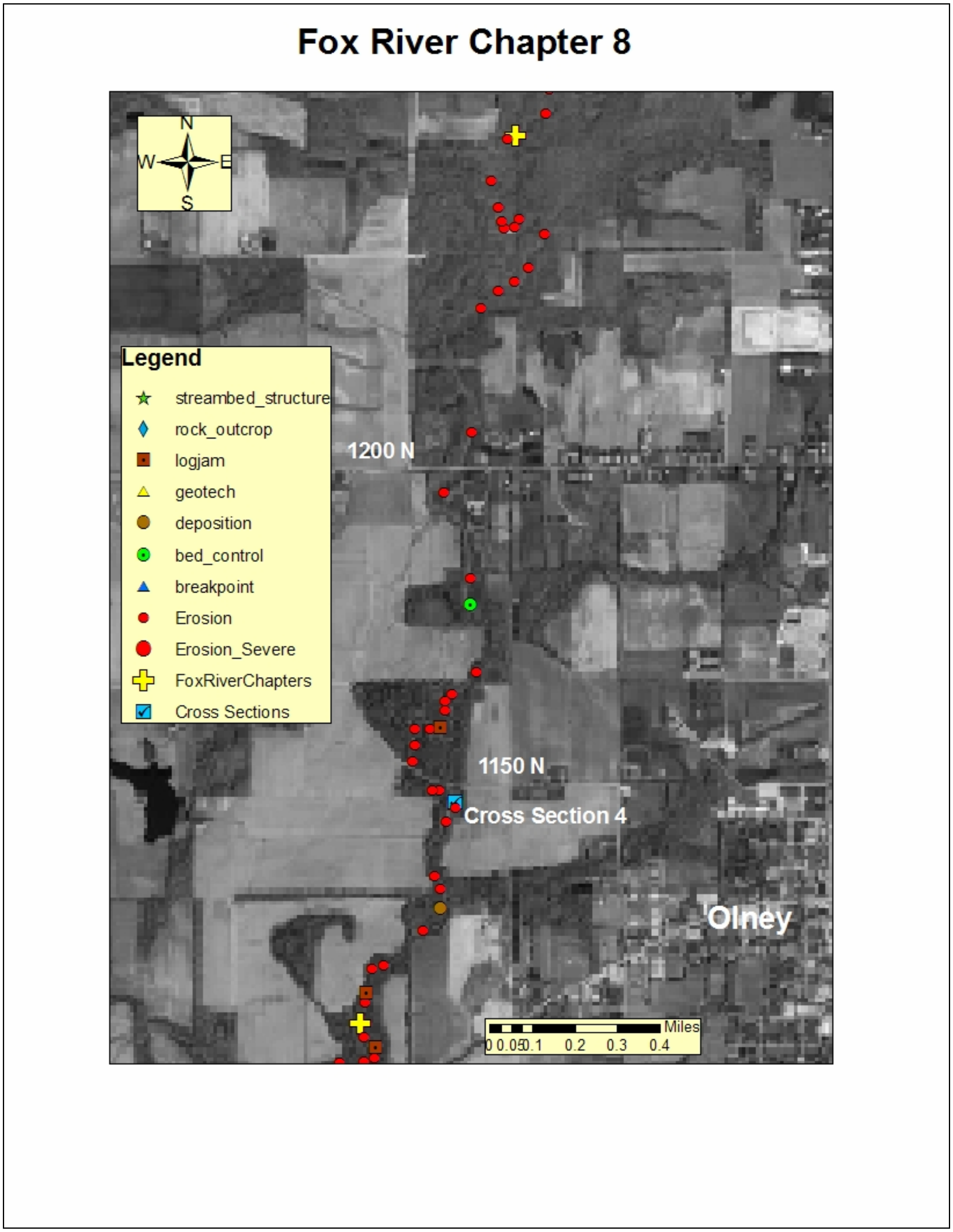

Figure 22 Chapter 8

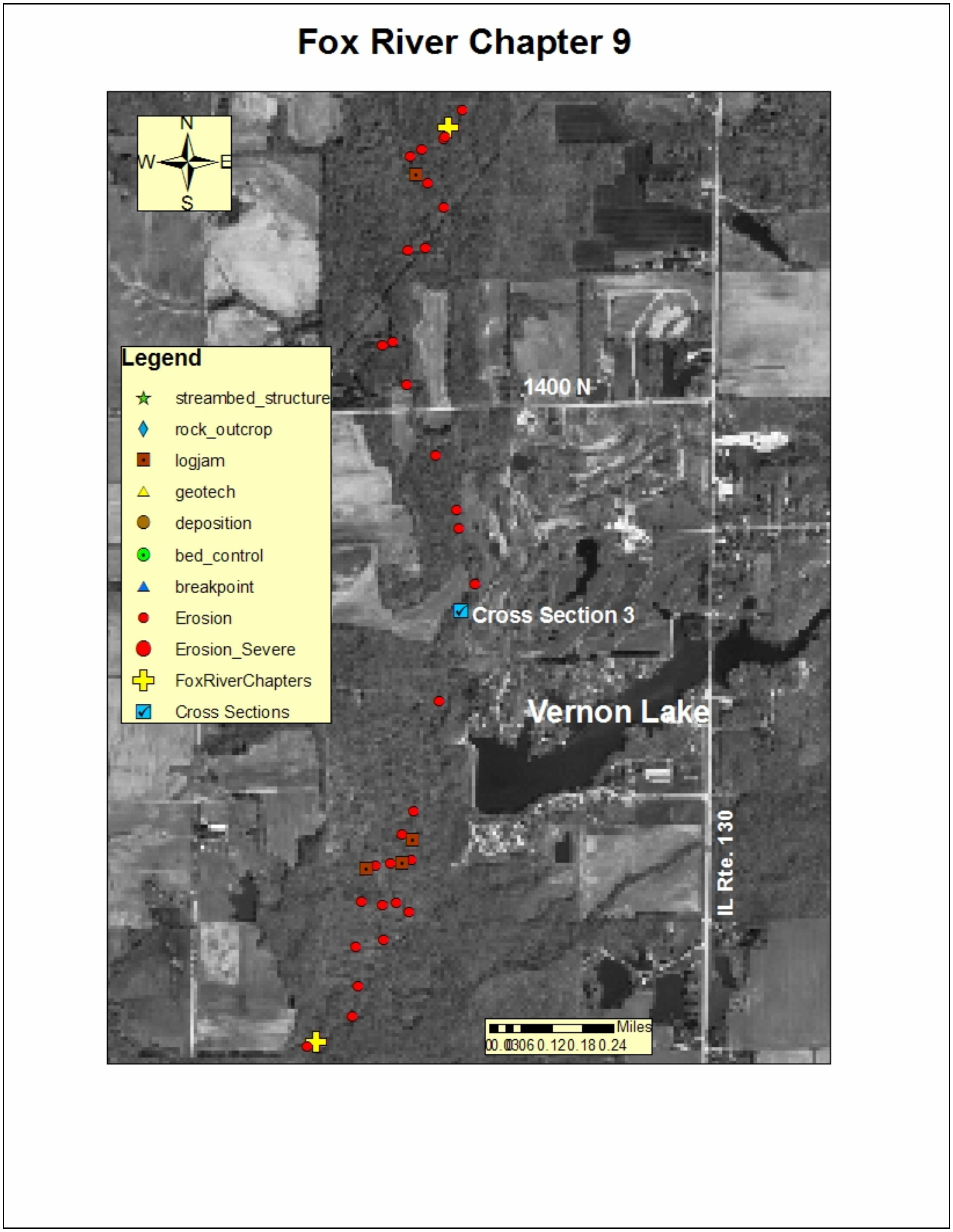

Figure 23 Chapter 9

