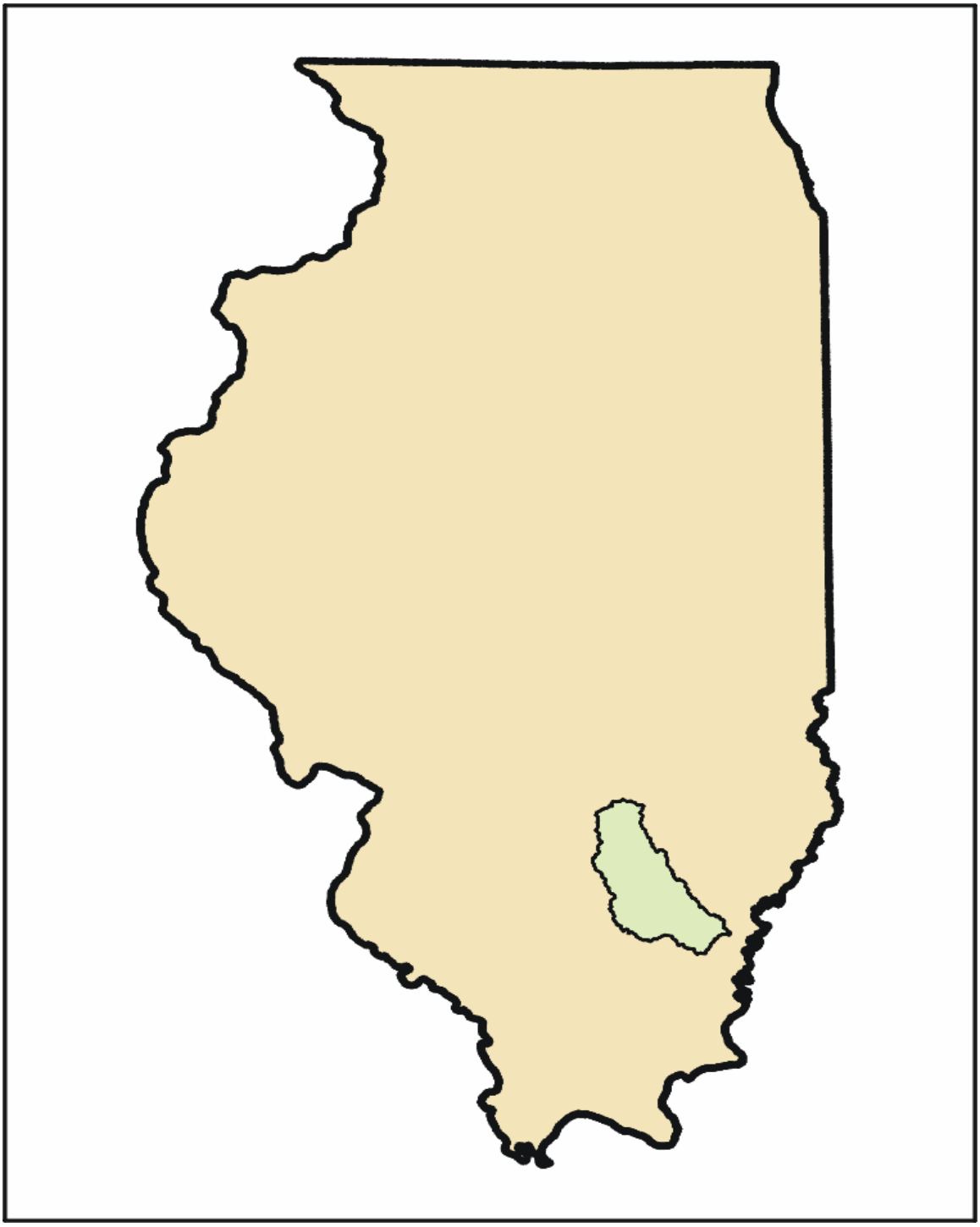


AERIAL ASSESSMENT REPORT FOR SKILLET FORK

MARION, WAYNE, HAMILTON and WHITE COUNTIES

November 2005

Prepared by Wayne Kinney for IL. Department of Agriculture

The Skillet Fork Watershed TMDL report prepared by LimnoTech, Inc. determined that segments CA03, CA05, CA06 and CA09 are impaired waterbodies. These segments make up 54.49 miles of the main channel of Skillet Fork from the confluence with the Little Wabash River near Carmi in White Co. to the headwaters east of Kinmundy in Marion Co... Each of these segments has been found to be impaired by Dissolved Oxygen with Manganese and pH also listed for CA03, CA05 and CA06. Atrazine is also listed in CA03 and CA05. TSS and sedimentation/siltation are also listed for CA03, CA05 and CA06, but are not subject to TMDL development.

According to the October 2004 Quarterly Report prepared by Limno-Tech, Inc. potential sources of impairment for Manganese include streambank erosion of soils naturally enriched with manganese. Natural background sources are also identified as potential sources of pH. The potential sources of DO impairment are algal respiration, sediment oxygen demand, degradation of CBOD, nitrification of ammonia, municipal point sources, agricultural runoff and intensive animal feeding operations. This report will present recommendations for the sources impacted either directly or indirectly by streambank erosion.

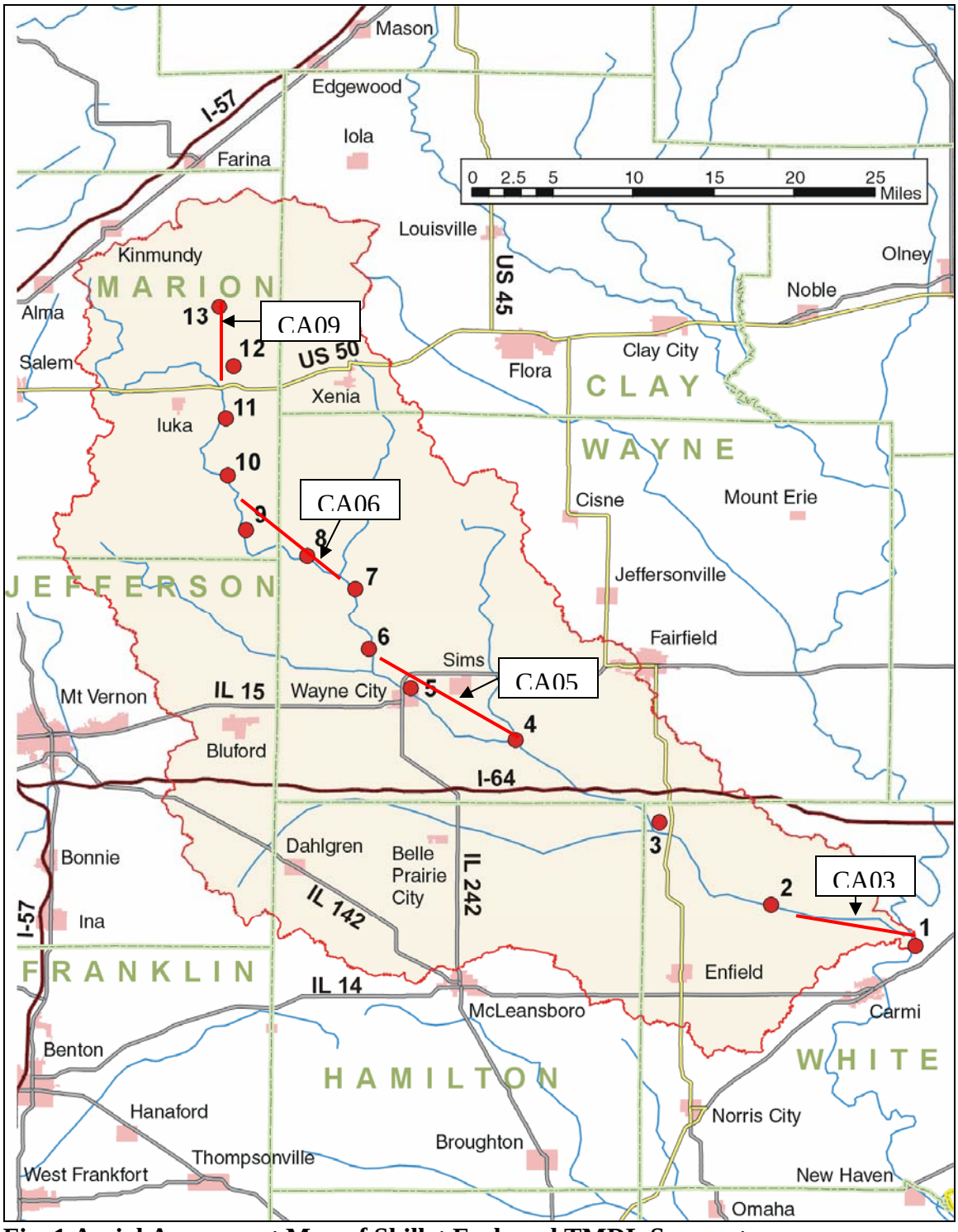


Fig. 1 Aerial Assessment Map of Skillet Fork and TMDL Segments

Assessment Procedure

Low level geo-referenced video was taken of Skillet Fork 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 with the Little Wabash River near Carmi, IL.The mapping progressed upstream to the junction of Lost Fork in Marion County and then continued upstream on Lost Fork to Stephen A. Forbes State Park. 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.

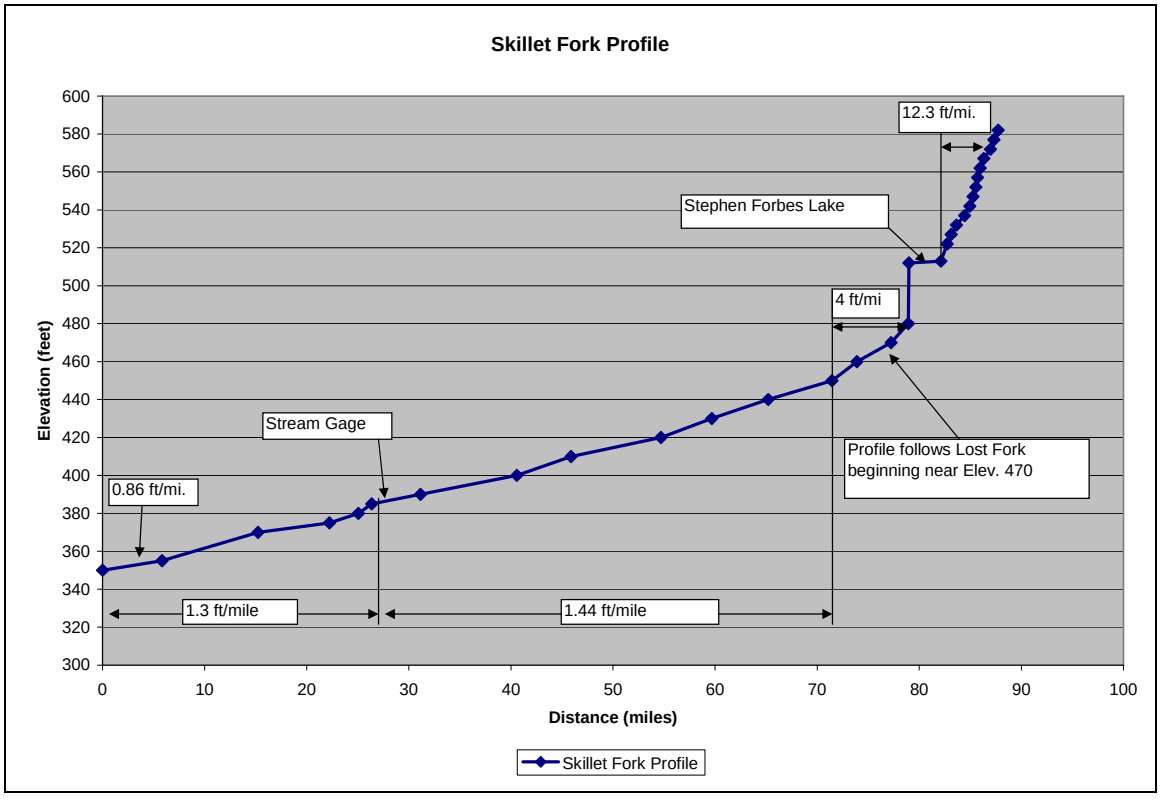


Figure 2 Channel Profile of Skillet Fork

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.

CHAPTERS ON DVD AND ASSESSMENT REPORT
Skillet Fork

DVD Disc	DVD chapter	Beginning Time	Report Chapter	Cross Sections
1	2	10:00	1	
1	3	20:00	2	
1	4	30:00:00	3	
1	5	40:00:00	4	6,7,8
1	6	50:00:00	5	
2	2	10:00	6	
2	3	20:00	7	5
2	4	30:00:00	8	
2	5	40:00:00	9	4
3	2	10:00	10	
3	3	20:00	11	3
3	4	30:00:00	12	2
3	5	40:00:00	13	1
3	6	50:00:00	14	

Fig. 3 DVD Chapters and Report Guide

The DVD has been divided into "chapters" of approximately ten 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 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".

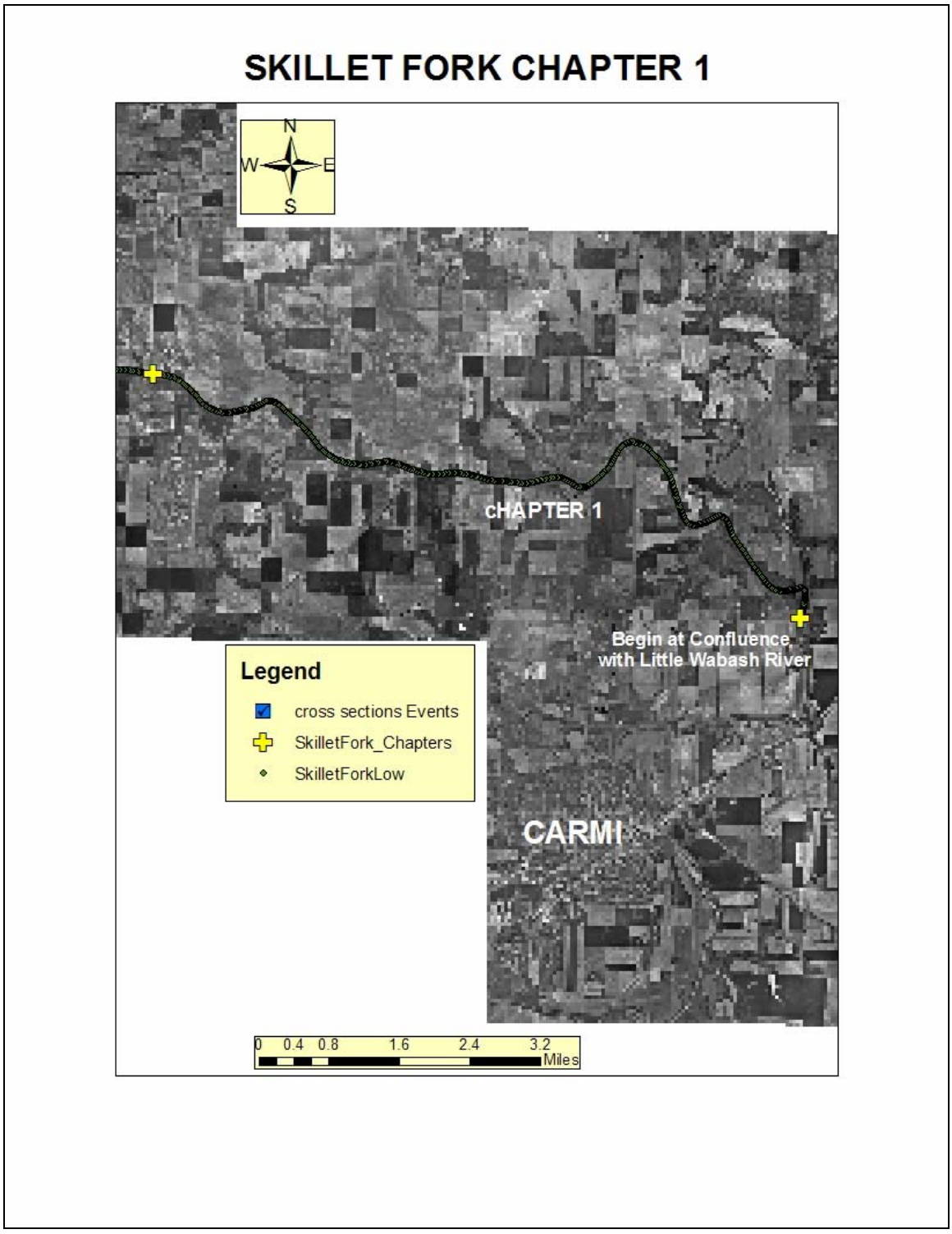


Fig. 4 Chapter Division and Cross Section locations (Chapter 1)

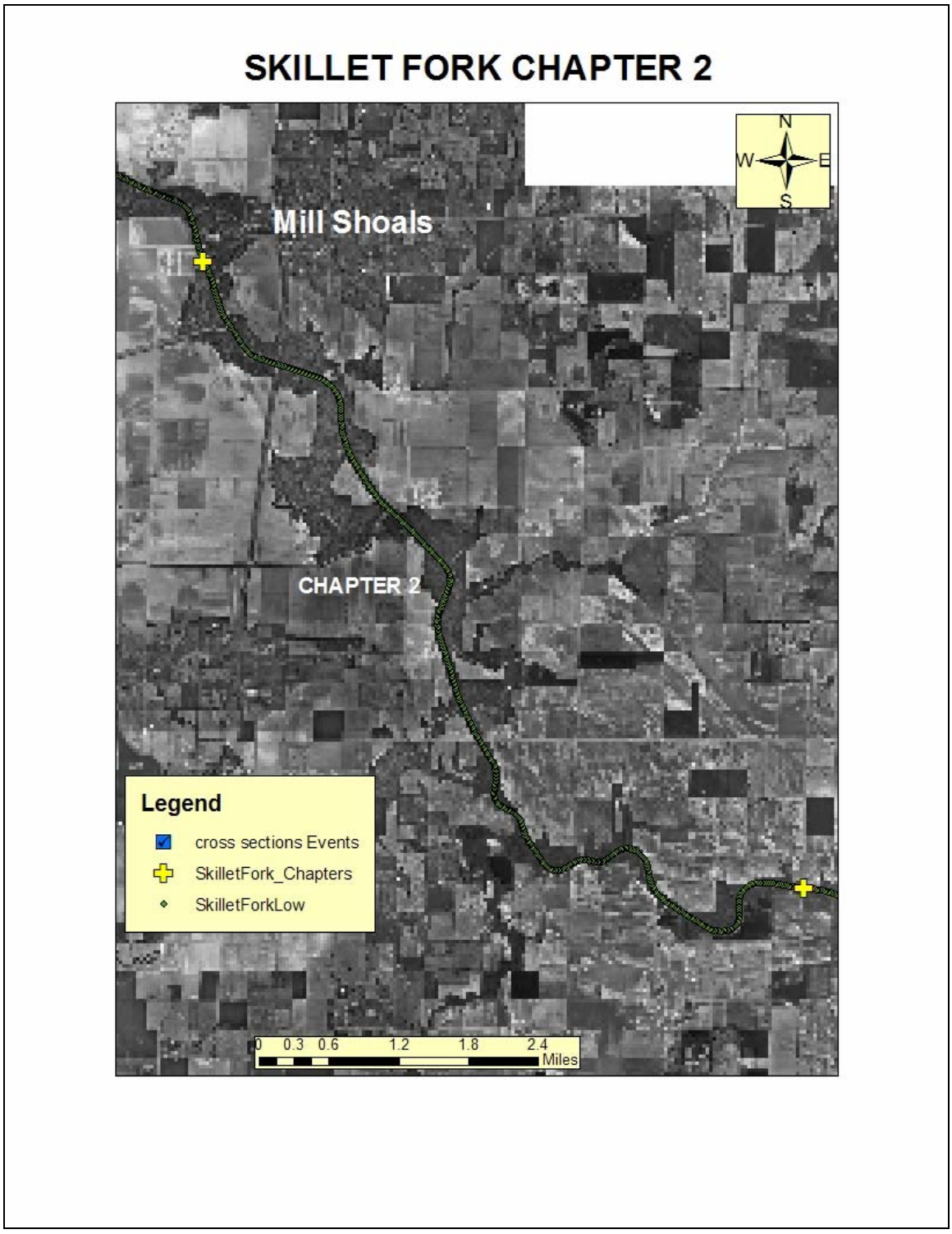


Fig. 5 Chapter Division and Cross Section locations (Chapter 2)