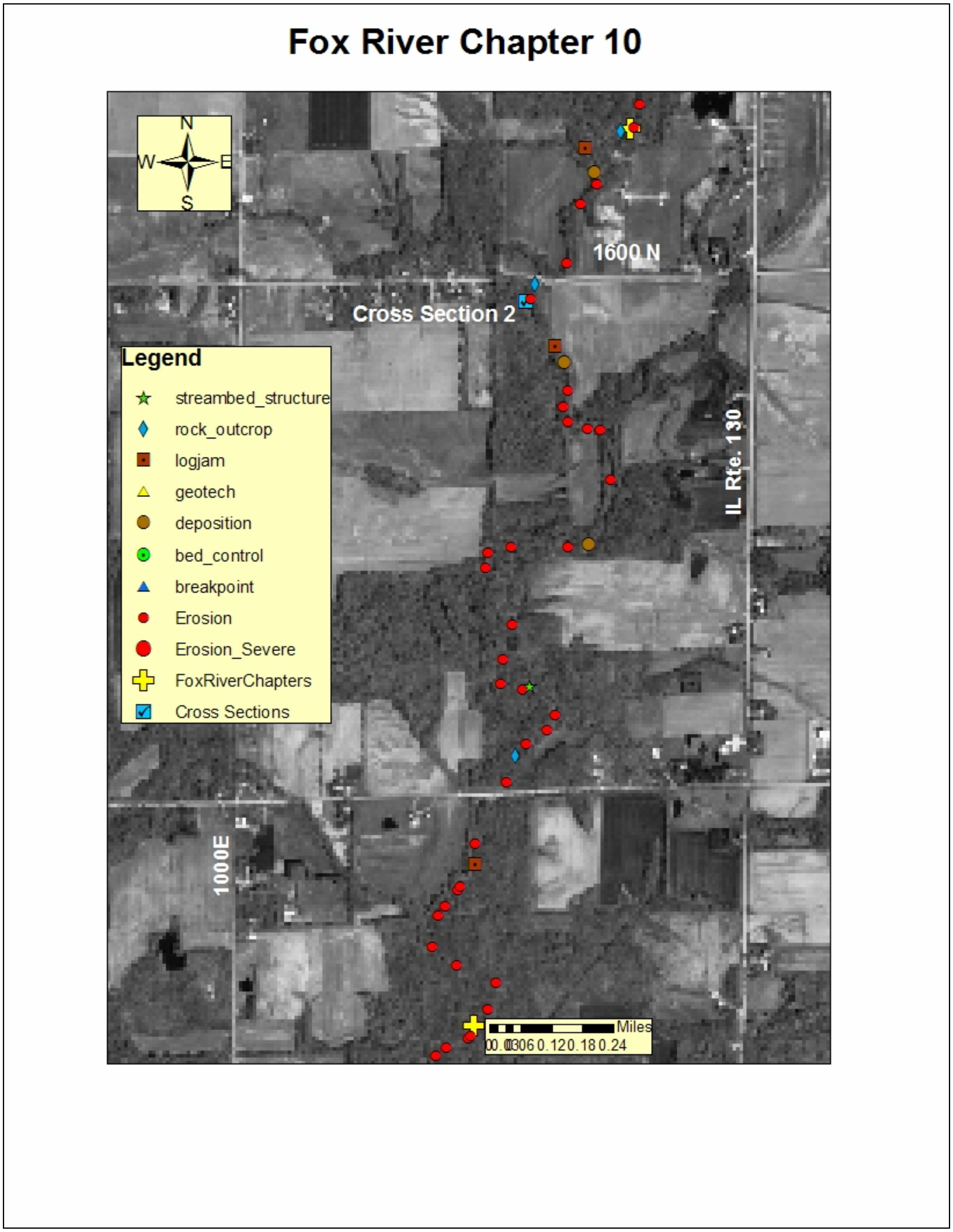

Figure 24 Chapter 10

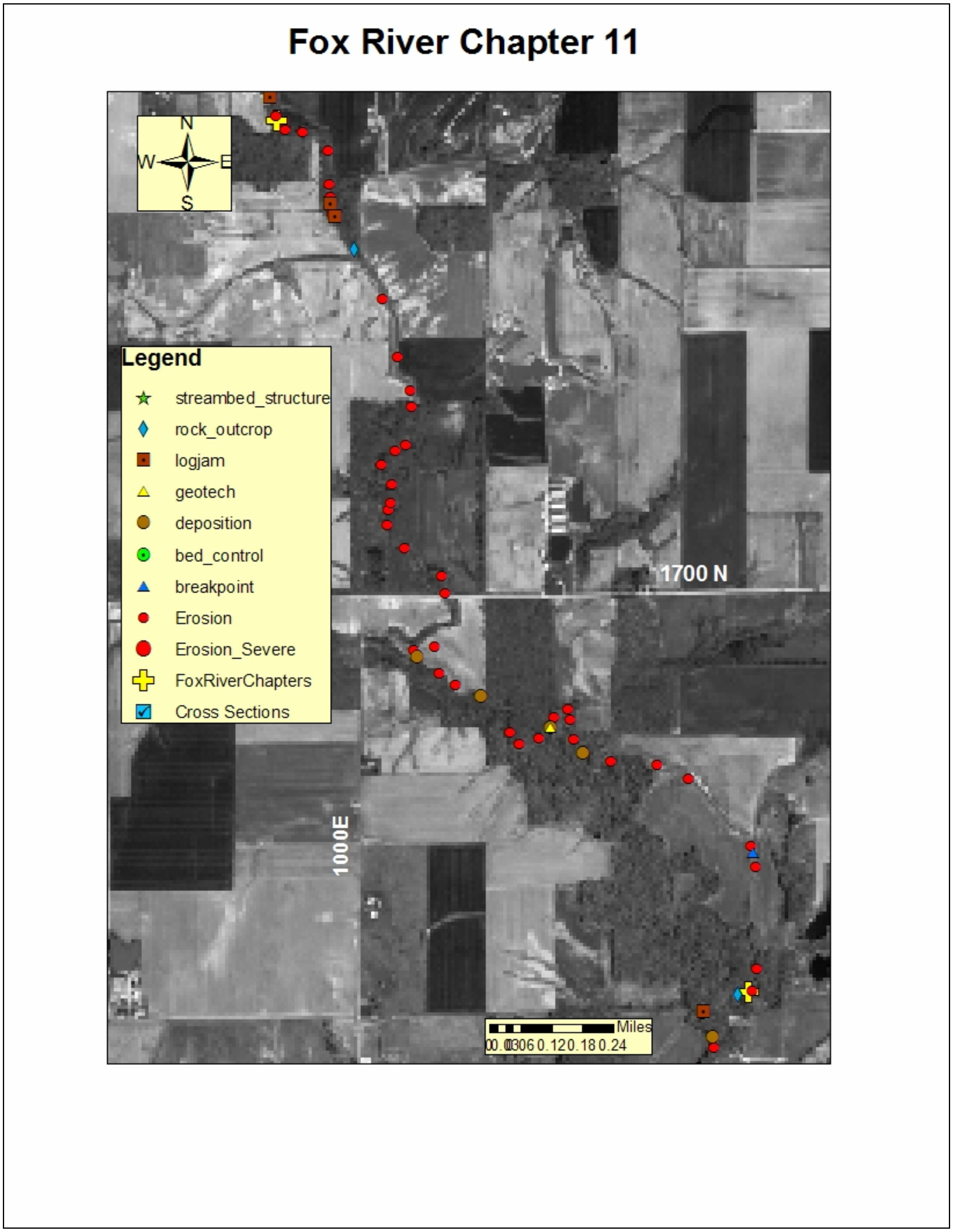

Figure 25 Chapter 11

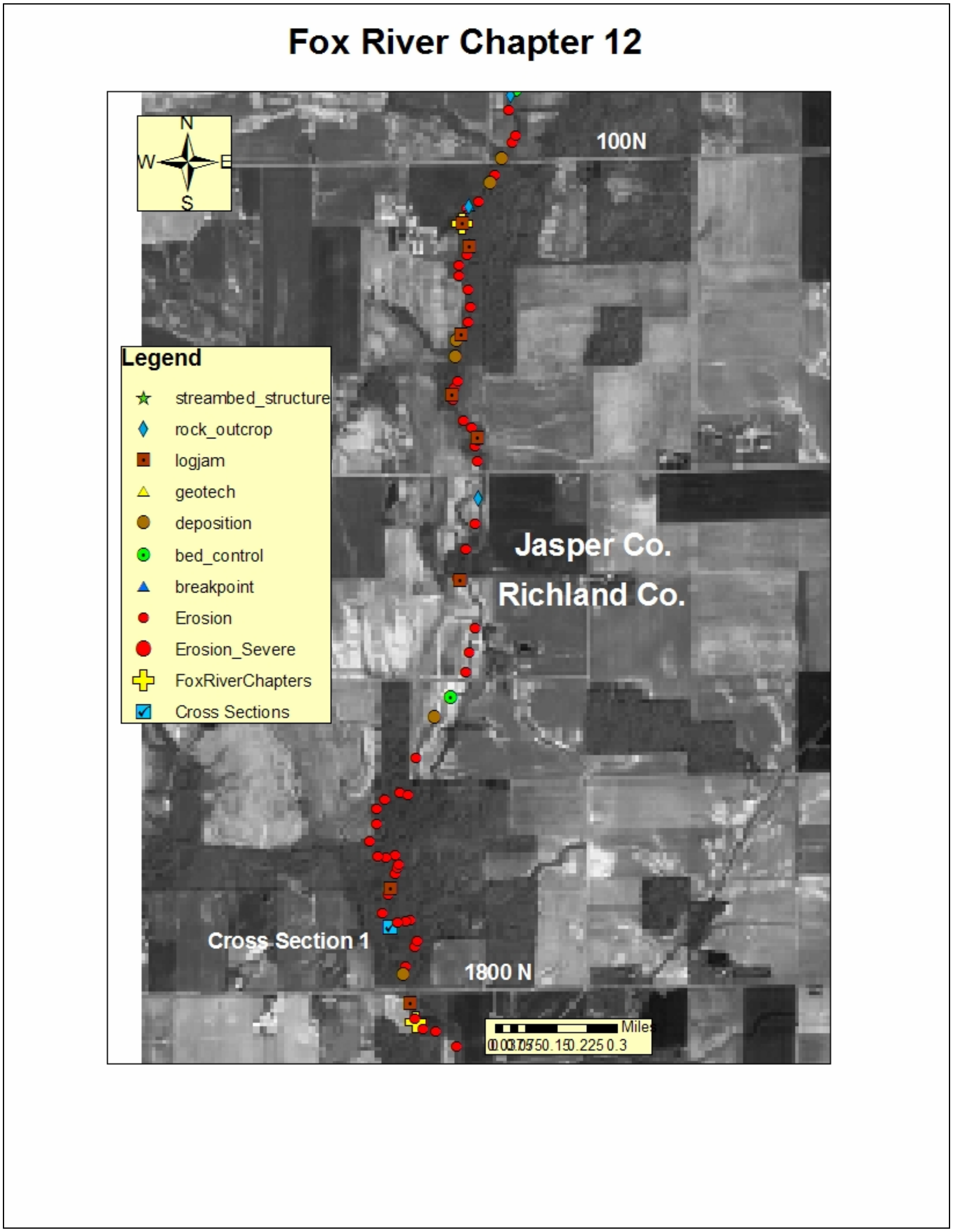

Figure 26 Chapter 12

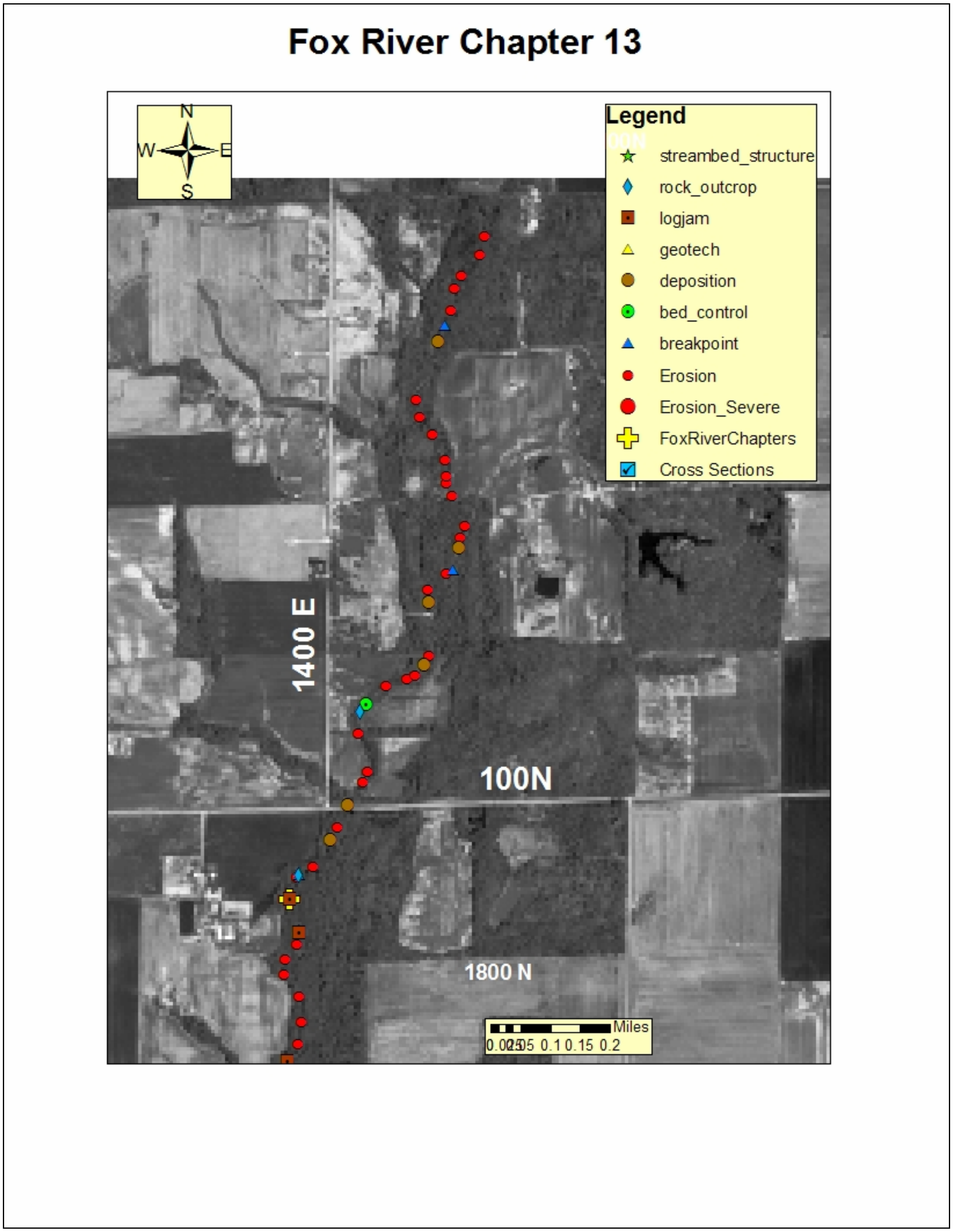

Figure 27 Chapter 13

APPENDIX A

CROSS SECTION DATA

Stream Stabilization I & E Form

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

County Richland T. R. Sec.