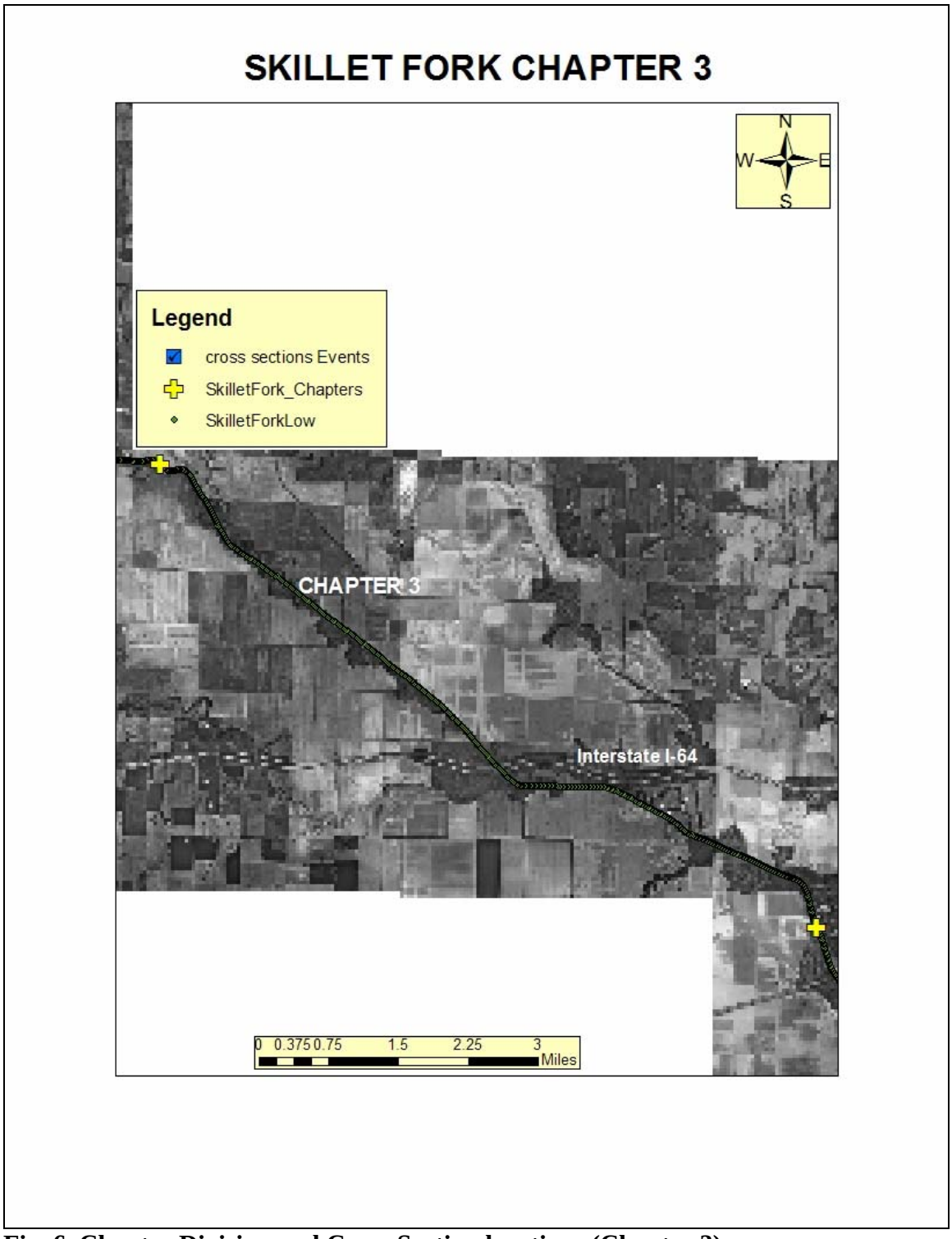


Fig. 6 Chapter Division and Cross Section locations (Chapter 3)

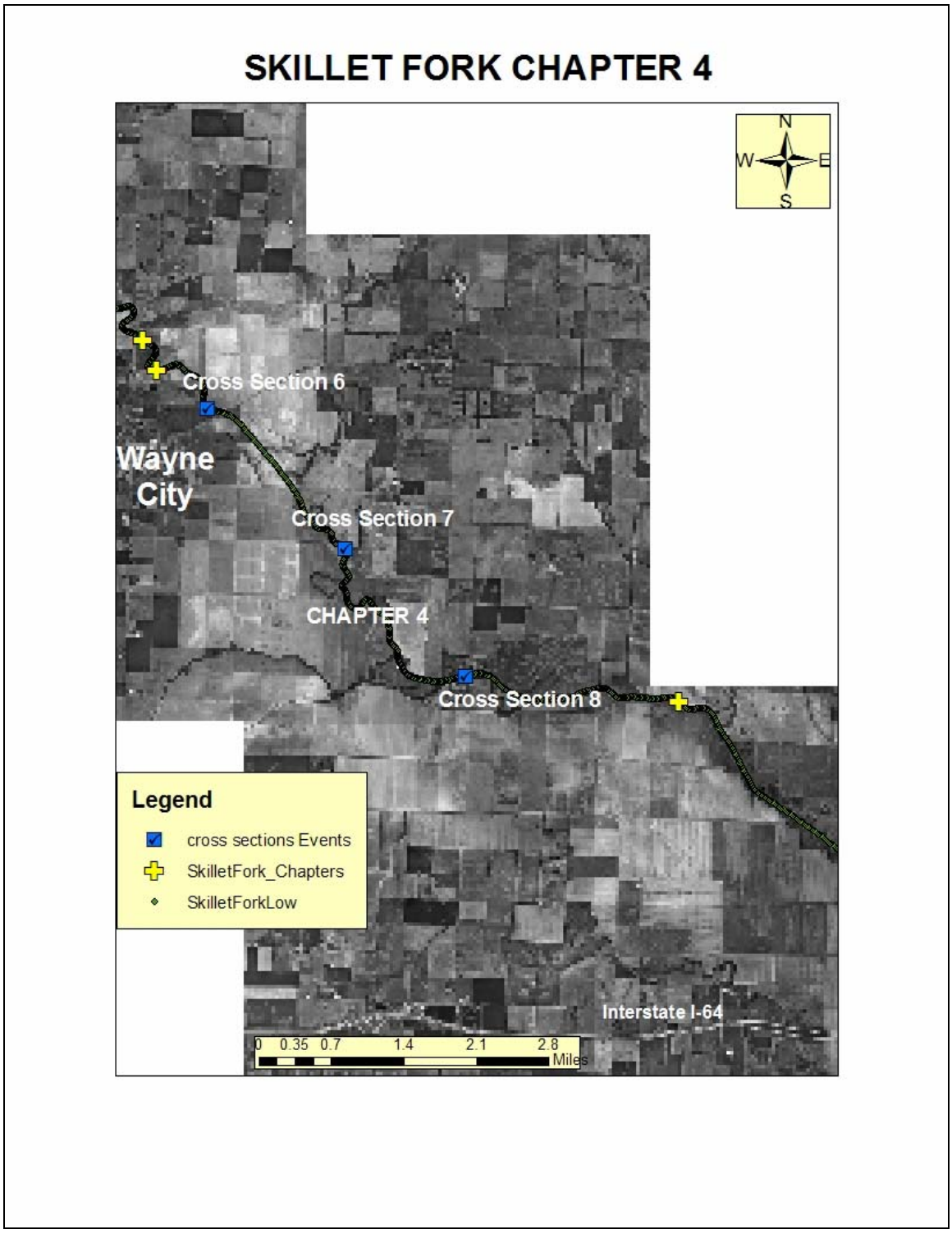


Fig. 7 Chapter Division and Cross Section locations (Chapter 4)

Fig. 8 Chapter Division and Cross Section locations (Chapter 5)

Fig. 9 Chapter Division and Cross Section locations (Chapter 6)

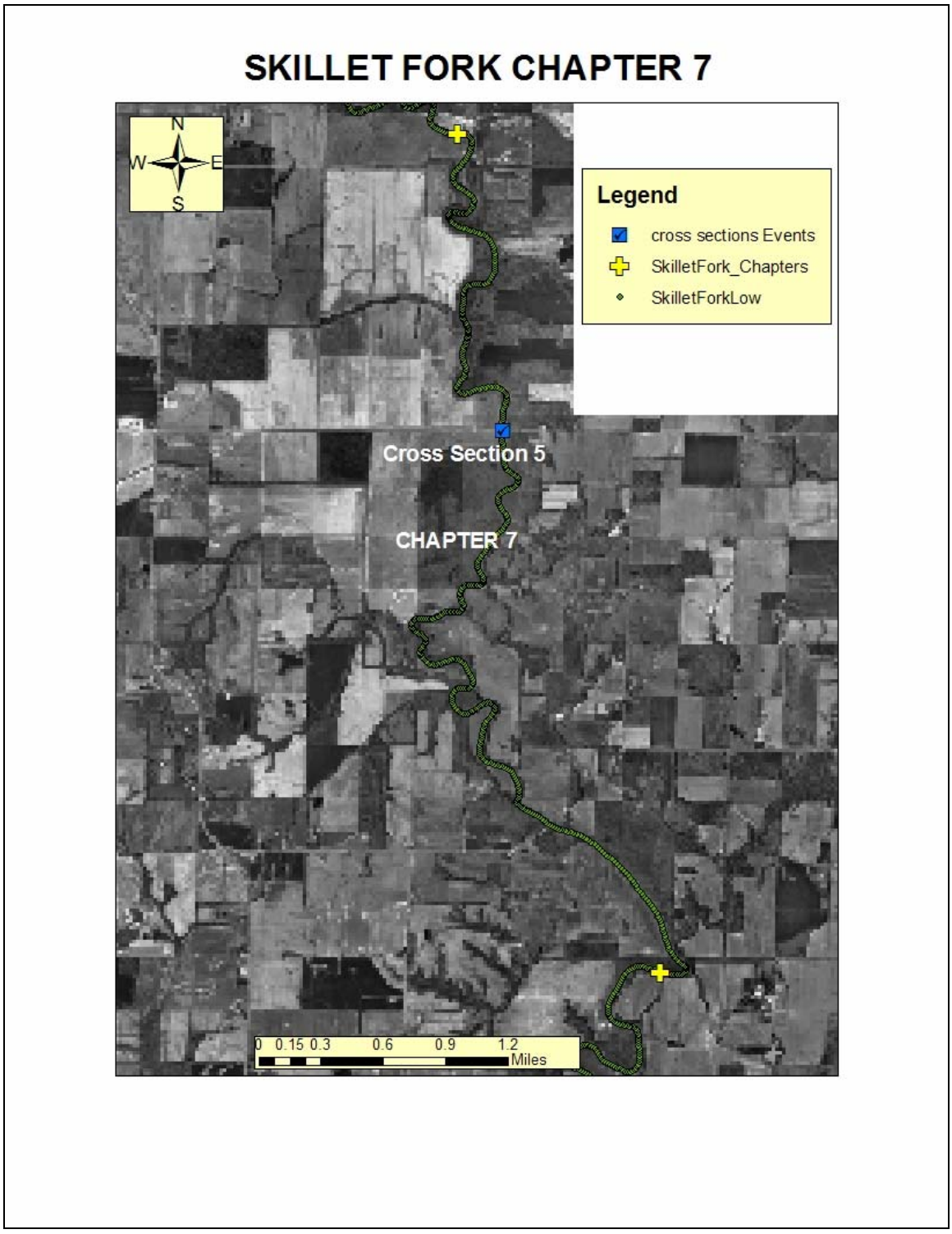


Fig. 10 Chapter Division and Cross Section locations (Chapter 7)

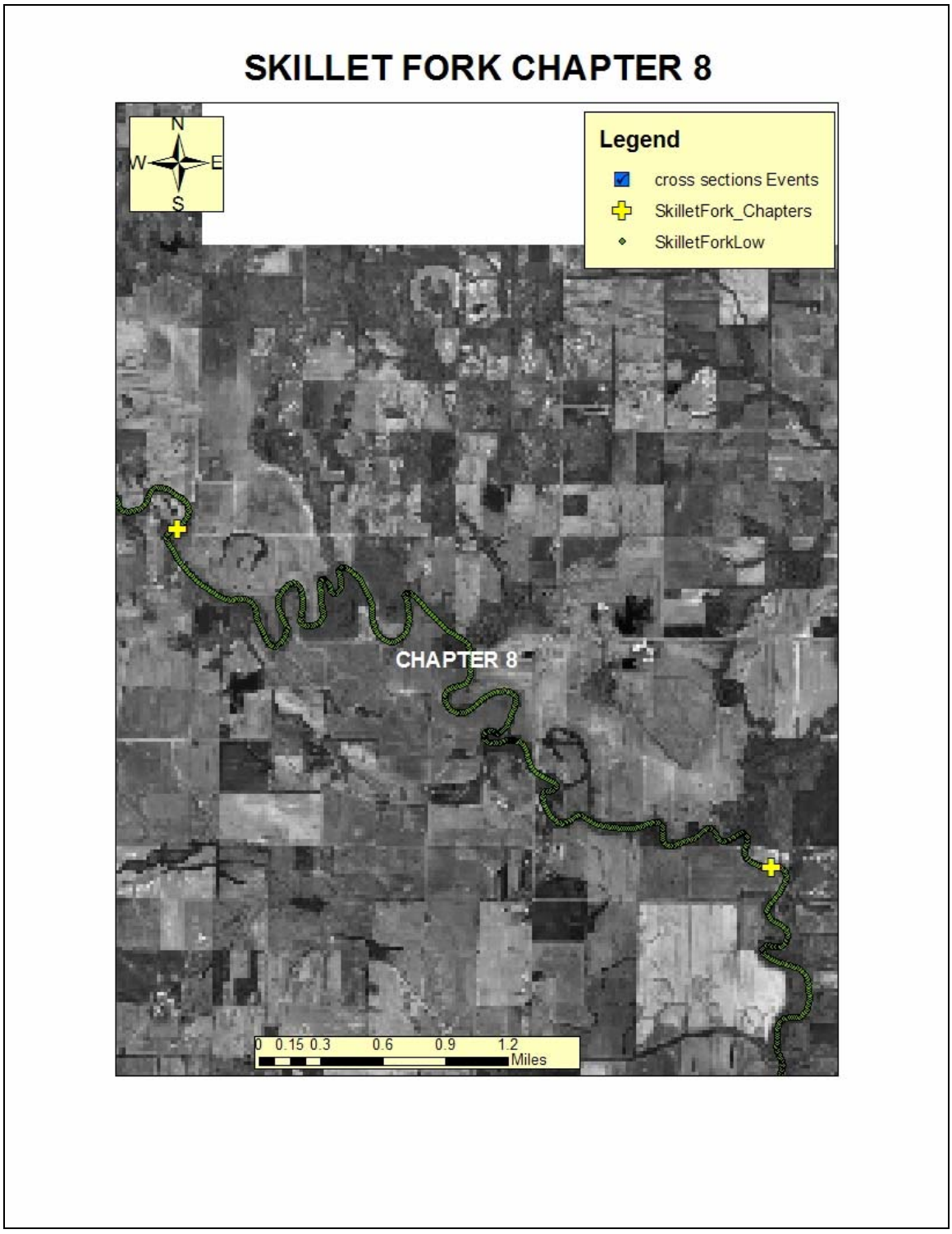


Fig. 11 Chapter Division and Cross Section locations (Chapter 8)

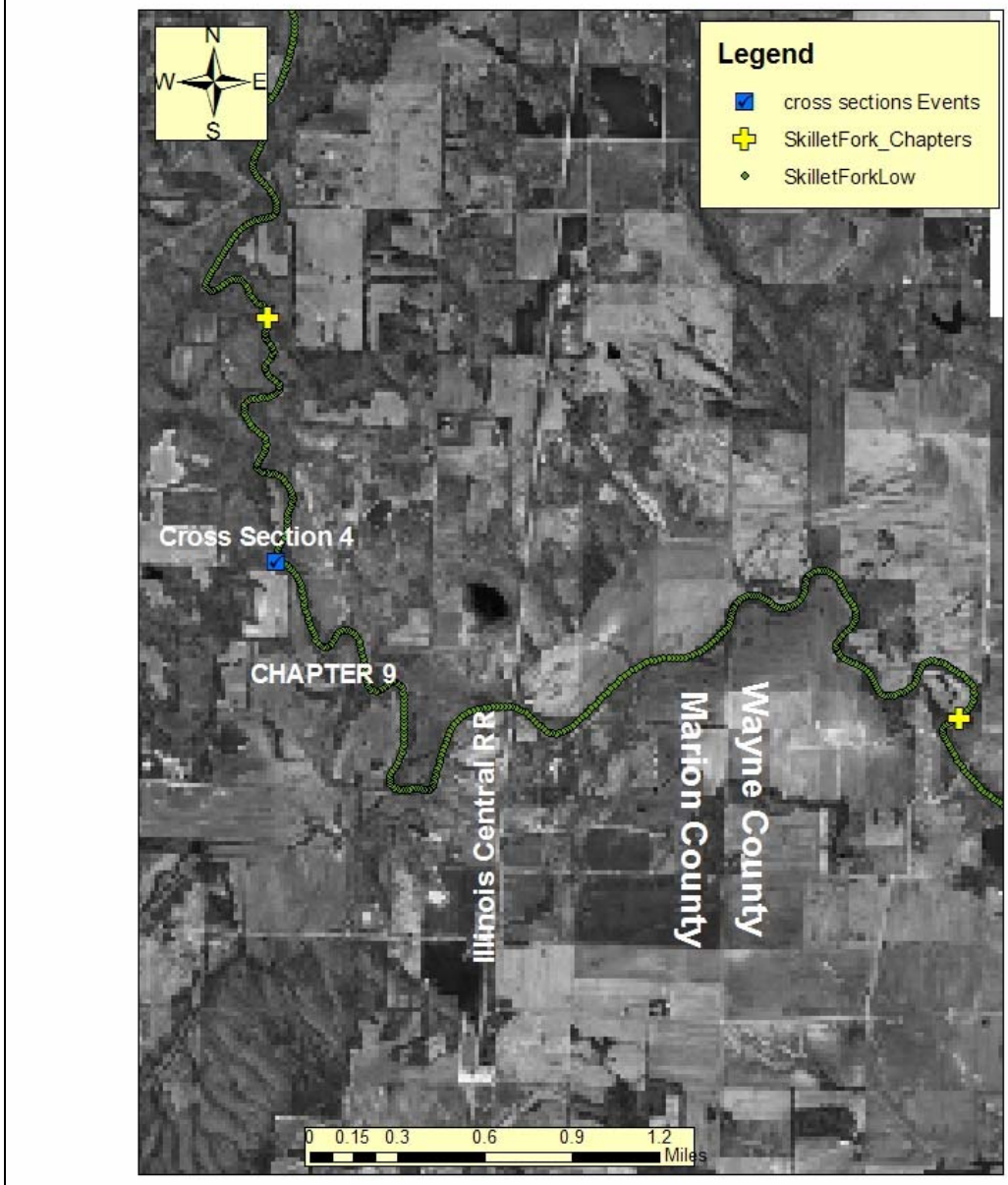


Fig**. 12 Chapter Division and Cross Section locations (Chapter 9)**

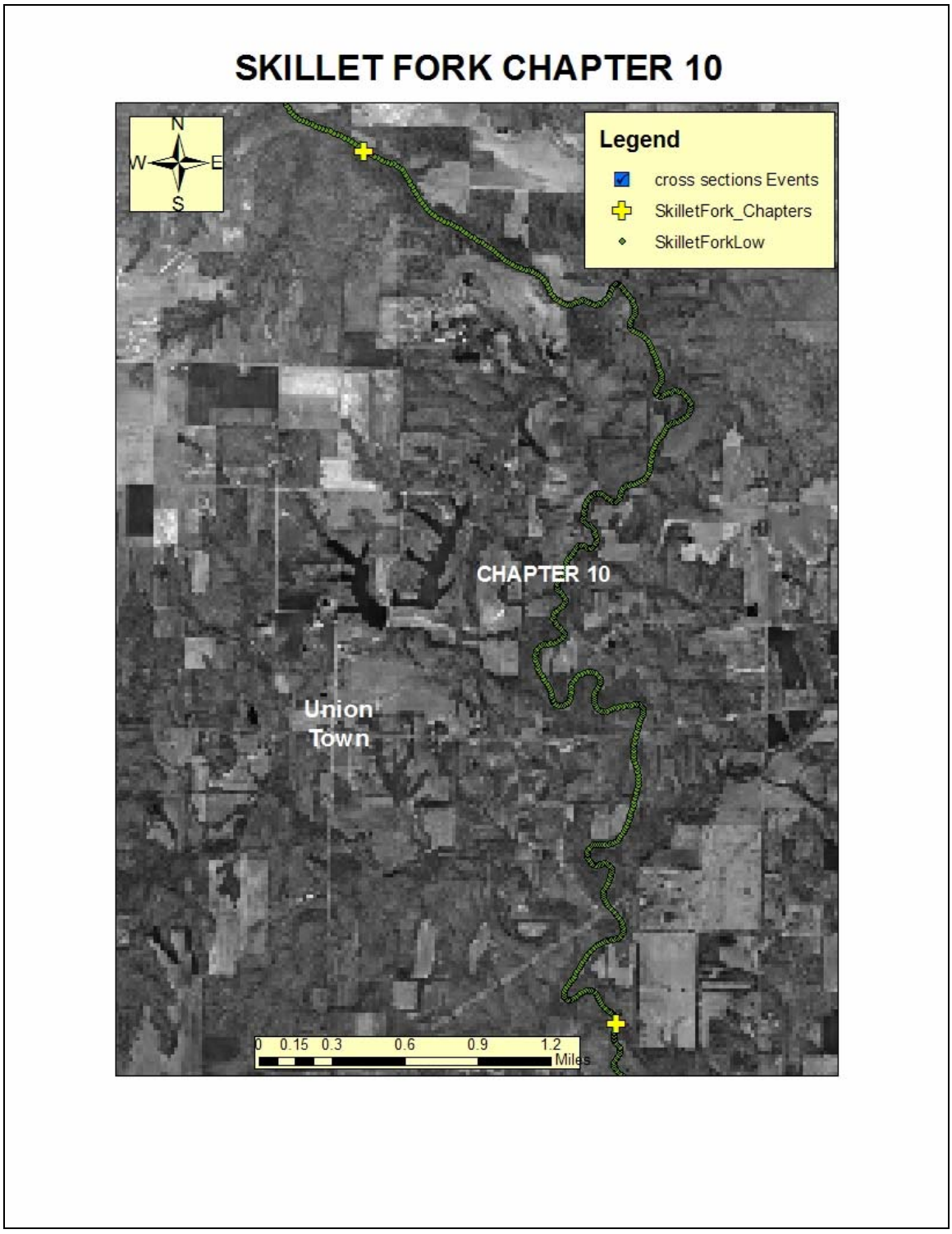


Fig. 13 Chapter Division and Cross Section locations (Chapter 10)

Fig. 14 Chapter Division and Cross Section locations (Chapter 11)

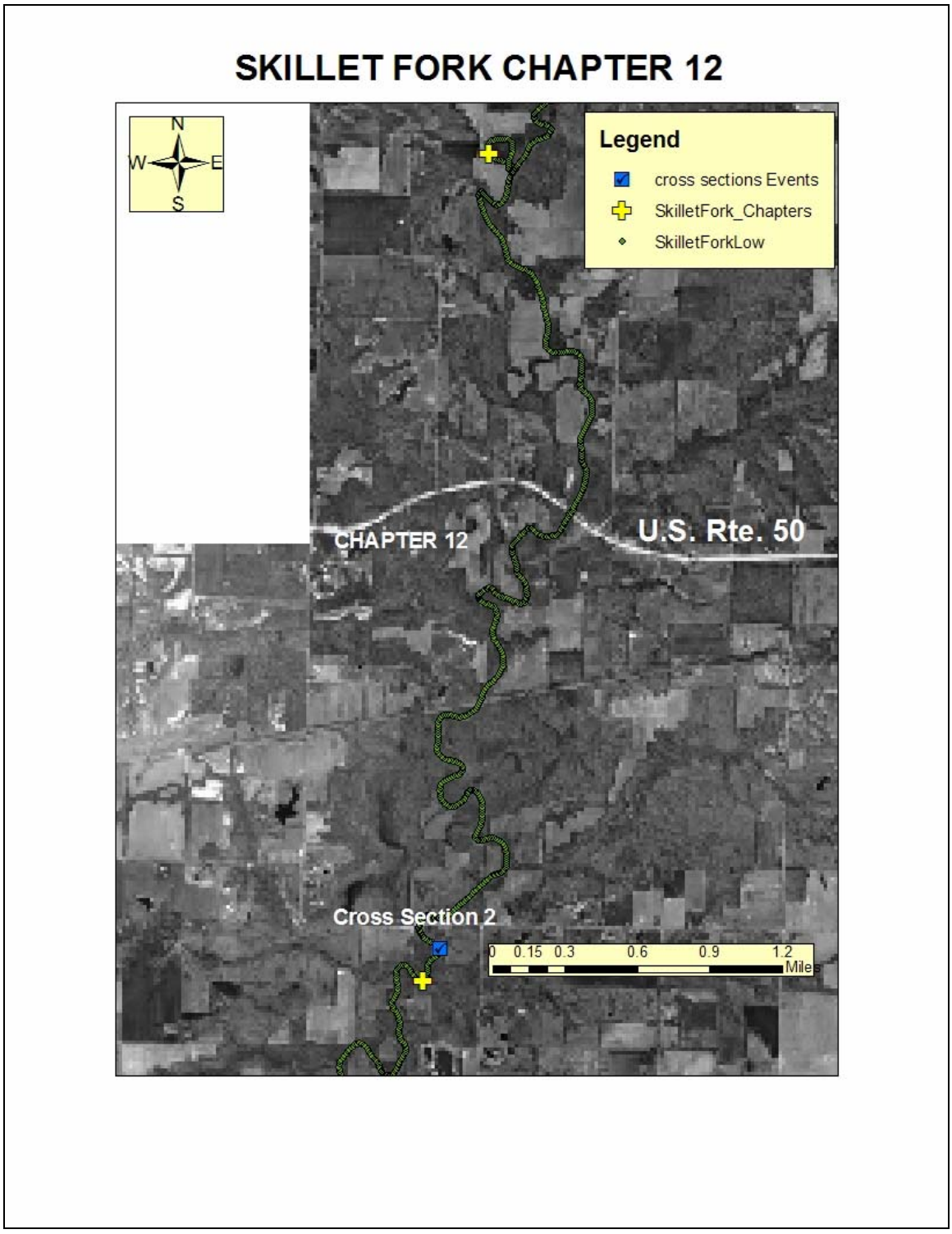


Fig. 15 Chapter Division and Cross Section locations (Chapter 12)

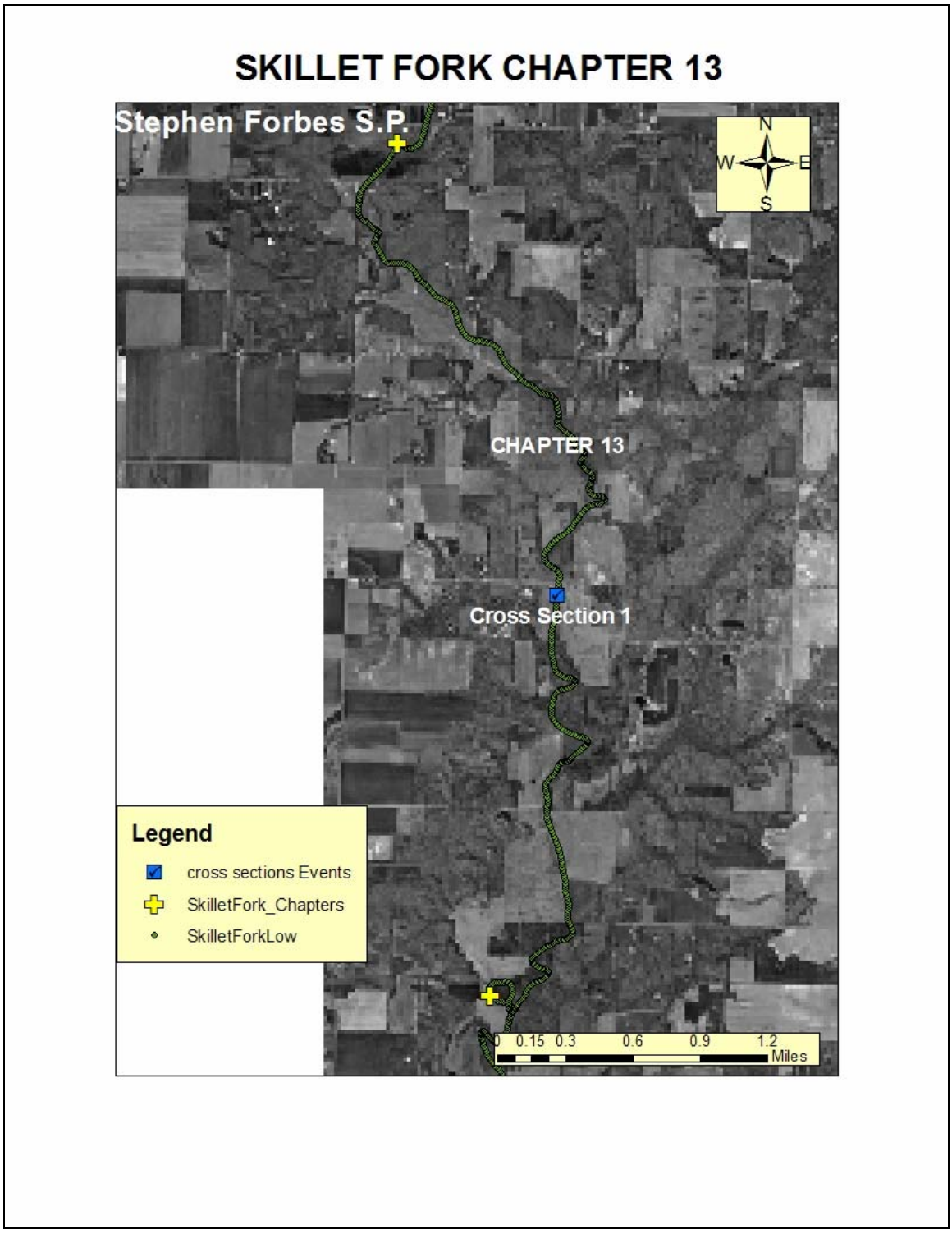


Fig. 16 Chapter Division and Cross Section locations (Chapter 13)

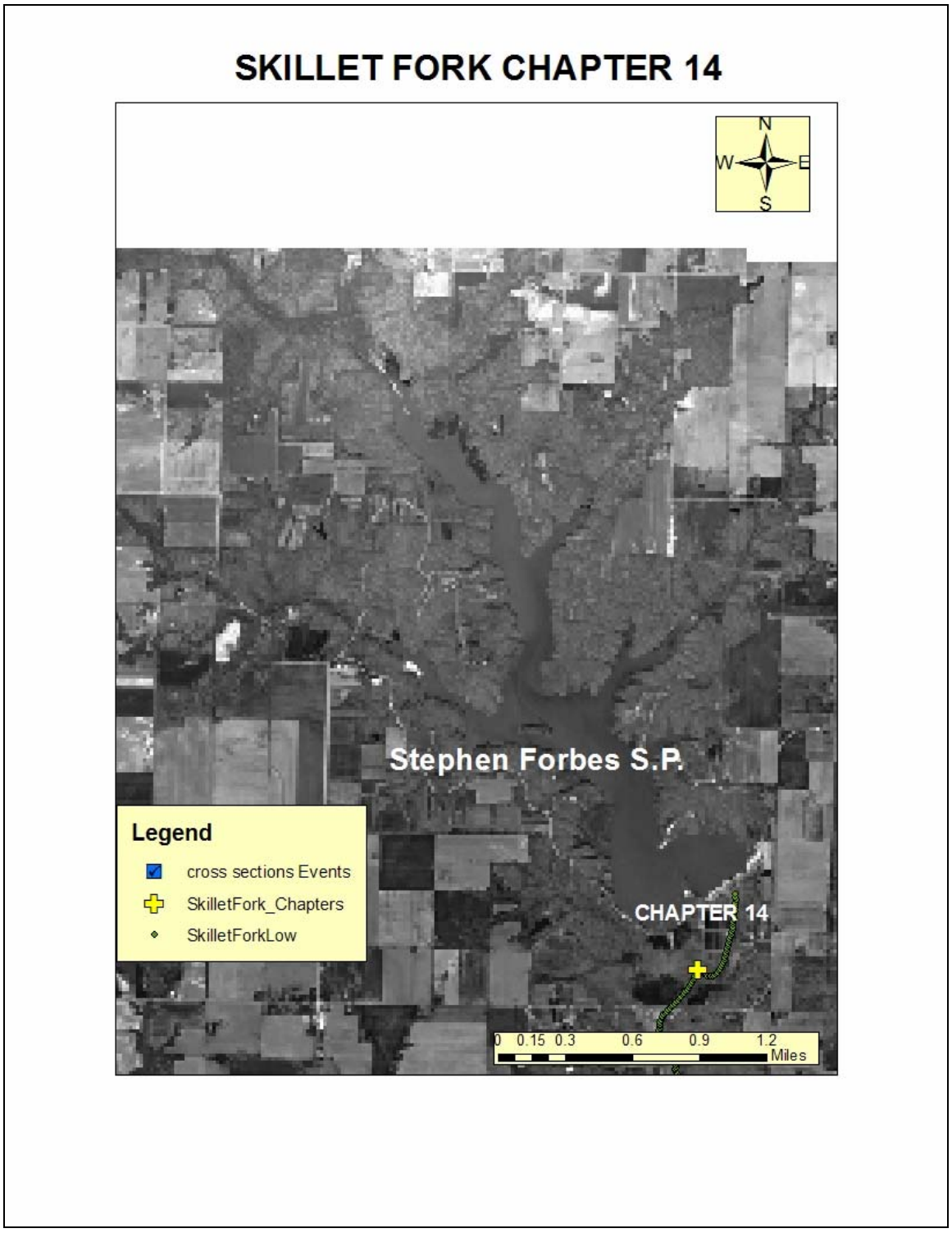


Fig. 17 Chapter Division and Cross Section locations (Chapter 14)

The major factors indicating channel conditions 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								
SKILLET FORK								
CHAPTER	ROCK OUTCROP	LOGJAM	GEOTECH FAILURE	DEPOSITION	BED CONTROL	BREAK POINT	EROSION	SEVERE EROSION
1	0	0	16	0	0	0	35	0
2	0	0	34	0	0	0	17	0
3	0	0	33	0	0	0	20	0
4	0	0	37	10	2	7	33	12
5	0	1	1	0	0	0	2	0
6	1	1	65	1	0	0	26	0
7	4	3	56	2	1	0	16	0
8	0	10	55	1	0	6	19	0
9	3	3	50	2	1	3	5	0
10	1	5	97	0	0	1	1	0
11	3	1	89	2	1	2	3	0
12	0	6	63	1	1	3	8	0
13	0	9	75	5	2	2	11	0
14	0	0	4	0	0	0	0	0
TOTALS	**12**	**39**	**675**	**24**	**8**	**24**	**196**	**12**

Table 1 Features by Chapter Identified with Aerial Assessment

Eight cross sections were taken at selected locations on Skillet 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. 18. Aerial views of cross sections locations and identified features are shown in Figs. 4 thru 17. Exact locations as Eastings and Northings and more detail can be found in Appendix A.

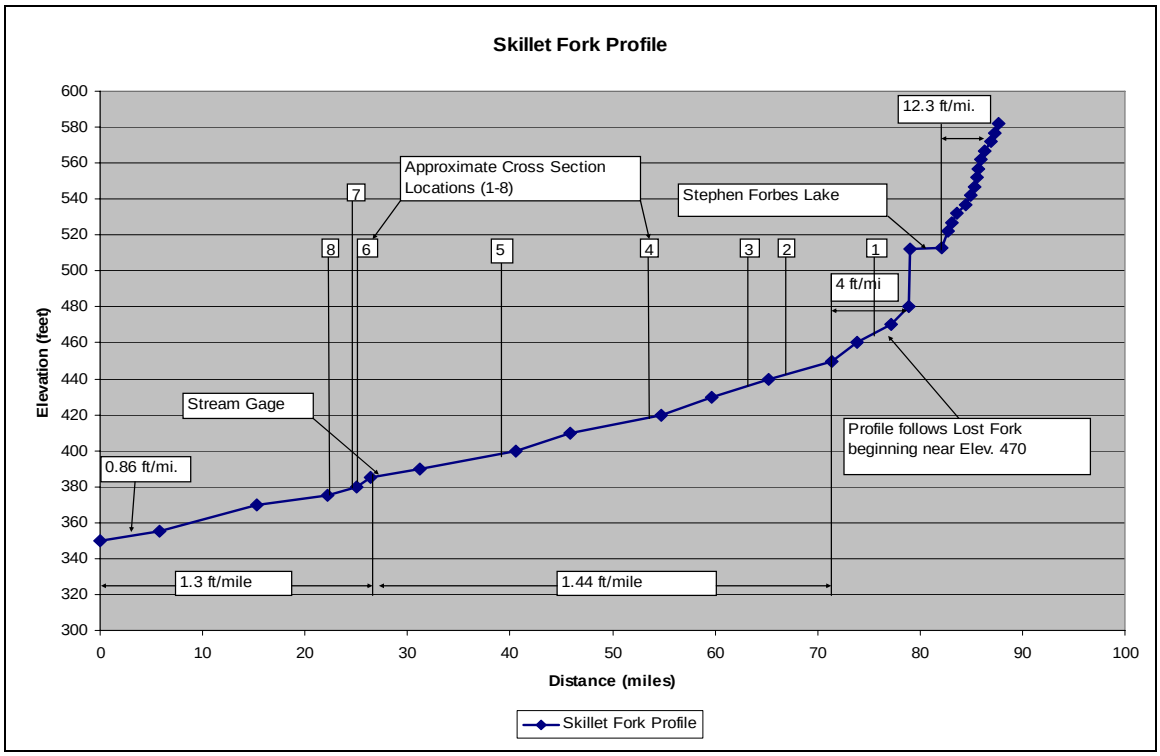


Fig. 18 Cross Section Locations on Skillet Fork Profile

Cross Section Summary-- SKILLET FORK														
X-Sec	Easting	Northing	ADA Sq. Mi.	Valley Slope ft/mi.	Q2 CFS	BKF CFS	Width ft.	Mean Depth	W/D	Vel. FPS	Bedload In. Dia.	CEM (Simon)	CFS sq. mi.	BKF cfs /Q2 cfs
1	349027	4282480	71.82	2.9	2381	593	47	4.58	10.26	2.8	2	3	8.3	0.25
2	348225	4274323	150.49	2.9	4272	1030	57	8.13	7.01	2.2	2	3	6.8	0.24
3	347141	4271302	156.83	2.9	4414	1195	67	7.7	8.70	2.3	1	3	7.6	0.27
4	349329	4261598	234.86	2.9	6072	1530	78	8.11	9.62	2.4	3	3	6.5	0.25
5	358056	4255801	325.77	2.9	7080	1910	82	9.05	9.06	2.6	2	3	5.9	0.27
6	362413	4246184	464	1.9	7639	2367	115	8.6	13.37	2.4	1	3	5.1	0.31
7	364572	4243992	474.5	1.9	7776	2702	121	9.1	13.30	2.5	1	3	5.7	0.35
8	366438	4242025	516.2	1.9	8311	2623	122	8.85	13.79	2.4	3	3	5.1	0.32
Note: 1.37 yr. R.I. = 11 cfs/sq. mi. 1.25 yr. R.I. = 8 cfs/sq. mi. 1.16 yr. R.I. = 6 cfs/sq. mi.														