Date 11/15/2005 By Wayne Kinney

Stream Name Fox River UTM Coord. E403011 N4299092

Landowner Name X-sec1

Drainage Area 28.01 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	55 ft.	Cross Sectional Area	216 sq. ft.
	Depth	3.9 ft.		

Reference Stream Gage:

Little Wabash River below Clay City — Station No. 03379500 — Gage Q_2 13000 cfs

Drainage Area 1131 sq.mi — Regression (12500 cfs

Clay County, IL — **REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope:	5.2	*ft./mi. (user-entered)*			Regression Q_2	976 cfs
		ft/mi (from worksheet)	Rainfall	3.20 in *(2 yr, 24 hr)*	Adjusted Q_2	1015 cfs
	0.0010	*ft./ft.*	Regional Factor	1.057	Typical Range for Bankfull Discharge:	400 to 820 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	33	*ft.*	Contour Interval		feet		
Mean Bankfull Depth	3.46	*ft.*	Estimated Sinuosity				
Width/Depth Ratio	9.54						
			Channel Slope:			Bankfull Q from:	
Max. Bankfull Depth	4.8	*ft.*	Surveyed:	0.000727	*ft./ft.*	Cross-Section	251 *cfs*
Width at twice max. depth	800	*ft.*	Estimated:		*ft./ft.*	Basic field data	262 *cfs*
(9.6 ft.)						Selected Q	256 *cfs*
Entrenchment Ratio	24.24		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:	2.19	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.30	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.2	*ft./sec.*

Channel Evolution Stage III — Stream Type (Rosgen)

Notes

9.13 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	X-sec1
Assisted by:	Wayne Kinney
Date:	11/15/2005
Channel Slope (***S***):	0.000727 *ft/ft*
Manning's ***n***:	0.040
Flow Depth:	4.8 *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:	4.8 *ft*	6.5	
Channel Flow (***Q***):	250.6 *cfs*	394.4	
Channel Velocity:	2.2 *ft/sec*	2.2	
Cross-Sectional Area (***A***):	114.2 *sq.ft.*	178.8	
Hydraulic Radius (***R***):	3.2 *ft*	3.3	

Survey Data:

Rod *(ft)*	Distance *(ft)*
9.3	72.0
8.9	62.0
9.5	59.0
10.6	55.0
13.2	50.0
14.0	46.0
15.3	42.0
15.4	37.0
15.3	32.0
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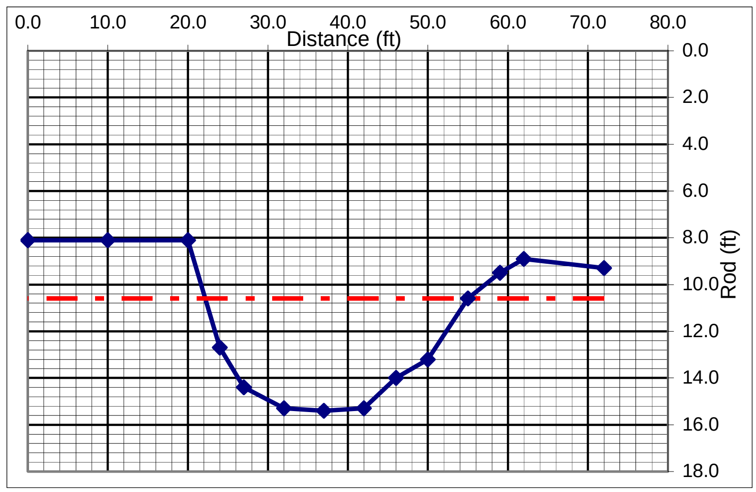
8.10	20
8.10	10
8.10	0



COMMENTS:

Stream Stabilization I & E Form

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

County Richland | T. | R. | Sec.

Date 11/15/2005 | By Wayne Kinney

Stream Name Fox River | UTM Coord. E404256 N4295454

Landowner Name X-sec2

Drainage Area 41.45 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	64 ft.	Cross Sectional Area	281 sq. ft.
	Depth	4.4 ft.		

Reference Stream Gage:

Little Wabash River below Clay City

Clay County, IL

Station No. 03379500 | Gage Q_2 13000 cfs

Drainage Area 1131 sq.mi | Regression (12500 cfs

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope:	3.7	*ft./mi. (user-entered)*				Regression Q_2	1129 cfs
		ft/mi (from worksheet)	Rainfall	3.20 in	*(2 yr, 24 hr)*	Adjusted Q_2	1175 cfs
	0.0007	*ft./ft.*	Regional Factor	1.057		Typical Range for Bankfull Discharge:	
							460 to 940 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	45 *ft.*	Contour Interval		feet
Mean Bankfull Depth	3.98 *ft.*	Estimated Sinuosity		
Width/Depth Ratio	11.31			

		Channel Slope:		Bankfull Q from:	
Max. Bankfull Depth	5.8 *ft.*	Surveyed:	0.00029 *ft./ft.*	Cross-Section	234 *cfs*
Width at twice max. depth	1000 *ft.*	Estimated:	*ft./ft.*	Basic field data	285 *cfs*
(11.6 ft.)				Selected Q	260 *cfs*
Entrenchment Ratio	22.22	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:	1.31	*ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	1.59	*ft./sec.*
velocities from different sources.		Velocity from selected Q:	1.5	*ft./sec.*

Channel Evolution Stage III | Stream Type (Rosgen)

Notes

6.27 cfs/sq. mi.

Natural Open Channel Flow

[back to I&E form]

Clear Cells

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

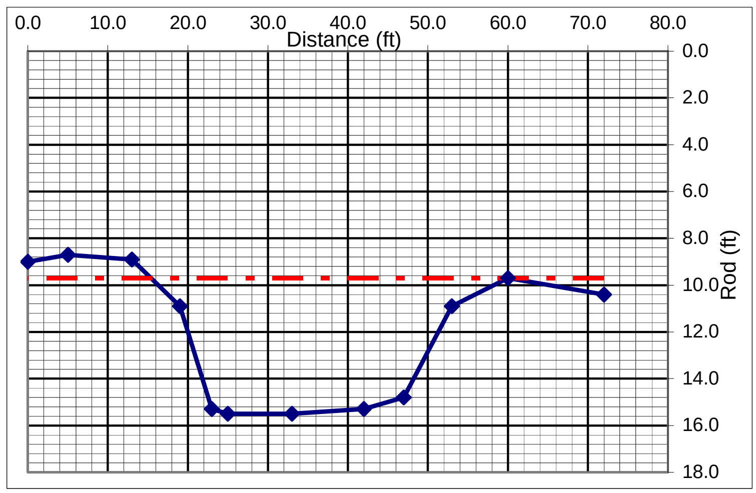
assuming uniform, steady flow

Project:	X-sec2
Assisted by:	Wayne Kinney
Date:	11/15/2005
Channel Slope (***S***):	0.000290 *ft/ft*
Manning's ***n*** :	0.040
Flow Depth:	5.8 *ft*

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	5.8 *ft*	5.8	
Channel Flow (***Q***):	234.3 *cfs*	234.3	
Channel Velocity:	1.3 *ft/sec*	1.3	
Cross-Sectional Area (***A***):	178.9 *sq.ft.*	178.9	
Hydraulic Radius (***R***):	3.0 *ft*	3.0	

Survey Data:

Rod *(ft)*	Distance *(ft)*
10.4	72.0
9.7	60.0
10.9	53.0
14.8	47.0
15.3	42.0
15.5	33.0
15.5	25.0
15.3	23.0
10.9	19.0
8.90	13
8.70	5
9.00	0



COMMENTS:

Stream Stabilization I & E Form

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

County Richland T. R. Sec.

Date 11/15/2005 By Wayne Kinney

Stream Name Fox River UTM Coord. E404132 N4291675

Landowner Name X-sec3

Drainage Area 58.46 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	73 ft.	Cross Sectional Area	355 sq. ft.
	Depth	4.9 ft.		

Reference Stream Gage:

Little Wabash River below Clay City

Station No. 03379500 Gage Q_2 13000 cfs

Drainage Area 1131 sq.mi Regression (12500 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 3.7 *ft./mi. (user-entered)* Regression Q_2 1482 cfs

ft/mi (from worksheet) Rainfall 3.20 in *(2 yr, 24 hr)* Adjusted Q_2 1541 cfs

0.0007 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge: 610 to 1240 cfs

Local Stream Morphology:

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

Manning's "n" 0.04

Stream Length *ft.*

Valley Length *ft.*

Basic Field Data:

Bankfull Width 60 *ft.* Contour Interval feet

Mean Bankfull Depth 4.31 *ft.* Estimated Sinuosity

Width/Depth Ratio 13.92

Channel Slope: Bankfull Q from:

Max. Bankfull Depth 6.6 *ft.* Surveyed: 0.00029 *ft./ft.* Cross-Section 423 *cfs*

Width at twice max. depth 1000 *ft.* Estimated: *ft./ft.* Basic field data 435 *cfs*

(13.2 ft.) Selected Q 429 *cfs*

Entrenchment Ratio 16.67 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: 1.63 *ft./sec.*

GOAL: Develop confidence by matching velocities from different sources. Velocity from basic field data: 1.68 *ft./sec.*

Velocity from selected Q: 1.7 *ft./sec.*

Channel Evolution Stage I Stream Type (Rosgen)

Notes

7.34 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

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

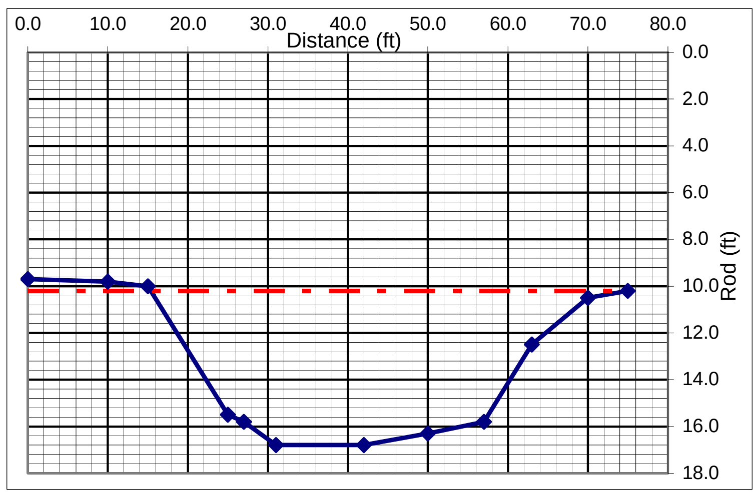
assuming uniform, steady flow

Project:	X-sec3	
Assisted by:	Wayne Kinney	
Date:	11/15/2005	
Channel Slope (***S***):	0.000290	*ft/ft*
Manning's ***n*** :	0.040	
Flow Depth:	6.6	*ft*

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	6.6 *ft*	6.6	
Channel Flow (***Q***):	422.9 *cfs*	422.9	
Channel Velocity:	1.6 *ft/sec*	1.6	
Cross-Sectional Area (***A***):	258.7 *sq.ft.*	258.7	
Hydraulic Radius (***R***):	4.2 *ft*	4.2	

Survey Data:

Rod *(ft)*	Distance *(ft)*
9.7	0.0
9.8	10.0
10.0	15.0
15.5	25.0
15.8	27.0
16.8	31.0
16.8	42.0
16.3	50.0
15.8	57.0
12.50	63
10.50	70
10.20	75



COMMENTS:

Stream Stabilization I & E Form

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

County Richland T. R. Sec.