Table 2 Cross Section Summary

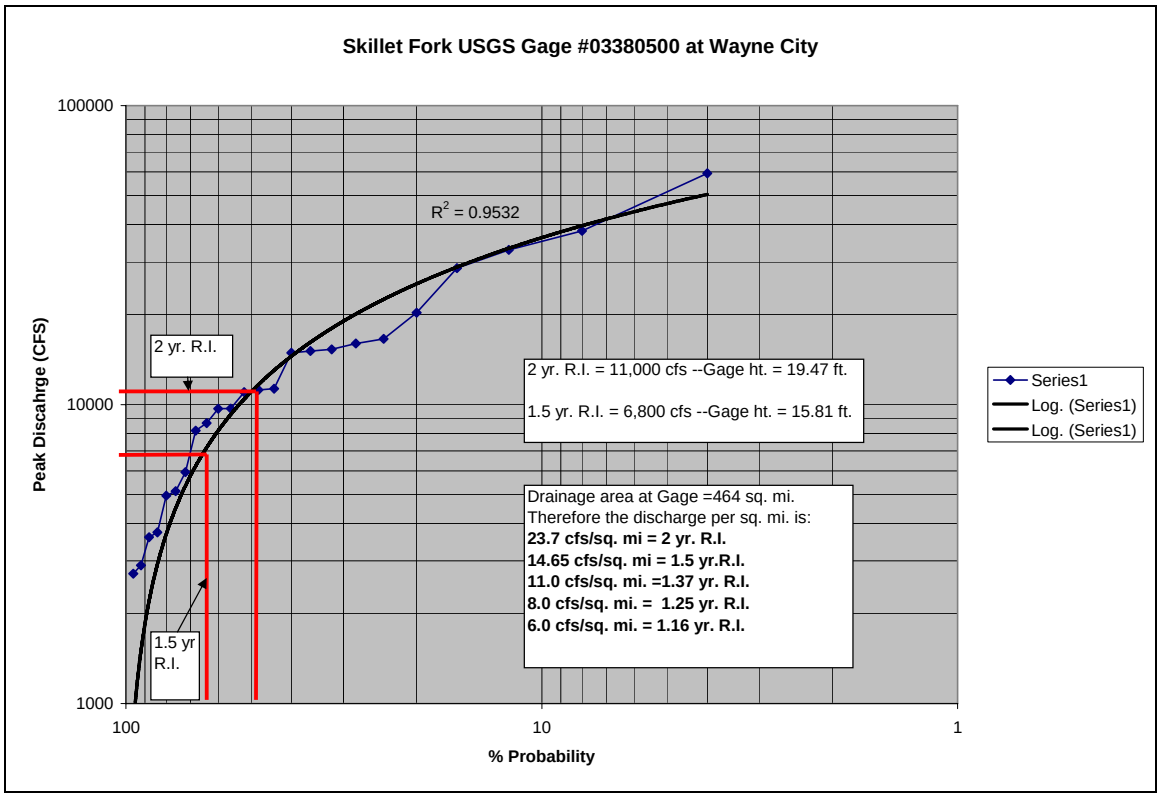


Fig. 19 Annual Maximum Peak Probability Curve: USGS Gage #03380500

USGS stream Gage #03380500 on the Skillet Fork at Wayne City has continuous flow records since 1909. Annual maximum peak discharge for 1981 through 2004 was selected to construct the probability curve found in Fig. 19. This is the only active gage on Skillet Fork and will be used will used to determine the probable flow at all cross section locations. (Gage #03380350 near Iuka has been discontinued since 1982)

A plot of the discharge probability curve from USGS Gage # 03380500 over the last 24 yrs. of continuous record (1981-2004) in Fig. 5 indicates the 2 yr. discharge (50% probability) at approx. 11,000 cfs and the 1.5 yr. discharge (67% probability) at approx. 6800 cfs. The drainage area at Gage # 03380500 near Wayne City is 464 sq. miles; therefore the discharge per sq. mile is 23.7 and 14.65 cfs per sq. mile respectively for the 2 yr. and the 1.5 yr. R.I. discharge.

The field determined "bankfull" discharge for Skillet Fork at cross sections 1 thru 3 ranges from 7.6 to 8.3 cfs/sq. mile. Referring to Fig. 19 an 8.0 cfs/sq. mi. discharge is equal to a 1.25 yr. R.I. based on the Wayne City gage. Discharge at sections 2 and 3 are calculated at the top bank elevation and are therefore by definition the maximum possible bankfull discharges Therefore the cross sections 4 thru 8 should not have significantly higher discharges and in fact, as drainage area increases, the discharge per sq. mi. normally declines somewhat.

This is particularly significant in Skillet Fork as the extent of the downcutting has made it very questionable if there are any "field indicators" in section 4 thru 8 to use as a guide for "bankfull discharge". Consequently a discharge of 8 cfs/sq.mi. has been assumed to be a maximum per unit discharge for all of Skillet Fork. Using this guide there does in fact appear to be a field indicator in sections 4 thru 8 that yields a discharge ranging

between 5.1 and 5.9 cfs/sq. mi. (see cross section plots in Appendix A) Comparing this to the Gage #03380500 data it becomes apparent that this discharge rate is just under the 1.16 yr. R.I. for 6.0 cfs/sq. mi. (Fig. 19) and within the "normal" range for "bankfull discharge". Therefore the "break in slope" shown on the cross sections are taken as field indicators approximating the level at which Skillet Fork is attempting to "rebuild" a floodplain, i.e." geomorphic bankfull".
The "annual maximum peak discharges" have also been plotted for Gage #03380500 and the linear trend line has been applied to indicate long term changes in maximum peaks. Fig. 20 shows this trend to have increased from 8000 cfs over the 95 yr. record at this gage to 14,000 cfs. An increase of 75% in maximum peaks.

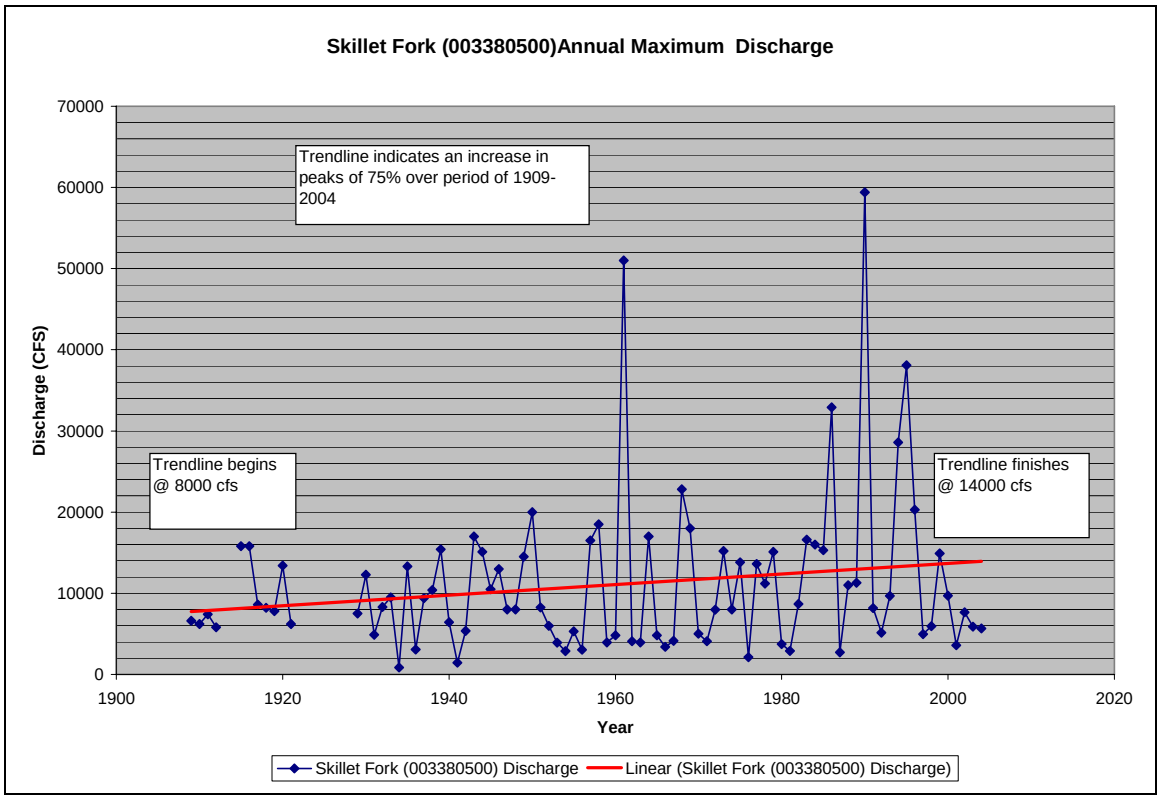


Fig. 20 Trend line of maximum peaks discharges show a 75% increase over past 95 years.

General Observations

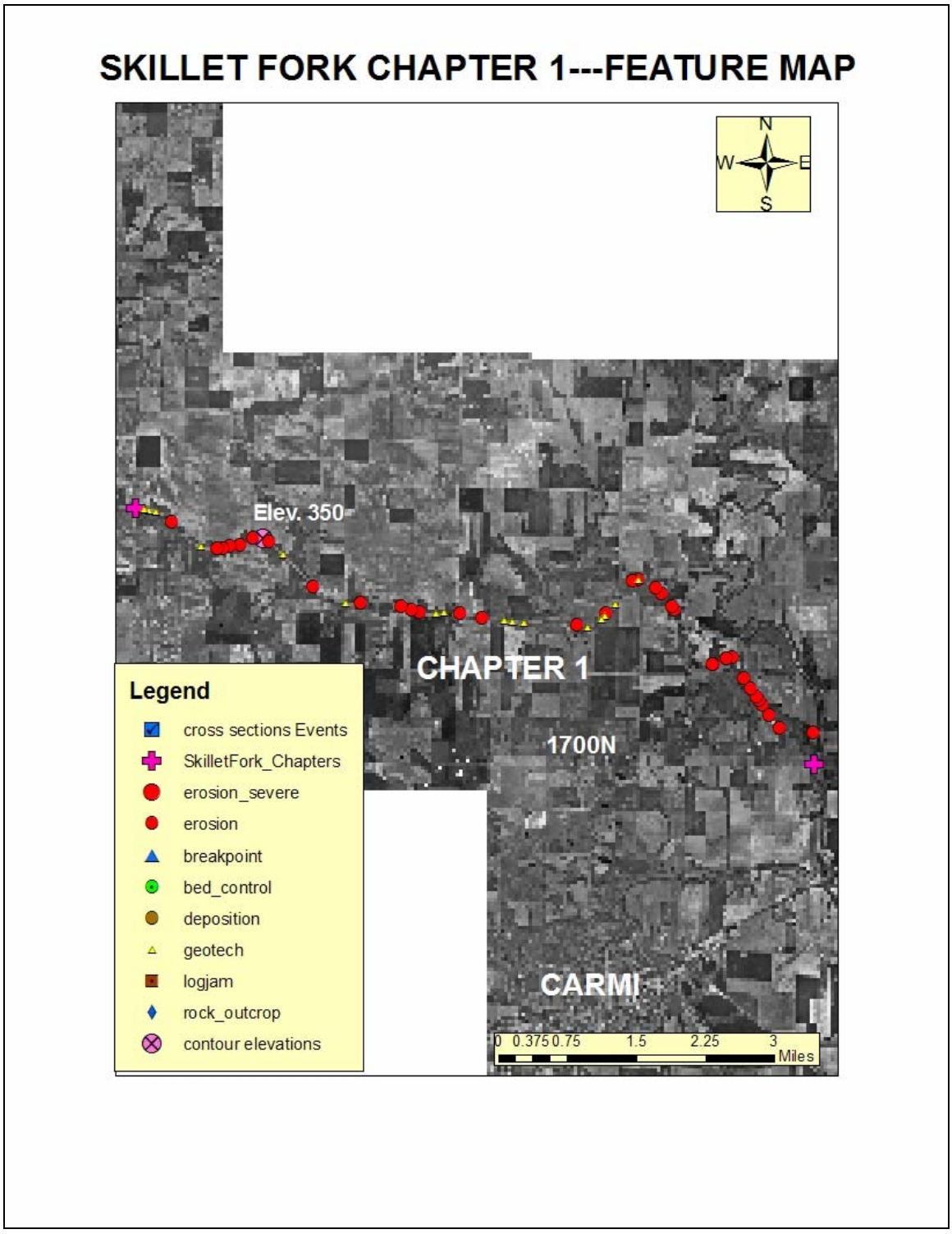
1. Skillet Fork has been extensively channelized, especially below Wayne City.
2. The channel is severely incised from 2 feet at x-sec 4 to almost 14 feet at the exposed bedrock at x-sec 6.
3. The channel gradient calculated from valley slope is low at about 0.00025 (1.4 ft./mi) however there are obviously active knickpoints in Skillet Fork that will continue to migrate upstream.
4. Geotechnical instability caused by glacial till overlain by more permeable soil is creating extensive bank failures throughout Skillet Fork.

5. The combination of incision and geotechnical problems make Skillet Fork extremely unstable.
6. The flow regime of Skillet Fork appears to have changed significantly over the course of the gage data record, increasing the maximum peak flow trend line by 75%. (Fig. 20)
7. There is very minimal point bar development, probably due to the lack of sand and gravel in much of the watershed to produce heavier bedload.
8. The USGS Gage at Wayne City has a weir that serves as a grade control and has been in place for many, many years. (1909?) Yet there are many eroding and failing banks above the gage site indicating that "grade control" alone will not provide a solution to the bank instability.

Recommendations Chapter 1-3

This segment begins at the confluence of Skillet Fork with the Little Wabash River and continues upstream past Interstate 64 for 4.8 miles. Chapter 1 contains segment CA03 which is impaired by DO, pH and Manganese. There are no cross sections in this reach as the flow conditions would not permit wading.
No active knickzones have been observed in this segment although the flow conditions included backwater from the Little Wabash that would have inundated any visible signs of downcutting. However there are 73 geotech failures and 72 active bank erosion sites identified in the aerial assessment.
This entire segment has been channelized and therefore the channel has lost significant length and therefore has a steepened gradient after channelization, although that steepened gradient may all be located upstream as the channel has downcut in response. (See recommendations for Chapter 4 and 5) The geotech failures are a result of oversteepened banks with seep zones where the more permeable soil on the upper bank meets the heavy dense till in the lower bank.
More detailed study needs to be completed before a recommendation can be formulated for this reach. It is not likely that there is an economically feasible solution to the geotech problems and the 72 eroding bends need individual analysis to determine the feasibility of a solution without addressing the geotech problem. There are a couple of alternatives that may be worth investigating however.
First, with a good profile survey and cross sections coupled with good hydrology it may be possible to determine how much more "adjustment" this lower end of Skillet Fork needs to reach stability at a CEM stage 6 where a new floodplain is developed and effective bank heights are reduced. An analysis can then be made of the sediment and related pollutants that could be reduced or eliminated by mechanically creating the needed floodplain and/or reconnecting Skillet Fork with its former floodplain rather than allowing the CEM to continue naturally.
Second, it may be worthwhile, without a large survey and modeling effort to simply try some "test" sites in this reach where a narrow "bench" is established on one or both sides at the "geomorphic bankfull" (1.1 to 1.2 yr. R.I. flow elevation) allowing the establishment of vegetation and dissipation of energy. The "bench" may need additional

protection with STP, Bendway Weirs or Stream Barbs. This approach if applied in several locations with several “alternative” designs would provide valuable information that could then be applied elsewhere in Skillet Fork and other similarly incised channels in southeastern Illinois.
No specific design details or cost estimates can be provided at this time.


SKILLET FORK CHAPTER 1---FEATURE MAP
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rock_outcrop
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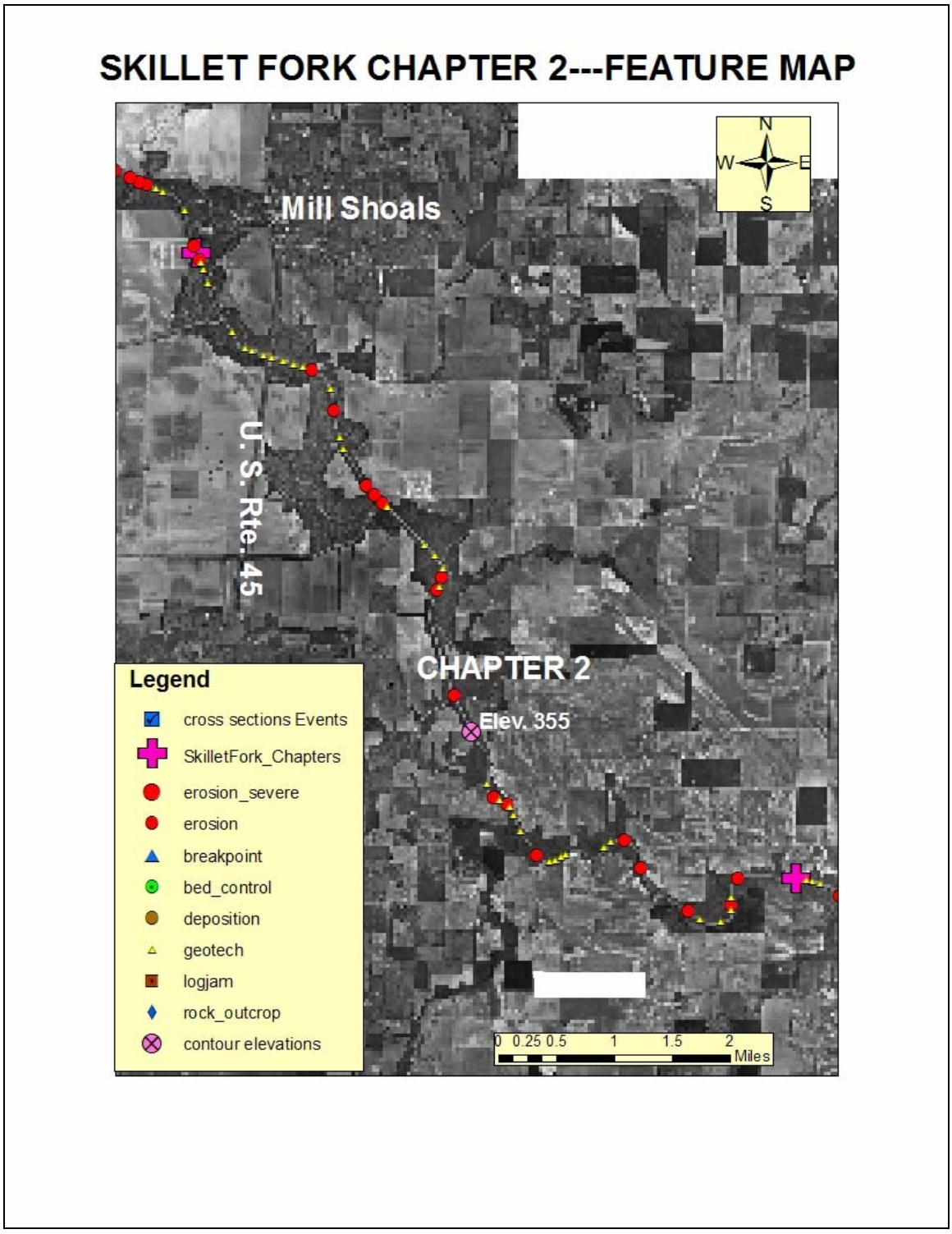
Miles

Fig. 21


SKILLET FORK CHAPTER 2---FEATURE MAP
Mill Shoals
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CHAPTER 2
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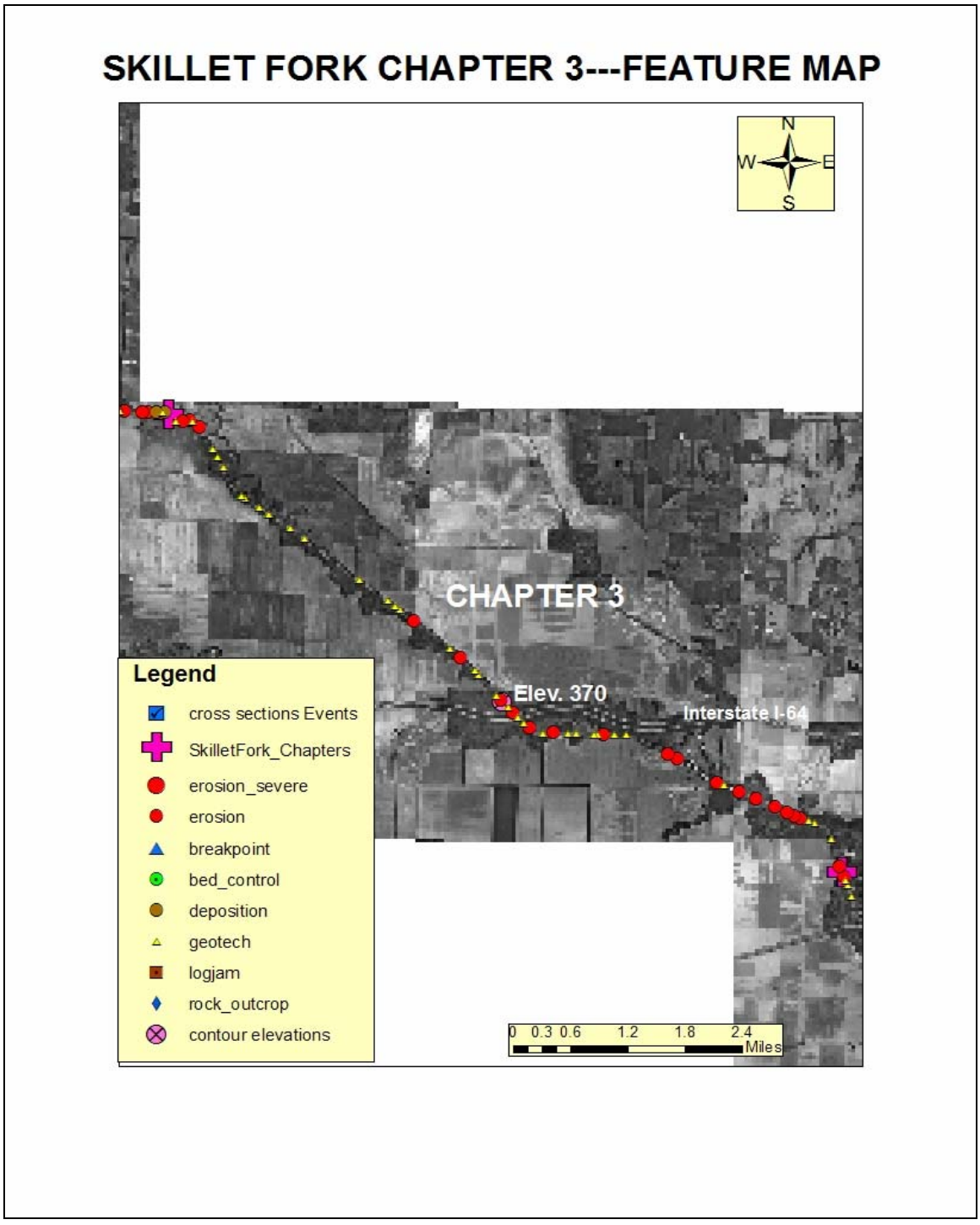
Fig. 22


SKILLET FORK CHAPTER 3---FEATURE MAP
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contour elevations
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Miles

Fig. 23

Recommendation—Chapter 4 and 5

This segment begins approximately 4.8 miles above I-64 and extends upstream to Wayne City and USGS Gage #03880500. It is about 7 miles long and contains most of the TMDL segment CA05 impaired by manganese, DO and pH. Cross sections 6, 7 and 8 are in this chapter as this is by far the most critical chapter in all of Skillet Fork. There are 37 geotechnical failures, 33 eroding bank sites and another 12 erosion sites classified as "severe", the only such sites identified in the aerial assessment.

The first observed "breakpoint" or knickzone is at 41:01 on DVD Disc 1 and the entire reach has an unstable bed up to 48:38 on DVD Disc 1 where there is a solid bedrock geologic control in the channel bed. Downstream of the bedrock the channel continues to incise and the banks are oversteepened and failing badly. Geomorphic bankfull elevations at the 1.1 to 1.2 yr. R.I. are 7 to 8 feet or more below the top bank indicating that much incision has already occurred. With soils naturally high in manganese, this reach is likely contributing significantly to the impairment. It seems apparent that the channelization from Wayne City to the Little Wabash River has generated major downcutting in Skillet Fork that is now concentrated in this 7 mile reach.

It also seems apparent that Grade Control alone will not provide a solution to the channel instability. In the reaches immediately upstream of the USGS gage where the headcut has been controlled there continues to be many geotechnical failures.

Therefore the recommended solution for Chapter 4 is to use Grade Control Structures to stabilize the bed and raise the flowline, plus bank stabilization practices. Preliminary data indicates that Rock Riffle Grade Controls can be built to a height of 5.0 ft above the existing bed with no effect on out of bank flow or backwater. The recommended spacing for these structures is typically the natural riffle spacing of 6 bankfull widths, however in streams without heavy bedload it may be feasible to install grade control at a wider spacing to accomplish the goal of bed stability at a reduced cost. The rational behind the wider spacing is the ability of the stream to continue to pass the silt and clay size particles that are predominant in Skillet Fork even after creating a riffle-pool sequence. This seems borne out at the existing low water crossings and the USGS Gage site where sediment accumulation has not been a major problem. Therefore the recommended spacing will be increased to 12 bankfull widths of this reach.

The lateral bank stabilization practices recommended are Stone Toe Protection and/or Stream Barbs for the eroding areas between the Rock Riffles. Table 3 provides the estimated quantities and cost for implementation.

TREATMENT --CHAPTERS 4 through 5					
Lateral Bank Treatment					
Chapter	**Erosion Sites**	**Average Length(ft)**	**Total Length**	**Average Cost/foot**	**Total Cost**
4	45	750	33750	$40.00	$1,350,000.00
5	2	500	1000	$40.00	$40,000.00
Total	**47**		**34750**		**$1,390,000.00**
Rock Riffle Grade Control					
	Rock Riffles	**Average Tonnage**	**Ave. Cost Ton**	**Average Cost/Riffle**	
4	25	2600	$40.00	$104,000.00	$2,600,000.00
5	n/a	0	$0.00	$0.00	$0.00
Total	**25**				$2,600,000.00

Table 3 Treatment recommended for Chapters 4 and 5

Fig. 24 Exposed bedrock in Skillet Fork is a geologic control preventing headcut from advancing upstream.

Fig. 25 Severe erosion below active knickzone at 40:37 on DVD disc 1.

Fig. 26 Eroding bend at DVD 46:10. What appears to be a central bar of deposition is really a pedestal of residual material about 2 to 3 feet above the current channel bed.

Fig. 27 Bedrock grade control at Cross Section 6

Fig 28 Clay and Shale Bed at Cross Section 8

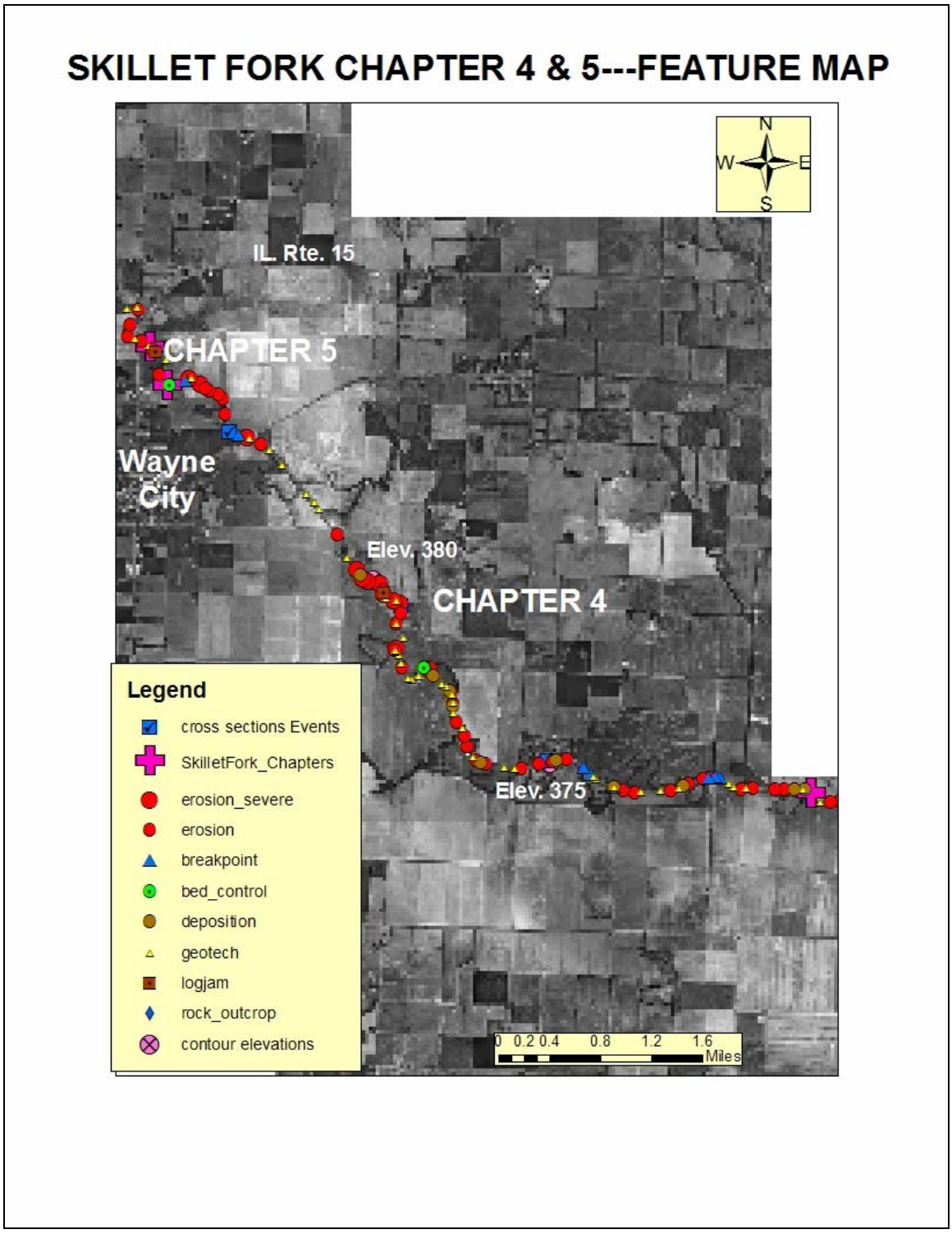

SKILLET FORK CHAPTER 4 & 5---FEATURE MAP
N
W
E
S
IL. Rte. 15
CHAPTER 5
Wayne City
Elev. 380
CHAPTER 4
Elev. 375
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations
0 0.2 0.4 0.8 1.2 1.6
Miles

Fig. 29

Recommendation-- Chapter 6-14

These chapters begin at Rte. 15 at the north edge of Wayne City and extend upstream to Stephen Forbes State Park on Lost Fork. This segment contains the impaired segments CA06 and CA09. They are represented by cross sections 1 thru 5 and all are classified as CEM 3. X-sec 2 and 3 are in CEM stage 3 even though they are well connected to the floodplain and used as the guide for "geomorphic bankfull" they have a hard clay bed with no bedload in the riffles and are definitely beginning to incise.

The significant element in this entire reach is the number of geotechnical failures found with 554 sites identified. Ground investigation found that these are the result of the same scenario of silty material over impervious glacial till that is creating a seep zone at the interface. Even though the incision is much less severe at 2 to 3 feet at cross sections 1 and 4 this seepage zone is above the flowline of the channel and is therefore resulting in geotechnical bank failures. There are also 89 identified bank erosion sites that are not the result of geotechnical conditions.

The number of sites in this reach suggests that once again, if the soils are naturally high in manganese that the streambank contribution must be very significant.

The recommended solution for this entire reach is to apply Rock Riffle Grade Controls to halt the incision process, creating a riffle-pool stream system to dissipate energy and create positive pore pressure in the seepage zones to stabilize the geotechnical problems. To do this successfully the base flow levels must be above the seepage zone and fortunately due to the naturally low gradient of Skillet Fork the Rock Riffles can be up to 4.5 ft. high in Chapters 6 thru 12 with no effect on out of bank flow or backwater. While a good profile of Skillet Fork will be required to design riffles, this preliminary data suggests that the riffle heights can be built to create the positive pore pressure required in most locations. Riffles in Chapters 13 and 14 will be limited to about 2.0 feet.

The Rock Riffle Grade controls must be supplemented with some lateral bank protection in the 89 identified erosion sites without a geotechnical problem. In addition some sites identified as geotechnical are actually a combination of "erosion" and "geotech problems" and will also need lateral bank protection. For planning purposes 50% of the geotechnical sites have been assumed to also need lateral bank treatment. Stone Toe Protection is the recommended bank treatment for this segment due to the narrow width/depth rations found in this reach.

As in Chapters 4 and 5, the bedload in this reach is silt and clay size particles and the recommended riffle spacing will be 12 bankfull widths.

Table provides preliminary estimates of the materials and cost required to treat Chapters 6 thru 14.

`	TREATMENT --CHAPTERS 6 THRU 14				
	Lateral Bank Protection with Stone Toe Ptotection (STP)				
Chapter	Erosion Sites	Average Length(ft)	Total Length	Average Cost/foot	Total Cost
6	58	400	23200	$25.00	$580,000.00
7	44	400	17600	$25.00	$440,000.00
8	46	400	18400	$25.00	$460,000.00
9	30	400	12000	$25.00	$300,000.00
10	49	400	19600	$25.00	$490,000.00
11	48	325	15600	$25.00	$390,000.00
12	39	275	10725	$25.00	$268,125.00
13	48	250	12000	$25.00	$300,000.00
14	2	250	500	$25.00	$12,500.00
Total	364		129625		$3,240,625.00

	Rock Riffle Grade Control				
Chapter	Rock Riffles	Average Tonnage	Ave. Cost Ton	Average Cost/Riffle	Total Cost
6	32	1100	$30.00	$33,000.00	$1,056,000.00
7	29	1100	$30.00	$33,000.00	$957,000.00
8	28	1100	$30.00	$33,000.00	$924,000.00
9	24	1000	$30.00	$30,000.00	$720,000.00
10	28	1000	$30.00	$30,000.00	$840,000.00
11	38	1000	$30.00	$30,000.00	$1,140,000.00
12	31	850	$30.00	$25,500.00	$790,500.00
13	42	250	$30.00	$7,500.00	$315,000.00
14	3	250	$30.00	$7,500.00	$22,500.00
Total	255				$6,765,000.00

Table 4 Treatment recommended for Chapters 6 thru 14

Fig. 30 Cross Section 1 has a hard clay bed throughout entire reach; downcutting

Fig. 31 Bank failure below Cross Section 2 showing mature trees ready to fall

Fig. 32 Geotech failure at Cross Section 2

Fig. 33 Geotech problem at interface of silt over glacial till at Cross Section 2

Fig. 34 Sandstone bed in riffle at Cross Section 4

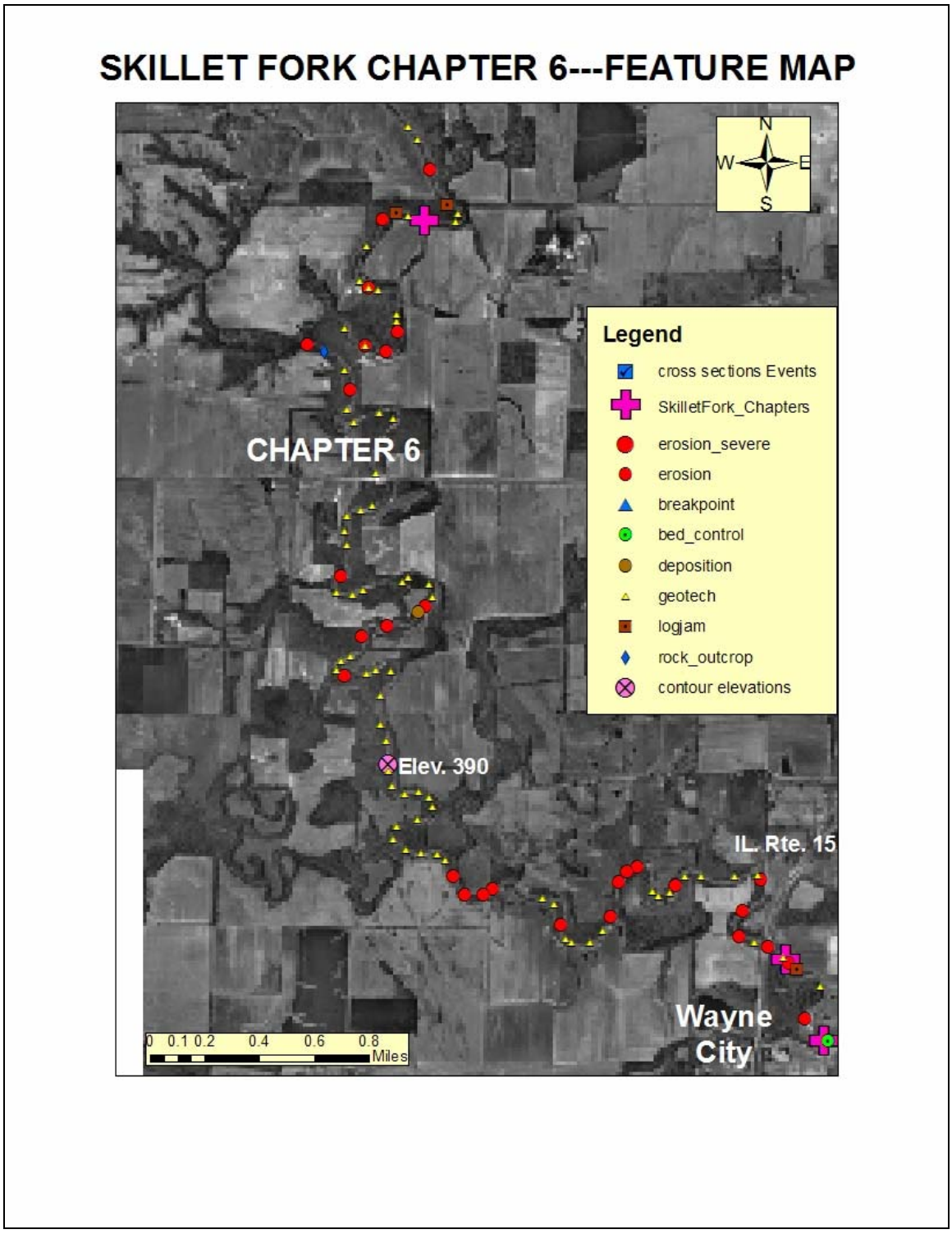

SKILLET FORK CHAPTER 6---FEATURE MAP
N
W
E
S
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations
CHAPTER 6
Elev. 390
IL. Rte. 15
Wayne City
0 0.1 0.2 0.4 0.6 0.8
Miles

Fig. 35

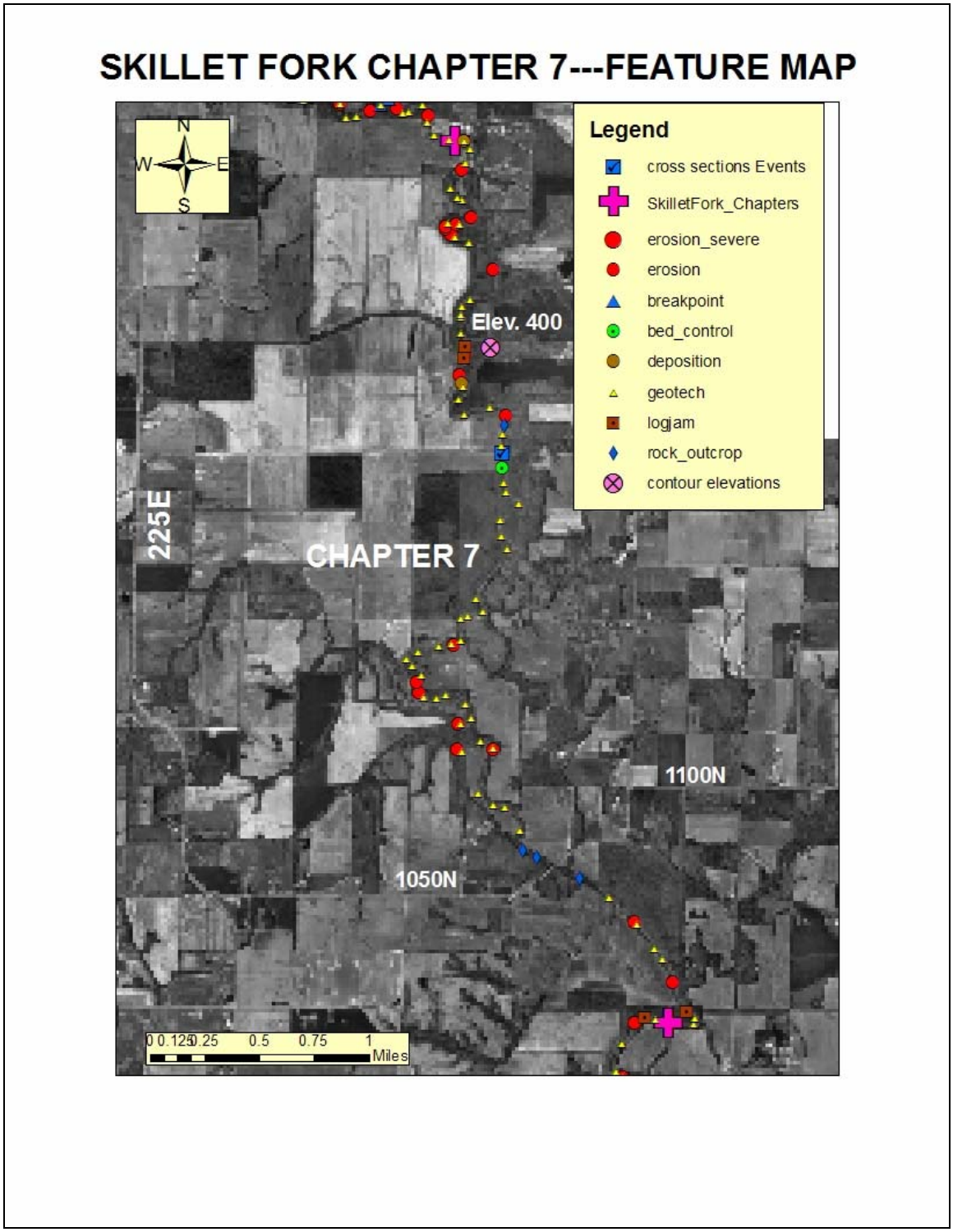

SKILLET FORK CHAPTER 7---FEATURE MAP
N
W
E
S
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations
Elev. 400
225E
CHAPTER 7
1100N
1050N
0 0.125 0.25 0.5 0.75 1
Miles

Fig. 36

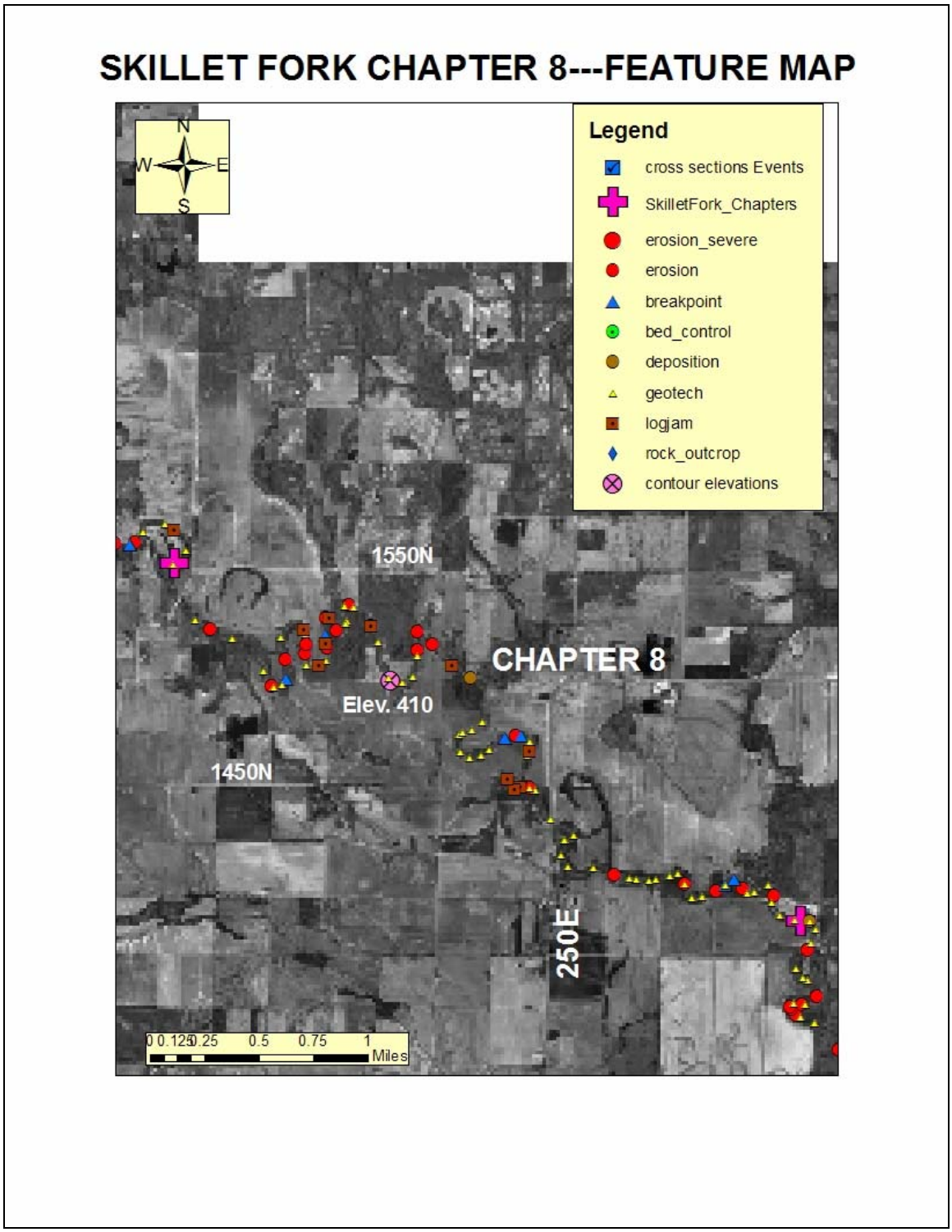

SKILLET FORK CHAPTER 8---FEATURE MAP
N
W
E
S
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations
1550N
CHAPTER 8
Elev. 410
1450N
250E
0 0.125 0.25 0.5 0.75 1
Miles

Fig. 37

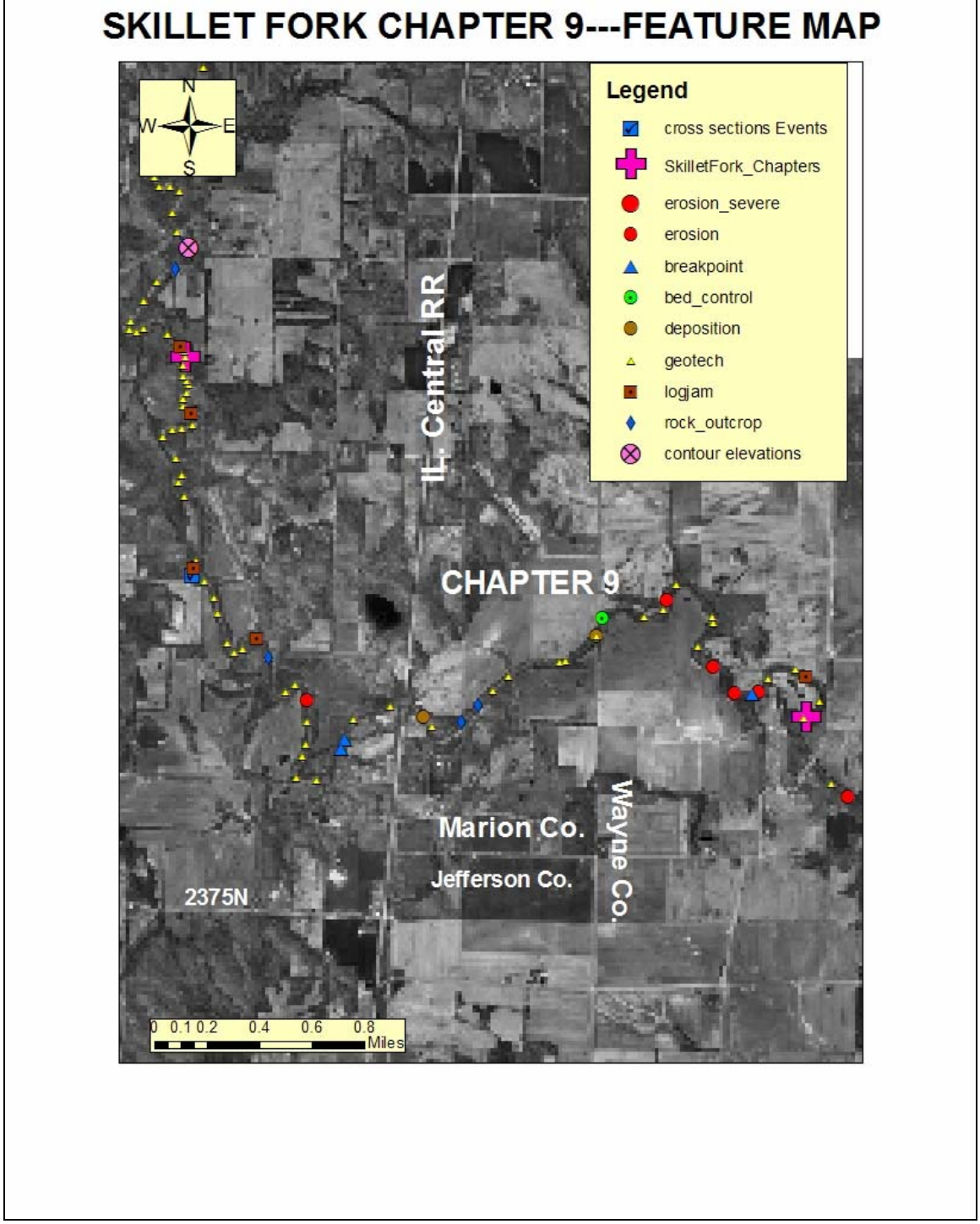

SKILLET FORK CHAPTER 9---FEATURE MAP
N
W
E
S
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations
IL. Central RR
CHAPTER 9
Marion Co.
Jefferson Co.
Wayne Co.
2375N
0 0.1 0.2 0.4 0.6 0.8
Miles

Fig. 38

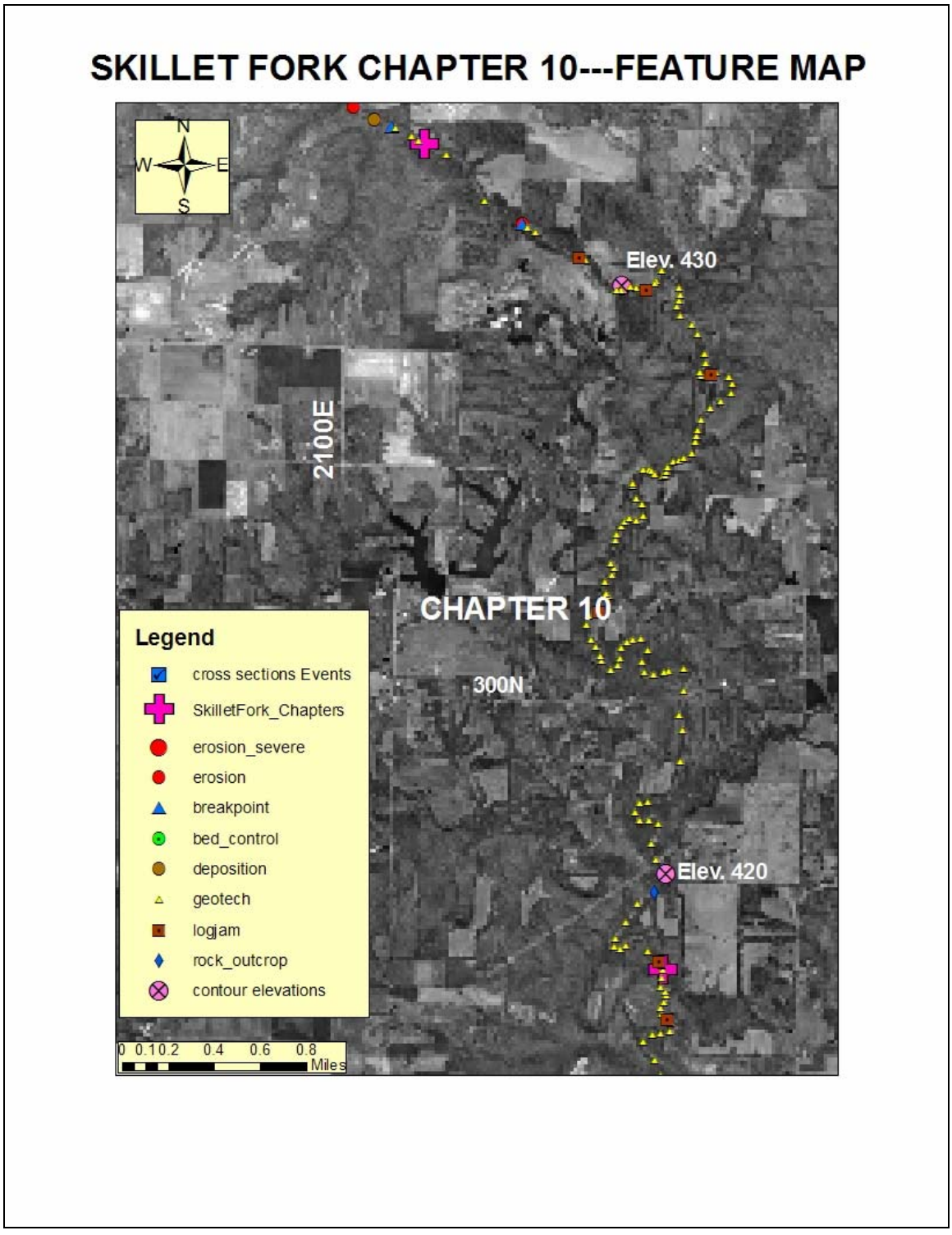

SKILLET FORK CHAPTER 10---FEATURE MAP
N
W
E
S
Elev. 430
2100E
CHAPTER 10
300N
Elev. 420
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations
0 0.1 0.2 0.4 0.6 0.8
Miles

Fig. 39

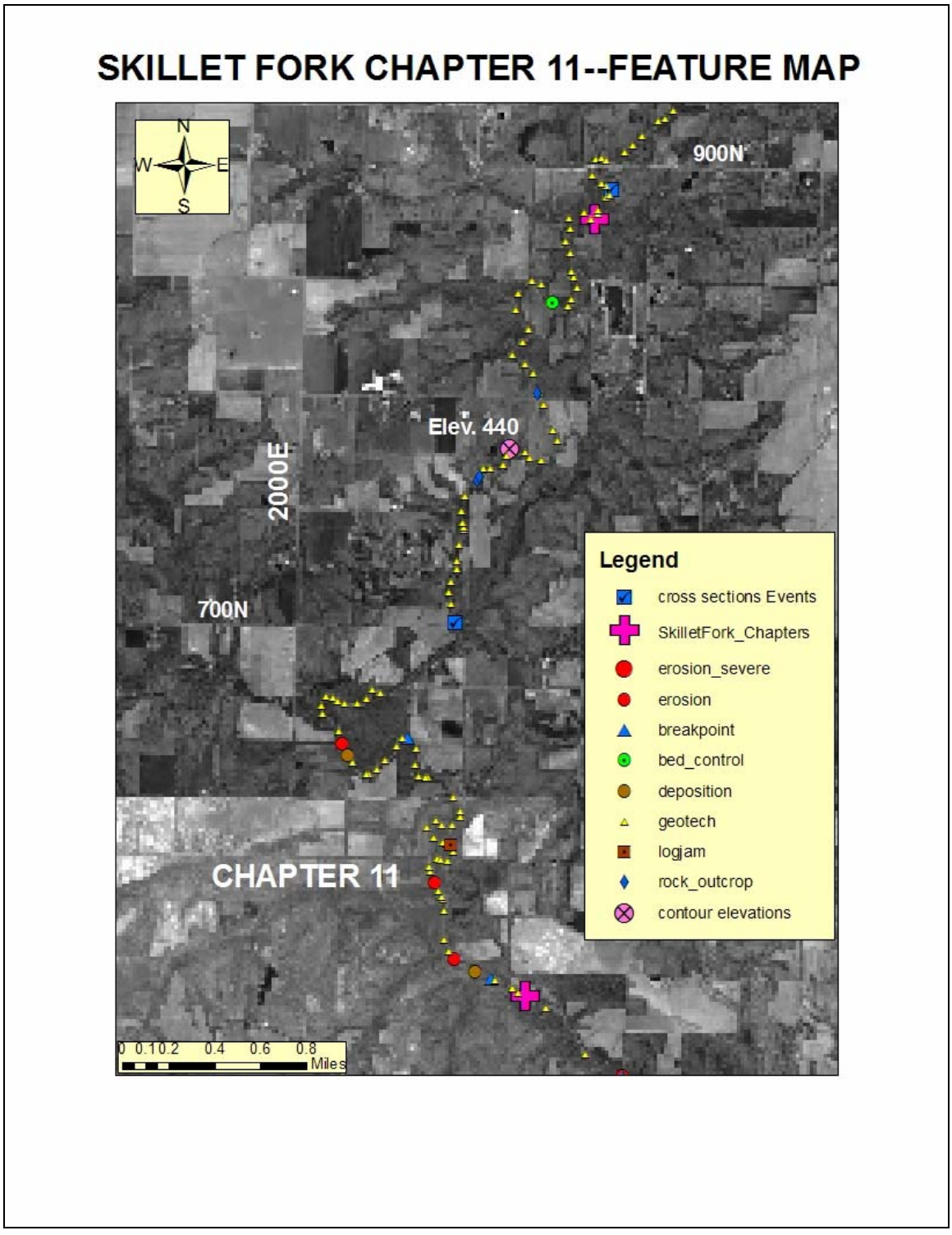

SKILLET FORK CHAPTER 11--FEATURE MAP
N
W
E
S
900N
Elev. 440
2000E
700N
CHAPTER 11
0 0.1 0.2 0.4 0.6 0.8
Miles
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations

Fig. 40

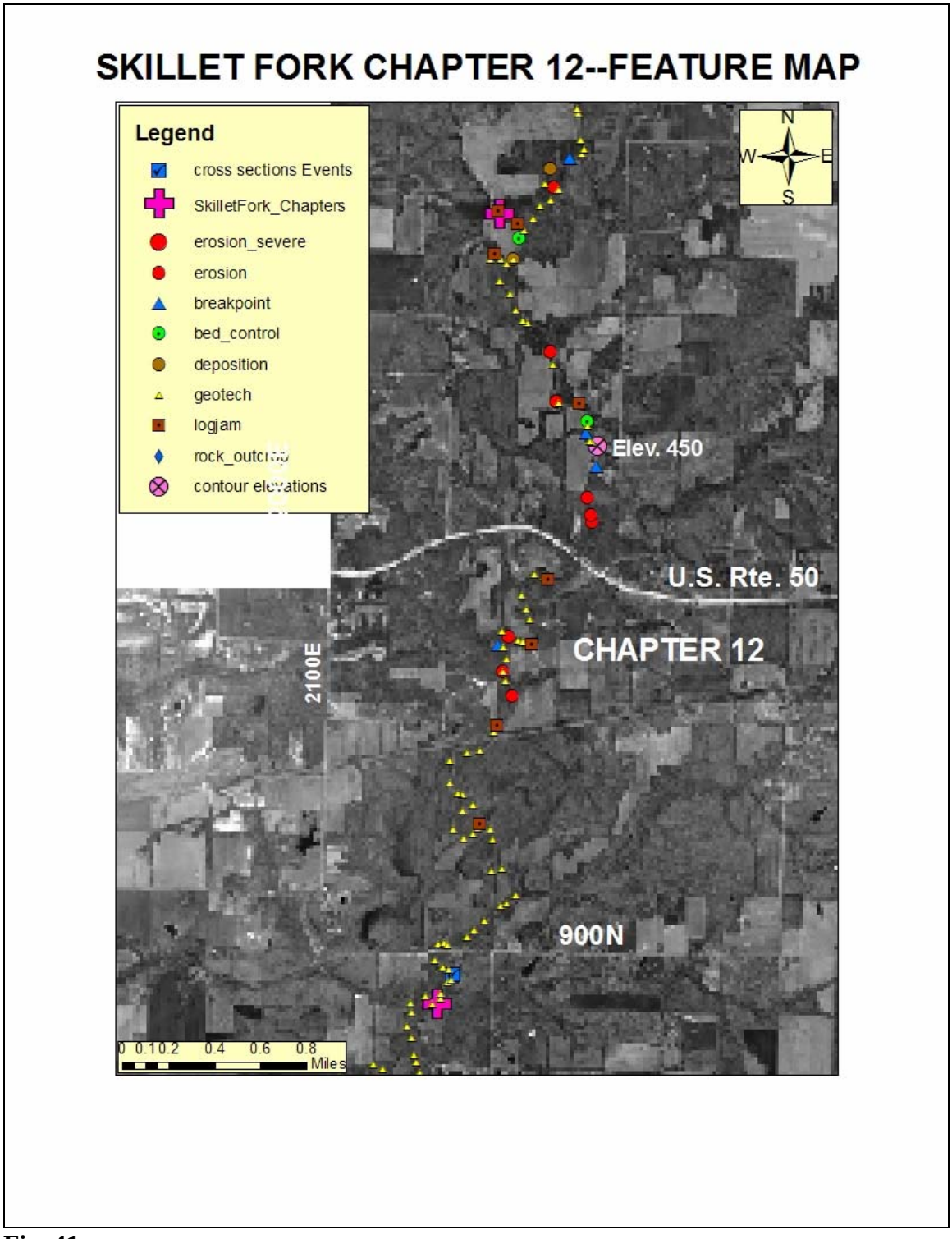

SKILLET FORK CHAPTER 12--FEATURE MAP
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations
N
W
E
S
Elev. 450
U.S. Rte. 50
CHAPTER 12
2100E
900N
0 0.1 0.2 0.4 0.6 0.8
Miles

Fig. 41

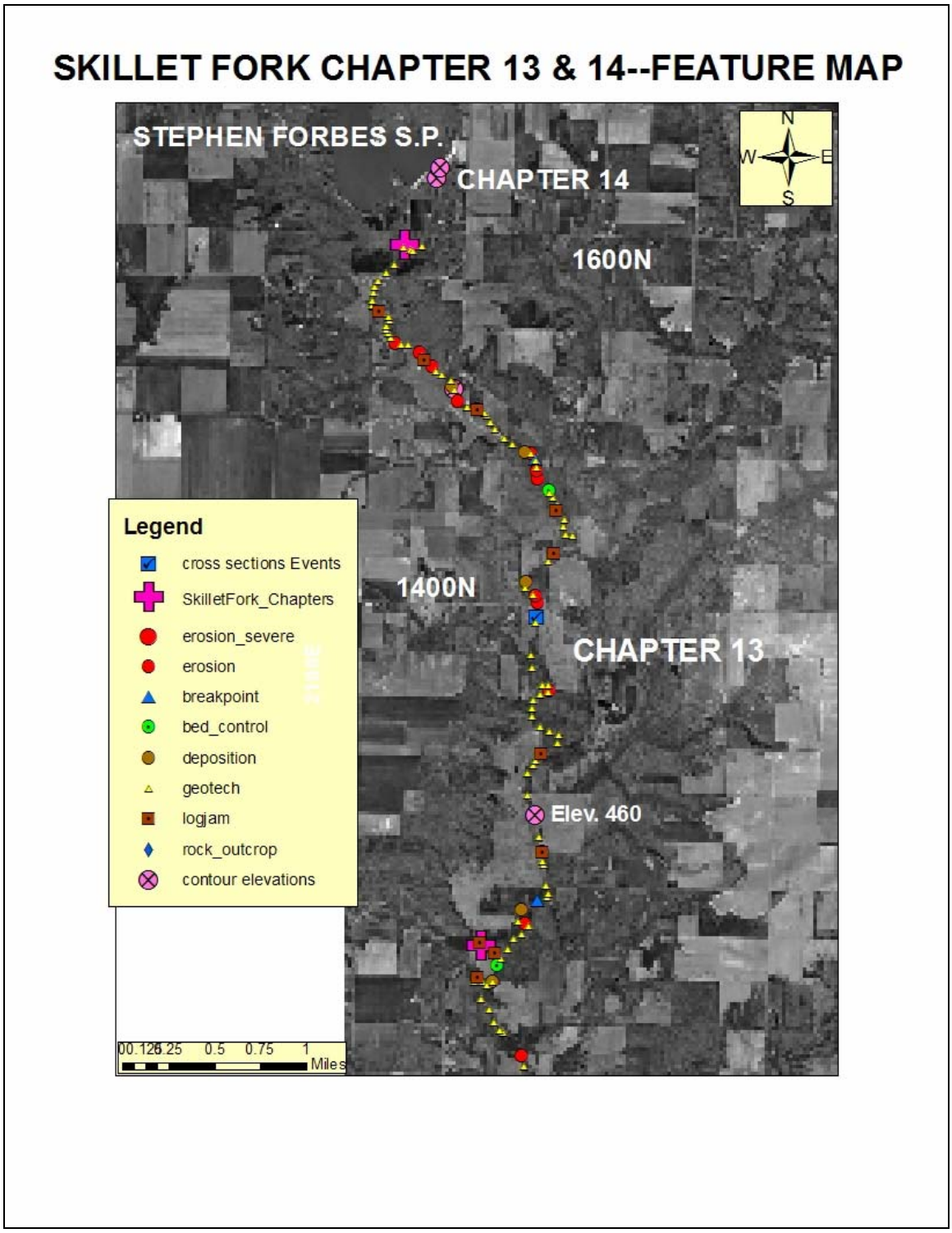

SKILLET FORK CHAPTER 13 & 14--FEATURE MAP
STEPHEN FORBES S.P.
CHAPTER 14
1600N
1400N
CHAPTER 13
Elev. 460
N
W
E
S
Legend
cross sections Events
SkilletFork_Chapters
erosion_severe
erosion
breakpoint
bed_control
deposition
geotech
logjam
rock_outcrop
contour elevations
0 0.125 0.25 0.5 0.75 1
Miles

Fig. 42

APPENDIX A

CROSS SECTION DATA

Stream Stabilization I & E Form

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

County Marion T. R. Sec.

Date 11/17/2005 By Wayne Kinney

Stream Name Skillet Fork UTM Coord. E349027 N4282480

Landowner Name X-sec1

Drainage Area 71.82 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	79 ft.	Cross Sectional Area	408	sq. ft.
	Depth	5.2 ft.			

Reference Stream Gage:

Skillet Fork near Iuka Station No. 03380350 Gage Q_2 5000 cfs

Drainage Area 208 sq.mi Regression (3850 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.9 *ft./mi. (user-entered)* Regression Q_2 1834 cfs

ft/mi (from worksheet) Rainfall 3.40 in *(2 yr, 24 hr)* Adjusted Q_2 2381 cfs

0.0005 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge:

950 to 1910 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	47	*ft.*	Contour Interval		feet
Mean Bankfull Depth	4.58	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	10.26				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	6.2	*ft.*	Surveyed:	0.00076 *ft./ft.*	Cross-Section 575 *cfs*
Width at twice max. depth	1000	*ft.*	Estimated:	*ft./ft.*	Basic field data 610 *cfs*
(12.4 ft.)					Selected Q 593 *cfs*
Entrenchment Ratio	21.28		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:	2.67	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.83	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.8	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

8.3 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec1
Assisted by:	Wayne Kinney
Date:	11/17/2005
Channel Slope (***S***):	0.000760 *ft/ft*
Manning's ***n***:	0.040
Flow Depth:	6.2 *ft*

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

assuming uniform, steady flow

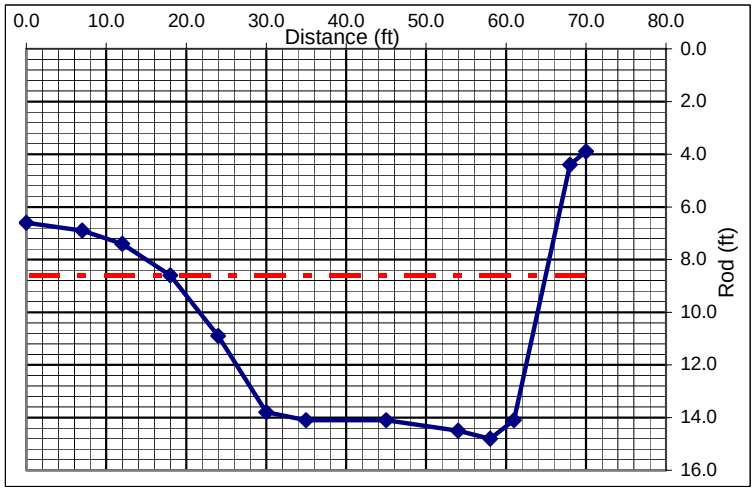
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	6.2 *ft*	8.2	
Channel Flow (***Q***):	575.3 *cfs*	901.7	
Channel Velocity:	2.7 *ft/sec*	2.8	
Cross-Sectional Area (***A***):	215.1 *sq.ft.*	322.7	
Hydraulic Radius (***R***):	4.2 *ft*	4.5	

Survey Data:

Rod *(ft)*	Distance *(ft)*
3.9	70.0
4.4	68.0
14.1	61.0
14.8	58.0
14.5	54.0
14.1	45.0
14.1	35.0
13.8	30.0
10.9	24.0
8.60	18
7.40	12
6.90	7
6.60	0



COMMENTS:

Hard Clay Bottom--Downcutting

Stream Stabilization I & E Form

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

County Marion T. R. Sec.

Date 11/17/2005 By Wayne Kinney

Stream Name Skillet Fork UTM Coord. E348225 N4274323

Landowner Name X-sec2

Drainage Area 150.49 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	105 ft.	Cross Sectional Area	674	sq. ft.
	Depth	6.4 ft.			

Reference Stream Gage:

Skillet Fork near Iuka Station No. 03380350 Gage Q_2 5000 cfs

Drainage Area 208 sq.mi Regression (3850 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.9 *ft./mi. (user-entered)* Regression Q_2 3289 cfs

ft/mi (from worksheet) Rainfall 3.40 in *(2 yr, 24 hr)* Adjusted Q_2 4272 cfs

0.0005 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge:

1700 to 3420 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	57	*ft.*	Contour Interval		feet
Mean Bankfull Depth	8.13	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	7.01				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	11.2	*ft.*	Surveyed:	0.00027 *ft./ft.*	Cross-Section 1011 *cfs*
Width at twice max. depth	1000	*ft.*	Estimated:	*ft./ft.*	Basic field data 1148 *cfs*
(22.4 ft.)					Selected Q 1030 *cfs*
Entrenchment Ratio	17.54		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:	2.18	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.48	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.2	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

6.84 cfs/sq.mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

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

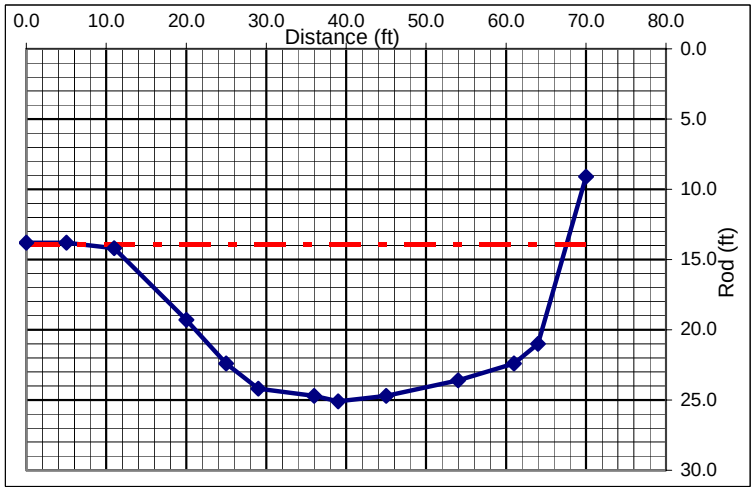
assuming uniform, steady flow

Project:	X-sec2	
Assisted by:	Wayne Kinney	
Date:	11/17/2005	
Channel Slope (***S***):	0.000270	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	11.2	*ft*

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	11.2 *ft*	11.3	
Channel Flow (***Q***):	1,011.4 *cfs*	972.4	
Channel Velocity:	2.2 *ft/sec*	2.1	
Cross-Sectional Area (***A***):	463.6 *sq.ft.*	469.8	
Hydraulic Radius (***R***):	6.8 *ft*	6.2	

Survey Data:

Rod *(ft)*	Distance *(ft)*
9.1	70.0
21.0	64.0
22.4	61.0
23.6	54.0
24.7	45.0
25.1	39.0
24.7	36.0
24.2	29.0
22.4	25.0
19.30	20
14.20	11
13.80	5
13.80	0



COMMENTS:
Hard Clay bottom with gravel from adjacent geotech
Silt over glacial till interface

Stream Stabilization I & E Form

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

County Marion T. R. Sec.

Date 11/17/2005 By Wayne Kinney

Stream Name Skillet Fork UTM Coord. E347141 N4271302

Landowner Name X-sec3

Drainage Area 156.83 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	107 ft.	Cross Sectional Area	693	sq. ft.
	Depth	6.5 ft.			

Reference Stream Gage:

Skillet Fork near Iuka Station No. 03380350 Gage Q_2 5000 cfs

Drainage Area 208 sq.mi Regression (3850 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.9 *ft./mi. (user-entered)* Regression Q_2 3398 cfs

ft/mi (from worksheet) Rainfall 3.40 in *(2 yr, 24 hr)* Adjusted Q_2 4414 cfs

0.0005 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge:

1760 to 3540 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	67	*ft.*	Contour Interval		feet
Mean Bankfull Depth	7.7	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	8.70				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	10.2	*ft.*	Surveyed:	0.00027 *ft./ft.*	Cross-Section 1157 *cfs*
Width at twice max. depth	1000	*ft.*	Estimated:	*ft./ft.*	Basic field data 1232 *cfs*
(20.4 ft.)					Selected Q 1195 *cfs*
Entrenchment Ratio	14.93		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:	2.24	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.39	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.3	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

7.62 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec3	
Assisted by:	Wayne Kinney	
Date:	11/17/2005	
Channel Slope (***S***):	0.000270	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	10.2	*ft*

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

assuming uniform, steady flow

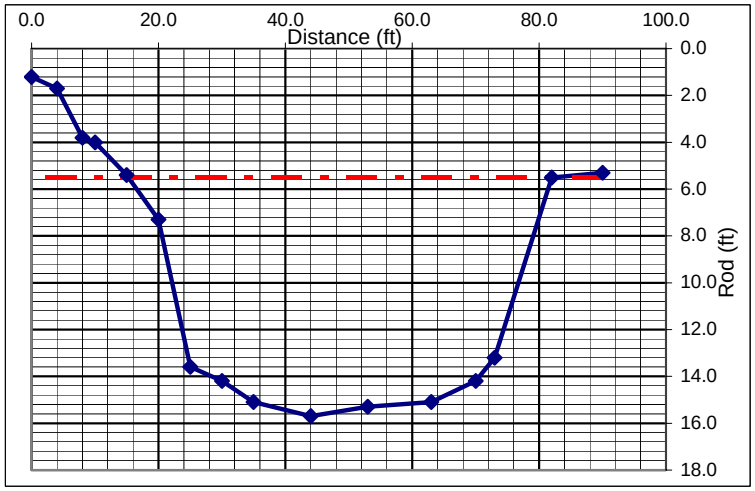
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	10.2 *ft*	10.4	
Channel Flow (***Q***):	1,157.3 *cfs*	1,124.1	
Channel Velocity:	2.2 *ft/sec*	2.1	
Cross-Sectional Area (***A***):	516.2 *sq.ft.*	530.4	
Hydraulic Radius (***R***):	7.0 *ft*	6.5	

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.3	90.0
5.5	82.0
13.2	73.0
14.2	70.0
15.1	63.0
15.3	53.0
15.7	44.0
15.1	35.0
14.2	30.0
13.60	25
7.30	20
5.40	15
4.00	10
3.80	8
1.70	4
1.2	0



COMMENTS:

Stream Stabilization I & E Form

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

County Marion T. R. Sec.

Date 11/17/2005 By Wayne Kinney

Stream Name Skillet Fork UTM Coord. E349329 N4261598

Landowner Name X sec 4

Drainage Area 234.86 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	125 ft.	Cross Sectional Area	911	sq. ft.
	Depth	7.3 ft.			

Reference Stream Gage:

Skillet Fork near Iuka — Station No. 03380350 — Gage Q_2 5000 cfs

Drainage Area 208 sq.mi — Regression (3850 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.9 *ft./mi. (user-entered)* — Regression Q_2 4676 cfs

ft/mi (from worksheet) Rainfall 3.40 in *(2 yr, 24 hr)* — Adjusted Q_2 6072 cfs

0.0005 *ft./ft.* Regional Factor 1.057 — Typical Range for Bankfull Discharge: 2420 to 4860 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	78	*ft.*	Contour Interval		feet
Mean Bankfull Depth	8.11	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	9.62				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	11.3	*ft.*	Surveyed:	0.00027 *ft./ft.*	Cross-Section 1495 *cfs*
Width at twice max. depth	1000	*ft.*	Estimated:	*ft./ft.*	Basic field data 1564 *cfs*
(22.6 ft.)					Selected Q 1530 *cfs*
Entrenchment Ratio	12.82		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:	2.36	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.47	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.4	*ft./sec.*

Channel Evolution Stage III — Stream Type (Rosgen)

Notes

6.5 cfs/sq/ mi.

Natural Open Channel Flow

Project:	X sec 4	
Assisted by:	Wayne Kinney	
Date:	11/17/2005	
Channel Slope (***S***):	0.000270	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	11.3	*ft*

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

assuming uniform, steady flow

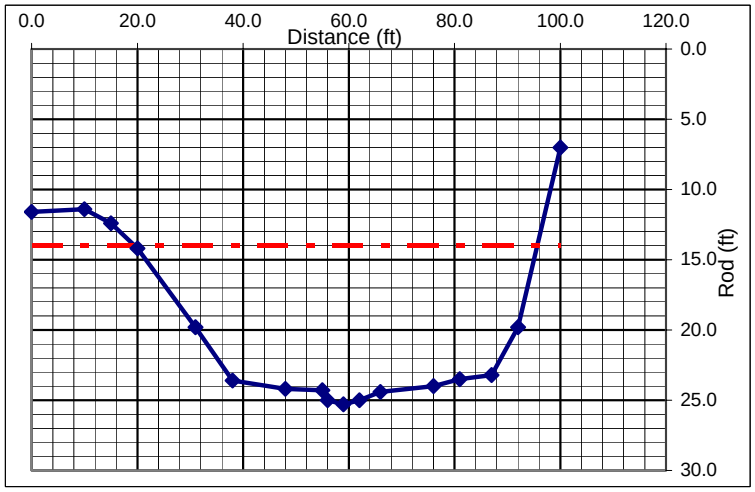
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	11.3 *ft*	13.9	
Channel Flow (***Q***):	1,495.1 *cfs*	2,056.4	
Channel Velocity:	2.4 *ft/sec*	2.4	
Cross-Sectional Area (***A***):	632.9 *sq.ft.*	844.6	
Hydraulic Radius (***R***):	7.6 *ft*	8.0	

Survey Data:

Rod *(ft)*	Distance *(ft)*
11.6	0.0
11.4	10.0
12.4	15.0
14.2	20.0
19.8	31.0
23.6	38.0
24.2	48.0
24.3	55.0
25.0	56.0
25.30	59
25.00	62
24.40	66
24.00	76
23.50	81
23.20	87
19.8	92
7.0	100



COMMENTS:

Sandstone bed in riffle

Stream Stabilization I & E Form

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

County Wayne T. R. Sec.

Date 11/17/2005 By Wayne Kinney

Stream Name Skillet Fork UTM Coord. E358056 N4255801

Landowner Name X-sec5

Drainage Area 325.77 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions				
	Width	142 ft.	Cross Sectional Area	1137 sq. ft.
	Depth	8.0 ft.		

Reference Stream Gage:

Skiillet Fork at Wayne City Station No. 03380500 Gage Q_2 8260 cfs

Drainage Area 464 sq.mi Regression (6530 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.9 *ft./mi. (user-entered)* Regression Q_2 5597 cfs

ft/mi (from worksheet) Rainfall 3.30 in *(2 yr, 24 hr)* Adjusted Q_2 7080 cfs

0.0005 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge:

2830 to 5670 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 82 *ft.* Contour Interval feet

Mean Bankfull Depth 9.05 *ft.* Estimated Sinuosity

Width/Depth Ratio 9.06

Channel Slope: Bankfull Q from:

Max. Bankfull Depth 11.7 *ft.* Surveyed: 0.00027 *ft./ft.* Cross-Section 1845 *cfs*

Width at twice max. depth 2000 *ft.* Estimated: *ft./ft.* Basic field data 1974 *cfs*

(23.4 ft.) Selected Q 1910 *cfs*

Entrenchment Ratio 24.39 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:	2.49	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.66	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.6	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

5.86 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec5	
Assisted by:	Wayne Kinney	
Date:	11/17/2005	
Channel Slope (***S***):	0.000270	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	11.7	*ft*

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

assuming uniform, steady flow

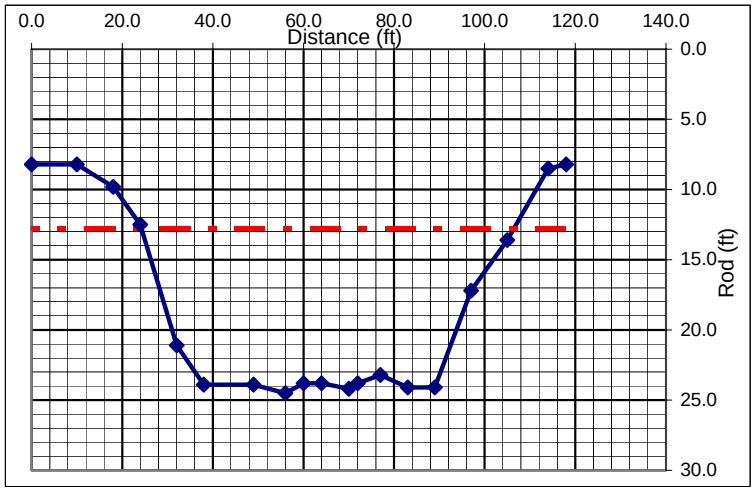
back to I&E form

Clear Cells

	Selected Flow Depth	*Trial Depth 2*	*Trial Depth 3*
Selected Flow Depth:	11.7 *ft*	16.3	
Channel Flow (***Q***):	1,845.1 *cfs*	3,095.3	
Channel Velocity:	2.5 *ft/sec*	2.7	
Cross-Sectional Area (***A***):	741.7 *sq.ft.*	1,164.1	
Hydraulic Radius (***R***):	8.2 *ft*	9.1	

Survey Data:

Rod *(ft)*	Distance *(ft)*
8.2	118.0
8.5	114.0
13.6	105.0
17.2	97.0
24.1	89.0
24.1	83.0
23.2	77.0
23.8	72.0
24.2	70.0
23.80	64
23.80	60
24.50	56
23.90	49
23.90	38
21.10	32
12.5	24
9.8	18
8.2	10
8.2	0



COMMENTS:

Stream Stabilization I & E Form

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

County Wayne T. R. Sec.

Date 11/17/2005 By Wayne Kinney

Stream Name Skillet Fork UTM Coord. E362413 N4246184

Landowner Name X-sec6

Drainage Area 464 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	163 ft.	Cross Sectional Area	1446	sq. ft.
	Depth	8.9 ft.			

Reference Stream Gage:

Skiillet Fork at Wayne City Station No. 03380500 Gage Q_2 8260 cfs

Drainage Area 464 sq.mi Regression (6530 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 1.9 *ft./mi. (user-entered)* Regression Q_2 6039 cfs

ft/mi (from worksheet) Rainfall 3.30 in *(2 yr, 24 hr)* Adjusted Q_2 7639 cfs

0.0004 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge: 3050 to 6120 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	115	*ft.*	Contour Interval		feet		
Mean Bankfull Depth	8.6	*ft.*	Estimated Sinuosity				
Width/Depth Ratio	13.37						
			Channel Slope:			Bankfull Q from:	
Max. Bankfull Depth	11.5	*ft.*	Surveyed:	0.000246	*ft./ft.*	Cross-Section	2307 *cfs*
Width at twice max. depth	190	*ft.*	Estimated:		*ft./ft.*	Basic field data	2427 *cfs*
(23.0 ft.)						Selected Q	2367 *cfs*
Entrenchment Ratio	1.65		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:	2.33	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.45	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.4	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

5.1 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec6	
Assisted by:	Wayne Kinney	
Date:	11/17/2005	
Channel Slope (***S***):	0.000246	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	11.5	*ft*

$$Q \left(\frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}} \right)$$

assuming uniform, steady flow

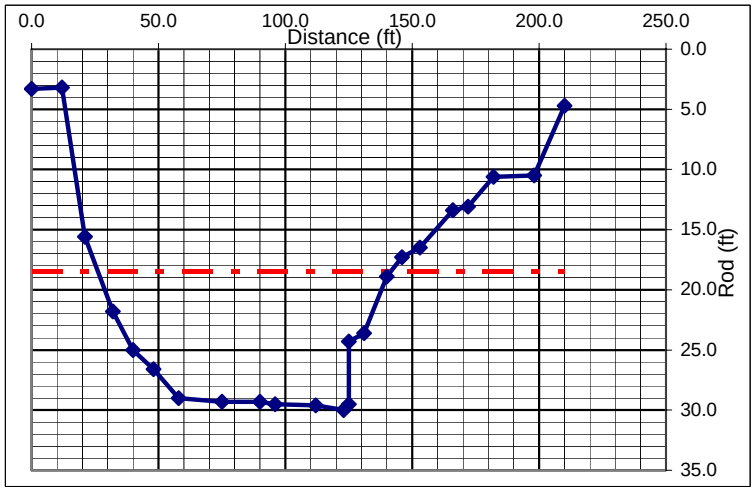
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	11.5 *ft*	25.3	
Channel Flow (***Q***):	2,307.0 *cfs*	11,426.6	
Channel Velocity:	2.3 *ft/sec*	3.6	
Cross-Sectional Area (***A***):	990.1 *sq.ft.*	3,217.9	
Hydraulic Radius (***R***):	8.0 *ft*	15.0	

Survey Data:

Rod *(ft)*	Distance *(ft)*
3.3	0.0
3.2	12.0
15.6	21.0
21.8	32.0
25.0	40.0
26.6	48.0
29.0	58.0
29.3	75.0
29.3	90.0
29.50	96
29.60	112
30.00	123
29.50	125
24.30	125
23.60	131
18.9	140
17.3	146
16.5	153
13.4	166
13.1	172
10.6	182
10.5	198
4.7	210



COMMENTS:

Bedrock channel with large overfall downstream of 4 ft +

Stream Stabilization I & E Form

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

County Wayne T. R. Sec.

Date 11/17/2005 By Wayne Kinney

Stream Name Skillet Fork UTM Coord. E364572 N4243992

Landowner Name X sec 7

Drainage Area 474.5 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	164 ft.	Cross Sectional Area	1468	sq. ft.
	Depth	8.9 ft.			

Reference Stream Gage:

Skiillet Fork at Wayne City Station No. 03380500 Gage Q_2 8260 cfs

Drainage Area 464 sq.mi Regression (6530 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 1.9 *ft./mi. (user-entered)* Regression Q_2 6147 cfs

ft/mi (from worksheet) Rainfall 3.30 in *(2 yr, 24 hr)* Adjusted Q_2 7776 cfs

0.0004 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge: 3110 to 6230 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	121	*ft.*	Contour Interval		feet
Mean Bankfull Depth	9.1	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	13.30				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	12	*ft.*	Surveyed: 0.000246	*ft./ft.*	Cross-Section 2598 *cfs*
Width at twice max. depth	2000	*ft.*	Estimated:	*ft./ft.*	Basic field data 2806 *cfs*
(24.0 ft.)					Selected Q 2702 *cfs*
Entrenchment Ratio	16.53		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:	2.36	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.55	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.5	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

5.69 cfs/sq. mi.

Natural Open Channel Flow

Project:	X sec 7
Assisted by:	Wayne Kinney
Date:	11/17/2005
Channel Slope (***S***):	0.000246 *ft/ft*
Manning's ***n***:	0.040
Flow Depth:	12.0 *ft*

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

assuming uniform, steady flow

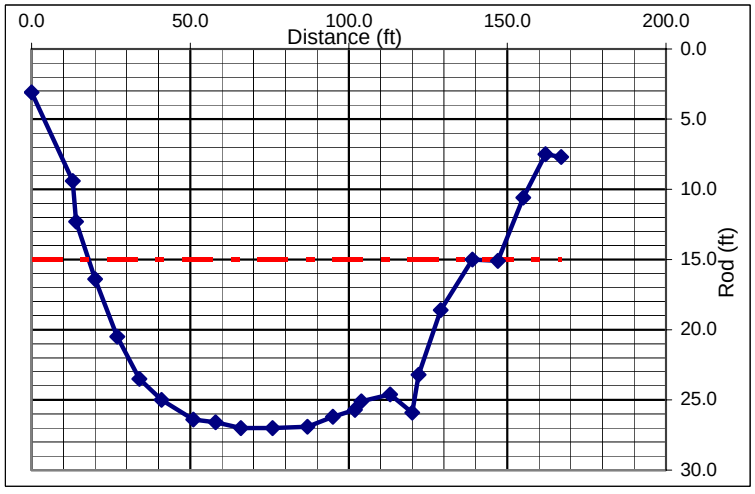
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	12.0 *ft*	19.5	
Channel Flow (***Q***):	2,598.1 *cfs*	6,737.3	
Channel Velocity:	2.4 *ft/sec*	3.1	
Cross-Sectional Area (***A***):	1,101.7 *sq.ft.*	2,155.6	
Hydraulic Radius (***R***):	8.1 *ft*	12.4	

Survey Data:

Rod *(ft)*	Distance *(ft)*
3.1	0.0
9.4	13.0
12.3	14.0
16.4	20.0
20.5	27.0
23.5	34.0
25.0	41.0
26.4	51.0
26.6	58.0
27.00	66
27.00	76
26.90	87
26.20	95
25.70	102
25.10	104
24.6	113
25.9	120
23.2	122
18.6	129
15.0	139
15.1	147
10.6	155
7.5	162
7.7	167



COMMENTS:

Stream Stabilization I & E Form

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

County Wayne T. R. Sec.

Date 11/17/2005 By Wayne Kinney

Stream Name Skillet Fork UTM Coord. E366438 N4242025

Landowner Name X-sec 8

Drainage Area 516.2 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions			Cross Sectional Area	
	Width	170 ft.	1554	sq. ft.
	Depth	9.2 ft.		

Reference Stream Gage:

Skiillet Fork at Wayne City Station No. 03380500 Gage Q_2 8260 cfs

Drainage Area 464 sq.mi Regression (6530 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 1.9 *ft./mi. (user-entered)* Regression Q_2 6570 cfs

ft/mi (from worksheet) Rainfall 3.30 in *(2 yr, 24 hr)* Adjusted Q_2 8311 cfs

0.0004 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge: 3320 to 6650 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 122 *ft.* Contour Interval feet

Mean Bankfull Depth 8.85 *ft.* Estimated Sinuosity

Width/Depth Ratio 13.79

Channel Slope: Bankfull Q from:

Max. Bankfull Depth 10 *ft.* Surveyed: 0.000246 *ft./ft.* Cross-Section 2544 *cfs*

Width at twice max. depth 2000 *ft.* Estimated: *ft./ft.* Basic field data 2701 *cfs*

(20.0 ft.) Selected Q 2623 *cfs*

Entrenchment Ratio 16.39 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:	2.36	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.50	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.4	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

5.1 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec 8	
Assisted by:	Wayne Kinney	
Date:	11/17/2005	
Channel Slope (***S***):	0.000246	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	10.0	*ft*

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

assuming uniform, steady flow

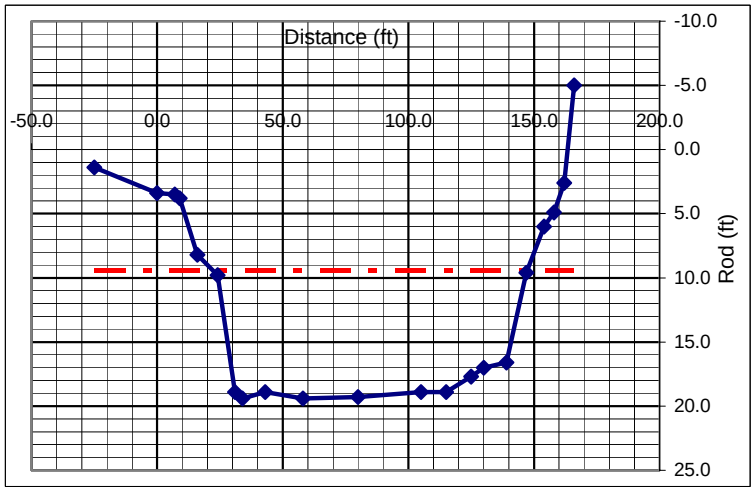
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	10.0 *ft*	18.0	
Channel Flow (***Q***):	2,543.9 *cfs*	6,710.7	
Channel Velocity:	2.4 *ft/sec*	3.0	
Cross-Sectional Area (***A***):	1,079.7 *sq.ft.*	2,270.9	
Hydraulic Radius (***R***):	8.1 *ft*	11.4	

Survey Data:

Rod *(ft)*	Distance *(ft)*
1.4	-25.0
3.4	0.0
3.5	7.0
3.8	9.0
8.2	16.0
9.8	24.0
18.9	31.0
19.4	34.0
18.9	43.0
19.40	58
19.30	80
18.90	105
18.90	115
17.70	125
17.00	130
16.6	139
9.6	147
6.0	154
4.9	158
2.6	162
-5.0	166



COMMENTS:
Hard clay bottom--downcutting