Date 11/15/2005 By Wayne Kinney

Stream Name Fox River UTM Coord. E403456 N4287803
Landowner Name X-sec 4

Drainage Area 65.17 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	76 ft.	Cross Sectional Area	382 sq. ft.
	Depth	5.0 ft.		

Reference Stream Gage:

Little Wabash River below Clay City
Clay County, IL

Station No. 03379500
Drainage Area 1131 sq.mi
Gage Q_2 13000 cfs
Regression (12500 cfs
REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 3.1 *ft./mi. (user-entered)*
ft/mi (from worksheet) Rainfall 3.20 in *(2 yr, 24 hr)*
0.0006 *ft./ft.* Regional Factor 1.057

Regression Q_2 1483 cfs
Adjusted Q_2 1542 cfs
Typical Range for Bankfull Discharge: 610 to 1240 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals
Manning's "n" 0.04

Basic Field Data:

Bankfull Width	69	*ft.*
Mean Bankfull Depth	4.99	*ft.*
Width/Depth Ratio	13.83	
Max. Bankfull Depth	6.8	*ft.*
Width at twice max. depth (13.6 ft.)	800	*ft.*
Entrenchment Ratio	11.59	

Stream Length		*ft.*
Valley Length		*ft.*
Contour Interval		feet
Estimated Sinuosity		

Channel Slope:
Surveyed: 0.000502 *ft./ft.*
Estimated: *ft./ft.*

Bankfull Q from:
Cross-Section 768 *cfs*
Basic field data 840 *cfs*
Selected Q 804 *cfs*

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.*
D_{50} *in.*

GOAL: Develop confidence by matching velocities from different sources.

Velocity required to move D_{90}:	2.1	*ft./sec.*
Velocity from Cross-Section data:	2.23	*ft./sec.*
Velocity from basic field data:	2.44	*ft./sec.*
Velocity from selected Q:	2.3	*ft./sec.*

Channel Evolution Stage IV Stream Type (Rosgen)

Notes

12.33 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	X-sec 4	
Assisted by:	Wayne Kinney	
Date:	11/15/2005	
Channel Slope (***S***):	0.000502	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	6.8	*ft*

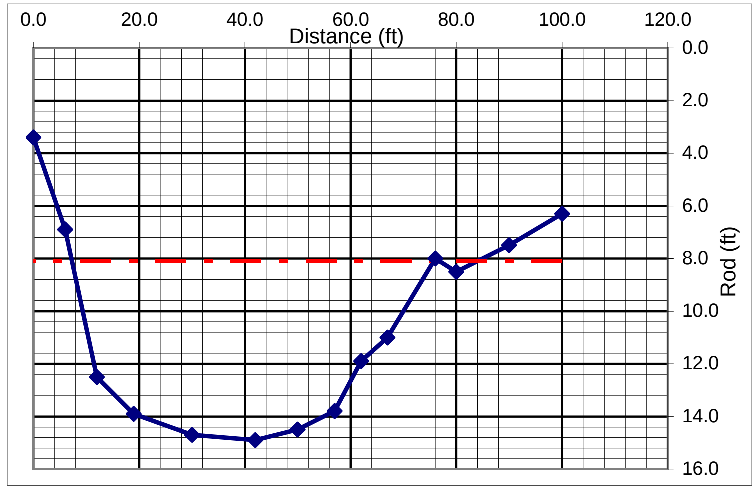
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	6.8 *ft*	8.6	
Channel Flow (***Q***):	768.1 *cfs*	1,224.7	
Channel Velocity:	2.2 *ft/sec*	2.5	
Cross-Sectional Area (***A***):	344.4 *sq.ft.*	499.3	
Hydraulic Radius (***R***):	4.4 *ft*	5.1	

Survey Data:

Rod *(ft)*	Distance *(ft)*
6.3	100.0
7.5	90.0
8.5	80.0
8.0	76.0
11.0	67.0
11.9	62.0
13.8	57.0
14.5	50.0
14.9	42.0
14.70	30
13.90	19
12.50	12
6.90	6
3.40	0



COMMENTS:

Stream Stabilization I & E Form

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

County Richland | T. | R. | Sec.

Date 11/15/2005 | By Wayne Kinney

Stream Name Fox River | UTM Coord. E403346 N4284418

Landowner Name X-sec5

Drainage Area 72.87 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	79 ft.	Cross Sectional Area	412 sq. ft.
	Depth	5.2 ft.		

Reference Stream Gage:

Little Wabash River below Clay City	Station No.	03379500	Gage Q_2	13000 cfs
	Drainage Area	1131 sq.mi	Regression (	12500 cfs
Clay County, IL	**REFERENCE STREAM DATA ONLY**			

USGS Flood-Peak Discharge Predictions:

Valley Slope:	3.1	*ft./mi. (user-entered)*			Regression Q_2	1620 cfs
		ft/mi (from worksheet)	Rainfall	3.20 in *(2 yr, 24 hr)*	Adjusted Q_2	1685 cfs
	0.0006	*ft./ft.*	Regional Factor	1.057	Typical Range for Bankfull Discharge:	670 to 1350 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	56	*ft.*	Contour Interval		feet
Mean Bankfull Depth	5.82	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	9.62				

			Channel Slope:			Bankfull Q from:		
Max. Bankfull Depth	8.7	*ft.*	Surveyed:	0.000502	*ft./ft.*	Cross-Section	826	*cfs*
Width at twice max. depth	1000	*ft.*	Estimated:		*ft./ft.*	Basic field data	881	*cfs*
(17.4 ft.)						Selected Q	854	*cfs*
Entrenchment Ratio	17.86		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:	2.53	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.70	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.6	*ft./sec.*

Channel Evolution Stage V | Stream Type (Rosgen)

Notes

11.71 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

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

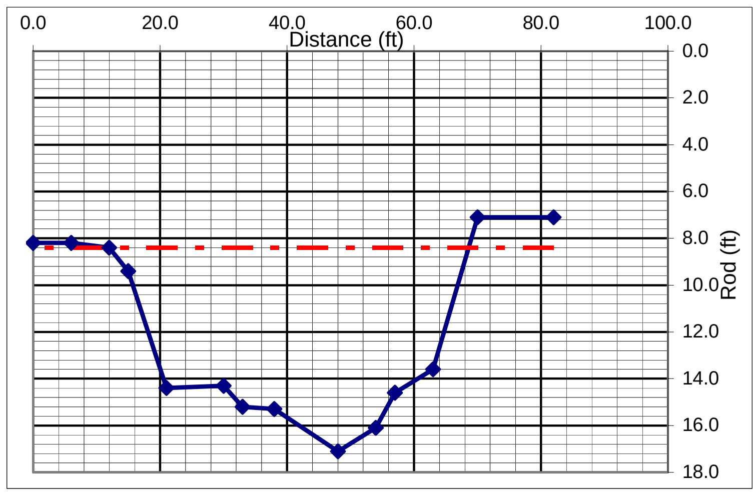
assuming uniform, steady flow

Project:	X-sec5	
Assisted by:	Wayne Kinney	
Date:	11/15/2005	
Channel Slope (***S***):	0.000502	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	8.7	*ft*

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	8.7 *ft*	8.9	
Channel Flow (***Q***):	826.3 *cfs*	776.8	
Channel Velocity:	2.5 *ft/sec*	2.3	
Cross-Sectional Area (***A***):	326.2 *sq.ft.*	338.1	
Hydraulic Radius (***R***):	5.3 *ft*	4.6	

Survey Data:

Rod *(ft)*	Distance *(ft)*
7.1	82.0
7.1	70.0
13.6	63.0
14.6	57.0
16.1	54.0
17.1	48.0
15.3	38.0
15.2	33.0
14.3	30.0
14.40	21
9.40	15
8.40	12
8.20	6
8.20	0



COMMENTS:

Stream Stabilization I & E Form

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

County Richland T. R. Sec.

Date 11/15/2005 By Wayne Kinney

Stream Name Fox River UTM Coord. E401250 N4281747

Landowner Name X-sec6

Drainage Area 103.81 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	91 ft.	Cross Sectional Area	524 sq. ft.
	Depth	5.8 ft.		

Reference Stream Gage:

Little Wabash River below Clay City

Station No. 03379500 Gage Q_2 13000 cfs

Drainage Area 1131 sq.mi Regression (12500 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 3.0 *ft./mi. (user-entered)* Regression Q_2 2109 cfs

ft/mi (from worksheet) Rainfall 3.20 in *(2 yr, 24 hr)* Adjusted Q_2 2193 cfs

0.0006 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge: 870 to 1760 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 63 *ft.*

Mean Bankfull Depth 6.59 *ft.*

Width/Depth Ratio 9.56

Max. Bankfull Depth 8.5 *ft.*

Width at twice max. depth 1000 *ft.* (17.0 ft.)

Entrenchment Ratio 15.87

Channel Slope:

Surveyed: 0.000502 *ft./ft.*

Estimated: *ft./ft.*

Radius of Curvature (Rc) ft.

Rc/Bankfull width: 0.00

Bankfull Q from:

Cross-Section 1162 *cfs*

Basic field data 1219 *cfs*

Selected Q 1190 *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: 2.80 *ft./sec.*

GOAL: Develop confidence by matching velocities from different sources.

Velocity from basic field data: 2.94 *ft./sec.*

Velocity from selected Q: 2.9 *ft./sec.*

Channel Evolution Stage IV Stream Type (Rosgen)

Notes

11.47 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	X-sec6
Assisted by:	Wayne Kinney
Date:	11/15/2005
Channel Slope (***S***):	0.000502 ft/ft
Manning's ***n***:	0.040
Flow Depth:	8.5 ft

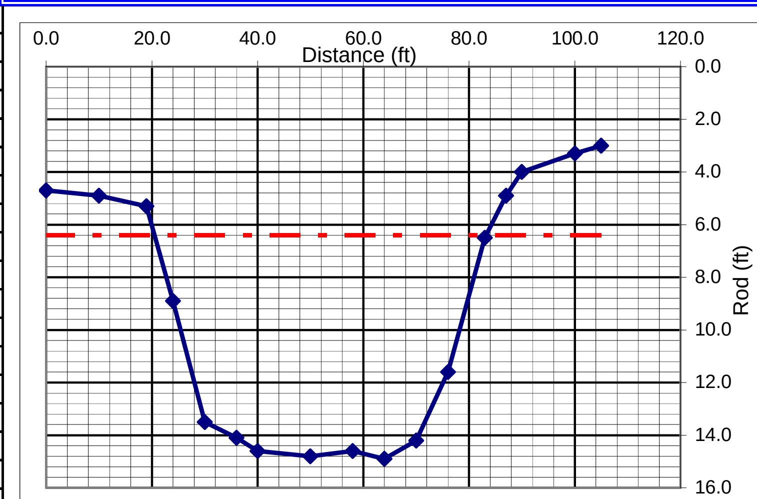
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	8.5 *ft*	10.2	
Channel Flow (***Q***):	1,161.6 *cfs*	1,415.5	
Channel Velocity:	2.8 *ft/sec*	2.7	
Cross-Sectional Area (***A***):	415.3 *sq.ft.*	531.9	
Hydraulic Radius (***R***):	6.2 *ft*	5.7	

Survey Data:

Rod *(ft)*	Distance *(ft)*
3.0	105.0
3.3	100.0
4.0	90.0
4.9	87.0
6.5	83.0
11.6	76.0
14.2	70.0
14.9	64.0
14.6	58.0
14.80	50
14.60	40
14.10	36
13.50	30
8.90	24
5.30	19
4.9	10
4.7	0



COMMENTS: