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HISTORICAL RIVER MORPHOLOGY STUDY OF THE KASKASKIA RIVER HEADWATERS TO LAKE SHELBYVILLE

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HISTORICAL RIVER MORPHOLOGY STUDY OF THE KASKASKIA RIVER

HEADWATERS TO LAKE SHELBYVILLE

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and Illinois Department of Natural Resources

INTRODUCTION

A historical river morphology study of the Kaskaskia River, between the headwaters and Lake Shelbyville was conducted by the U.S. Army Corps of Engineers, St. Louis District, and co-sponsored by Upper Kaskaskia LPC and the Illinois Department of Natural Resources under the Conservation 2000 – Ecosystem Program. The Study transpired between the period of September 2007 and June 2010 and was prepared by Mr. Michael Rodgers, Mr. Edward Brauer, Mr. Wayne Kinney, Mr. Robert Davinroy, and Mr. David Gordon.

Other Corps personnel involved in the study included Ms. Deanne Strauser, Project Study Manager, Mr. Leonard Hopkins, Chief of the Hydrologic and Hydraulics Branch, Information and technical assistance was also provided by Ms. Mary Miles, P.E., Hydraulic Engineer, Mr. Russell Errett, Hydraulic Engineer, Mr. Timothy Lauth, Hydraulic Engineer, Mr. Bob Wilkens, Manager at Carlyle Lake, and Ms. Norma Hall, Park Ranger at Carlyle Lake.

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STUDY REACH

This study documented the status of 75 miles of the main channel of the Kaskaskia River, from the headwaters in Champaign County to the upper end of Lake Shelbyville. The data from this report can be used for future analysis for potential river restoration projects. Plate 1 is the vicinity and location map of the area. Plate 2 is the study reach map outlining Lake Shelbyville and the upper reach of the Kaskaskia River, including the various drainage basins. The Kaskaskia River outline and river mile markers are based on the 2007 National Agriculture Imagery Program (NAIP) orthorectified aerial photos with a ground resolution of one meter.

The study reach incorporated approximately 678,400 acres (1,060 square miles) of total drainage area including portions of Champaign, Coles, Douglas, Macon, Moultrie, Piatt, and Shelby Counties. This study also includes 25 miles of Lake Fork and West Okaw Rivers that the Illinois Environmental Protection Association has listed as impaired as well as determining the impacts the Kaskaskia and West Okaw Rivers siltation has on the Lake Shelbyville Reservoir.

A town hall meeting was held in September 2007 to discuss the ongoing status of the Upper Kaskaskia River and to allow public a chance to voice their concerns. Although there was a fairly large turnout for the meeting, the locals had little to comment on and voiced little concerns. A group of farmers expressed how stable they thought the banks were over the years. Another group commented on the impact of log jams on the channel and what measures can be taken to remove them.

BASIN GEOLOGY

The Kaskaskia River is encompassed by the greater Illinois Basin, which is a structural basin that formed from tectonic warping during the Paleozoic Era. The Illinois Basin is a geologic depression covering approximately 60,000 mi^2 and underlies most of the state of Illinois and portions of Indiana, Kentucky, Tennessee, and Missouri (Plate 3).

The basin began as a failed rift concurrent with the breakup of the supercontinent during the Early and Middle Cambrian time. After the rifting episode, the basin began to form as a thick succession of sandstone and carbonate rocks deposited over the rift complex. The skeletal remains from the lime-secreting organisms formed a carbonate platform comprising the bedrock.

Bedrock beneath the mantle of Quaternary glacial-related sediments within the Kaskaskia River Basin consists of sedimentary rocks of the Devonian, Mississippian, and Pennsylvanian age (IDNR V1, 2000). Most of the bedrock sub crop (bedrock that lies directly beneath glacial sediment) within the assessment area is of the Pennsylvanian age, 320 to 286 million years before present (IDNR V1, 2000). The buried bedrock surface within the Kaskaskia River Basin is a complex topographical area that includes buried valleys, lowlands, and uplands. Buried bedrock valleys are filled with coarse grained sediments, sands, and gravels. The relief of the bedrock surface was most likely carved during the middle Pleistocene by a regional river drainage system that existed through much of the Tertiary period (IDNR V1, 2000)

Most of the unlithified sediments that overlie the bedrock in the Kaskaskia River Basin were deposited by the succession of continental glaciers that advanced across the basin during the Pleistocene Epoch (IDNR V1, 2000). The sediments fall into two major categories: till and outwash. Overlying the deposits of glacial origin is loess, windblown silt of late glacial and post-glacial age (IDNR V1, 2000).

The glacial deposits that form the uppermost layers beneath the loess across the Kaskaskia Basin were deposited during the two most recent major glacial episodes: the Illinois (300,000 yrs BP – 125,000 yrs BP) and the Wisconsin (25,000 yrs BP – 10,000 yrs BP) Episodes (IDNR V1, 2000). Following both the Illinois and Wisconsin glacial episodes, there were prolonged periods of warming. During these periods, the glaciers retreated to the north and northeast, depositing vast quantities of melt water and outwash sands and gravels down the Kaskaskia River Valley. The thickness of the glacial drift varied from 25 ft – 200 ft, with increased thickness trending north to northeast (IDNR V1, 2000)

NATURAL RIVER CHANNEL MECHANICS

In order to access the condition of this particular study reach of the Kaskaskia River, some basic natural river channel mechanics are briefly outlined. The shape of the cross section of any river channel is a function of the flow, the quantity and character of the sediment in motion through the section, and the character or composition of materials (including the vegetation) that make up the bed and banks of the channel (Leopold). Because the flow exerts an eroding force per unit area, or shear stress, on the bed and banks, the stable form the channel can assume is one in which the shear stress at every point on the perimeter of the channel is approximately balanced by the resisting stress of the bed or bank (Leopold, 1994).

A natural channel migrates laterally due to the erosion of one bank, maintaining on average a constant channel cross section by deposition on the opposite bank (Leopold, 1994). There is equilibrium between erosion and deposition (Leopold, 1994). As the channel migrates, sinuosity develops in the channel pattern to help balance the flow and sediment load in the river system. The rate of migration is determined by channel flow and bed and bank material. Channels with excess energy migrate at a more rapid rate. The natural channel succession includes channel migration, increase in sinuosity, and overall increase in channel length, resulting in a lower gradient and reduced energy per unit area. A natural balance exists between shear stress in the stream and bank and bed resistance as energy is dissipated. Once in equilibrium, the channel forms a series of pools and riffles. This is natural succession and evolution of the channel with pools forming on bends and riffles forming at channel crossings. A natural stream in equilibrium is expected to exceed full bank (channel forming discharge) every 1.0 to 2.5 years. Localized studies indicate streams in southern Illinois exceed full bank on a 1.0 year to 1.5 year return period.

CHANNEL EVOLUTION MODEL

The Channel Evolution Model (CEM) is a conceptual model that describes channel changes and adjustments over time (Plate 4). It is based on the channel response to disturbance as it occurs, broken into stages which are dependent on the previous stage. The CEM provides scientists and engineers a better understanding of cause and effect of channel change, guidance in historical analysis, a template of the current and future conditions, and a foundation for restoration procedures. The CEM was used in this study to describe the status of the river channel and to help provide any recommendations suggested for remedial actions.

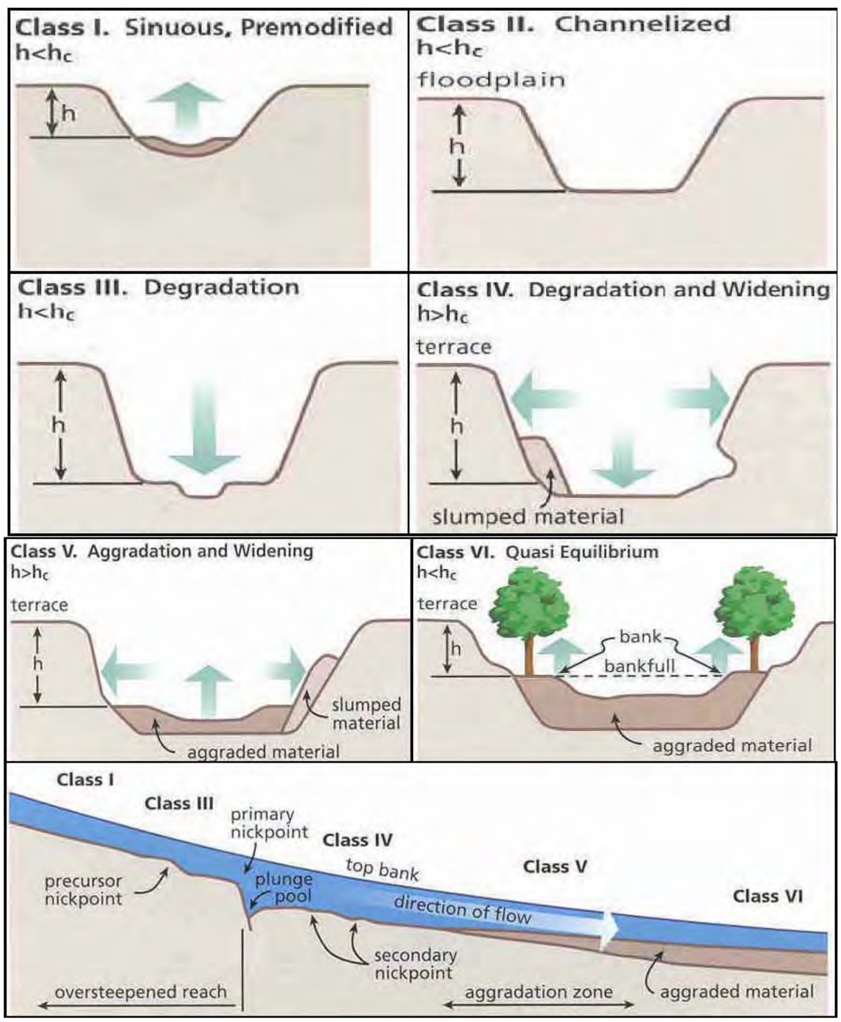

Figure 1. Channel Evolution Model

LAND USE CHANGES

1821 LAND COVER

Historical land cover maps indicated that the majority of the land within the Kaskaskia River Basin was originally made up of prairies and forests. Two soil orders, Mollisols and Alfisols formed based on the historic land cover. Mollisols developed under natural prairie or marsh vegetation, which are rich in organic material and are the fertile agricultural fields we have today. Alfisols developed under forested vegetation and are not as organically rich as Mollisols.

The 1821 land use maps identified the land cover type directly surrounding the Kaskaskia River as primarily forested (Plates 5-13). Defined as having a tree-crown areal density (crown closure percentage) of 10 percent or more which are stocked with trees capable of producing timber, forested land cover provided the river bank stability in the form of root mass. The root mass increased soil cohesion, leading to increased overall soil strength and thereby reduced erosion tendencies and limited the abilities of the river to meander.

As the river rose and flooded out of the banks, the timber mass of forested areas and root mass of the prairie grasses provided channel roughness. This roughness created a pooling effect, which reduced stream power and the ability of the river to erode. On the maps near River Mile (RM) 56, there were intermittent reaches of prairie and forest until RM 61. At this point all the land cover upstream was prairie.

LAND USE CHANGES

During the time period from the mid 19th century through the early 20th century major land use changes occurred within the Kaskaskia River Valley. The majority of fertile prairie lands were converted to croplands and the forested lands were logged and use for timber and fuel (Plates 14-22). During this time frame the segments of the upper Kaskaskia River were straightened to increase overall channel conveyance and increase the drainage rate of croplands to maximize productive land use (Plates 20-22). This is termed channelization and is the reduction in channel length by substituting straight cuts for meandering courses, thereby reducing overall sinuosity. Sinuosity is defined as the channel length over the valley length. Typically a higher sinuosity means there are more bends in the system.

The impacts of land use change can lead to river instability. The development of croplands from prairies significantly increased the rill and sheet erosion associated with the exposed soils within this basin. The loess soils that predominantly make up this basin are easily entrained and transported by both water and wind. The low shear resistance of the soil allows for it to be rapidly incised. Sediments within the basin that were typically trapped by the native prairie grasses entered the river system as a non-point source water pollutant. With the additional soils entering the river system the natural processes of the channel can come out of balance. Lane's Equation (Plate 23) explains the relationship between stream power and the discharge of bed-material sediment, where sediment discharge multiplied by median sediment size is equal to discharge, multiplied by bed slope. The land use changes and the effects on the river are consistent with other studies completed within the Kaskaskia Basin (Gordon, Rodgers, Davinroy, Brauer, Lamm, 2000, 2003, 2006)

PRECIPITATION ANALYSIS

Precipitation data was analyzed to determine if changes in precipitation have occurred within the Upper Kaskaskia River Drainage Basin. Precipitation data was plotted versus time, from 1906 to 2009, with a calculated average annual precipitation of 38.0 inches per year. A linear/regression type trend line was examined (Plate 24). The trend line shows an overall increase in precipitation over time. This upward trend was consistent with a previous sedimentation study completed on the Upper Mississippi River Basin (Davinroy 2006).

Based on the historical precipitation data and the corresponding land use change, the Kaskaskia River must now manage more flow from additional precipitation and changes in the representative hydrograph. The conversion of woodlands and prairies to agriculture fields, combined with a vast array of drain tiles (UMR Basin Report, Davinroy 2006) resulted in a net gain of water surface runoff, increasing peak runoff. Additionally, the practice of channelizing the river in the upper section to increase conveyance increased peak discharge and stream power in the system. Modifications in the channel pattern, dimension, and profile have occurred as a response to the changes in precipitation over time.

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RIVER MORPHOLOGY

The analysis of the Kaskaskia River included channel morphology, in which channel pattern, dimension, and profile were studied. Pattern refers to the planform or physical geometry of the river channel, the numbers of bends, radius of curvature, etc (USACE, 2000). Dimension refers to width and depth of the channel cross section (USACE, 2000). Profile refers to the gradient or slope of channel bottom throughout the study length.

Historical data was limited for this study. The utilization of historical surveys and aerial photographs were the main source historical data. 1821 General Land Office (GLO) maps, 1940 aerial photographs, and 1966 aerial photographs were scanned into GIS and georeferenced to NAD 1927 State Plane Illinois West coordinates. Additionally, orthorectified 2007 aerial photographs were used for present day analysis. ARC-GIS 9.3 was utilized in the analysis and comparison of the aerial photographs. Data collection techniques were primitive compared to modern techniques, so the accuracy of the 1821 GLO maps are limited. The 1821 GLO maps can be found in Appendix A.

RECONNAISSANCE – KASKASKIA RIVER

The present day condition of the main channel of the Kaskaskia River was assessed by conducting both aerial and ground reconnaissance. Field recon trips were conducted in September of 2007 and January of 2008. Channel cross-sectional data was collected between the 21st and 25th of January 2008. During this site visit, 11 Kaskaskia River cross sections were taken at riffle locations intermittently throughout the basin. Cross sections were taken at riffle locations in order to maintain uniform geometry for analysis purposes.

The cross section data collection methodology consisted of identifying riffle locations, and using a laser level, rod, and tape to measure topography change and water depth in 5 feet increments (Picture 1). The cross sectional data provided the necessary information to analyze the channel and utilize the CEM, which ultimately led to identifying the channel stage or condition.

Picture 1

Additional data was gathered during a helicopter reconnaissance trip on November 28, 2007. Aerial video and Red Hen software were used to geographically link the video and geospatial reference data. The video was used to identify bank failure locations, river blockages, and any channel anomalies.

PATTERN

Rivers are rarely straight and typically follow a sinuous course. Sinuosity is defined as the rivers channel length divided by its valley length and quantifies the meandering rate of the river. The plan view of various stream patterns will also exhibit specific a geometric relationship that may be quantitatively defined through measurement of meander wavelength, radius of curvature, amplitude, and belt width (Rosgen, 1996).

The Kaskaskia River pattern was analyzed for the years 1821, 1940, 1966, and 2007. The results obtained were the number of bends, radius of curvature, and sinuosity (Plates 25-44). The river channel was broken down into two segments, below RM 22 and above RM 22. The river reaches were separated by change in valley slope. The data is summarized on the table below.

Year	Sinuosity RM (0-22)	Number of Bends RM (0-22)	Average Radius of Curvature RM (0-22)	Sinuosity RM (22-71)	Number of Bends RM (22-71)	Average Radius of Curvature RM (22-71)
1821	1.61	35	800	1.32	89	890
1940	2.06	88	371	1.41	134	538
1966	2.06	80	344	1.37	127	435
2007	2.06	80	344	1.37	127	435

Table 1

The channel pattern analysis revealed that sinuosity on the lower end of the river increased from 1821 to 1940. This was attributed to increased peak flows from resulting land use changes that occurred during this time period. The increase in channel sinuosity was caused by an increase in bends forming, as the stream/river attempted to regain balance based on new flow regimes. Post 1940 analysis revealed a very stable channel, meaning the channel pattern did not vary much from 1940 to present day. No significant channel pattern changes have occurred post 1960's, the construction time frame for the Lake Shelbyville Reservoir.

The analysis of channel pattern of the upper end of the Kaskaskia RMs 22-71, showed no significant change in sinuosity from 1821 to 1940. This was not expected. We expected an increase in sinuosity similar to the lower reach. Looking closely at the channel pattern data revealed a period of channel straightening that occurred on RMs 61 to 71 from 1821 to 1940. This reduced channel sinuosity. The combination of increased sinuosity from land use changes combined with decrease from channel straightening resulted in no net change in sinuosity overall.

From 1821 to 1940 there was a significant decrease in the average radius of curvature and an increase in the number bends on both the upper and lower reaches. This was attributed to the land use changes that occurred during this time period and is caused by the added energy in the system. A channel with long, gentle bends has the ability to maintain higher velocities and energy in the system. As the radius of the curvature is reduced and bends are added to the system, energy is dissipated, velocities are reduced, and the channel becomes less efficient. Once again, these are signs that the channel is adjusting to manage the added energy in the system.

A radius of curvature comparison on both the upper and lower reaches showed a slight decrease in the number of bends and radius from 1940 to 1966 and no significant change from 1966 to 2007. The consistent number of bends and radius of curvature indicated that the channel pattern has been stable since 1940, and the channel has stabilized from the land use changes of the 19th and early 20th Century.

DIMENSION

River channel width and the representative cross section is a function of the channel hydrograph, suspended sediments, bed load, and bank materials. Channel widths generally increase downstream due to increase flow regimes. Channel width can be modified by the following influences: direct channel disturbance such as channelization; changes in riparian vegetation that may alter the boundary resistance and susceptibility to stream bank erosion; changes to the stream flow regime due to watershed changes; and changes in sediment regime (Rosgen, 1996).

To evaluate the Kaskaskia River dimension properties, eleven channel cross sections were taken on in January of 2007. The channel cross sections were taken at channel crossings i.e. riffles. Plates 45-55 identify the location of the cross-sections and the accompanying drainage basin and Appendix B show the cross section and data associated with it. Stream Stabilization I&E Form from the Illinois NRCS was used to populate the cross section data.

Maximum flow probability curves at two USGS gages, Cooks Mill, IL , Gage #05591200 (Plate 56) and Chesterville, IL, gage #05590950 (Plate 57) were developed to predict the 1.5 year and 2 year Return Interval (RI). The results from the probability curves were 4,300 cfs at 1.5 year RI and 5,750 cfs at 2.0 year RI at the Cooks Mill Gage and 3,025 cfs at 1.5 year RI and 4,500 cfs at 2.0 year RI at the Chesterville Gage. These values are important because it is widely accepted that the 2 year Return Interval is the "Channel Forming Discharge" or "Bankfull". These are the flows that contribute most to the channel dimension. The table below was the resulting data from the Stream Stabilization I&E Form used by the NCRS for the channel and was used to help determine the Channel Evolution Stage based on the CEM (Plate 4). Plate 58 shows a comparison of the 2 year USGS regression equation (channel forming discharge) and the maximum channel capacity. Cross sections 5 thru 8 showed a dramatic reduction in channel capacity, meaning the channel no longer has the capacity to carry the 2 year storm. There was a direct correlation between channel capacity and stream gradient.

Cross Section	River Mile	Drainage Area (mi^2)	Slope (ft/mile)	Q2 (cfs)	B-full Q (cfs)	B-full Width (ft)	B-full Depth (ft)	W/D Ratio	B-full Velocity (fps)	B-full Q/ Q2	Channel Evolution Stage
1	67.5	36.7	3.5	1,331	600	47	4.0	11.6	3.2	0.5	III
2	58.3	61.5	3.5	1,454	831	45	5.1	8.8	3.6	0.6	III
3	52.3	111.2	1.27	2,147	1,248	69	6.8	10.2	2.7	0.6	III
4	48.8	122	1.27	2,297	1,274	80	6.8	11.7	2.3	0.6	IV
5	44.5	129.8	1.27	2,203	915	54	7.2	7.5	2.4	0.4	VI
6	40.8	137	1.27	2,299	448	69	4.3	15.9	1.5	0.2	I
7	35.1	362	1.27	3,975	972	87	6.0	14.6	1.9	0.2	I
8	29.2	406	0.95	4,199	561	103	3.9	26.6	1.4	0.1	I
9	18.4	478	0.95	4,778	1,678	170	5.5	31.0	1.8	0.4	I
10	12	496	0.95	4,919	2,508	119	7.6	15.6	2.8	0.5	IV
11	7.7	504	1.52	5,521	2,096	92	8.1	11.4	2.8	0.4	VI

Table 2

PROFILE

Channel profile is commonly referred to channel slope or gradient and typically decreases in a downstream direction. Sediment size decreases proportionally as well. Lane's equation (Plate 23) shows that stream gradient is directly related to bed-material load and grain size, and inversely related to stream flow (Rosgen, 1996). Bed formations are a function channel flow, gradient, and material.

A water surface profile was developed on the Kaskaskia River (Plate 59) from RMs 0 to 69. The profile showed five distinct slopes and decreased dramatically from upstream to downstream with the lower end having approximately 3% of the upstream slope.

RM 65.6 – 69.1 = 37.2 ft/mile

RM 55.5 – 65.6 = 3.50 ft/mile

RM 36.4 – 55.5 = 1.27 ft/mile

RM 9.9 – 36.4 = 0.94 ft/mile

RM 0 – 9.9 = 1.52 ft/mile

The reach from RM 9.9 to RM 36.4 began a short distance below the channelization section of the Kaskaskia River and represented a 35% reduction in slope from RM 36.4 to RM 55.2. It is natural for the water surface profile to decrease traveling downstream. Natural topography of the channel basin plays the main role in channel profile. The headwaters of most rivers start at relatively high elevation and the decrease in elevation is rapid, which generates a steep channel slope. Traveling downstream changes in elevation are less rapid and more tributaries begin to enter the main channel, and slope is reduced. As the slope decreases, sediment transport capacity also is reduced. This, combined with influx of tributaries creates more of a depositional area as profiles continue to flatten. This can cause aggradations in the system, leading the channel to go out of bank on a more frequent basis.

IMPAIRED STREAM ANALYIS

As part of the initial scope of work, 55 miles of impaired streams identified by the Illinois Environmental Protection Agency (IEPA) within the Upper Kaskaskia River Basin were to be analyzed. Table 3 identifies the IEPA impaired streams along with the causes and sources. Based on the causes of stream impairment, it was determined that traditional stream restoration efforts would best be served within the channelized sections of the Lake Fork River. While stream restoration and bank stabilization techniques do improve water quality, land use practices are typically the main culprit of chemical pollution. For this reason, Asa Creek, Coon Creek, and Dry Fork River were not analyzed. Data was gathered from the West Okaw River so that a comparison could be made between it and the Dry Fork. Efforts were focused on 14.2 miles of Lake Fork and 9.7 miles West Okaw, listed on the figure below.

Stream	Assessment ID	Length (miles)	Category	Causes	Sources
Asa Creek	IL-OZZT01	9.05	5	DO, TSS, N	Source Unknown, Crop Production
Coon Creek N.	IL-OZZU	4.78	5	Impairment Unknown	NA
Dry Fork	IL-OZZW	11.89	5	Impairment Unknown	NA
Lake Fork	IL-OW-01	9.37	5	Alteration in stream-side or littoral vegetative covers, Sedimentation, TDS, N, Polychlorinated biphyenyls	Channelizatoin, Source Unknown, Crop Production
	IL-OW-02	4.79	5	Alteration in stream-side or littoral vegetative covers, Sedimentation, TDS, N, Polychlorinated biphyenyls	Channelizatoin, Source Unknown, Crop Production
W. Okaw	IL-OT-02	4.96	5	DO, TDS, pH, N, P, Fecal Coliform	Source Unknown, Crop Production
	IL-OT-04	4.77	5	DO, TDS, pH, N, P	Source Unknown, Crop Production

Table 3

RECONNAISSANCE – LAKE FORK AND WEST OKAW RIVERS

Six cross-sections were taken at riffle locations on the Lake Fork and West Okaw rivers using the same methodology as data collected on the Kaskaskia River. The Lake Fork River is a tributary of the Kaskaskia and they converge near Upper Kaskaskia RM 38 (plate 2). The West Okaw River is not tributary of the Kaskaskia River and enters Lake Shelbyville in the northwest portion of the reservoir. The Basin comparison of Lake Shelbyville, Upper Kaskaskia, West Okaw, and Lake Fork is listed.

Water Body	Basin Area (mi^2)	% Lake Shelbyville Basin	% Kaskaskia River Basin
Lake Fork River	174	17	30
West Okaw River	240	23	0
Upper Kaskaskia River	578	55	100
Lake Shelbyville	1,058	100	100

Table 4

PATTERN

The patterns of the Lake Fork and West Okaw Rivers for 2007 were analyzed and results were obtained for the number of bends, radius of curvature, and sinuosity (plates 60 & 61). Based on the valley slope, a single slope was used to determine the sinuosity for both river analyses. The data is summarized on the table below.

River	Channel Length (ft)	Valley Length (ft)	Sinuosity	Number of Bends	Average Radius of Curvature
Lake Fork	62,380	44,420	1.4	52	404
West Okaw	98,400	51,750	1.9	87	275

Table 5

The channel pattern analysis revealed that Lake Fork River had a lower sinuosity than the West Okaw River. This could be evidence of channelization. Based on comparable channel size, drainage area, soil type, and land use changes, sinuosity in Lake Fork and in the West Okaw should be closer. The pattern analysis and sinuosity comparison supported the report that Lake Fork River has been channelized.

DIMENSION

Six cross sections were taken on the Lake Fork and West Okaw Rivers in January of 2007. The channel cross sections were taken at channel crossings i.e. riffles. Plates 62-64 and 65-67 identify the location of the cross-sections and the accompanying drainage basin and Appendix B show the cross sections and data associated with it.

Maximum flow probability curves at two USGS gages, Atwood, IL (Lake Fork River) , gage #05590800 (Plate 68) and Lovington, IL (West Okaw River), gage #05591700 (Plate 69) were developed to predict the 1.5 year and 2 year Return Intervals (RI). The results from the probability curves were 1,750 cfs at 1.5 year RI and 2,300 cfs at 2.0 year RI at the Atwood Gage and 2,100 cfs at 1.5 year RI and 2,750 cfs at 2.0 year RI. Additionally, the USGS regression equation for flood-peak discharge predictions was used to compare with channel capacity.

Field analysis identified bankfull elevation and Stream Stabilization I&E Form from the Illinois NRCS was used to populate the cross section data and help develop the channel evolution stage based on the CEM. The data indicated Lake Fork River is in channel evolution stages II and I (table 6). Stage II indicates that this section of the channel currently going through an episode of down cutting, while stage I indicates a channel that is stable and connected to its floodplain. A channel evolution stage III is post headcut and the channel is widening with major bank failure is occurring, (see figure 8).

LAKE FORK RIVER											
Cross Section	**River Mile**	**Drainage Area (mi^2)**	**Slope (ft/mile)**	**Q2 (cfs)**	**B-full Q (cfs)**	**B-full Width (ft)**	**B-full Depth (ft)**	**W/D Ratio**	**B-full Velocity (fps)**	**B-full Q/ Q2**	**Channel Evolution Stage**
1	8.8	155	1.09	1,720	755	75	5.2	14.4	1.9	0.4	II
2	5.5	160	1.09	1,880	785	78	5.6	13.9	1.8	0.4	I
3	1.2	165	1.09	1,938	926	120	4.8	25.0	1.6	0.5	I

Table 6.

Looking closely at the Lake Fork River data, you would expect flows to increase traveling downstream with the larger drainage basin. The gradient of the channel and roughness coefficient played large roles in the resulting flows. The upper cross section was considered a channelized section with a roughness of 0.0003 while the lower two cross sections contained more vegetation and had a roughness of 0.00035. Gradient was uniform within both of these reaches (plate 42). The main controlling factor in the reduction of bankfull flow was the proximity of confluence with the Kaskaskia River. Traveling downstream on the Lake Fork River a pool effect developed, reducing velocities. Over time, the channel cross section was reduced due to sediment dropping out of suspension at low velocities.

Based on the cross sectional data, West Okaw in channel evolution stages I and IV (table 7). As mentioned above, stage I is representative of a stable channel connected to its flood plain. Stage IV represents a channel that has gone through an episode of headcutting and channel widening. The channel is repairing itself and stable, (see the Channel Evolution Model figure 8).

WEST OKAW RIVER											
Cross Section	**River Mile**	**Drainage Area (mi^2)**	**Slope (ft/mile)**	**Q2 (cfs)**	**B-full Q (cfs)**	**B-full Width (ft)**	**B-full Depth (ft)**	**W/D Ratio**	**B-full Velocity (fps)**	**B-full Q/ Q2**	**Channel Evolution Stage**
1	18.1	113	3.26	2,143	968	121	3.9	31.0	2.0	0.5	I
2	14.6	137	3.26	2,451	545	75	3.6	20.8	2.0	0.2	I
3	9.2	162	3.26	2,759	1,088	73	5.7	12.8	2.6	0.4	IV

Table 7

PROFILE

A water surface profile was developed for the Lake Fork and West Okaw rivers (Plates 70 & 71) from RMs 2.8 to 35.1 and 0 to 27.9, respectively. Lake Fork was divided into two distinct profiles from River Mile 2.8 to 25.4 and 25.4 to 35.1. West Okaw has a uniform profile through the entire reach. The resulting profiles are listed below.

Lake Fork	West Okaw
RM 25.4 – 35.1 = 4.73 ft/mile	RM 0 – 27.9 = 3.26 ft/mile
RM 2.8 – 25.4 = 1.09 ft/mile	

The Lake Fork profile progressed as expected, with the gradient decreasing from upstream to downstream. The West Okaw profile was unusually linear, with no definitive slope changes through the river miles measured. This was most likely due to the uniform topography within this region and a relatively short reach measured. Resulting pool impacts from Lake Shelbyville on the West Okaw profile were not evident. A gentler gradient would be expected if the lake had an impact on the channel profile.

LAKE SHELBYVILLE SILTATION

As part of the scope of work, the impacts of Lake Shelbyville siltation was included in this study. For this portion of the study siltation from the Kaskaskia and West Okaw Rivers were analyzed along with bank erosion of Lake Shelbyville from wind fetch.

KASKASKIA AND WEST OKAW RIVER SILTATION

The methodology used in determining the siltation impact from the Kaskaskia and West Okaw Rivers was analyzing historical cross sections from 1974, 1980, and 1984 and compare them to 2010 bathymetric data. An incomplete data set from 1970 was available but not used because limited data. The focal point of the 2010 bathymetric data was to identify the deltaic formation caused from the Kaskaskia and West Okaw Rivers entering Lake Shelbyville and quantify the amount of sediment entering the reservoir. Cross sections were then generated from the 2010 bathymetric data at the same ranges as the historical sediment data.

Plates 72 and 75 are the 2010 bathymetric data collected and historic range locations. Due to money constraints the entire delta formation could not be surveyed. Additionally, only two transects 34A and 33A were covered under the 2010 bathymetric survey on the Kaskaskia River delta and no historical transects on the West Okaw River delta were covered under the 2010 bathymetric survey. The limited data was not a full representation of the siltation rate but gave us a qualitative estimate. Cross sections of ranges 33-A, 34-A, 21-A, and 22-B (Plates 73, 74, 76, & 77) were analyzed and the results were listed in table 8.

KASKASKIA RIVER				
Range	Mean Siltation from 1974-1984 (ft)	Max Siltation at Historic Channel 1974-1984 (ft)	Mean Siltation from 1984-2010 (ft)	Max Siltation at Historic Channel 1984-2010 (ft)
33-A	1.5	5.0	0.5	4.0
34-A	1.5	3.5	-0.5	2.0
WEST OKAW RIVER				
21-A	1.5	2.0	NA	NA
22-B	1.0	3.0	NA	NA

Table 8.

The analysis of the cross section data indicated a mean siltation rate of 0.1 to 0.15 feet per year for the entire cross section and averaged 0.2 to 0.5 feet per year at the location of the historic channel from 1974 to 1984. The mean siltation rate reduced to +/- 0.03 feet per year for the entire cross section and averaged 0.13 to 0.25 feet per year at the location of the historical channel from 1984 to 2010. The aforementioned data was from the Kaskaskia River delta data only. It was believed that upper end of the delta formation becoming stable while the lower portion continues to advance and deposit material deeper into the reservoir.

This data set was strictly qualitative and should not be extrapolated to the entire reservoir. Much more data needs to be collected to get a quantitative siltation rate and a true understanding of the reservoir status.

WIND FETCH EROSION

For this analysis 100 points were identified and surveyed for bank erosion (Plate 78). This was done by measuring the eroded bank as well as the resulting bench. 100 points were randomly selected to produce a statistically significant data set but due to field conditions only 96 were measured. The average bank erosion rate at the 96 points was then determined and extrapolated to the entire Lake Shelbyville bankline length (Appendix C).

The analysis of the wind fetch data deduced that over 15,000,000 cubic yards of sediment has entered the reservoir from bank erosion. This was truly a qualitative analysis and much more time and studies are needed prior to any impacts from this added sediment can be identified.

RESULTS AND RECOMMENDATIONS

KASKASKIA RIVER

The analysis of the channel dimension, pattern, and profile identified three distinct river reaches within the Upper Kaskaskia River; the upper reach RMs 45-70 denoted by a channelized channel not connected to the flood plain, the middle reach RMs 10-45 denoted by a aggradated reach, and the lower reach RMs 0-10 denoted by a “natural” channel with localized sites of bank erosion. This segregation of the reaches was determined by the examination of field data using the channel evolution model along with field observations.

UPPER REACH

The upper reach of the Kaskaskia River acts as a high water conveyance channel. This reach has seen multiple episodes of channelization and is not connected to its flood plain. Based on the CEM stage classification this reach is a stage III, meaning it has gone through episodes of channel straightening and possibly an episode of headcutting. This reach has been converted into a straight, trapezoidal channel with near vertical banks and continuously cleared of deposition and debris. The channelization and resulting vertical banks of this river reach have a high potential for bed degradation and bank stability issues. This is not a localized concern but rather a potential problem in which bank failures can occur through the entire upper reach.

Picture 2 is of a typical section of the upper Kaskaskia River reach between RMs 45 -70 as noted by the steep, vertical river banks. This section of river had a minimum of 8’ of freeboard, and has been straightened for conveyance purposes. Multiple sessions of channel cleaning have occurred, removing deposited sediments. This practice can lead to future bank stability issues.


Picture 2. Typical Upper Reach Channel Section

Although there may not be any current bank stability issues, current channel maintenance practices identify the possibility for future issues. A recommendation is to incorporate grade control structures; specifically, engineered rock riffles (ERRs) within this reach. These EERs keep the bed from degrading by having a hardened bed which is non-erodible. As the channel tries to degrade it hits a non-erodible and the channel cannot continue to deepen. The ERRs are elevated grade control structures that create a pool-riffle-pool sequence, which dissipates energy. As flow enters the upstream pool the depth of the pool reduces the rivers energy and as the river flows over the riffle portion, energy is again dissipated from the added roughness and downstream slope. A HEC-RAS model should be used to determine the proper elevation of the structures so proper conveyance can be maintained.

Typical design parameters specify that the ERRs should be spaced an average of six channel widths apart (Figure 2) and at the location of channel crossings (Figure 3). The exact spacing and location of the ERRs are site dependent and vary from project to project. It is extremely important to consult a qualified stream restoration specialist and local regulatory agencies prior to implementing any channel enhancements.

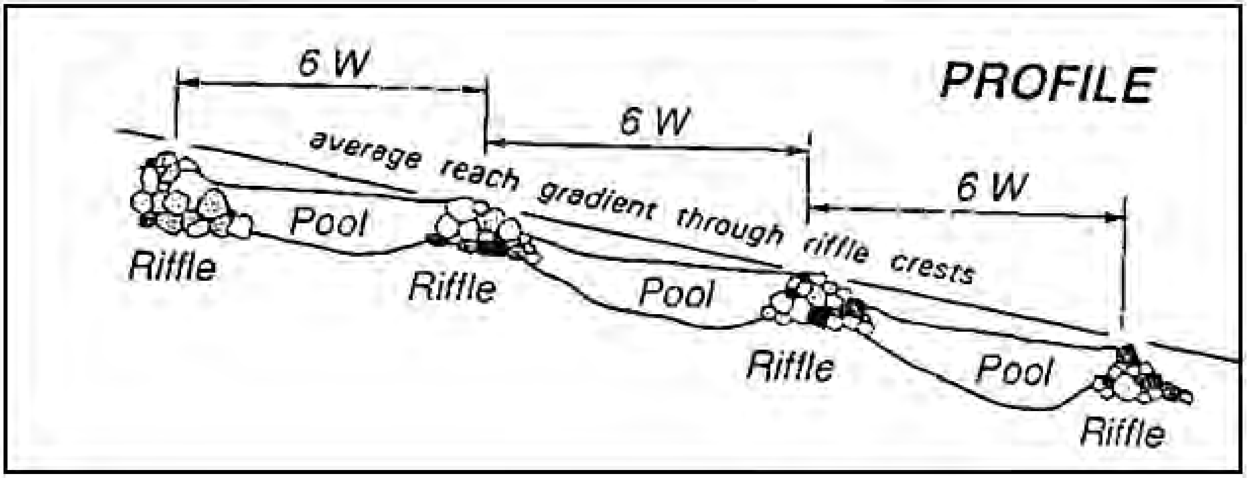

Figure 2. Profile View of ERR Design

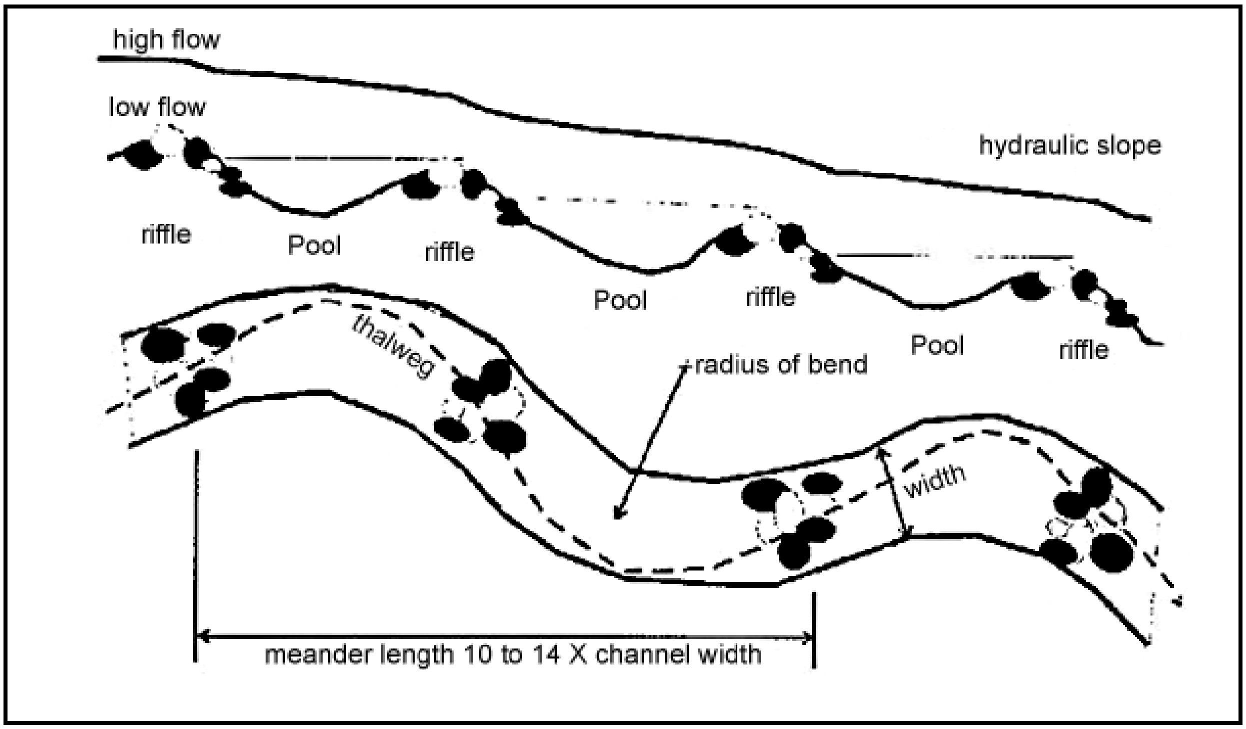

Figure 3. Plan View of ERR Design

Picture 3. ERR on Stream in Southern IL (flow is right to left)

MIDDLE REACH

The middle reach shows signs of long-term aggradation. Over time, the middle reach has filled with sediment caused from the deposition of the channelized material from the upper reach. This section of river the channel is out of bank more frequently than expected; meaning the 2 year USGS regression discharge exceeds channel capacity. The problem with this condition is the out of bank occurrences and potential for localized flooding at a higher than average rate.

Picture 4 is of a typical section of the middle Kaskaskia River reach between miles 10 – 45, as noted by the low level banks. This section of river had less than 2' feet of freeboard and no bank stability issues were identified. As the water comes out of bank, energy is dissipated and the added roughness from the riparian corridor acts as bank stabilization. This reach of the river is identified by the 2 yr USGS regression discharge as exceeding the current channel capacity. With the stability of the banks within this reach, no action is needed for stream restoration. Continued monitoring and data collection is recommended.

Picture 4. Typical Section of Middle Kaskaskia River

LOWER REACH

Compared to the middle and upper reaches, the lower reach behaves most like a natural channel. The channel goes out of bank every 1-2 years, which is typical for streams and rivers in the region. There are localized sections of bank erosion, but overall, the channel is stable. The lower end of this section does have some backwater effects from Lake Shelbyville, but there are no significant concerns.

Picture 5 is a typical section of the lower Kaskaskia River reach between miles 0 – 10 as noted by the mid-level banks. This section of river had approximately 5 feet of freeboard. This reach has locations of localized bank failure but overall the system is very stable within this reach.

Picture 5. Localized Bank Erosion on Left Descending Bank (flow is left to right)

There are multiple bank stabilization techniques that could be used on localized bank failures but based on the channel planform and conditions, longitudinal peak stone toe protection (LPSTP) is recommended. This technique includes providing protection of the existing toe, keying the structure in on the upstream and downstream, and includes tie backs perpendicular along the structure (Figure 4). This will not allow the toe of the structure to erode and the tie backs will lead to deposition of material over time. The deposition will incur vegetation and the vegetation will attract additional sediment. This stabilization technique should only be used once the comparison of the upstream and downstream reaches of the river have been analyzed and evaluated. Once again a stream restoration specialist and local regulatory agencies should be consulted prior to implementing any channel enhancements.

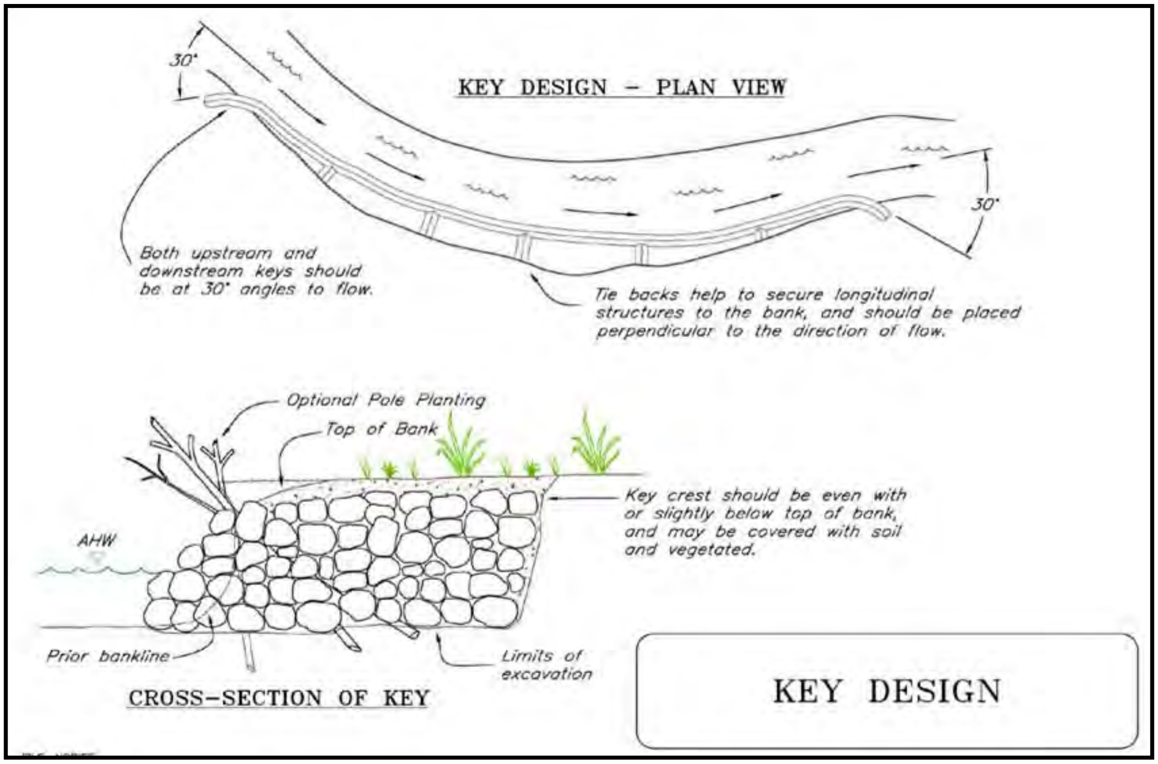

Figure 4. Plan View of LPSTP

LPSTP is also the most economical form of bank stabilization. Rather than using revetments to stabilize the entire bank, LPSTP provide protection of the toe (Picture 6). This requires less material, and therefore, more river bank length can be stabilized. It is also less evasive and the bankline can be returned back to a relative “natural” state in a short period of time (Picture 7).


Picture 6. LPSTP Immediately Post Construction


Picture 7. LPSTP Three Months Post Construction (notice sedimentation & vegetation)

LAKE FORK AND WEST OKAW RIVERS

The Lake Fork River was listed as impaired due to channelization and the West Okaw was listed as impaired due to chemical pollutants. The analysis of the channel dimension, pattern, and profile identified that the Lake Fork and West Okaw were stable river systems. This is verified by the CEM stage I at four of the six cross sections taken. The Lake Fork River may have localized channelization or bank failures but overall this river system is stable. Bank stabilization structures akin to LPSTP could be used in these situations. The chemical pollutants found in the West Okaw River were most likely due to land use change and can be attributed to surface water runoff. To reduce the impacts of surface water runoff filter strips could be planted near the river banks and retention ponds could be built.

LAKE SHELBYVILLE

The results of the Lake Shelbyville siltation were limited to the upper end of the reservoir at the deltaic formations on the Kaskaskia and West Okaw Rivers. Data analysis indicates that the siltation rates averaged 0.1 to 0.15 feet per year after reservoir completion to 1984. The siltation rate was reduced to +/- 0.03 feet per year at the same cross section locations from 1984 to 2010. It is believed that the delta formations have become stable at the upper portions but continue to advance downstream causing additional siltation further down into the reservoir. Additional data collection and studies are required for a reservoir siltation analysis.

BIBILIOGRAPHY

LEOPOLD L.B. (1994): "A View of the River". Harvard University Press, Cambridge, MA

IDNR (2000): Kaskaskia River Area Assessment, Volume 1: Geology. Illinois Department of Natural Resources, State Geological Survey Division, Champaign, IL

ROSGEN, D. (1996): "Applied River Morphology". Wildland Hydrology, Pagosa Springs, CO

USACE (2000): "Bank Erosion Study of the Kaskaskia River, Carlyle Lake to New Athens, IL." Technical Report M13, Unite States Army Corps of Engineers, St. Louis District

USACE (2003): "Bank Erosion and Morhology of the Kaskaskia River", United States Army Corps of Engineers, St. Louis District

USACE (2006): "Bank Erosion and Historical River Morphology Study of the Kaskaskia River, Lake Shelbyville to Upper End of Carlyle Lake", Technical Report M30, United States Army Corps of Engineers, St. Louis District

USACE (2006): "Sedimentation in the Upper Mississippi River Basin", United States Army Corps of Engineers, St. Louis District

FOR MORE INFORMATION

For more information about Historical River Morphology of the Kaskaskia River Headwaters to Lake Shelbyville, please contact Michael Rodger, P.E. or Robert Davinroy, P.E. at:

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Or you can visit us on the World Wide Web at:
http://www.mvs.usace.army.mil/arec/index.html

INDEX OF PLATES

Plates number 1 through 78 follow:

PLATE NUMBER 1

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

VICINITY MAP
UPPER KASKASKIA RIVER

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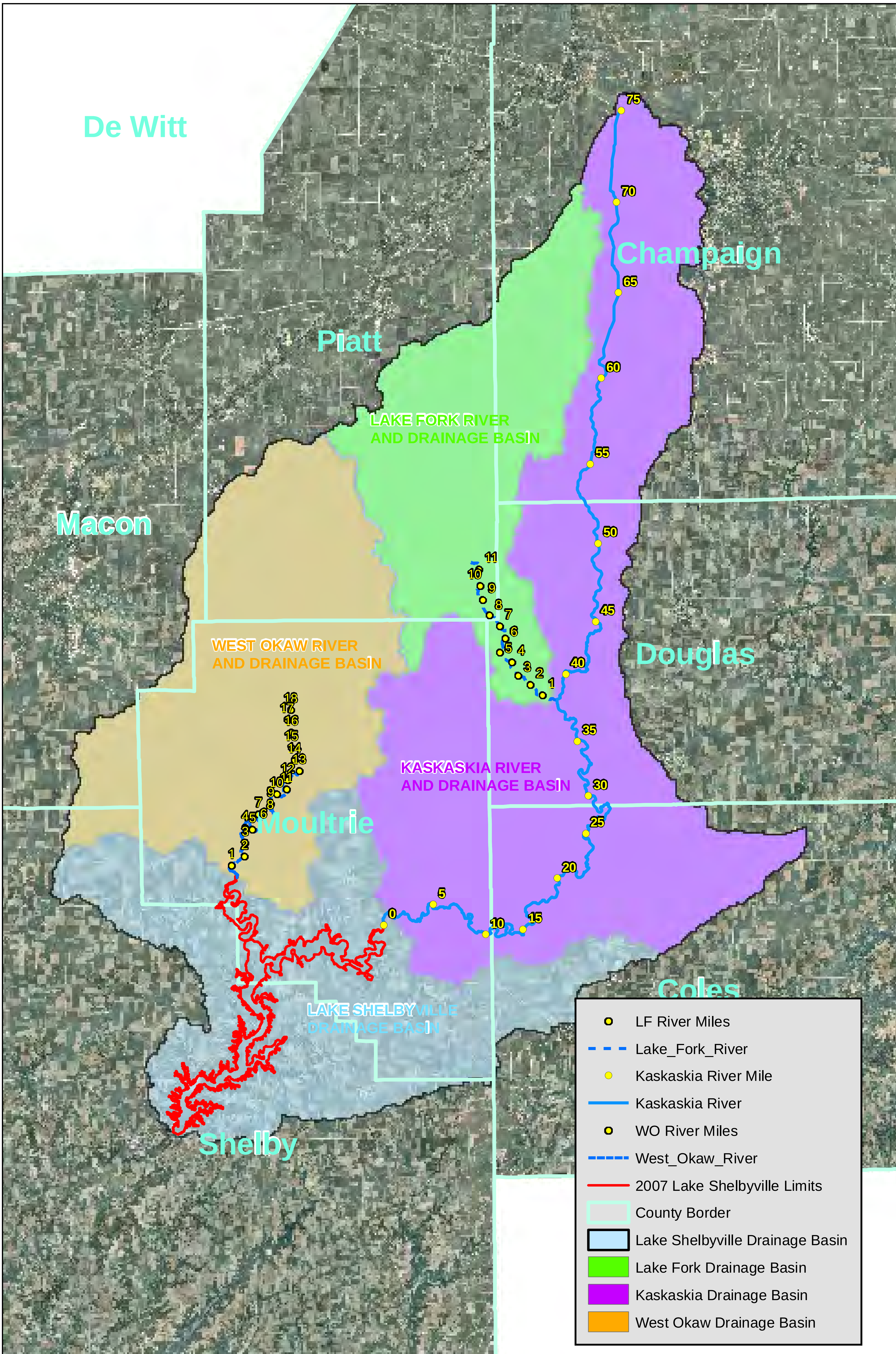
St. Louis District



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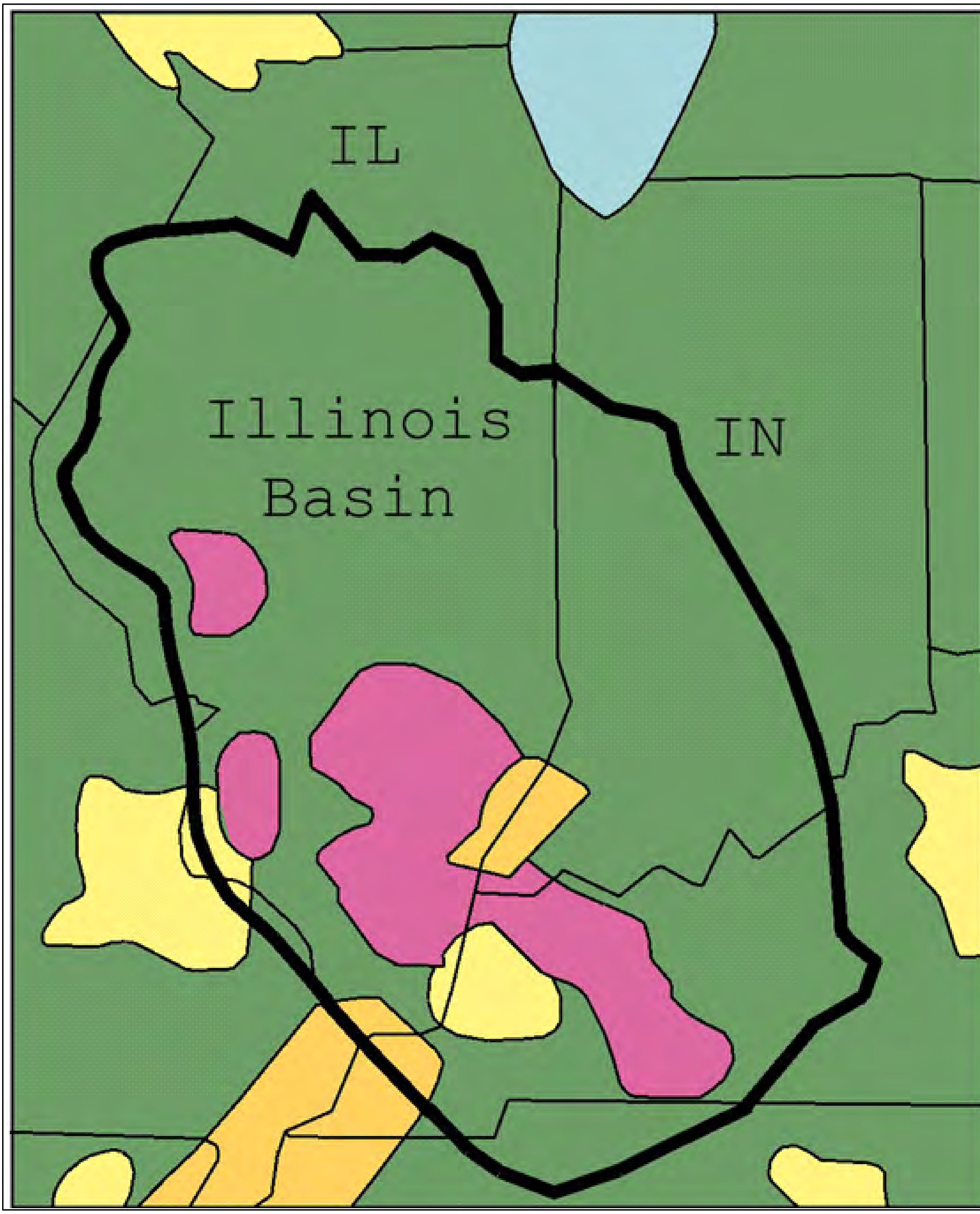
UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

PLATE NUMBER 2



ILLINOIS BASIN

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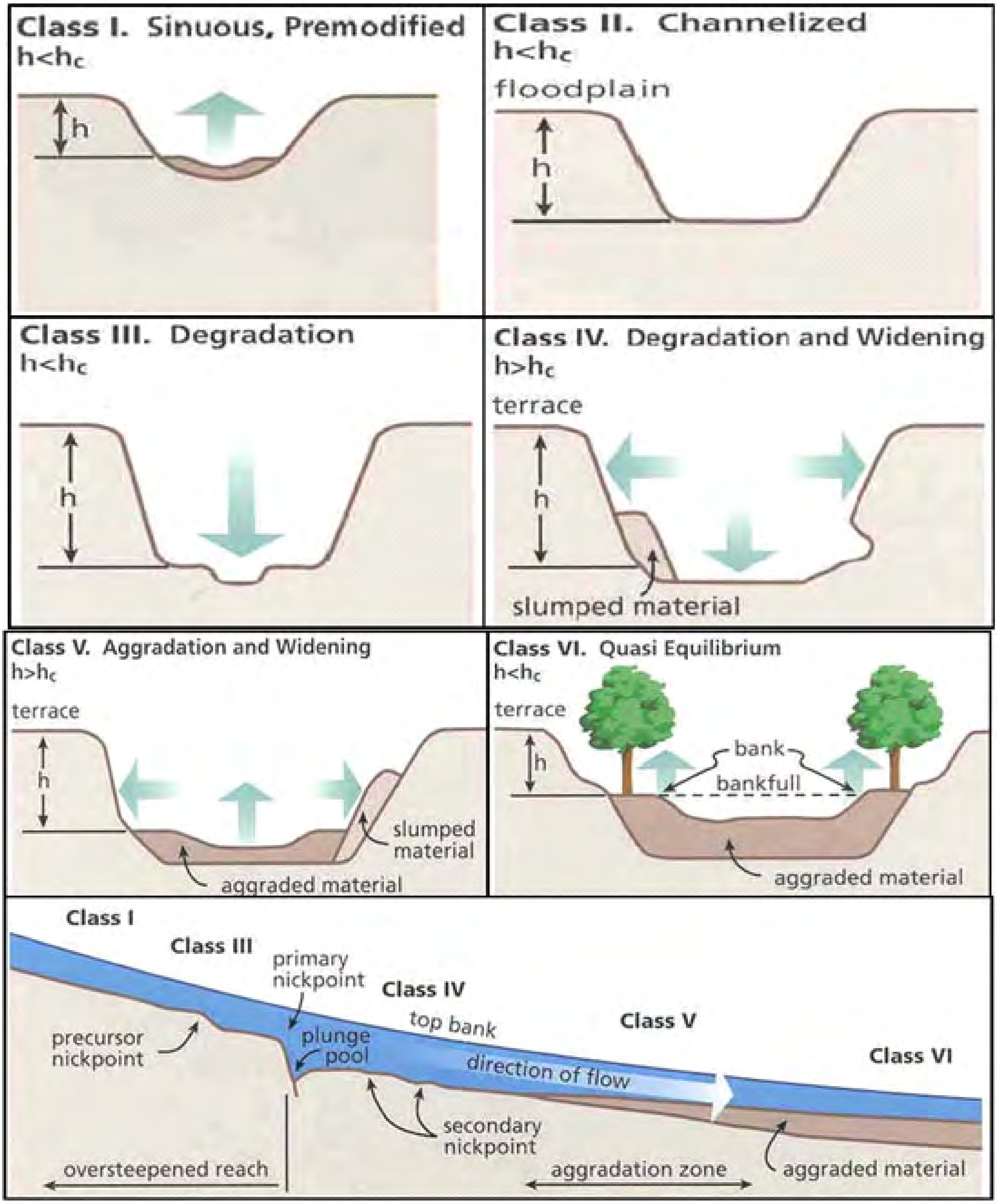
UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 3



CHANNEL EVOLUTION MODEL

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

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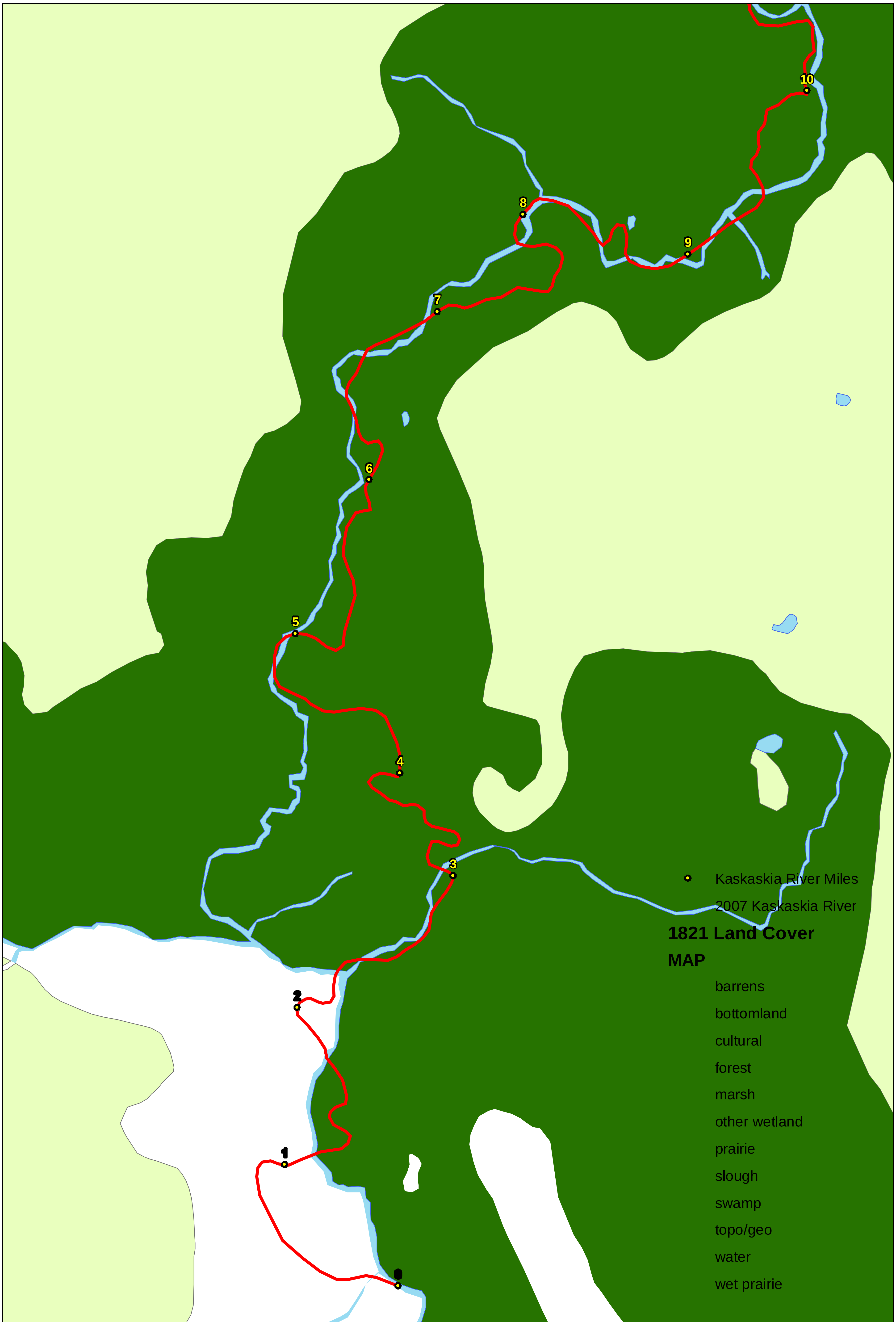
PLATE NUMBER
4



1821 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 0-10

0 395 790 1,580 2,370 3,160 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

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PLATE NUMBER
5

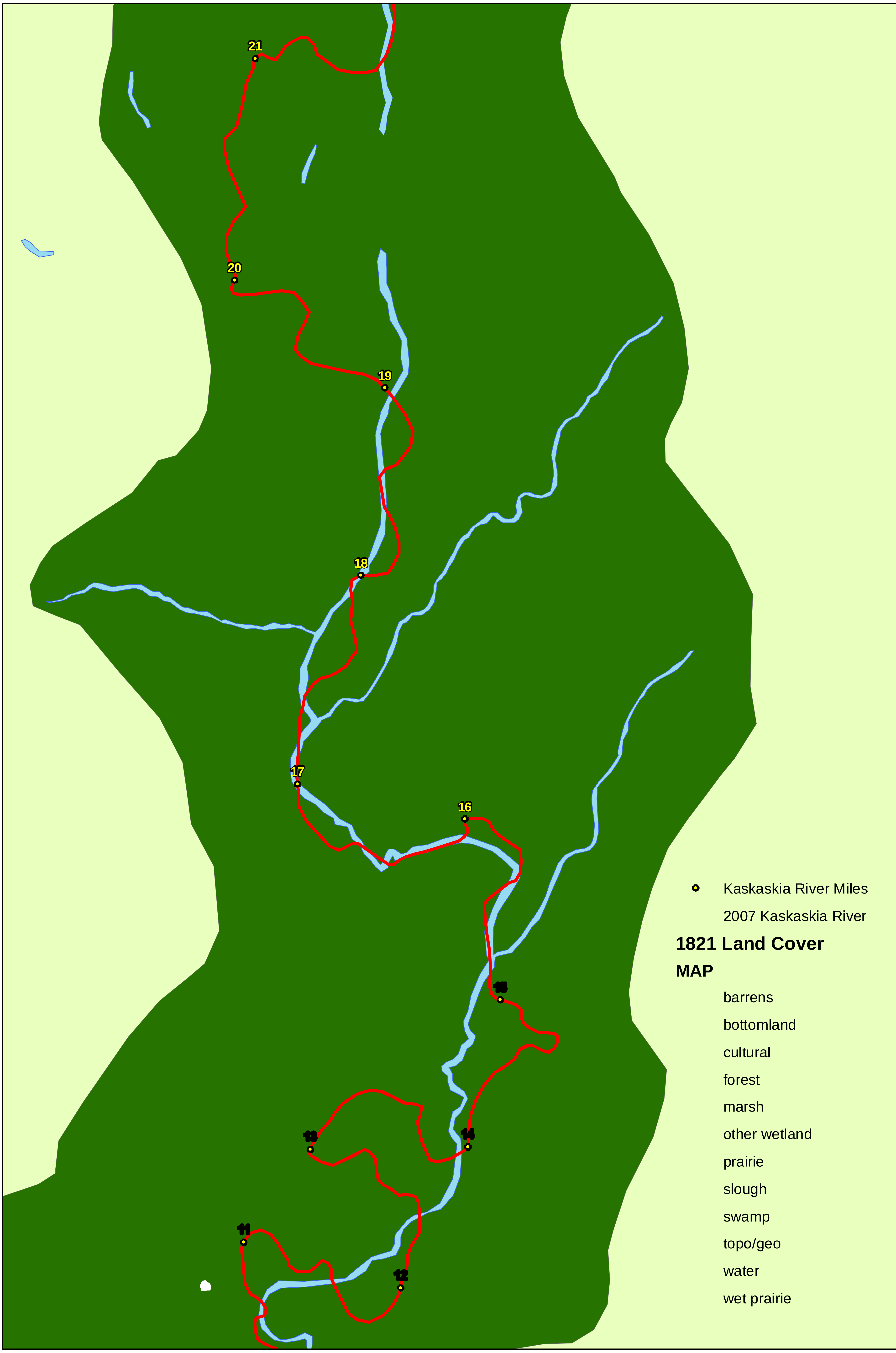

PLATE NUMBER 6

0 375 750 1,500 2,250 3,000 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 11-21

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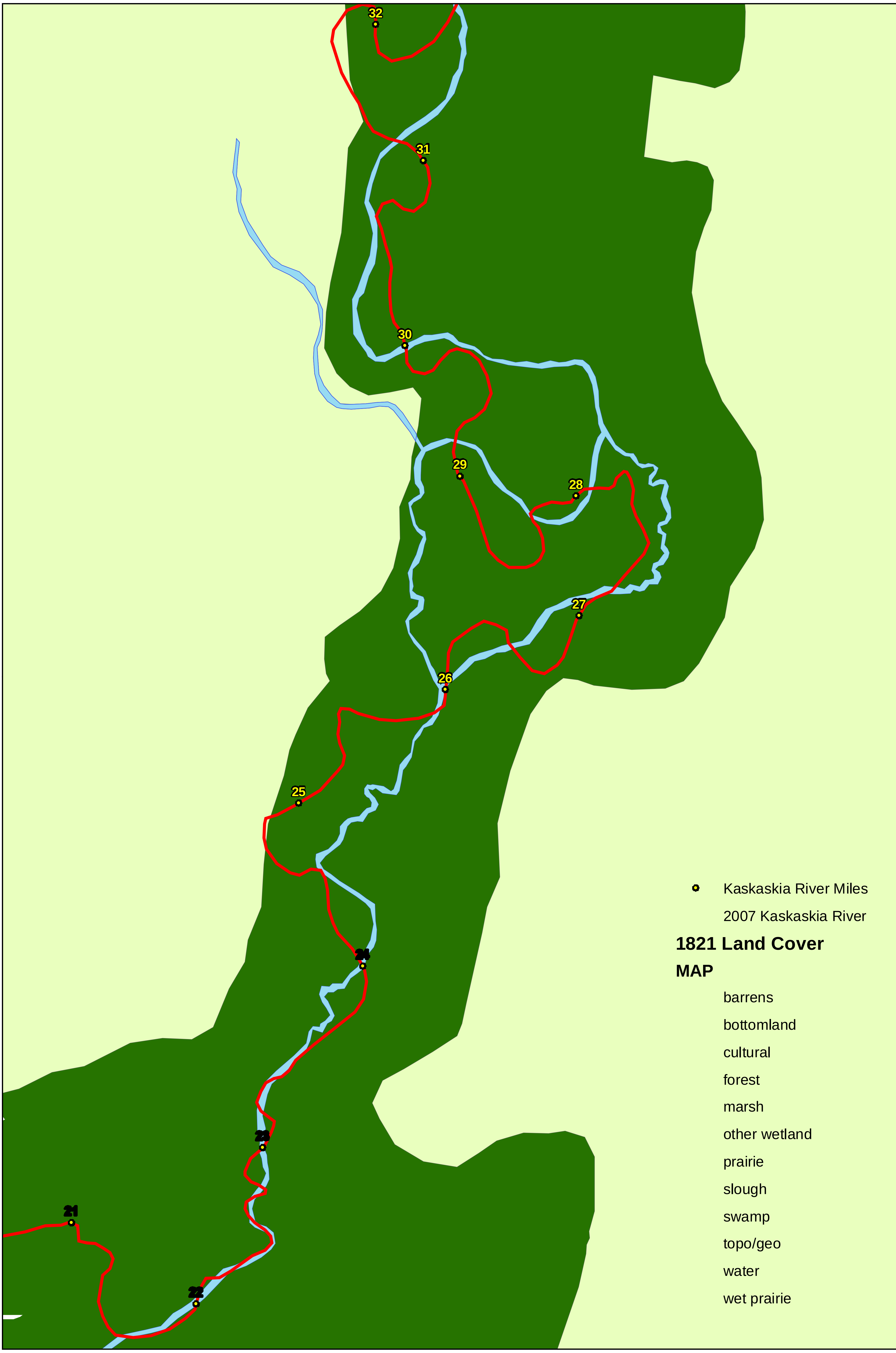

PLATE NUMBER 7

0 380 760 1,520 2,280 3,040 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 22-32

N W E S

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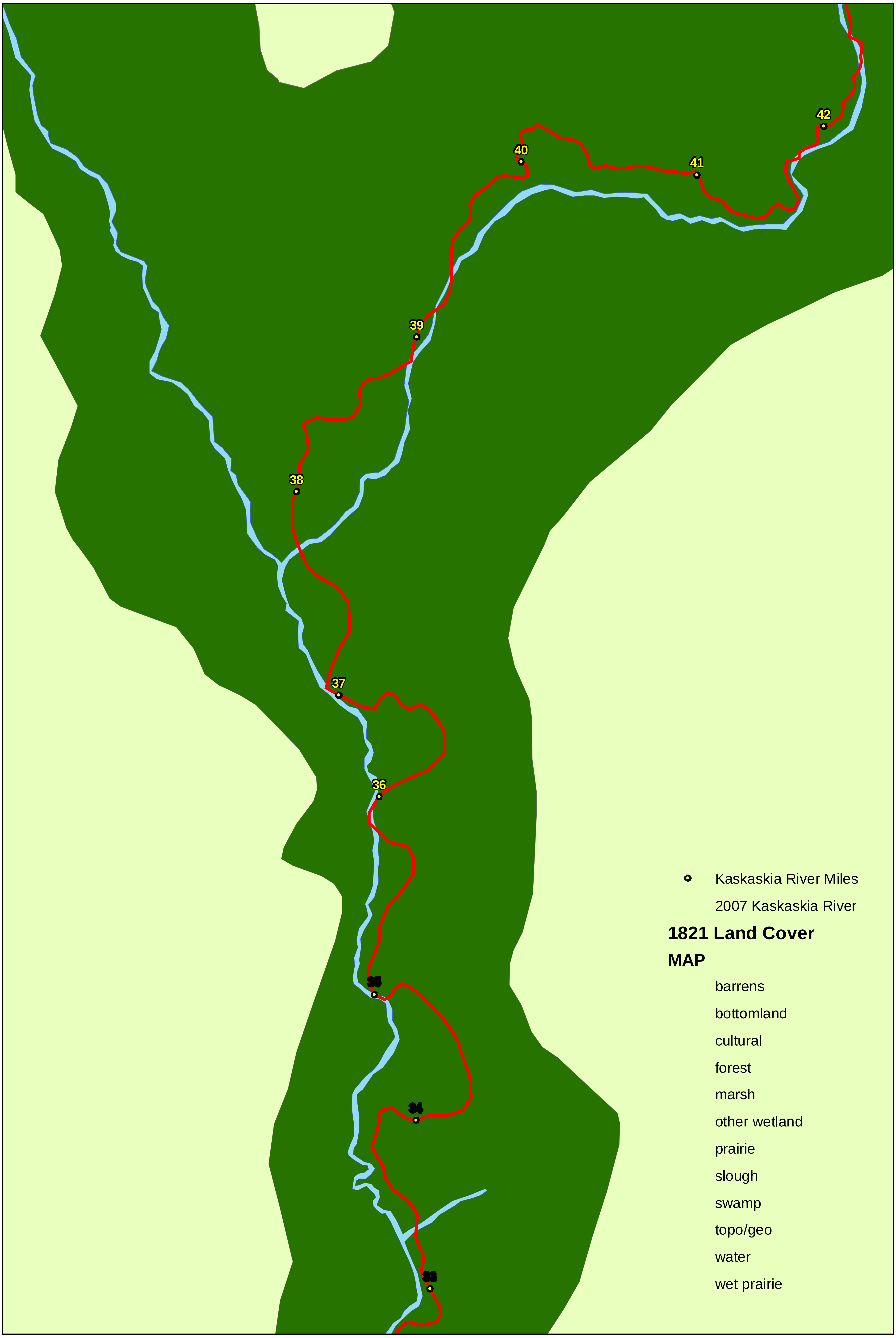

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 33-42

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PLATE NUMBER 8

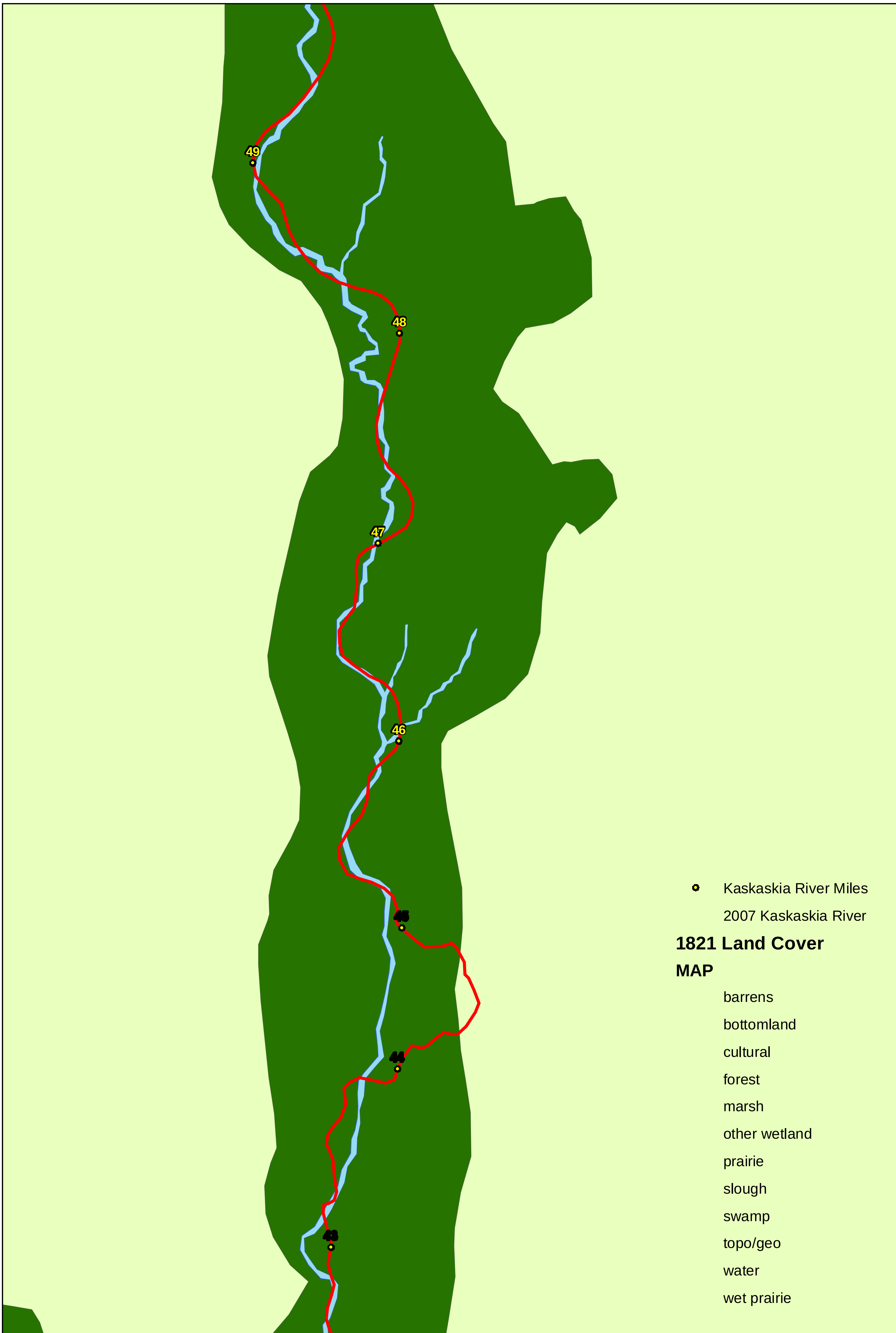

PLATE NUMBER 9

0 380 760 1,520 2,280 3,040 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 43-49

N W E S

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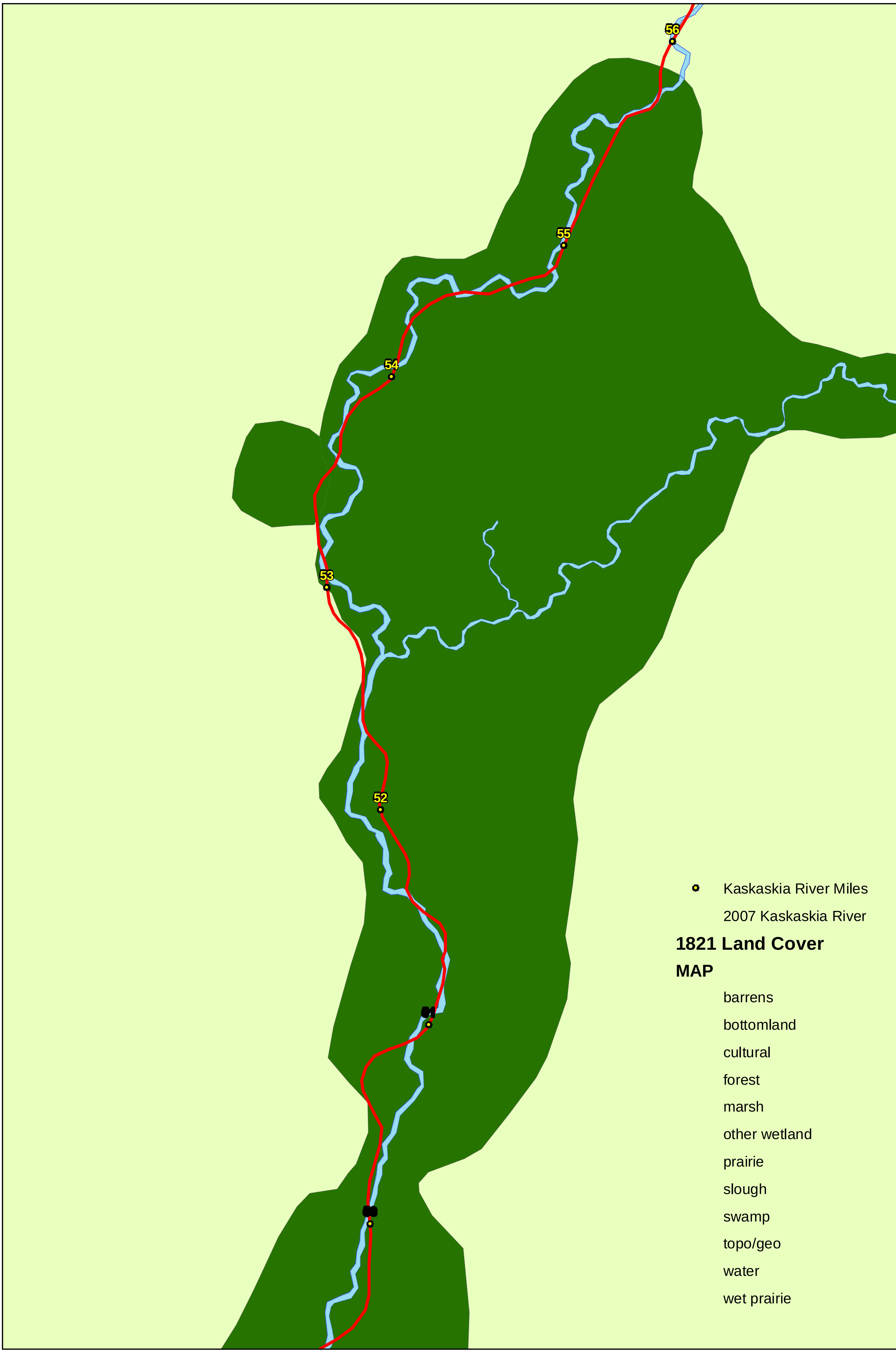

PLATE NUMBER 10

0 380 760 1,520 2,280 3,040 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 LAND COVER MAP KASKASKIA RIVER BASIN MILES 50-56

N W E S

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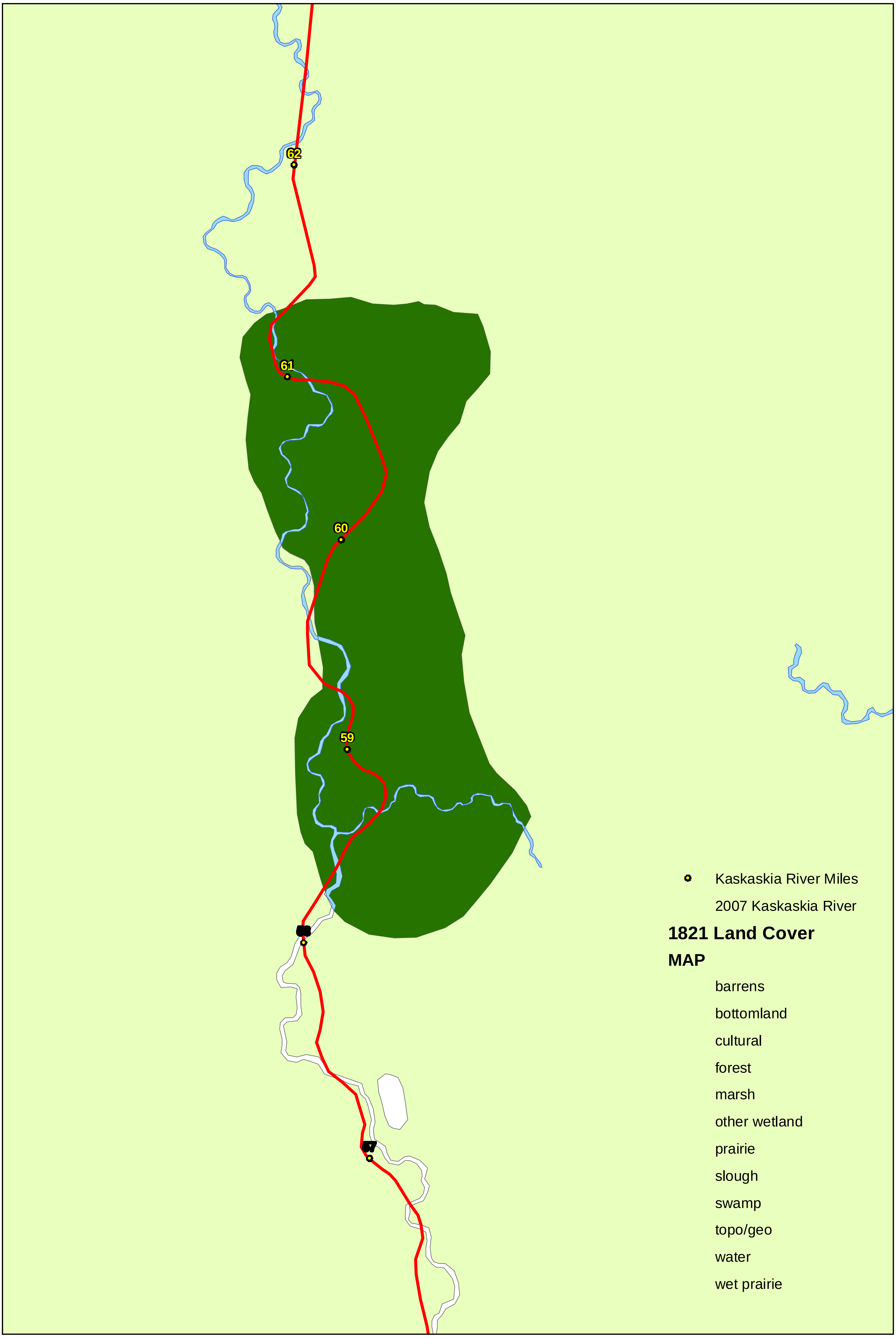

PLATE NUMBER 11

0 380 760 1,520 2,280 3,040 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 57-62

N E S W

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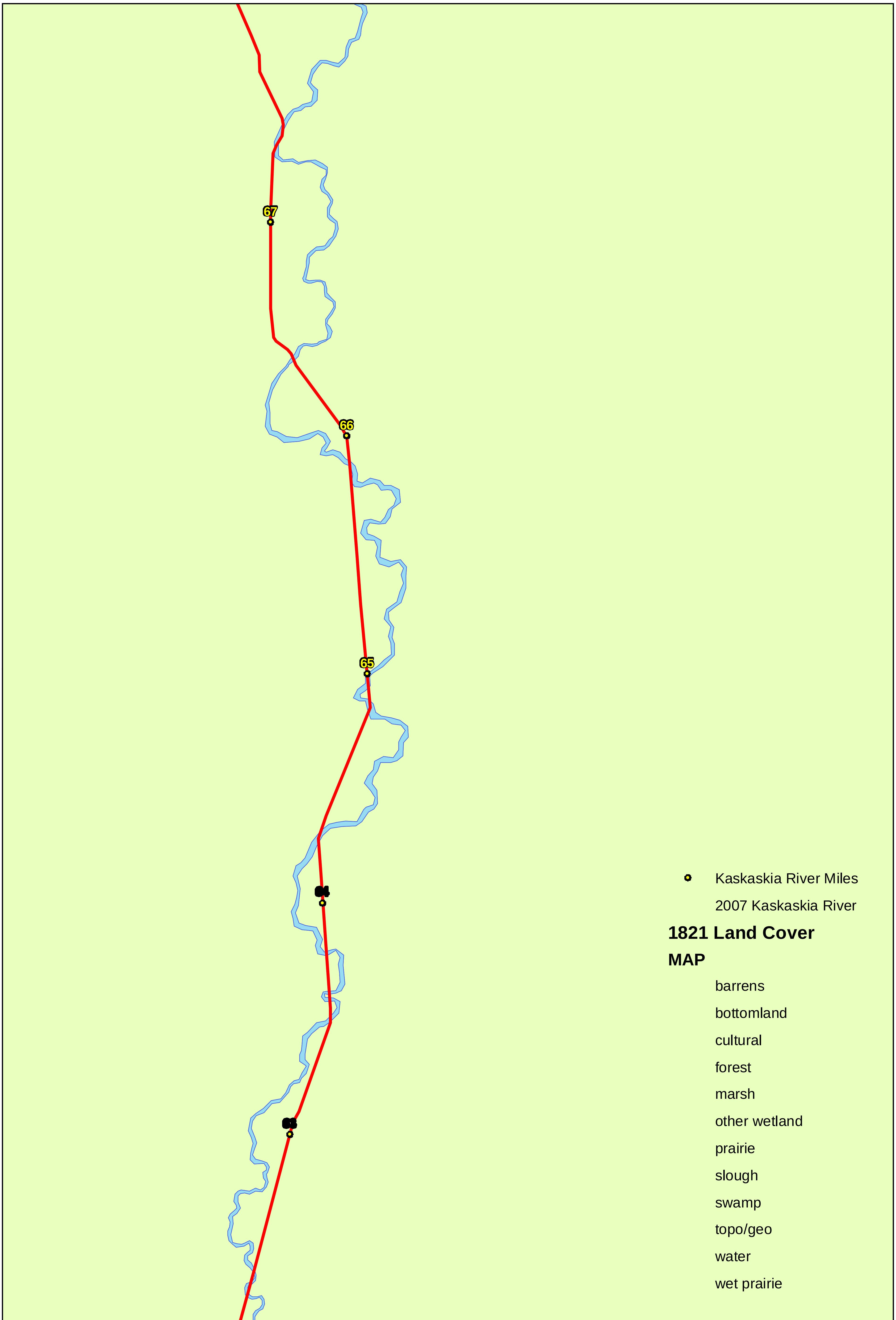

Kaskaskia River Miles

2007 Kaskaskia River

1821 Land Cover MAP

- barrens
- bottomland
- cultural
- forest
- marsh
- other wetland
- prairie
- slough
- swamp
- topo/geo
- water
- wet prairie

PLATE NUMBER 12

0 380 760 1,520 2,280 3,040 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 LAND COVER MAP KASKASKIA RIVER BASIN MILES 63-67

N W E S

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0 380 760 1,520 2,280 3,040 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 68-71

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PLATE NUMBER 13

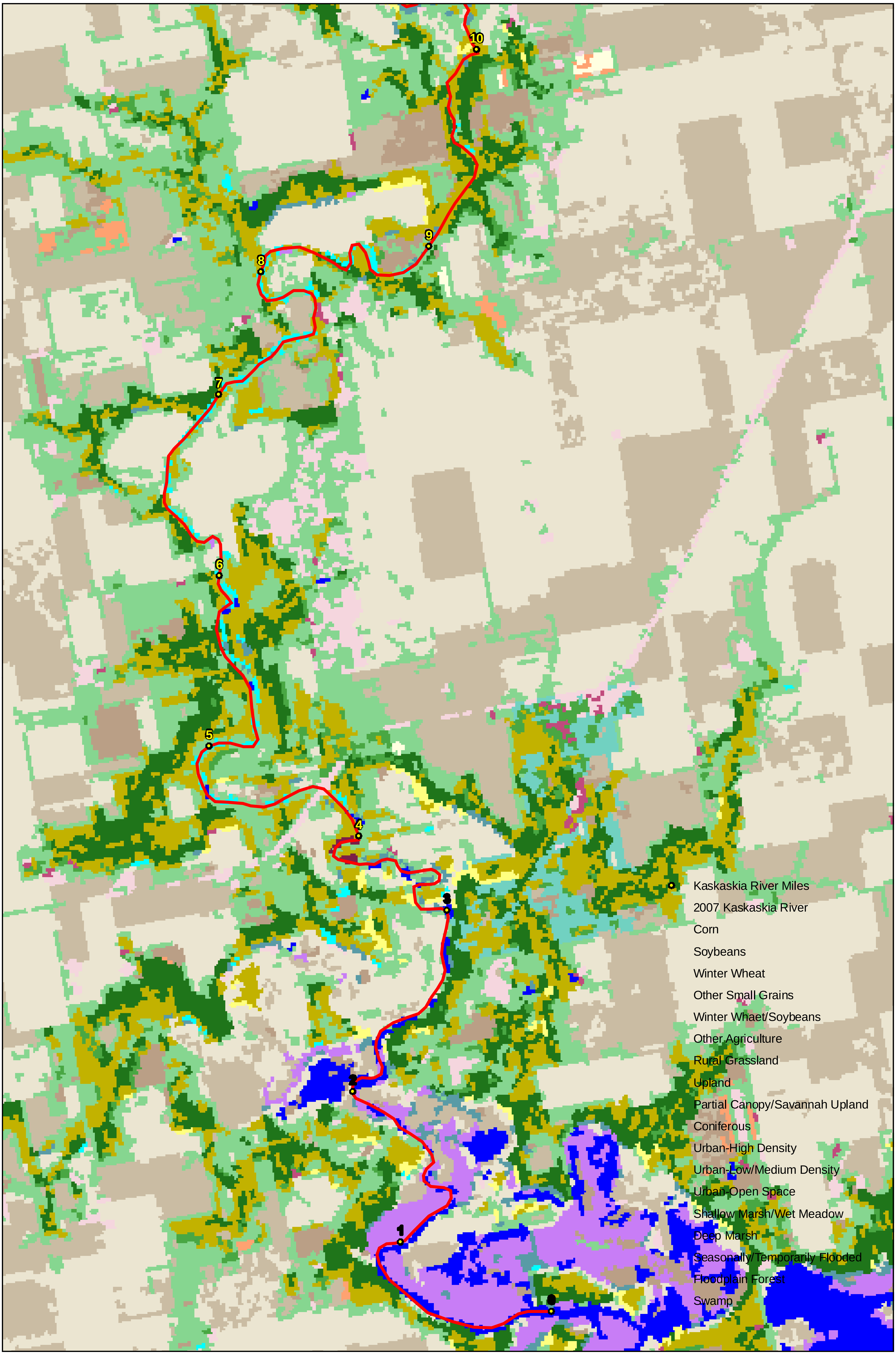

PLATE NUMBER 14

0 375 750 1,500 2,250 3,000 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

2000 LAND COVER MAP KASKASKIA RIVER BASIN MILES 0-10

N E S W

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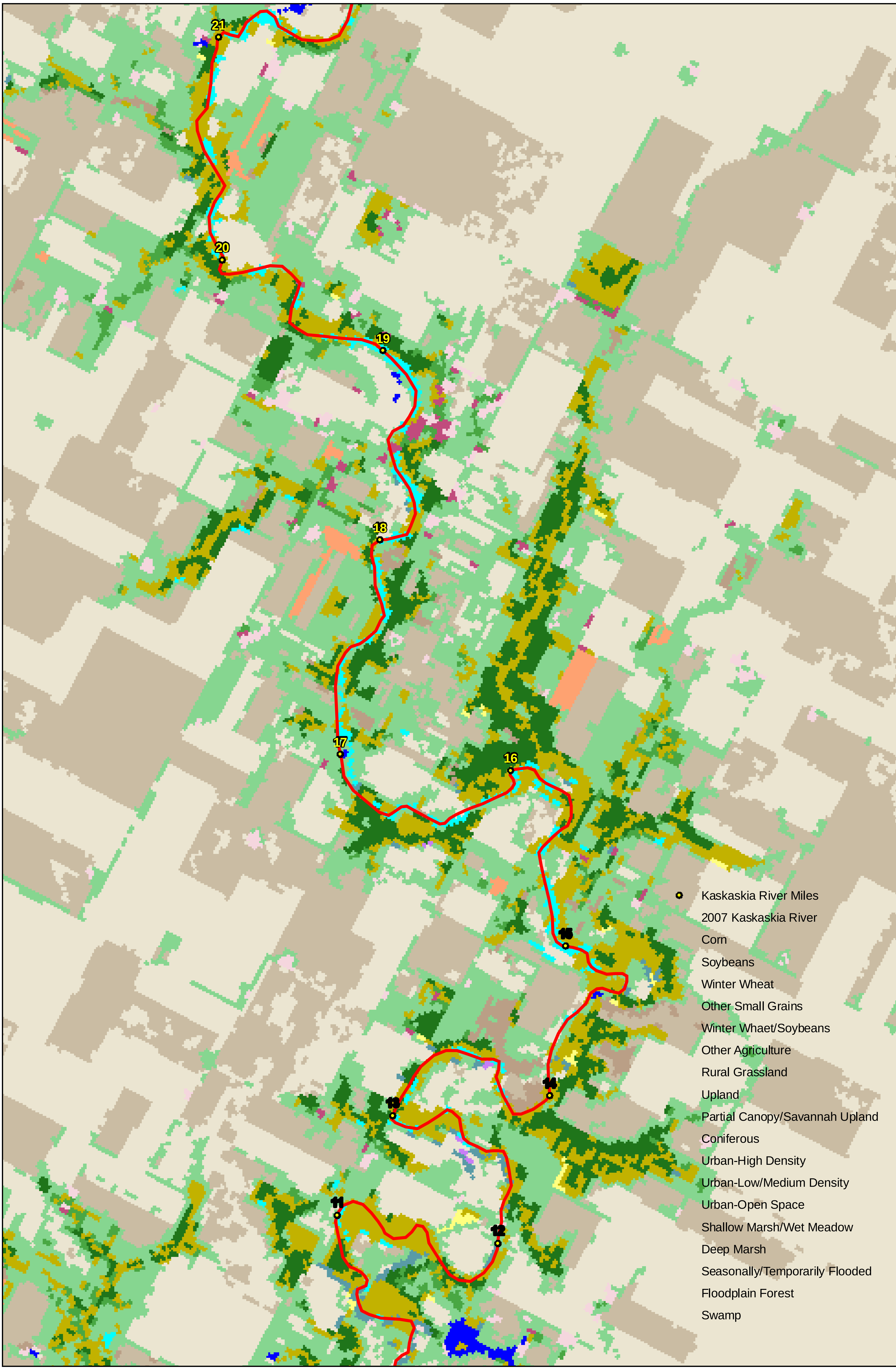

PLATE NUMBER 15

0 375 750 1,500 2,250 3,000 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

2000 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 11-21

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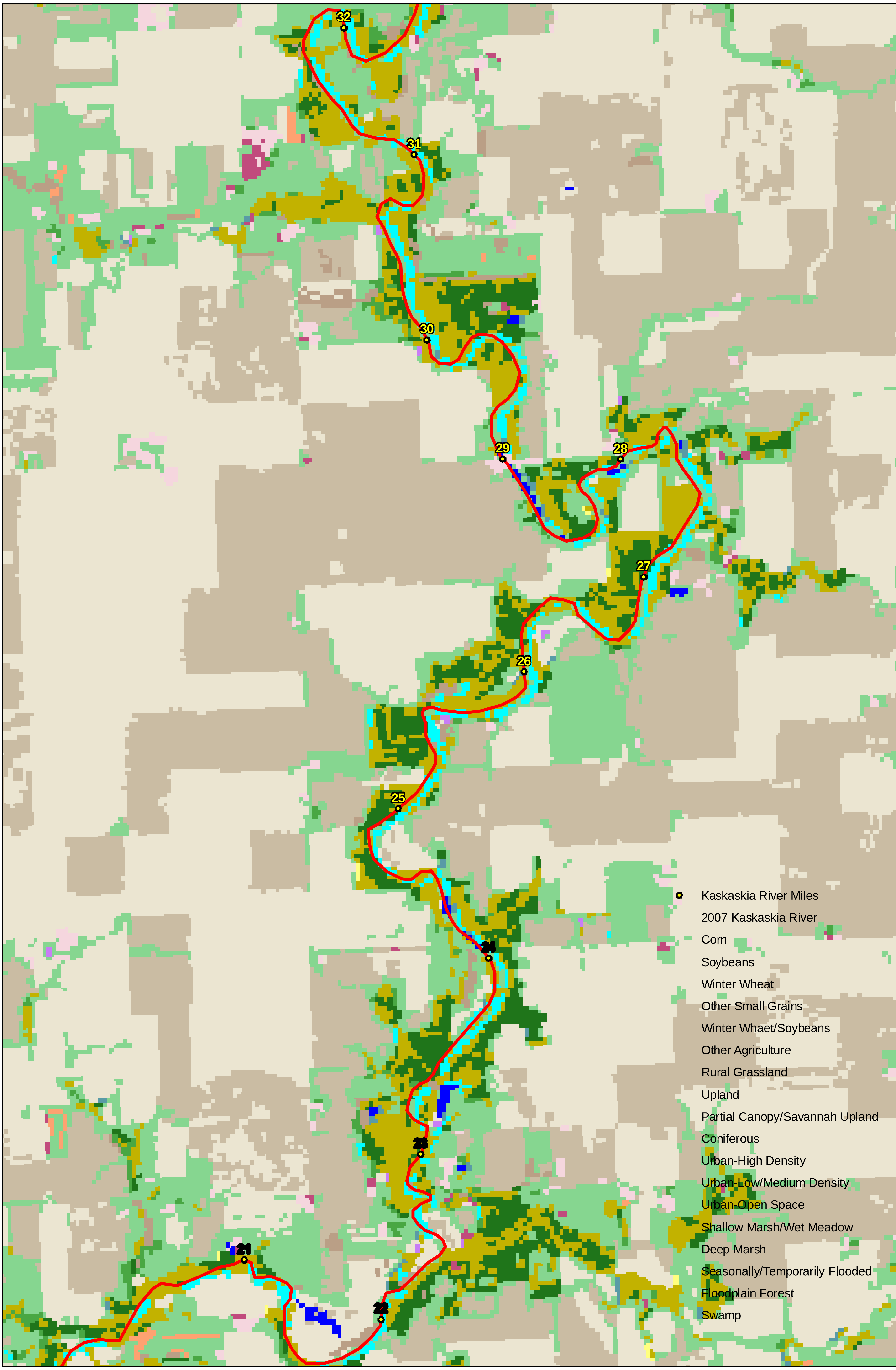

0 375 750 1,500 2,250 3,000
Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

2000 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 22-32

N
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S

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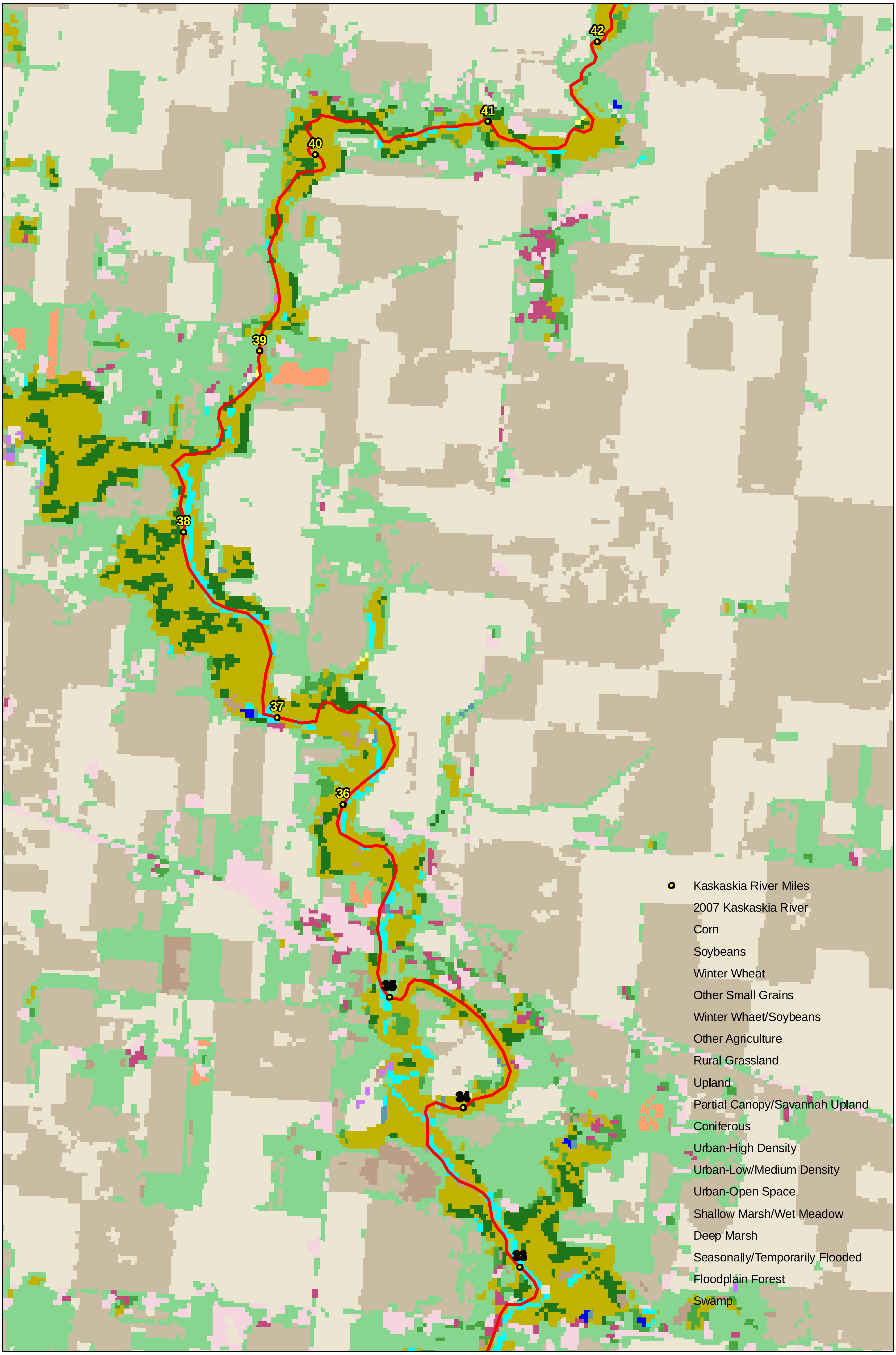
PLATE NUMBER
16



2000 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 33-42

PLATE NUMBER 17

0 375 750 1,500 2,250 3,000 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

US Army Corps of Engineers
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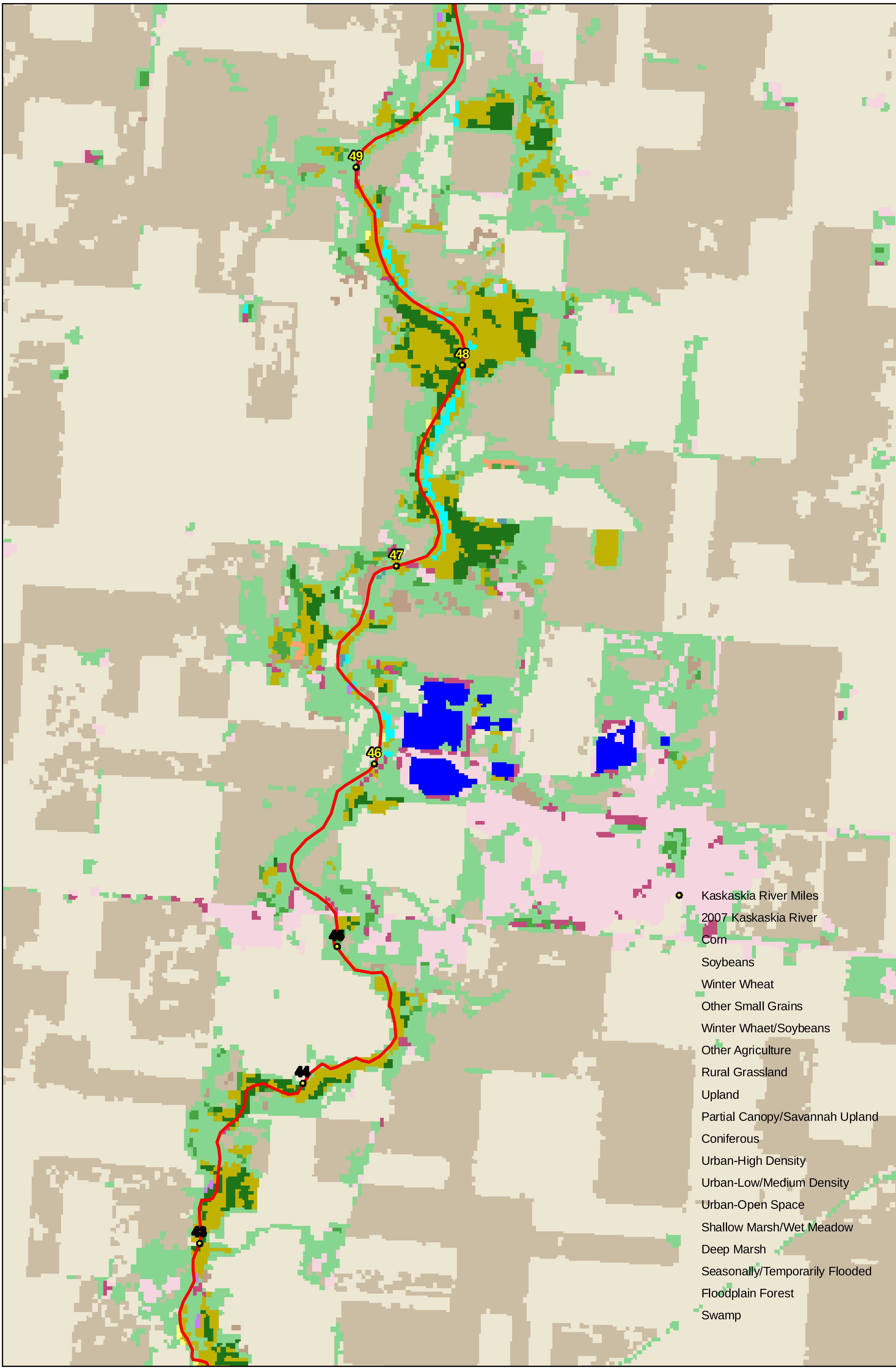

PLATE NUMBER 18

0 375 750 1,500 2,250 3,000 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

2000 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 43-49

N W E S

US Army Corps of Engineers
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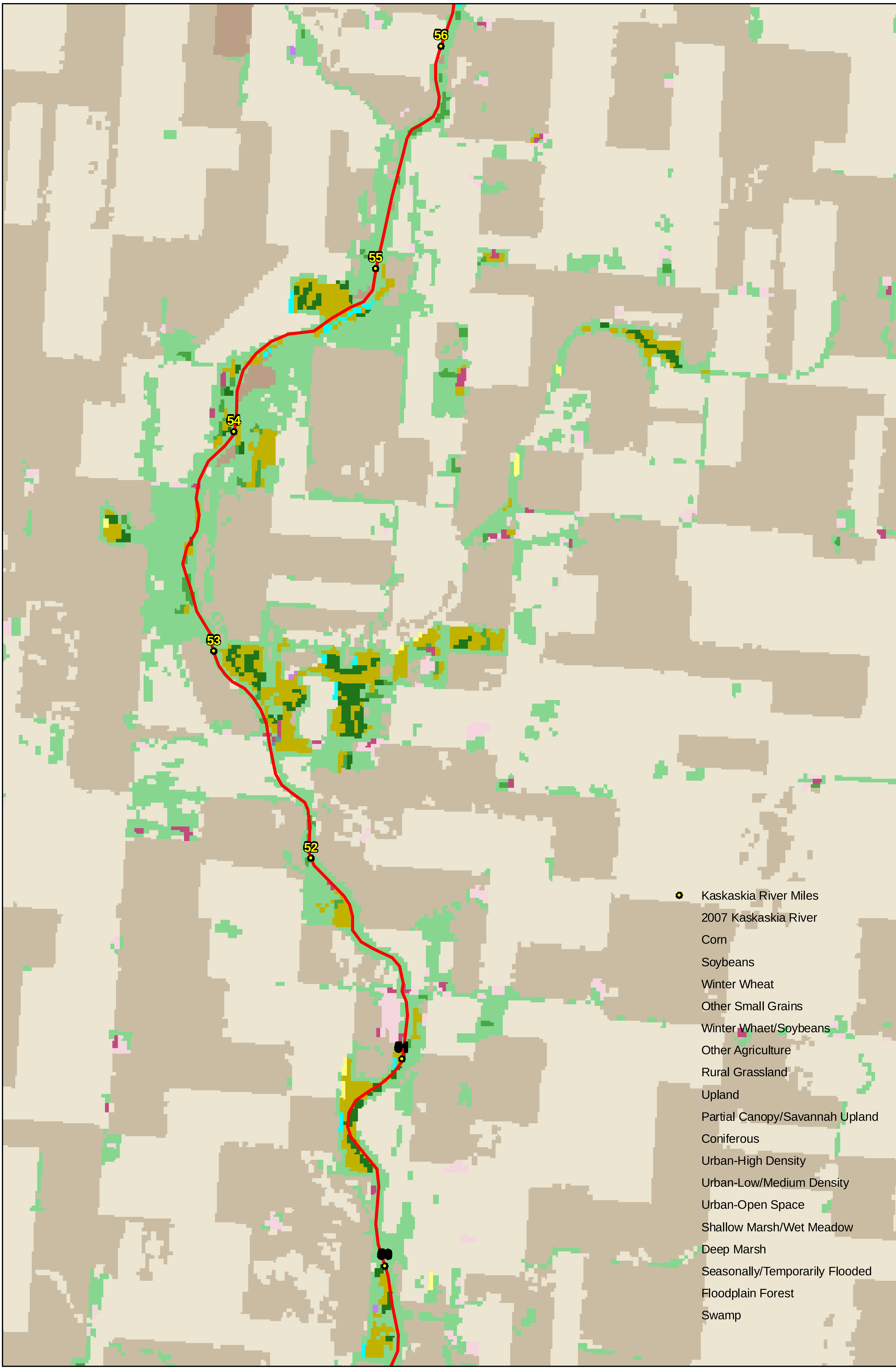

PLATE NUMBER 19

0 375 750 1,500 2,250 3,000 Feet

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UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

2000 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 50-56

N W E S

US Army Corps of Engineers
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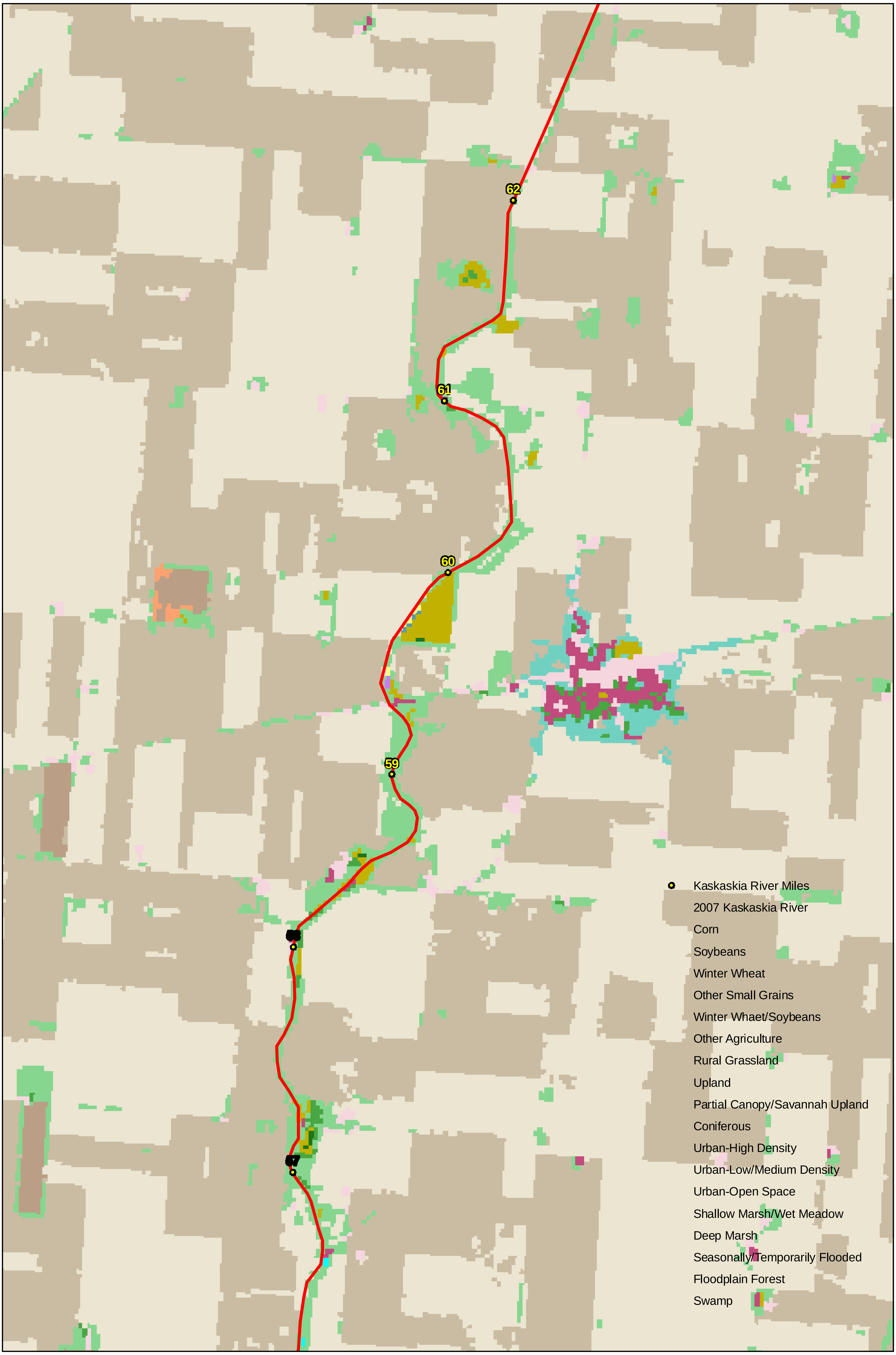


2000 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 57-62

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 20

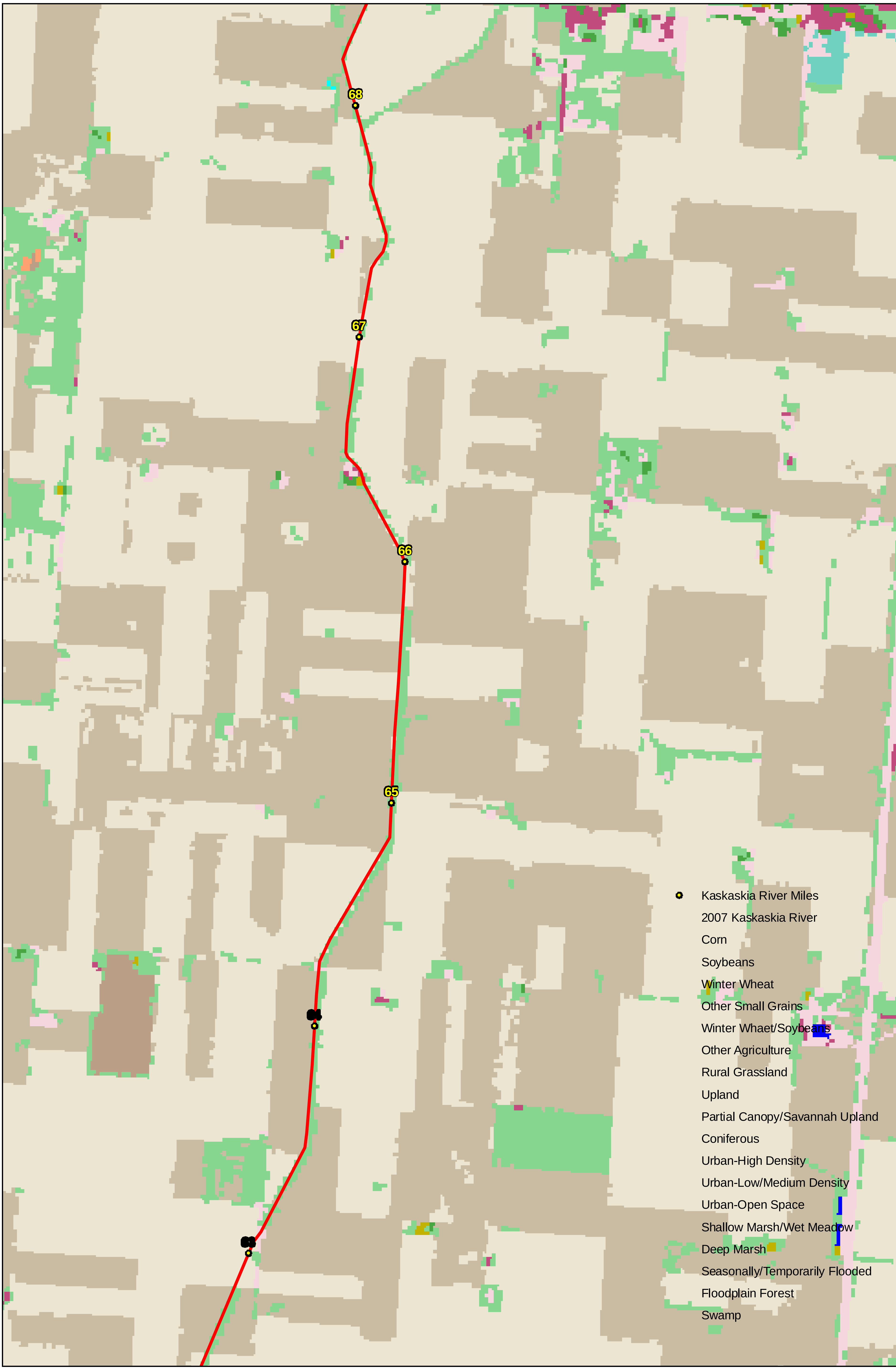


PLATE NUMBER 21

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

2000 LAND COVER MAP
KASKASKIA RIVER BASIN
MILES 63-68

N W E S

US Army Corps of Engineers
St. Louis District®

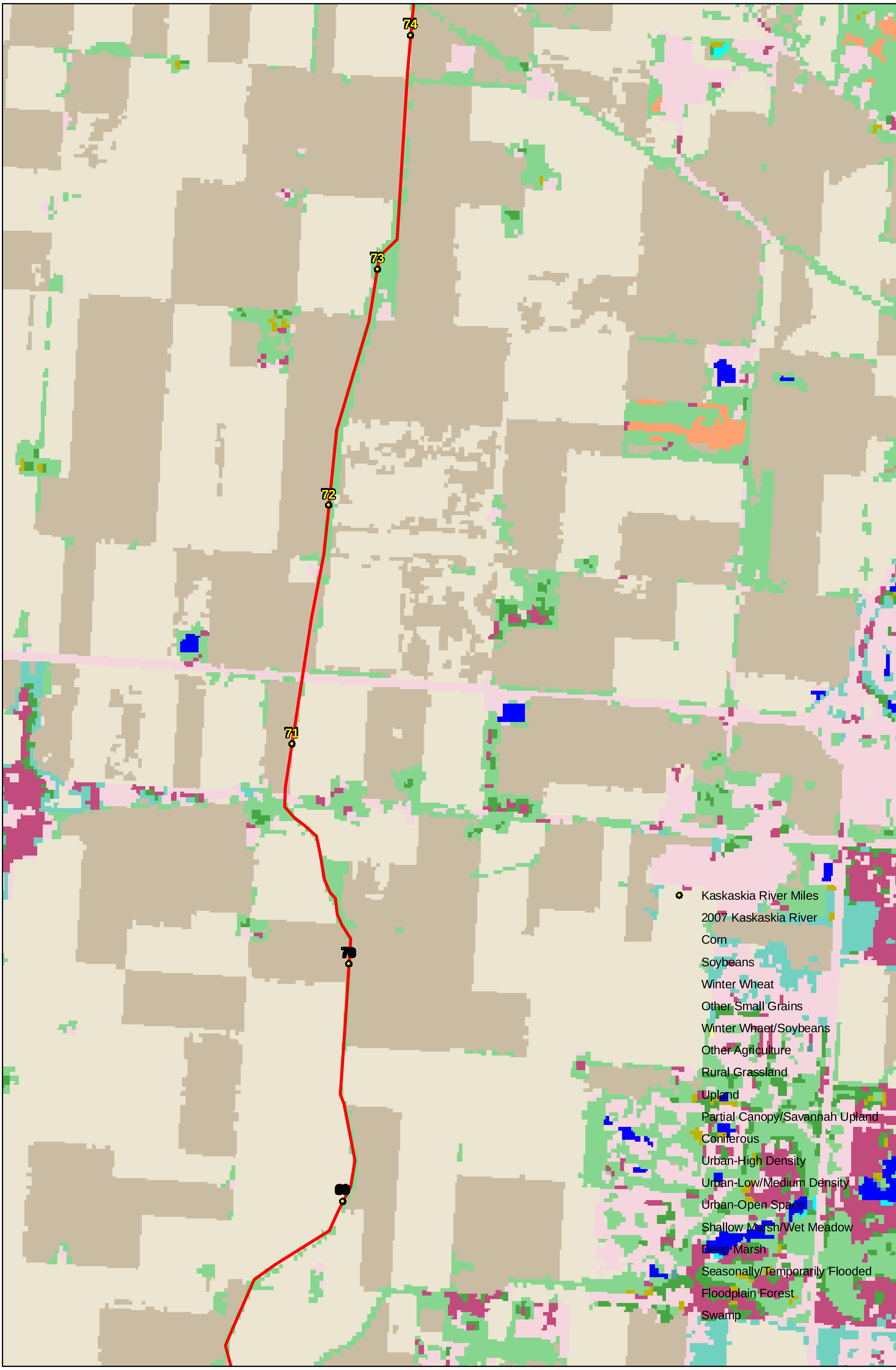


PLATE NUMBER 22

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

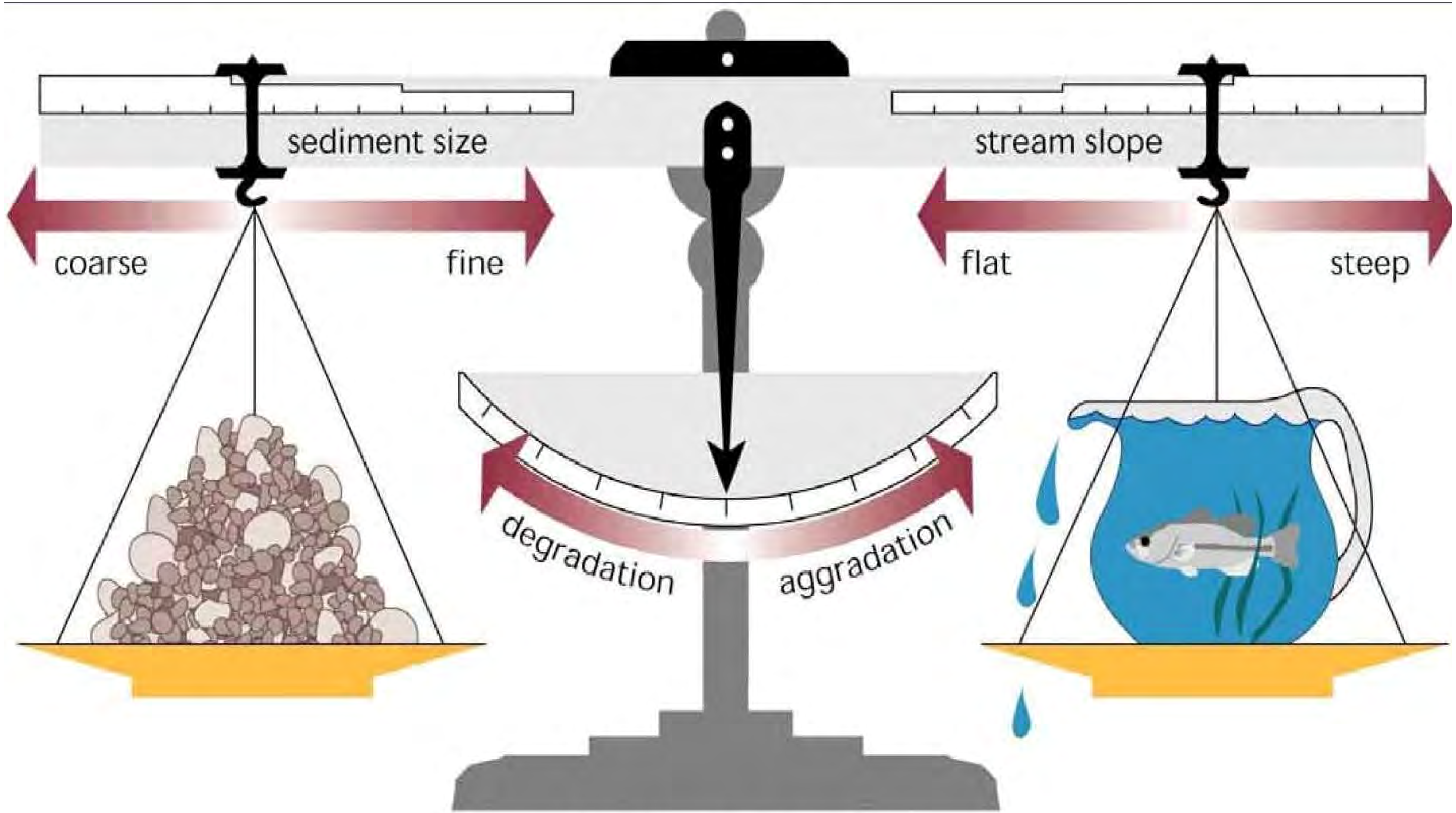
HEADWATERS TO LAKE SHELBYVILLE

2000 LAND COVER MAP KASKASKIA RIVER BASIN MILES 69-74

N W E S

US Army Corps of Engineers St. Louis District®

US Army Corps of Engineers
St. Louis District®



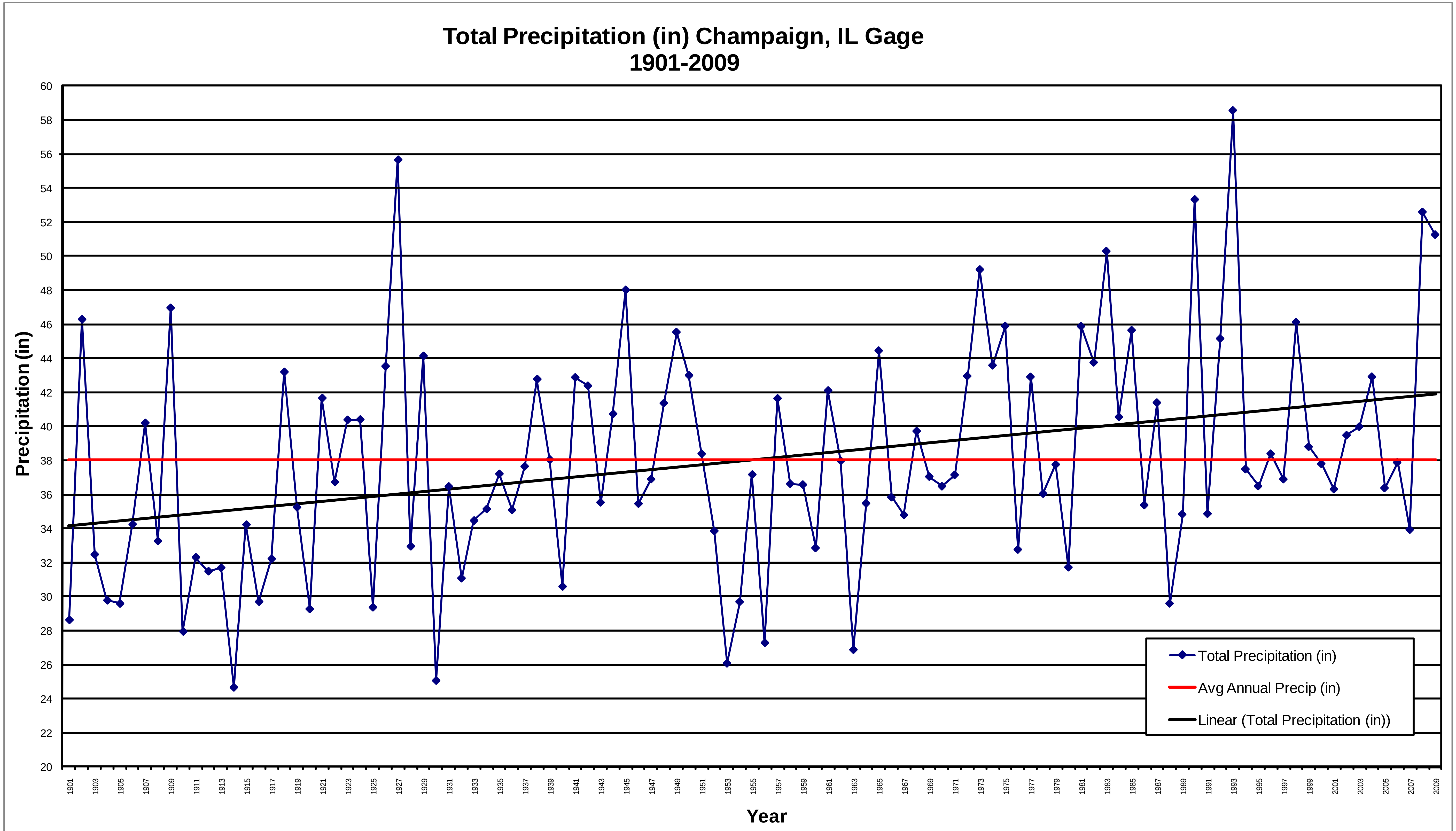
$$Q_s \cdot D_{50} \propto Q_w \cdot S$$

From Rosgen (1996), from Lane, Proceedings, 1955.
Published with the permission of American Society of Civil Engineers.

LANE'S EQUATION

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
23



PRECIPITATION GAGE
CHAMPAIGN, IL
1902-2009

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
24

KASKASKIA RIVER 1821, 1940, 1966, & 2007 CHANNEL LOCATIONS MILES 0-4

PLATE NUMBER 25

PLATE NUMBER 26

0 175 350 700 1,050 1,400 Feet

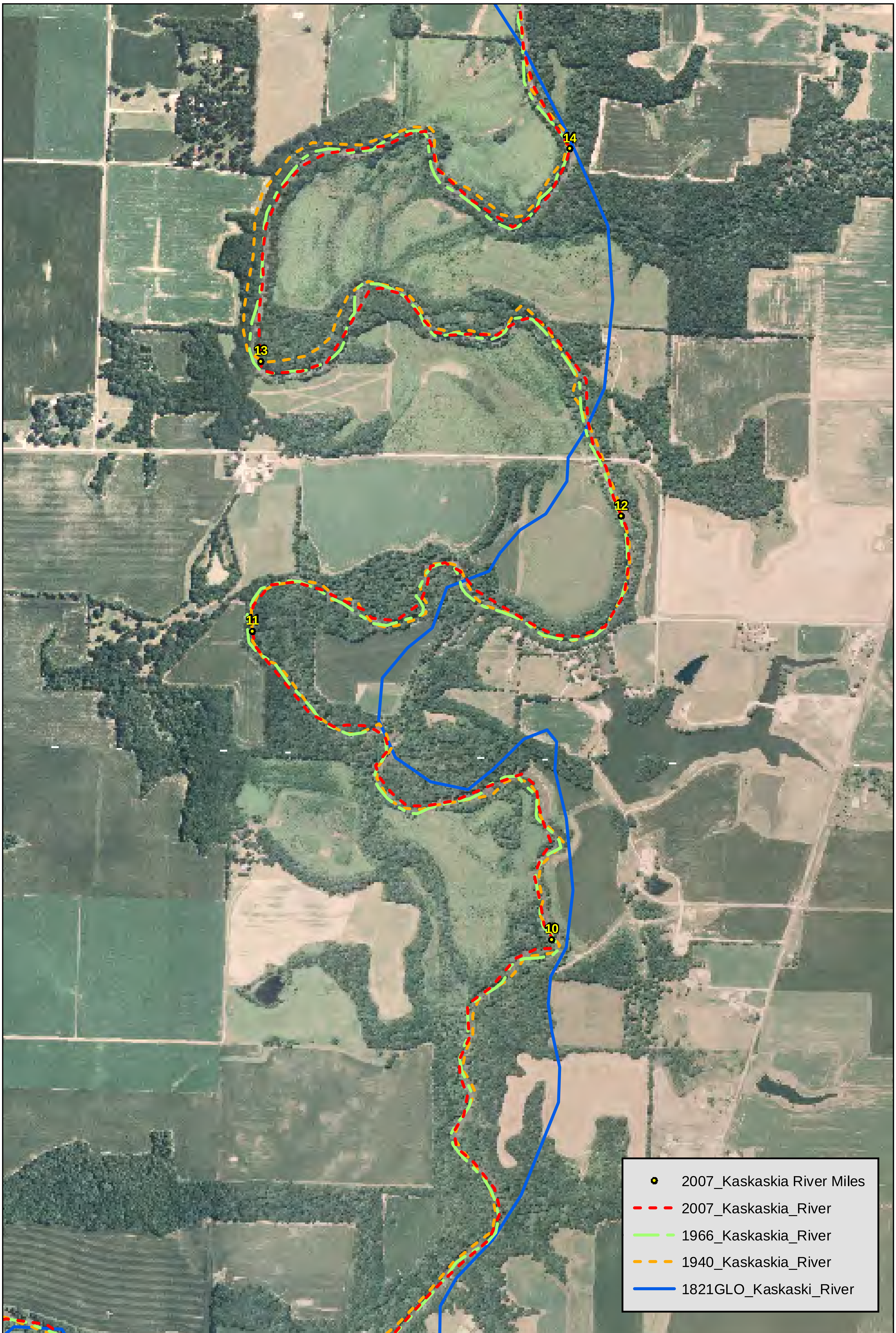
THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER 1821, 1940, 1966, & 2007 CHANNEL LOCATIONS MILES 5-9

US Army Corps of Engineers
St. Louis District®



THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 10-14

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 27

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 15-18

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 28

US Army Corps of Engineers
St. Louis District®

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

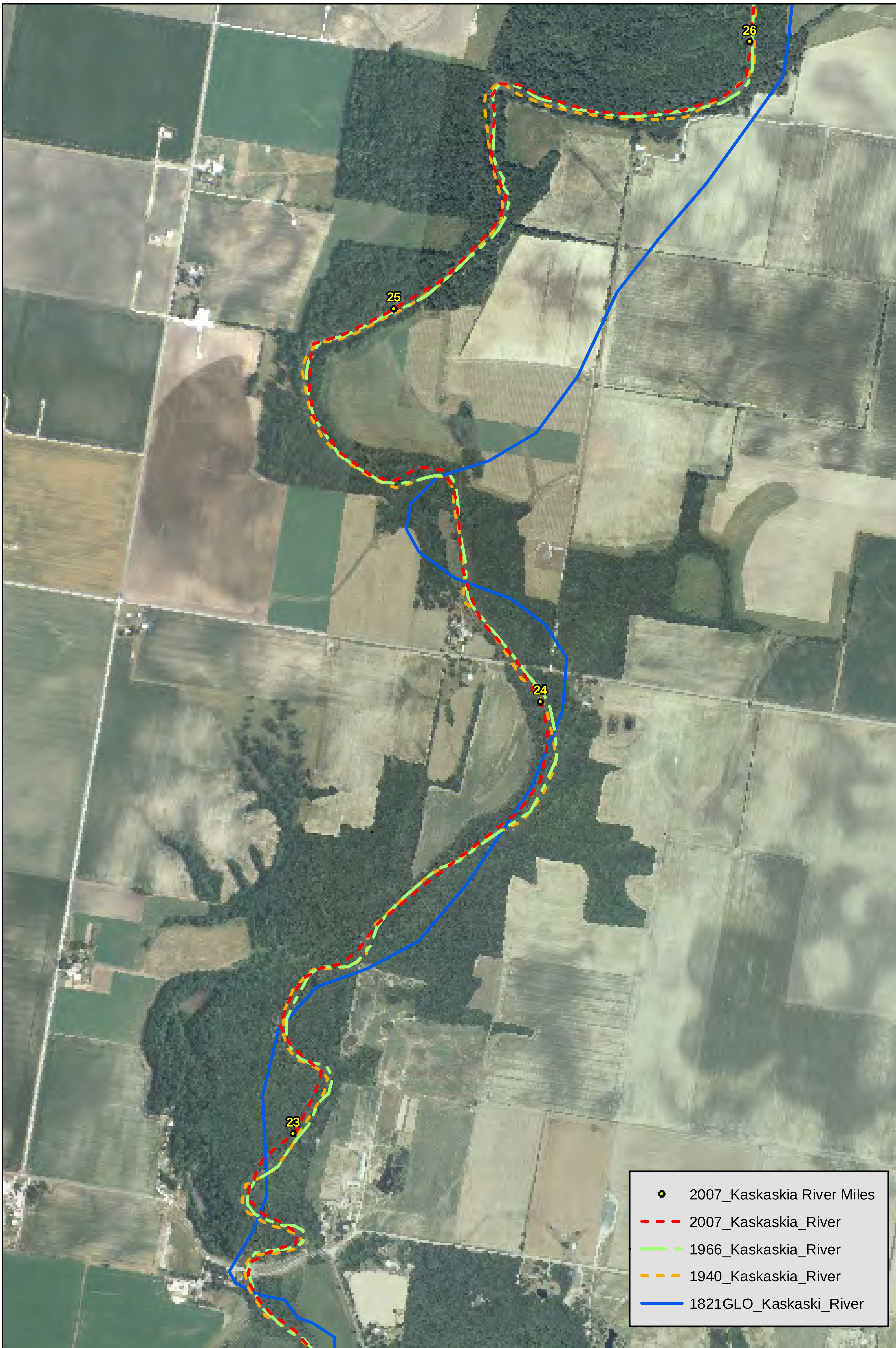
HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 19-22

N E S W

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 29



KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 23-26

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 30

US Army Corps of Engineers
St. Louis District®

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 27-31

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 31

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 32

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER 1821, 1940, 1966, & 2007 CHANNEL LOCATIONS MILES 32-35

US Army Corps of Engineers
St. Louis District®

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 36-39

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 33

US Army Corps of Engineers
St. Louis District®

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 40-43

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 34

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 35

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 44-46

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 36

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 47-49

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 37

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 50-52

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 38

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER 1821, 1940, 1966, & 2007 CHANNEL LOCATIONS MILES 53-55

N E S W

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 39

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

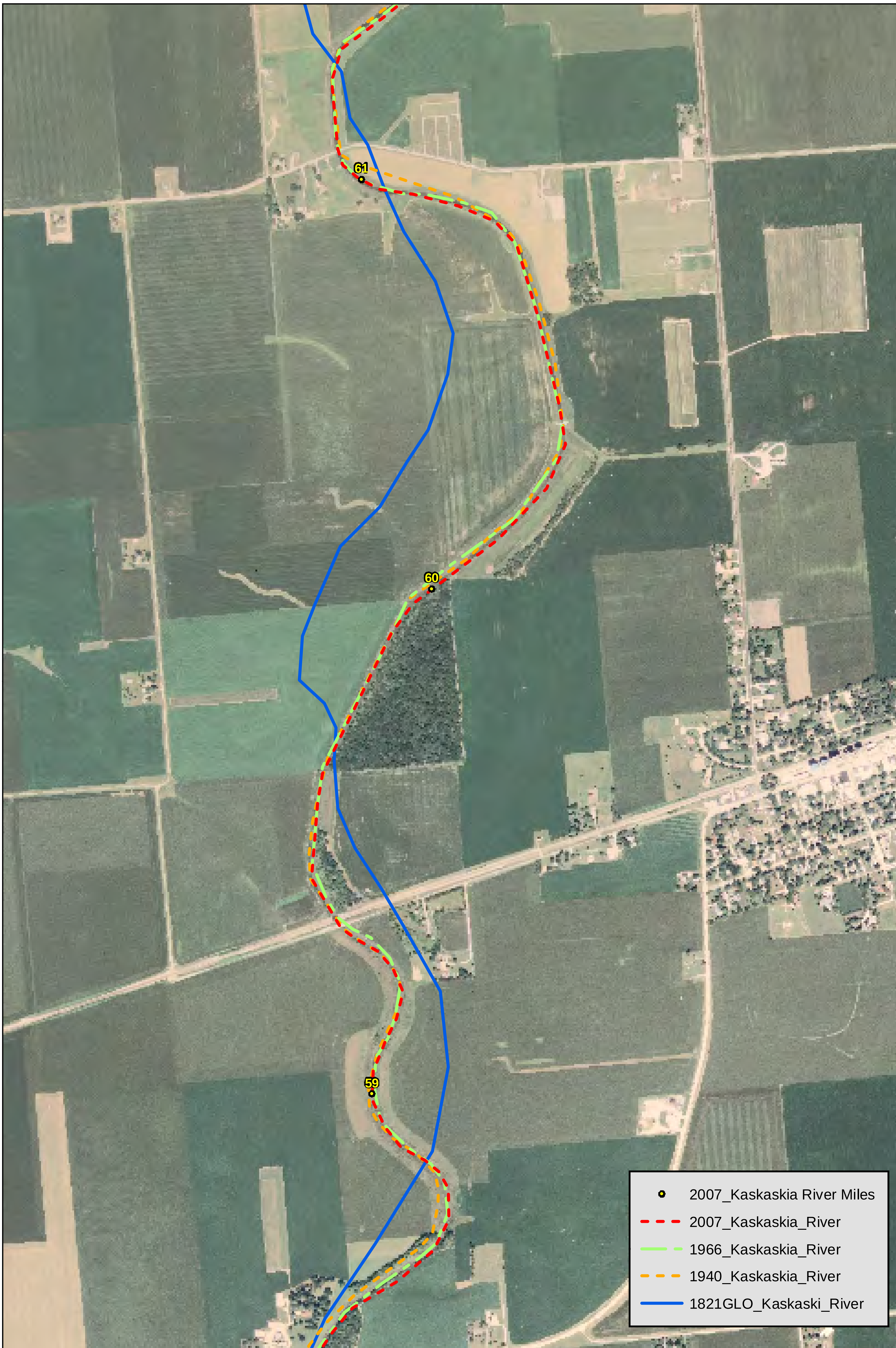
UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 56-58

N E S W

US Army Corps of Engineers
St. Louis District®



KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 59-61

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 40

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 62-63

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 41

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 42

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER 1821, 1940, 1966, & 2007 CHANNEL LOCATIONS MILES 64-66

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 43

0 175 350 700 1,050 1,400 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 67-69

N W E S

US Army Corps of Engineers
St. Louis District®

KASKASKIA RIVER
1821, 1940, 1966, & 2007
CHANNEL LOCATIONS
MILES 70-71

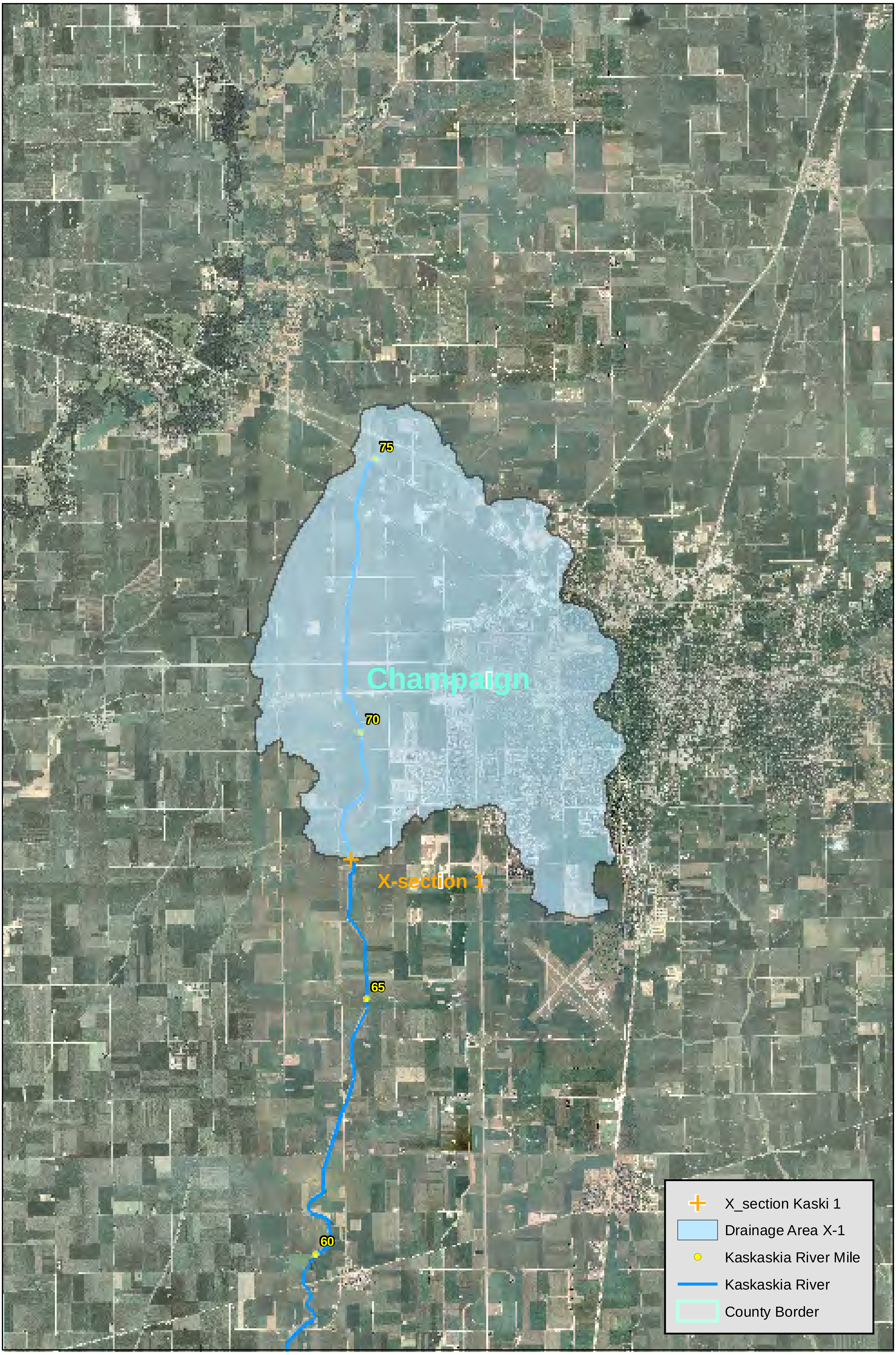
THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 44

US Army Corps of Engineers
St. Louis District®



0 0.35 0.7 1.4 2.1 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

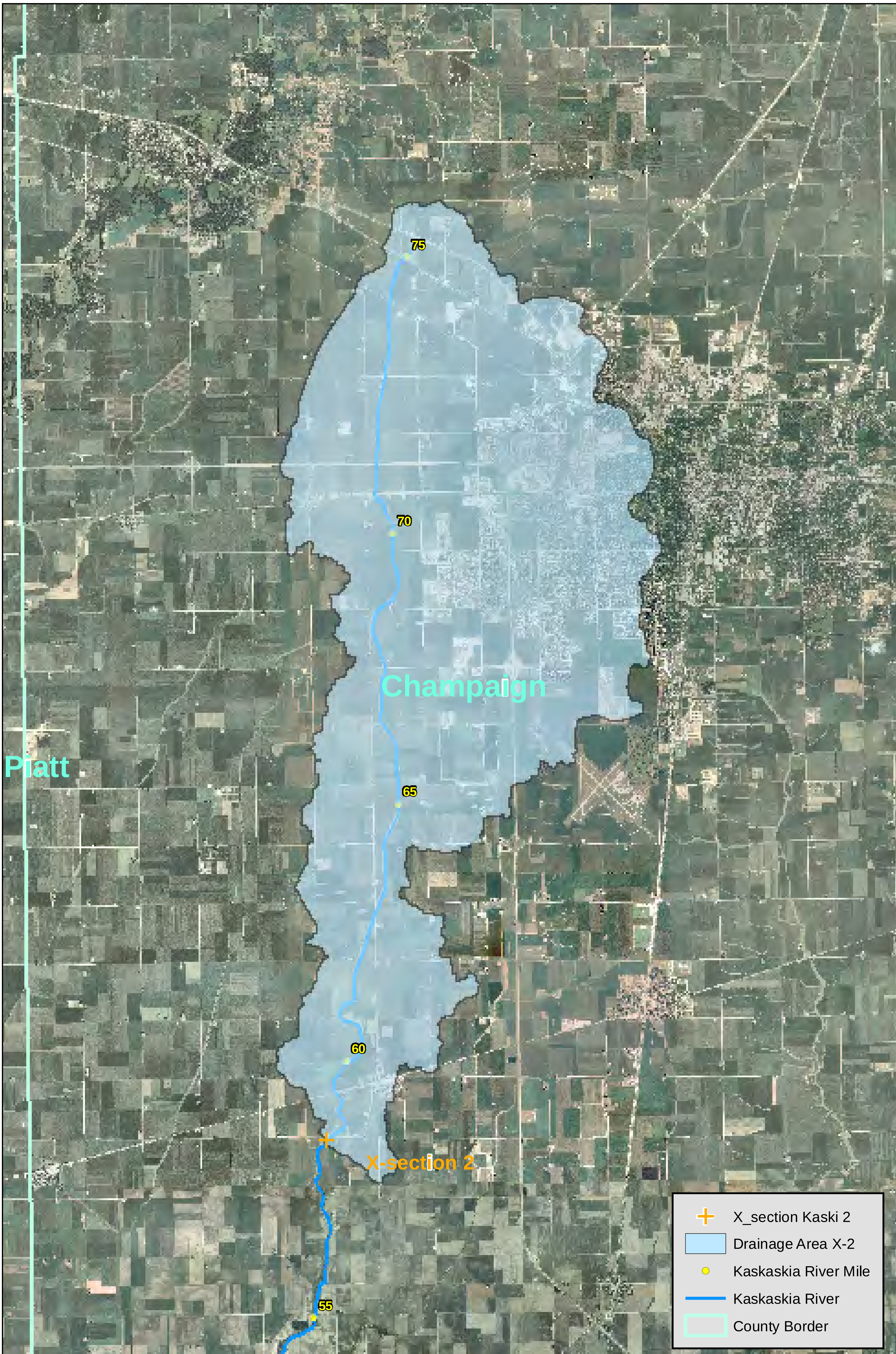
HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 45



0 0.35 0.7 1.4 2.1 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

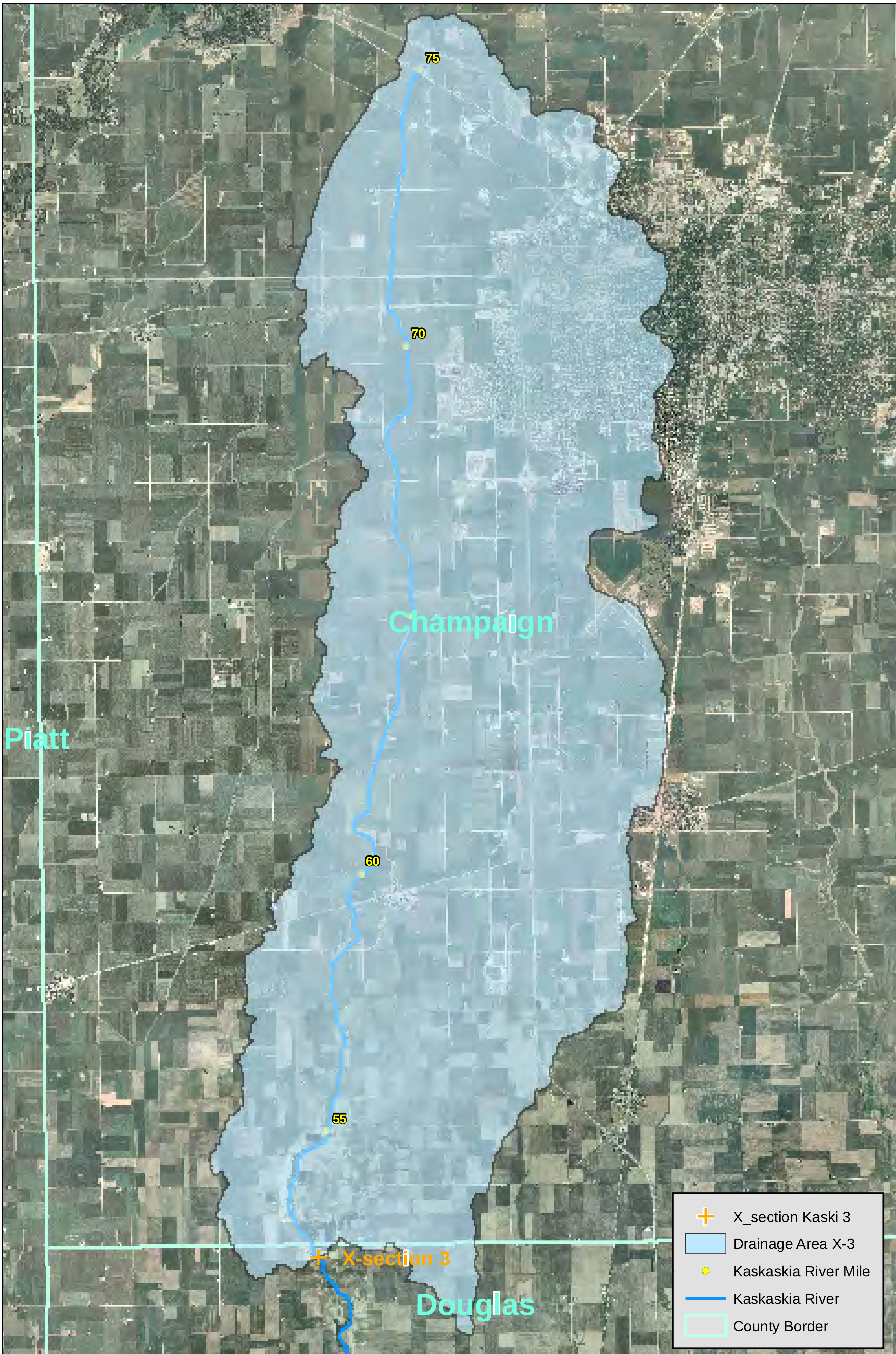
HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 46



0 0.35 0.7 1.4 2.1 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

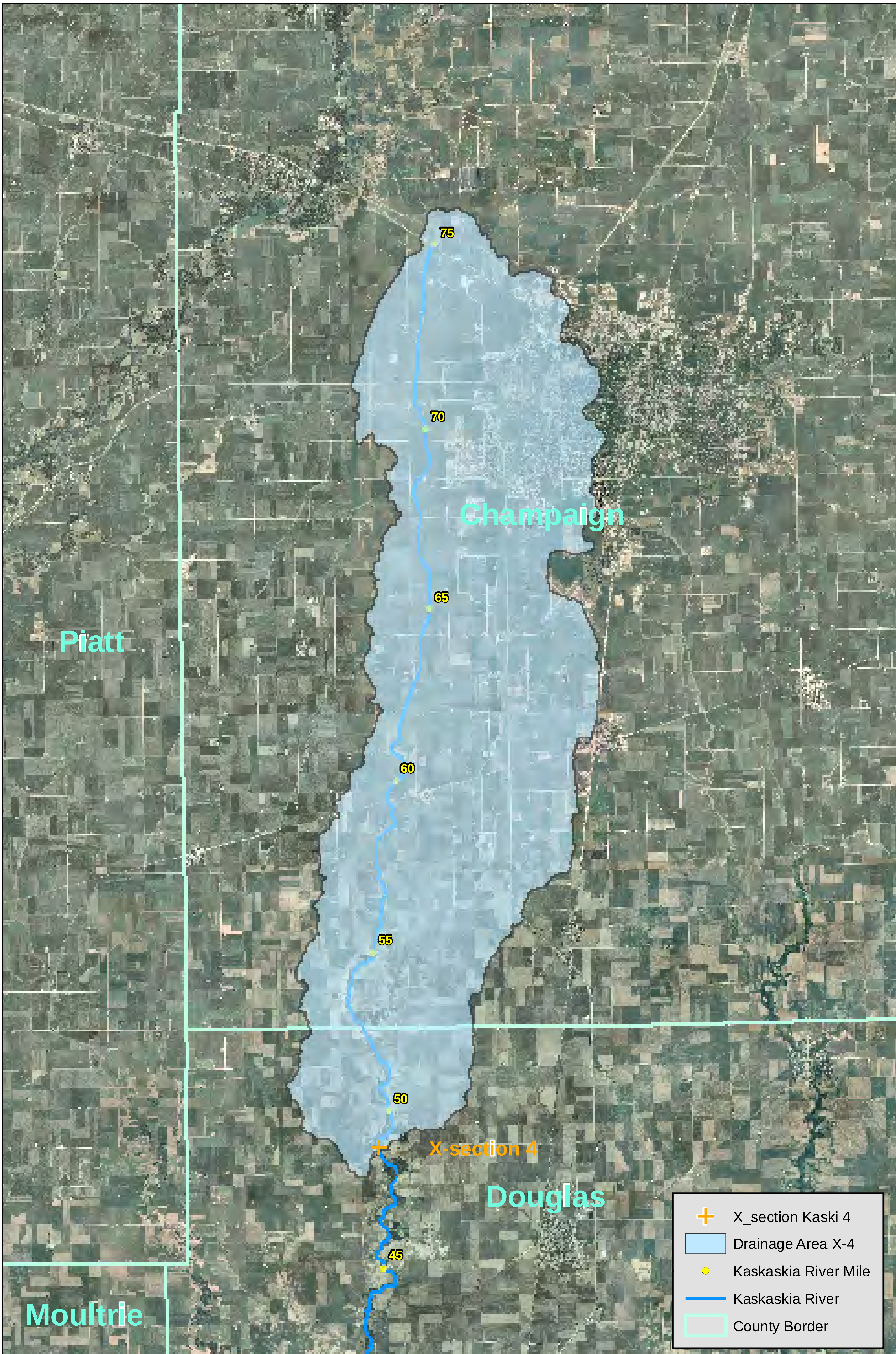
HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 47



0 0.5 1 2 3 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

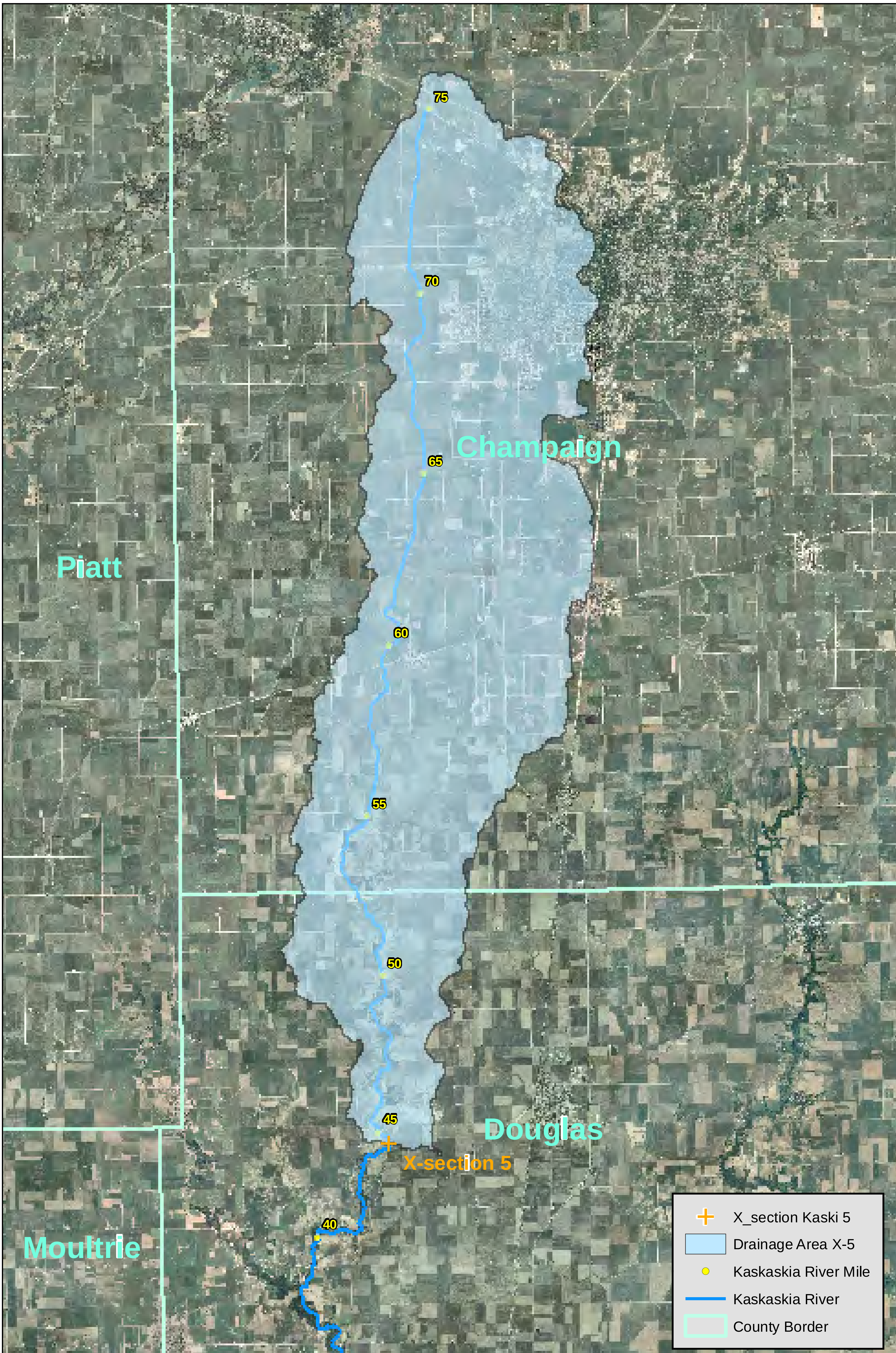
UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

US Army Corps of Engineers
St. Louis District

PLATE NUMBER 48



0 0.5 1 2 3 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

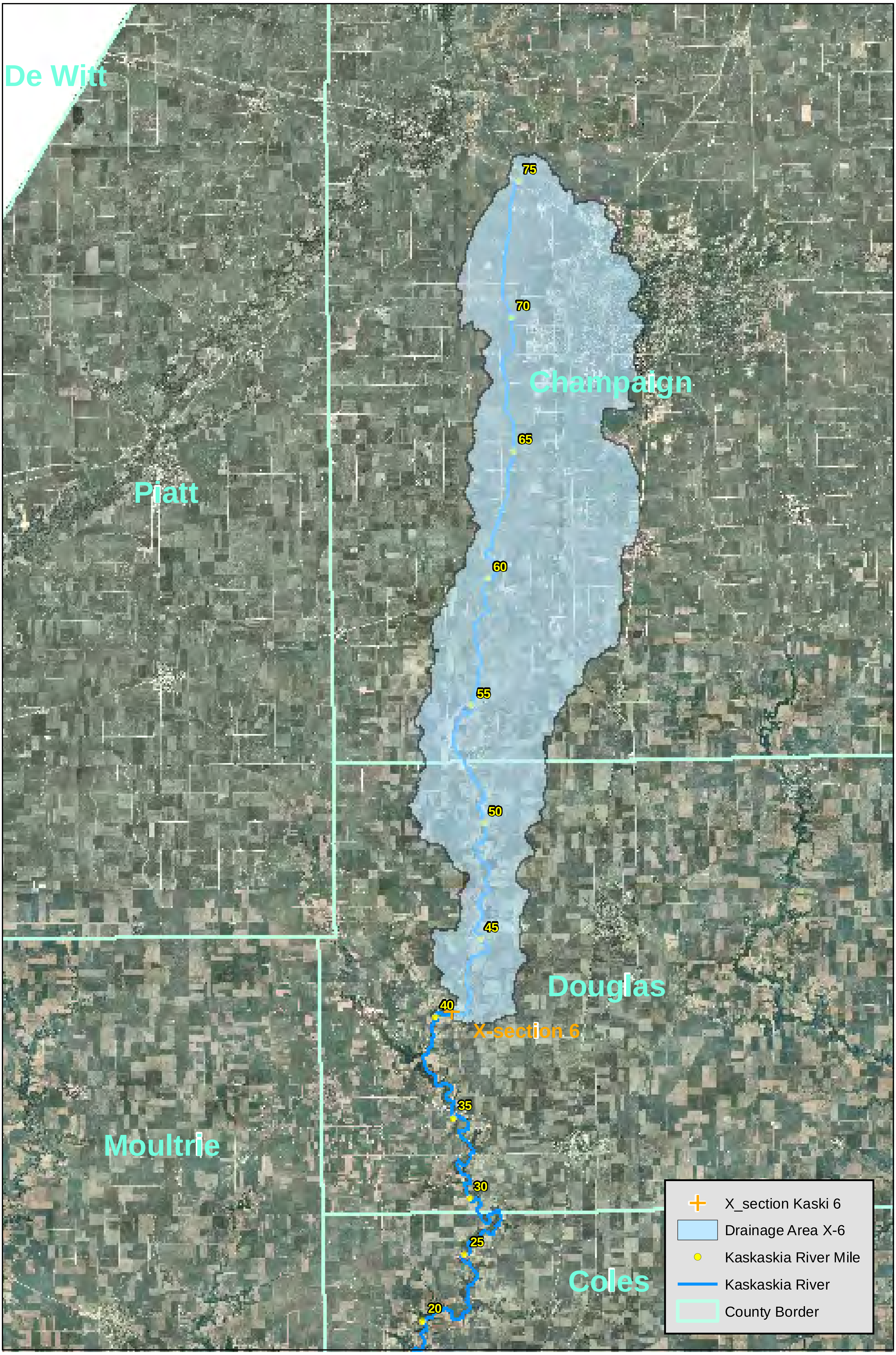
HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 49



0 1 2 4 6 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

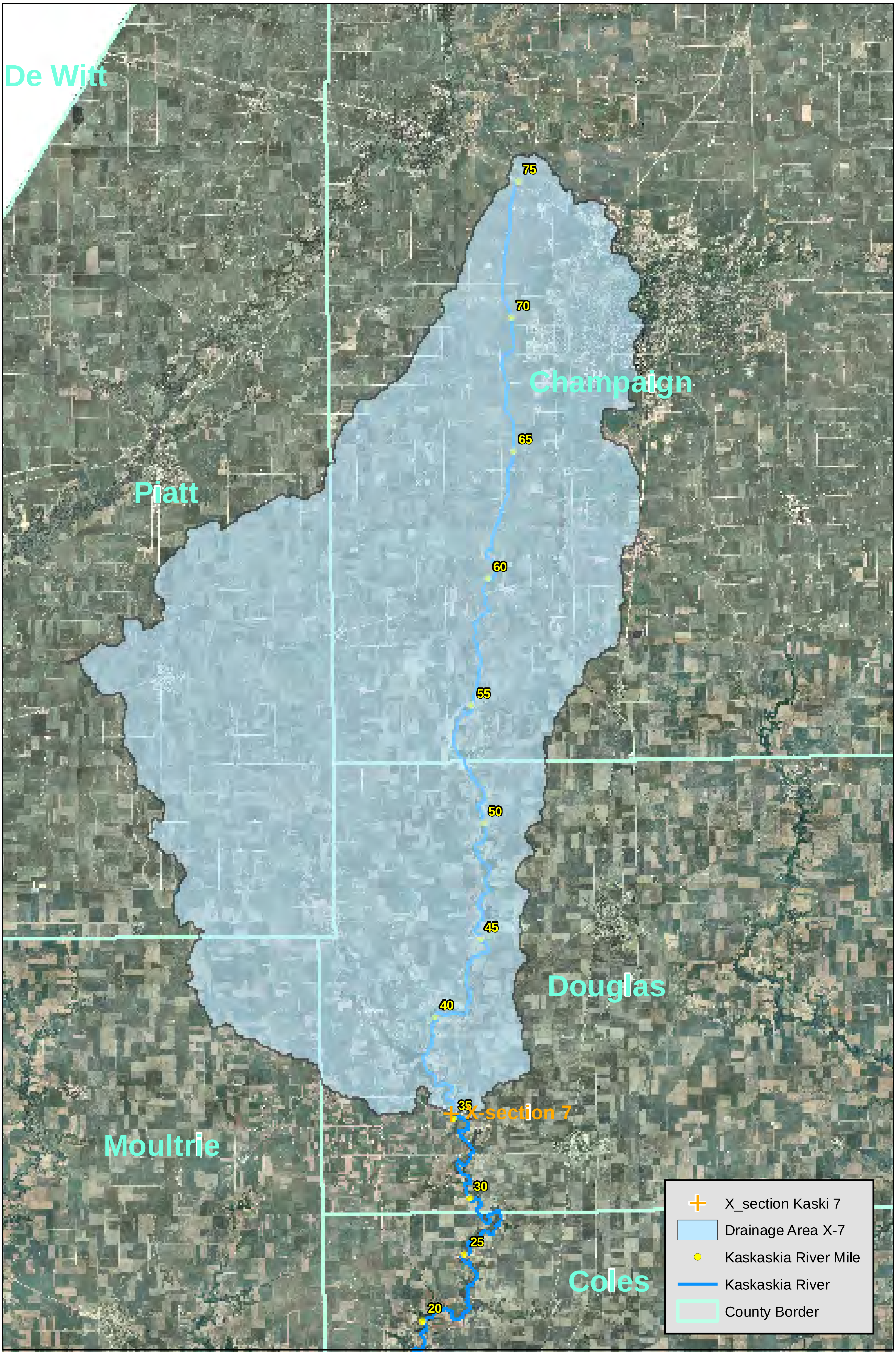
HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 50



DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

0 1 2 4 6 Miles

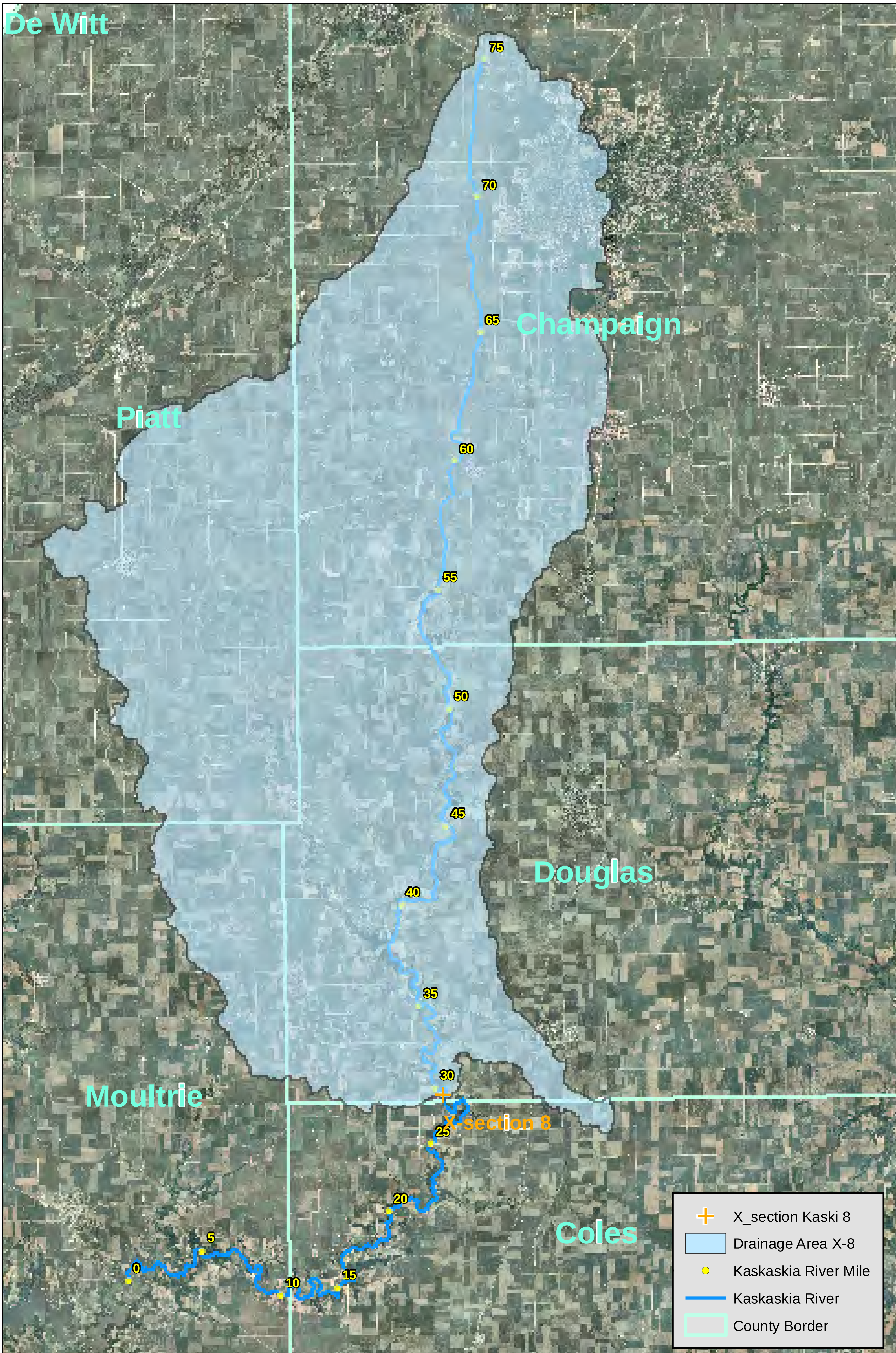
THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER 51

US Army Corps of Engineers
St. Louis District®



0 1 2 4 6 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

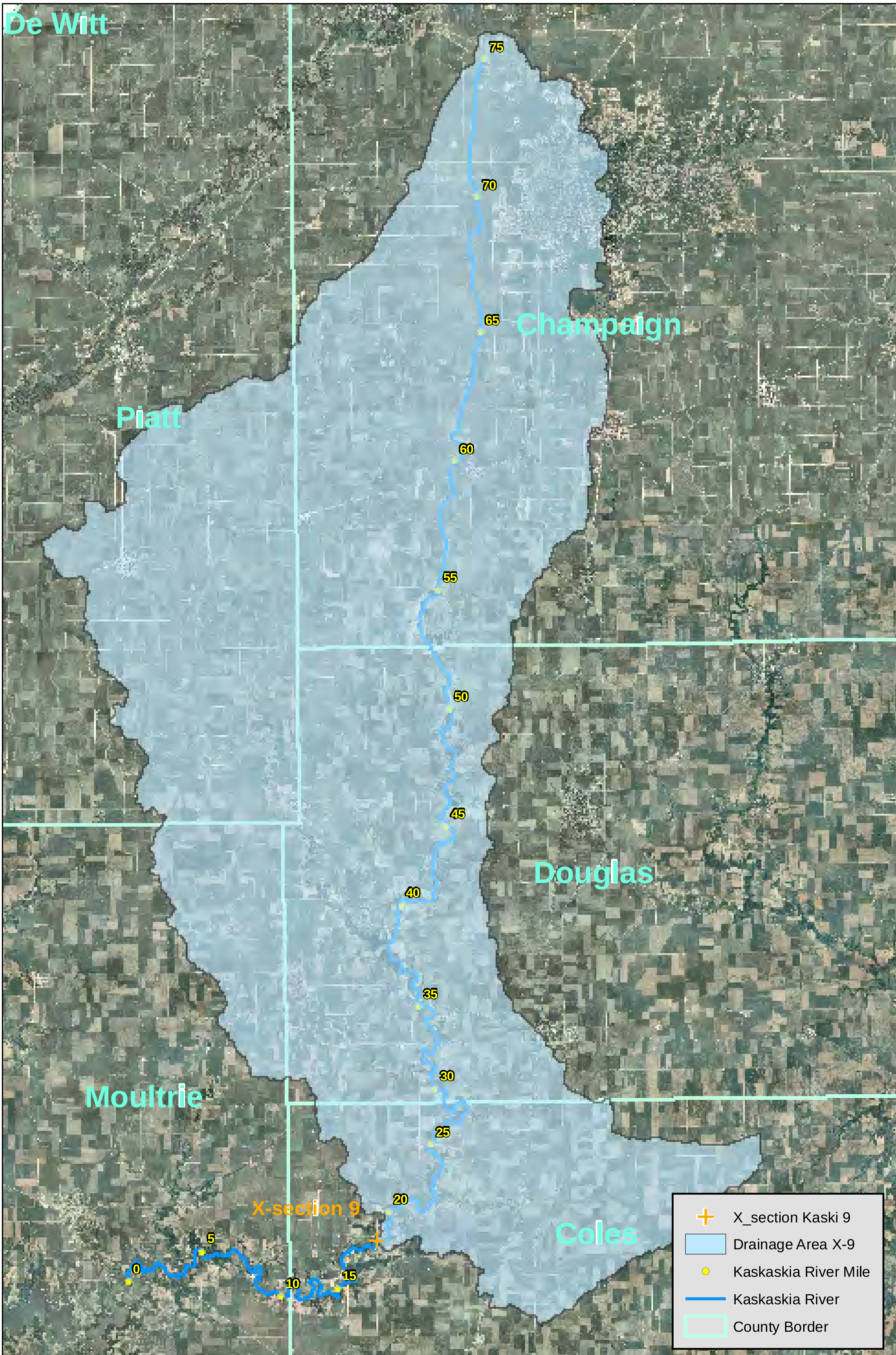
HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER
52



0 1 2 4 6 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

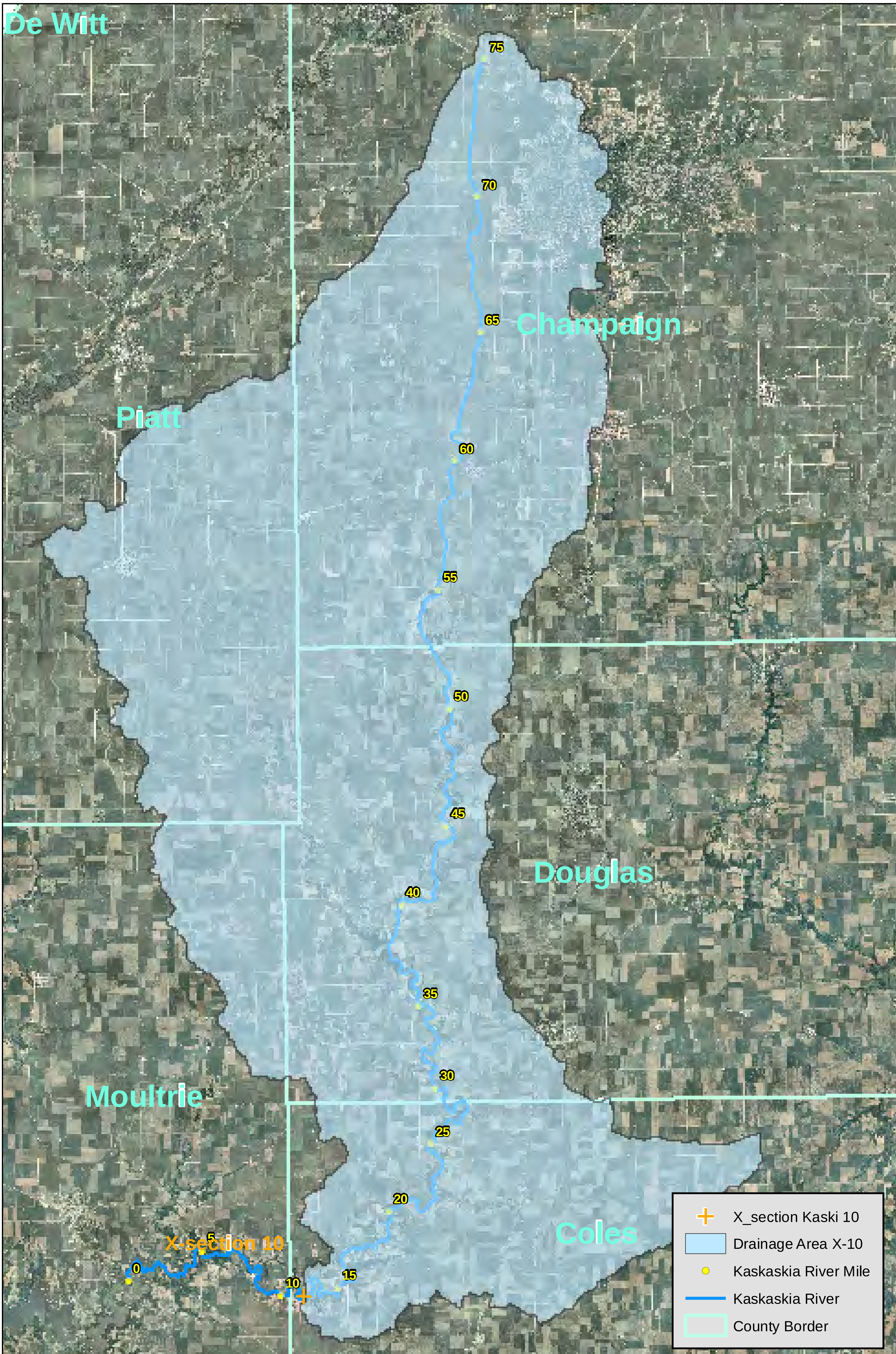
HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER
53



0 1 2 4 6 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER
54

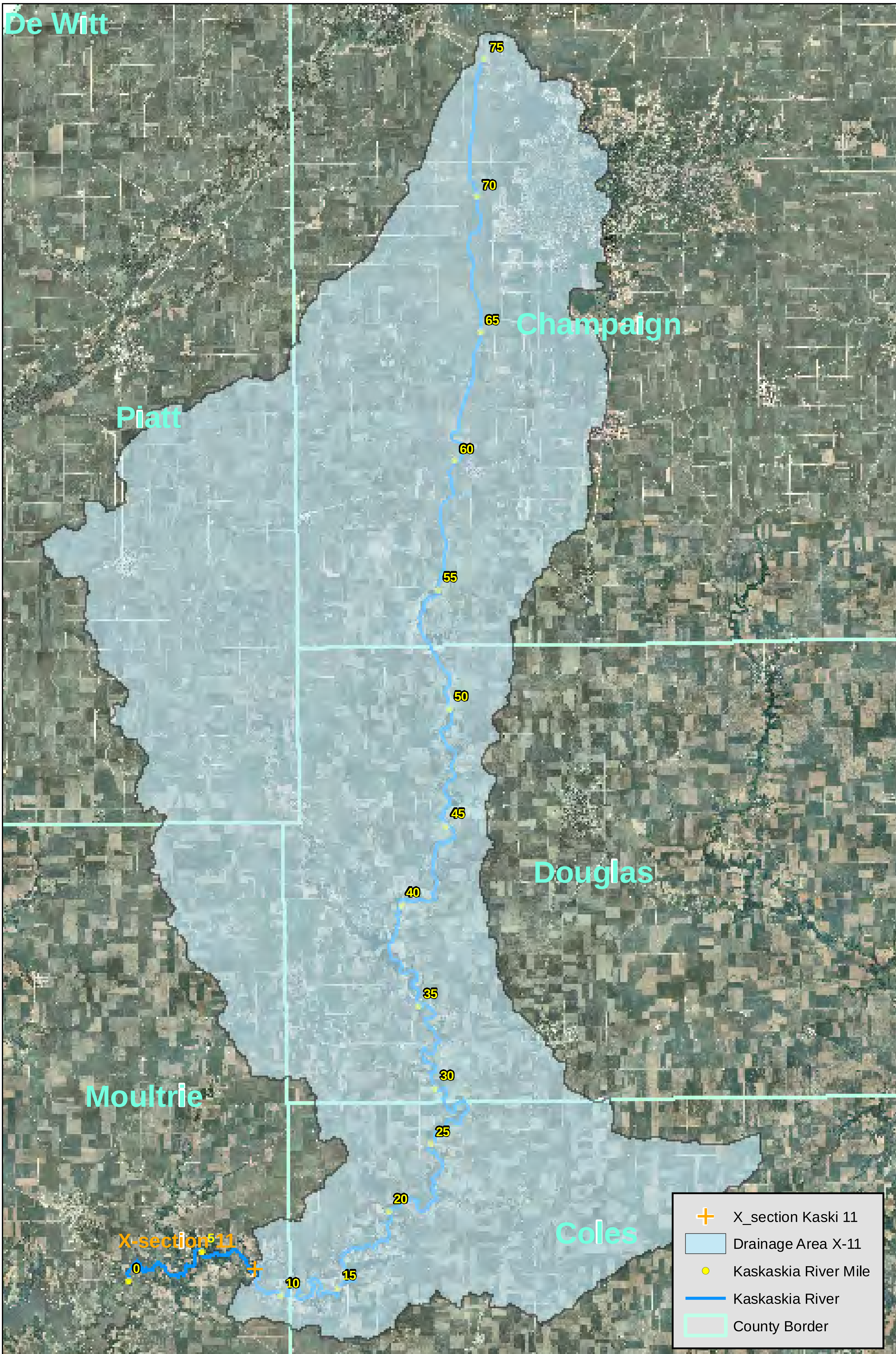


PLATE NUMBER 55

0 1 2 4 6 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

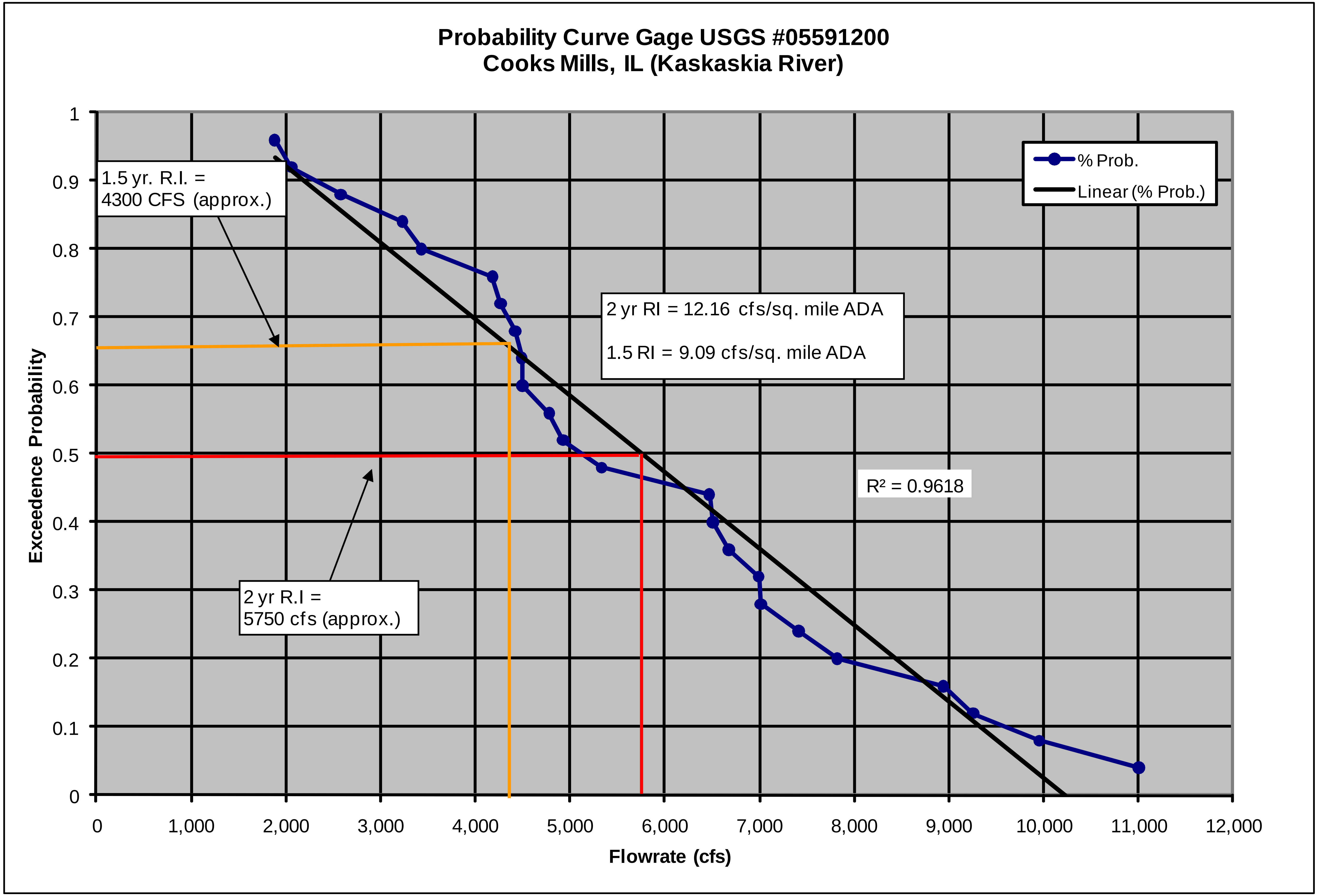
UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

DRAINAGE BASINS OF THE UPPER KASKASKIA RIVER

N W E S

US Army Corps of Engineers
St. Louis District

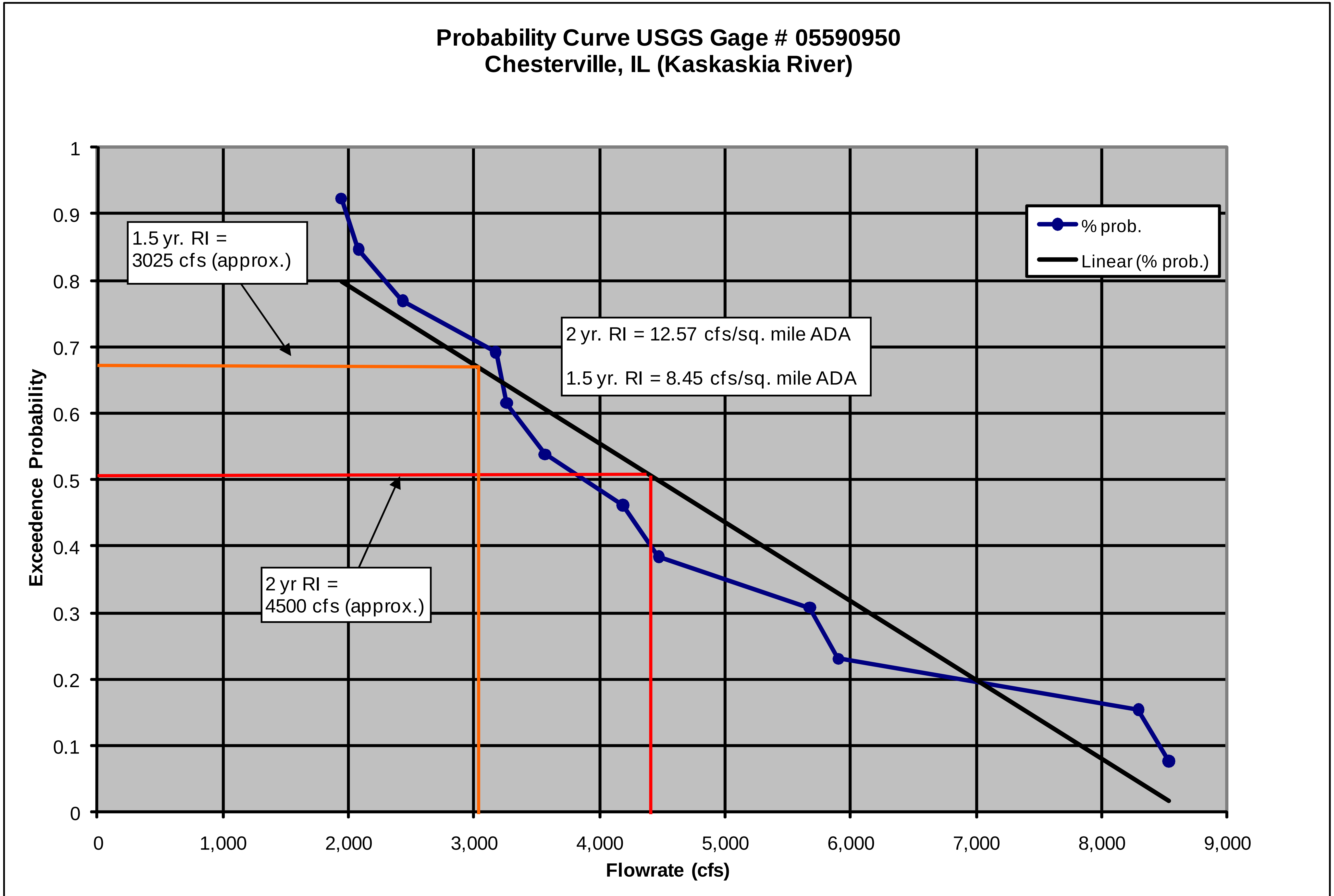


US Army Corps
of Engineers
St. Louis District

PROBABILITY CURVE
KASKAKIA RIVER
COOKS MILLS, IL

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE
NUMBER
56

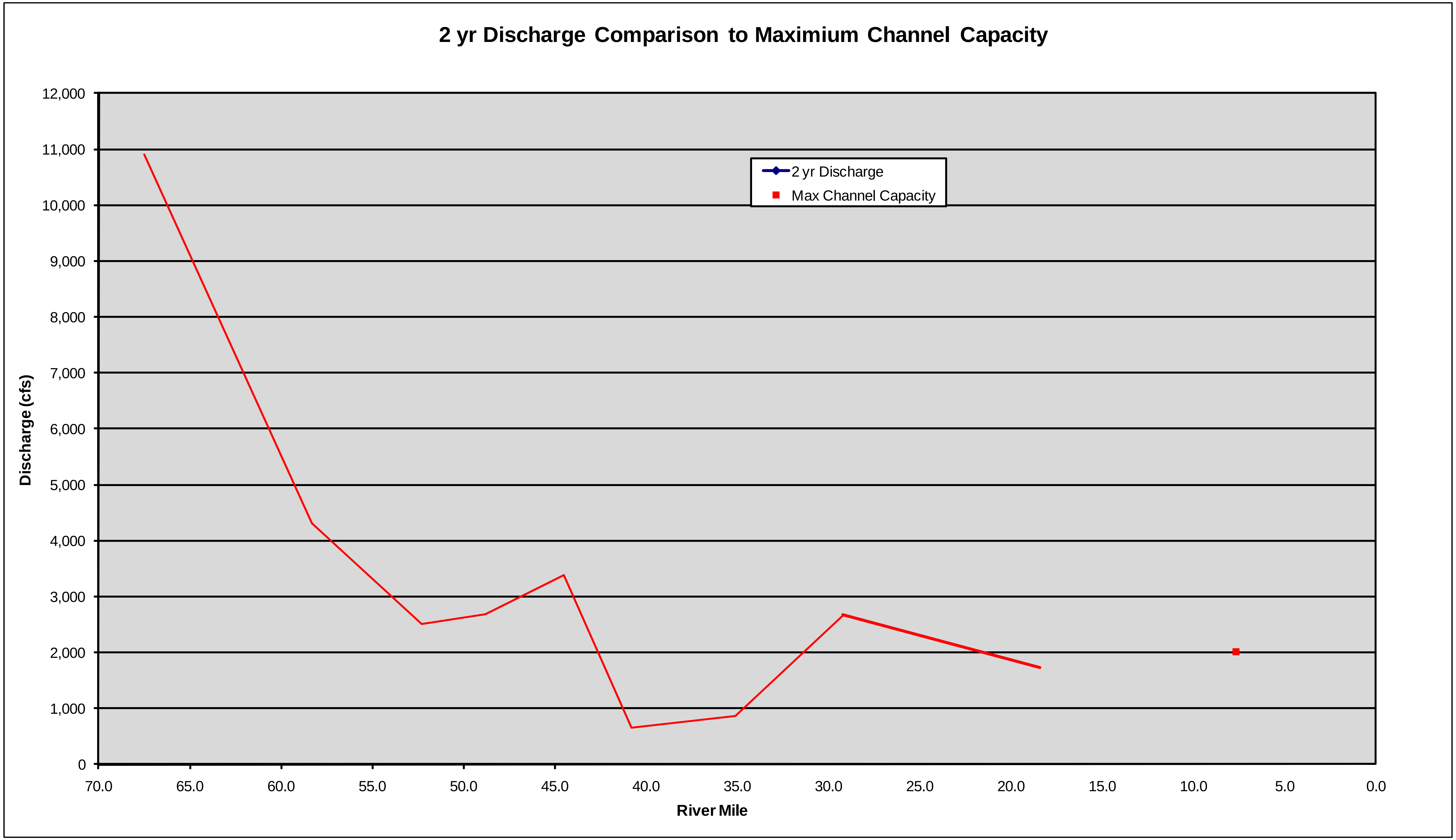


US Army Corps of Engineers
St. Louis District

PROBABILITY CURVE
KASKASKIA RIVER
CHESTERVILLE, IL

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

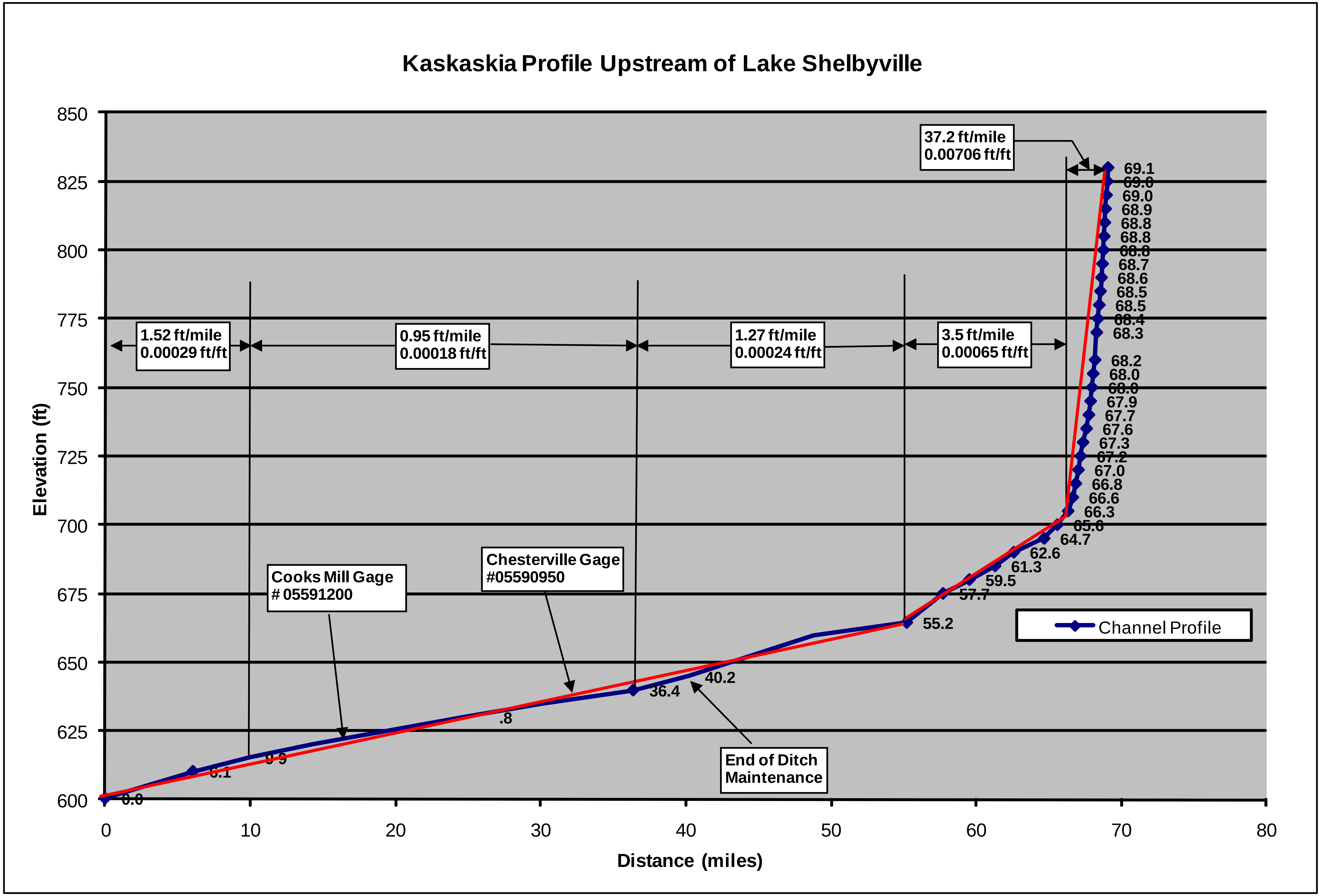
PLATE NUMBER
57



TWO YEAR DISCHARGE COMPARISON
KASKASKIA RIVER

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

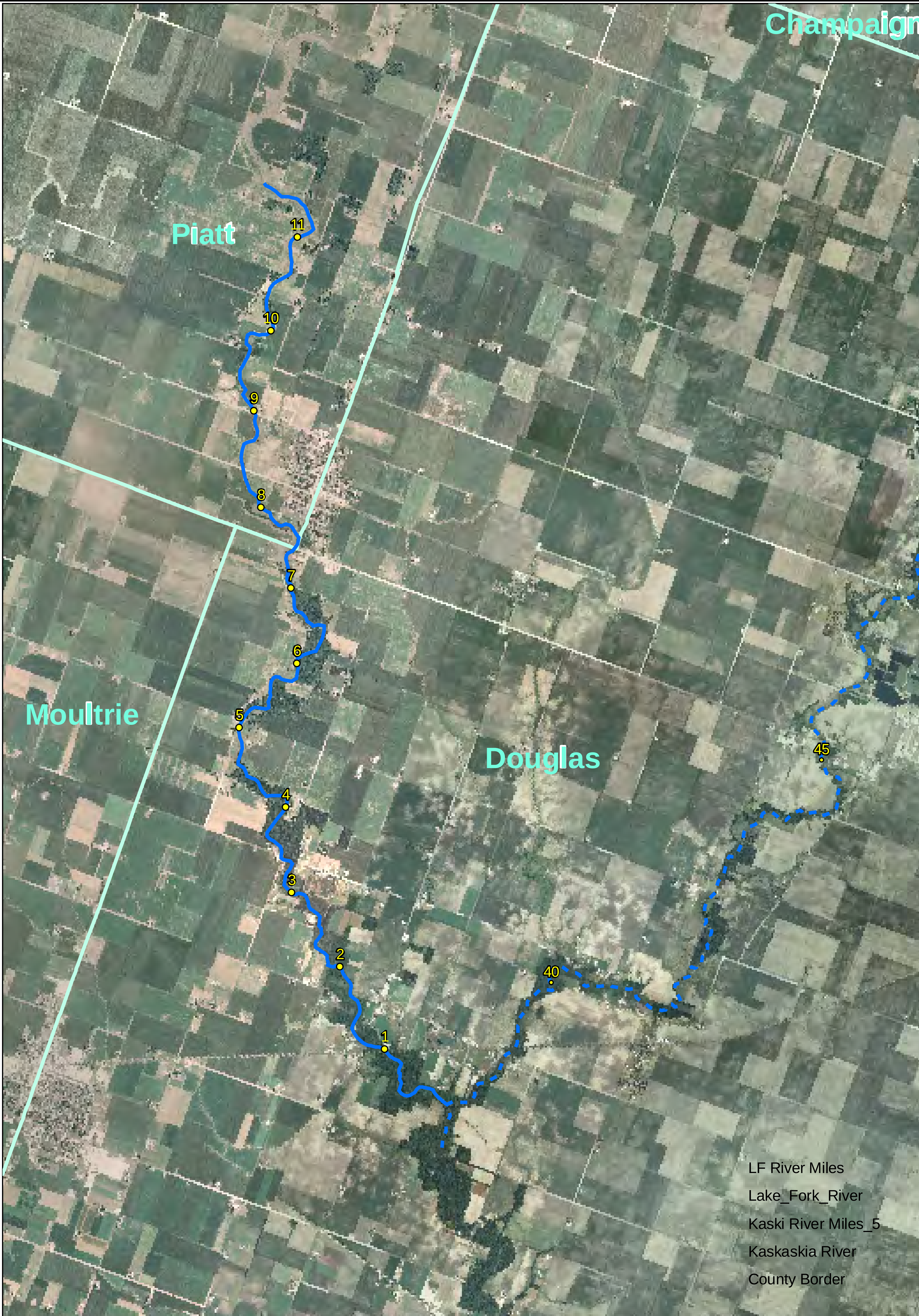
PLATE NUMBER 58



CHANNEL PROFILE
KASKASKIA RIVER
UPSTREAM OF LAKE SHELBYVILLE

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
59



LAKE FORK RIVER

US Army Corps of Engineers
St. Louis District

0 0.2 0.4 0.8 1.2 1.6 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

LAKE FORK TRIBUTARY

PLATE NUMBER 60

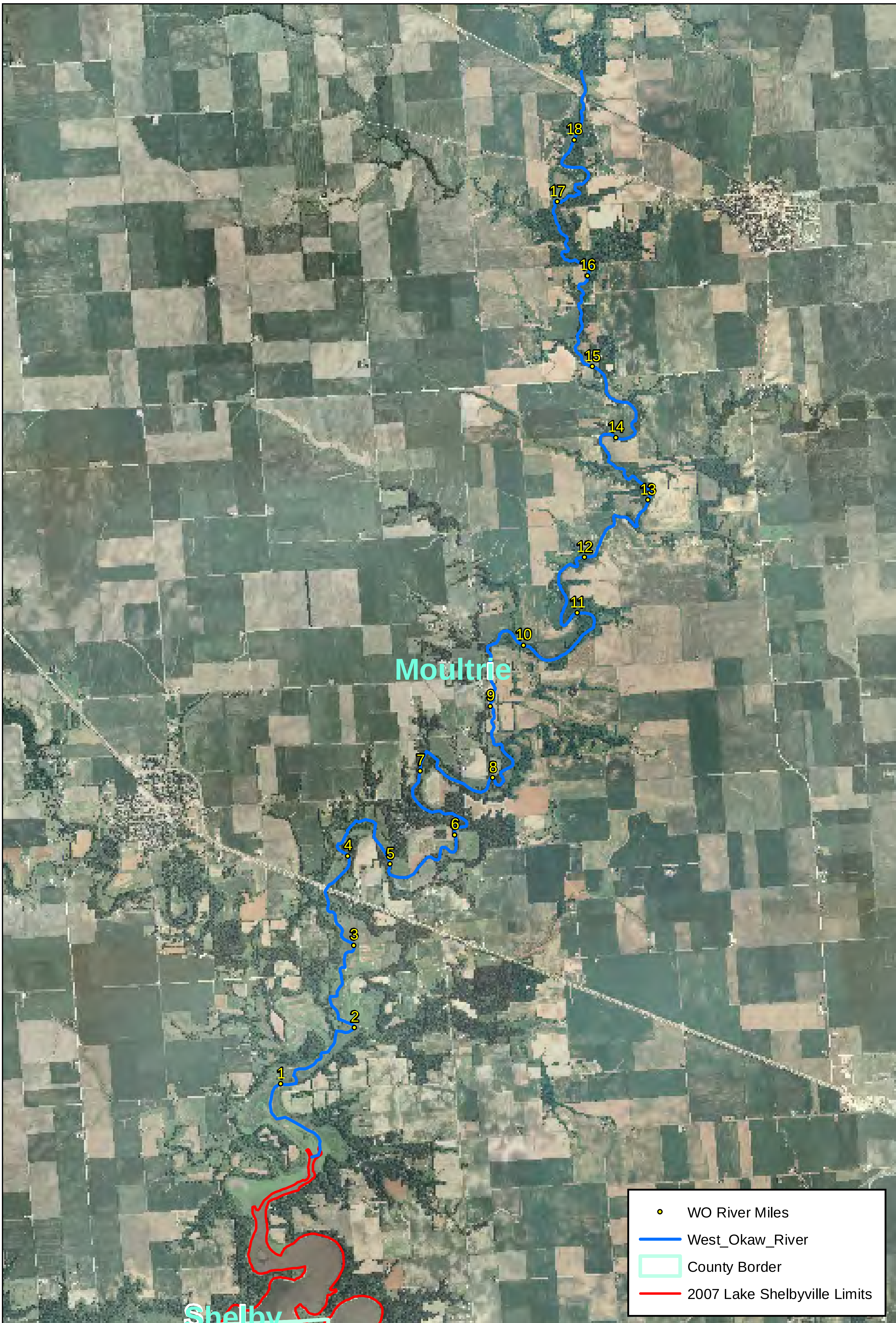


PLATE NUMBER 61

0 0.25 0.5 1 1.5 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

WEST OKAW RIVER

WEST OKAW RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 62

0 0.5 1 2 3 4 5 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

LAKE FORK TRIBUTARY

DRAINAGE BASINS OF THE LAKE FORK RIVER

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER 63

0 0.5 1 2 3 4 5 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

LAKE FORK TRIBUTARY

DRAINAGE BASINS OF THE LAKE FORK RIVER

US Army Corps of Engineers
St. Louis District®

0 0.5 1 2 3 4 5 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

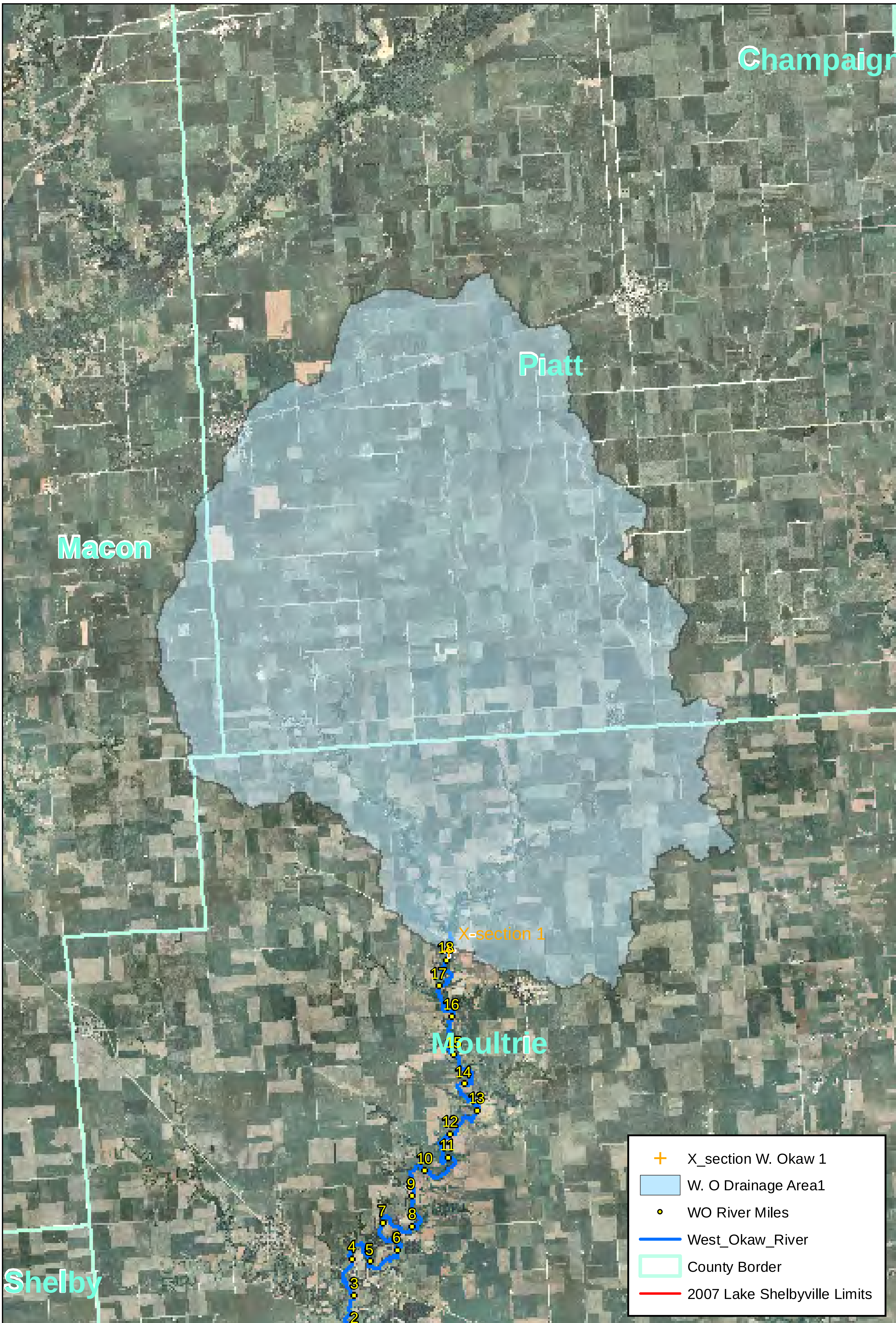
UPPER KASKASKIA RIVER STUDY

LAKE FORK TRIBUTARY

DRAINAGE BASINS OF THE LAKE FORK RIVER

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER
64



0 0.5 1 2 3 Miles

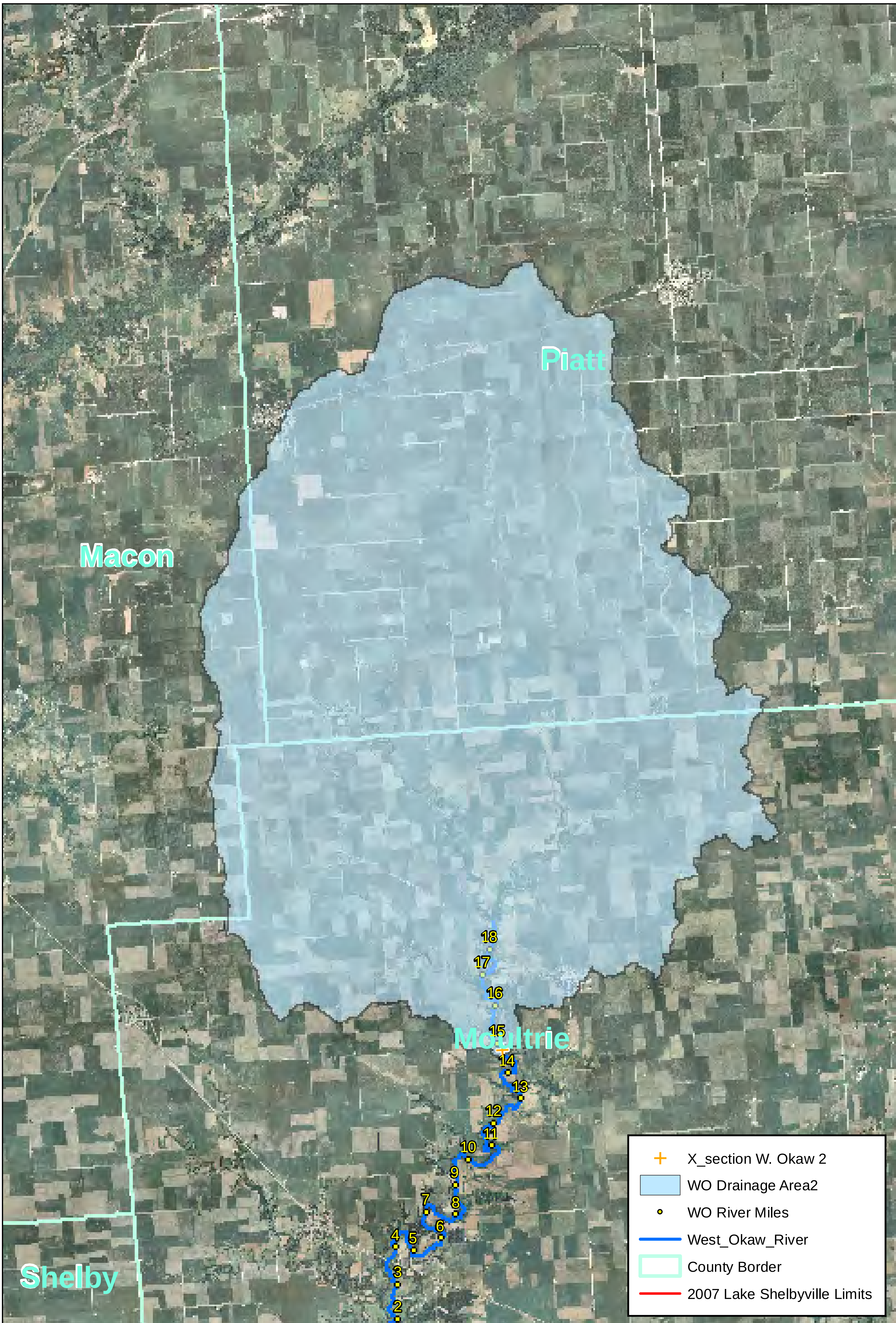
THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

WEST OKAW RIVER

DRAINAGE BASINS OF THE WEST OKAW RIVER

PLATE NUMBER 65



DRAINAGE BASINS OF THE WEST OKAW RIVER

US Army Corps of Engineers
St. Louis District®

N
W
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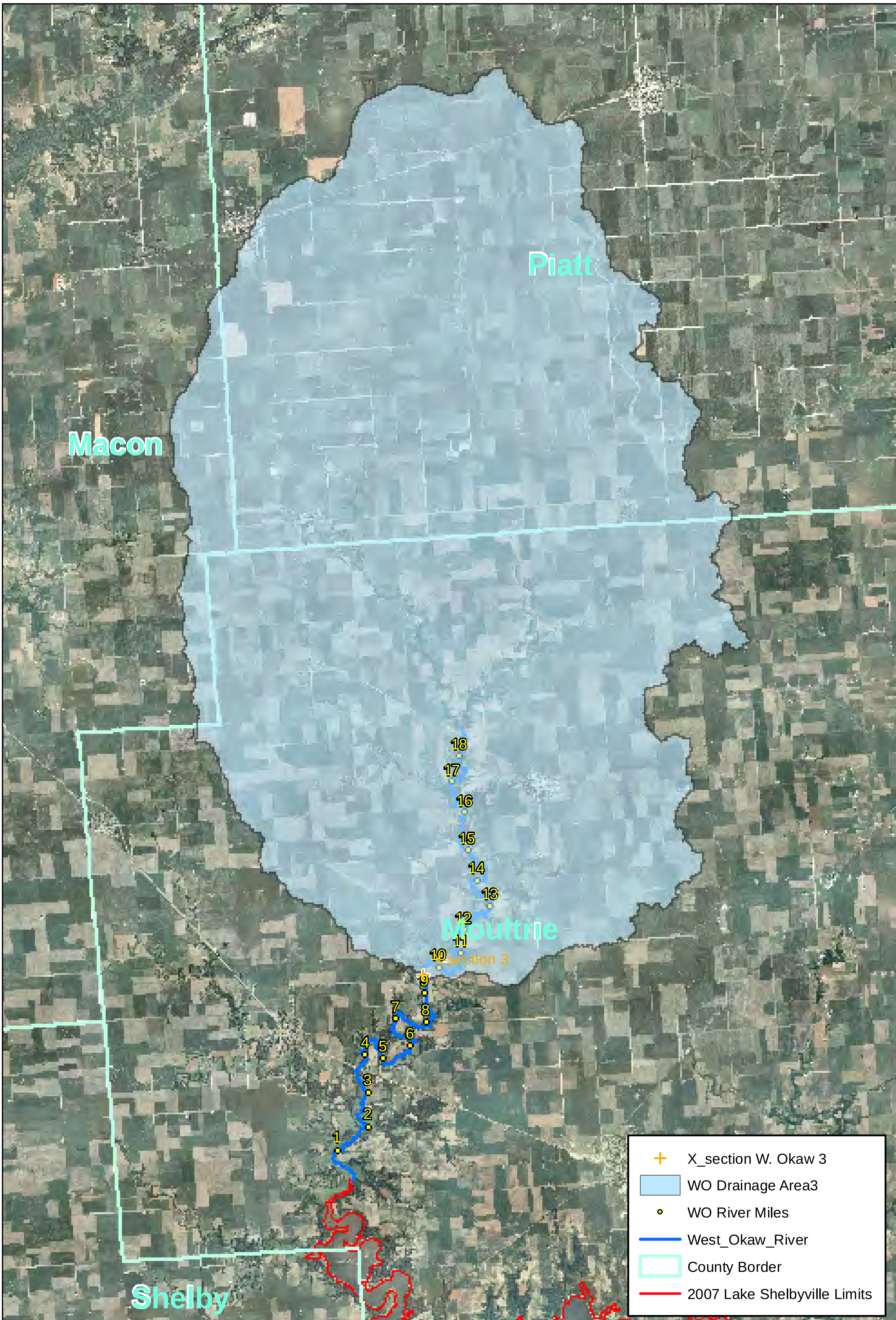
0 0.5 1 2 3 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

WEST OKAW RIVER

PLATE NUMBER 66



DRAINAGE BASINS OF THE WEST OKAW RIVER

0 0.5 1 2 3 Miles

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

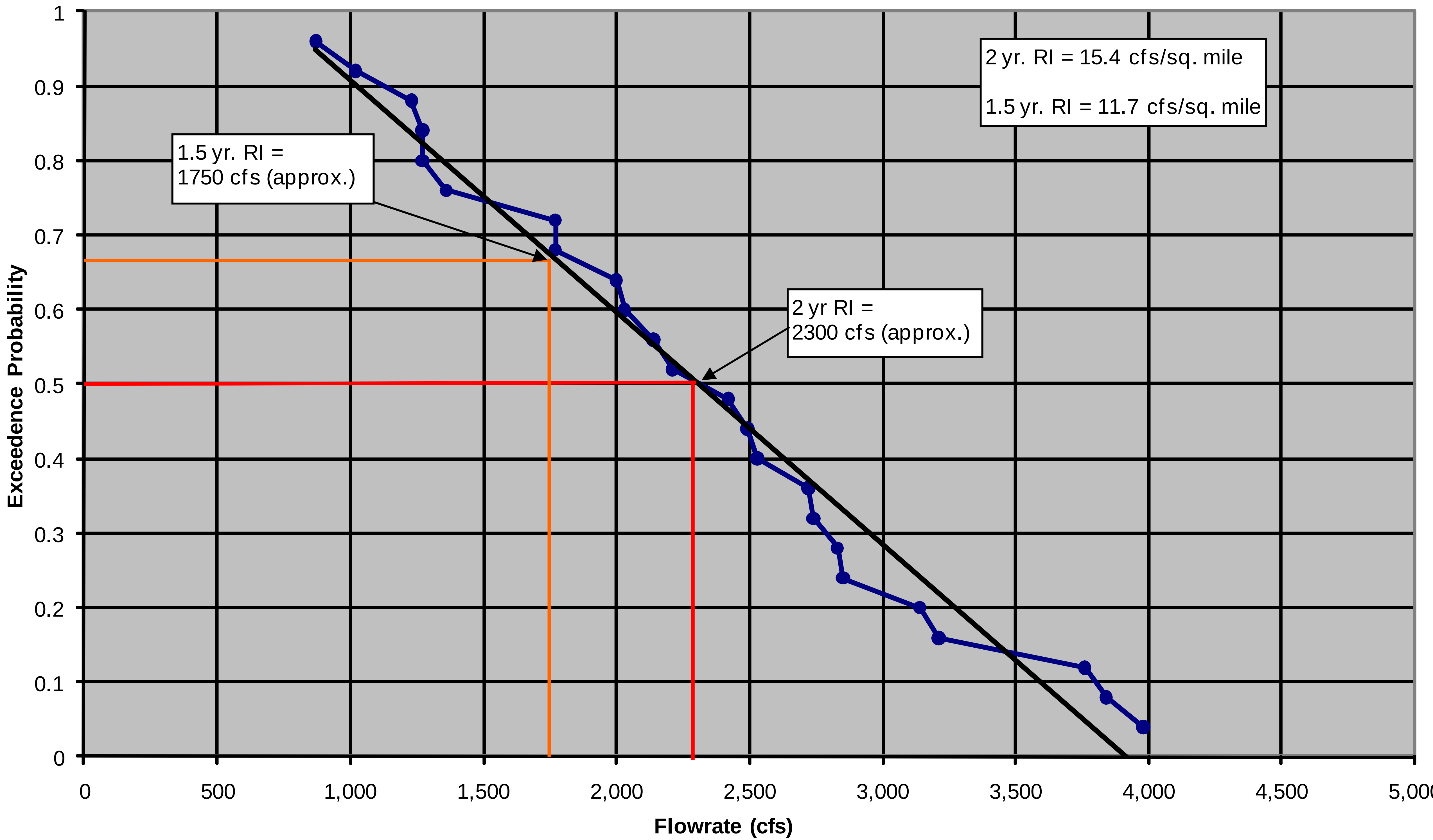
UPPER KASKASKIA RIVER STUDY

WEST OKAW RIVER

PLATE NUMBER 67

US Army Corps of Engineers
St. Louis District

Probability Curve USGS Gage # 05590800
Atwood, IL (Lake Fork River)



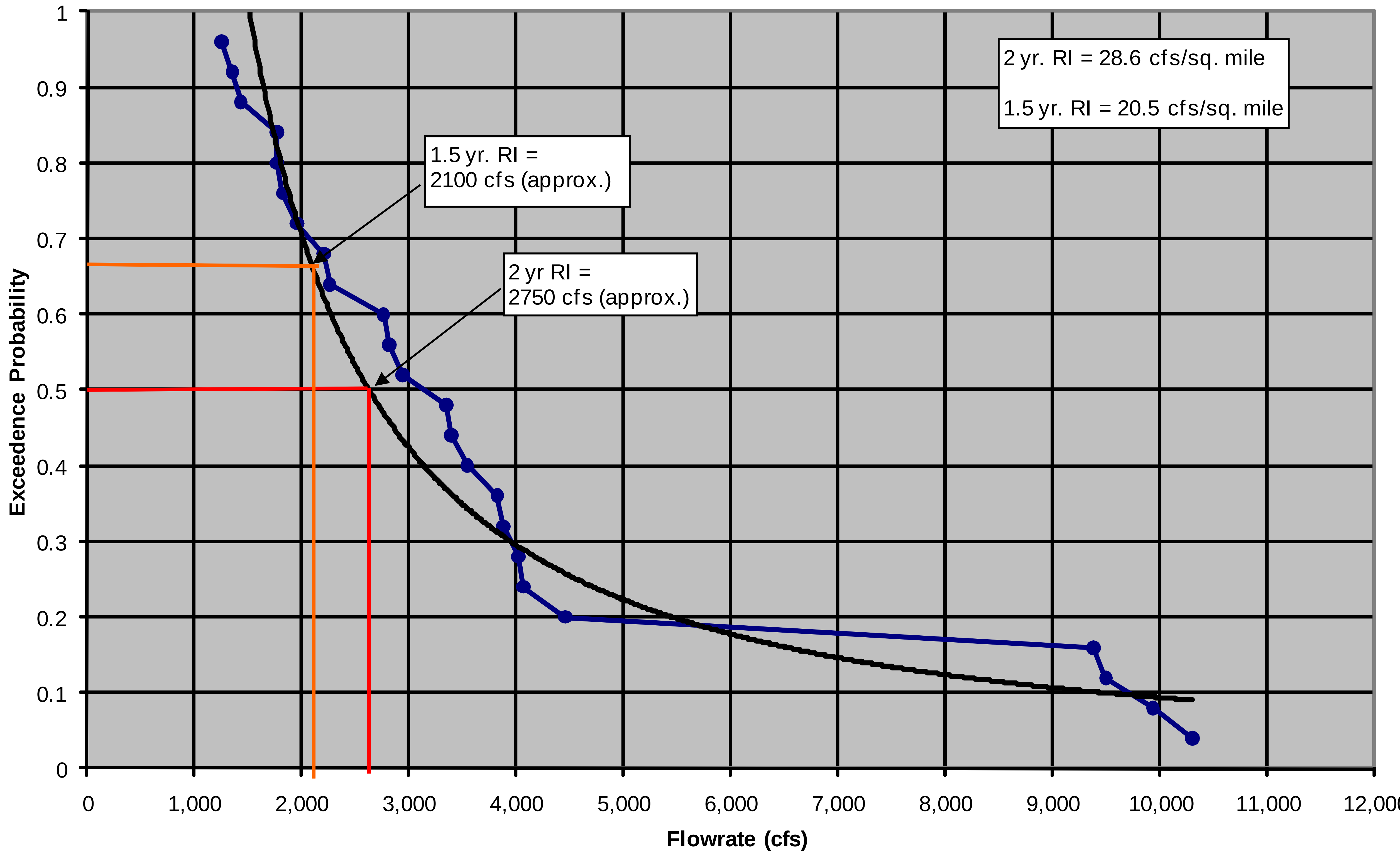
US Army Corps of Engineers
St. Louis District

PROBABILITY CURVE
LAKE FORK RIVER
ATWOOD, IL

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
68

Probability Curve USGS Gage # 05591700
Lovington, IL (West Okaw River)

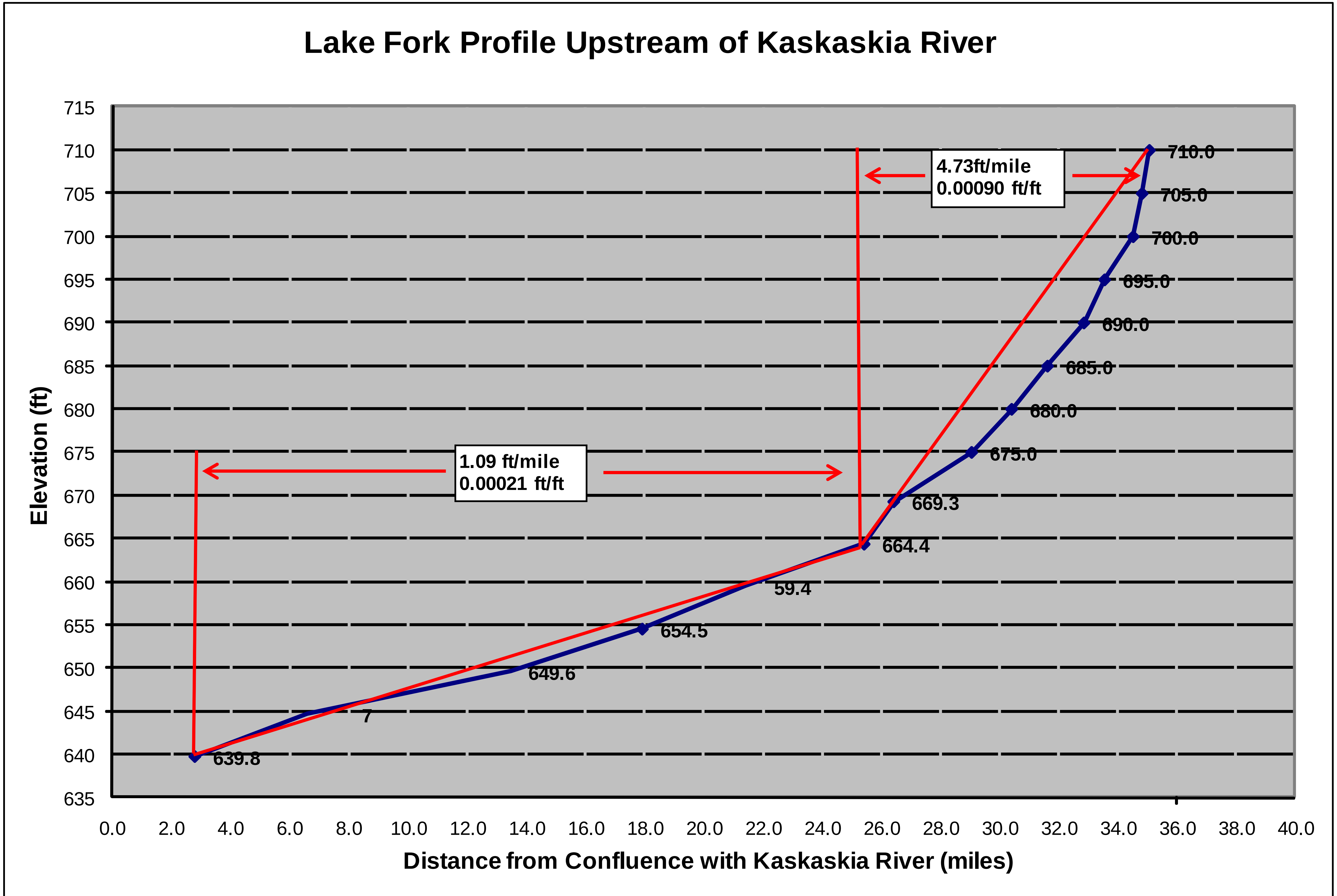


US Army Corps of Engineers
St. Louis District

PROBABILITY CURVE
WEST OKAW RIVER
LOVINGTON, IL

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

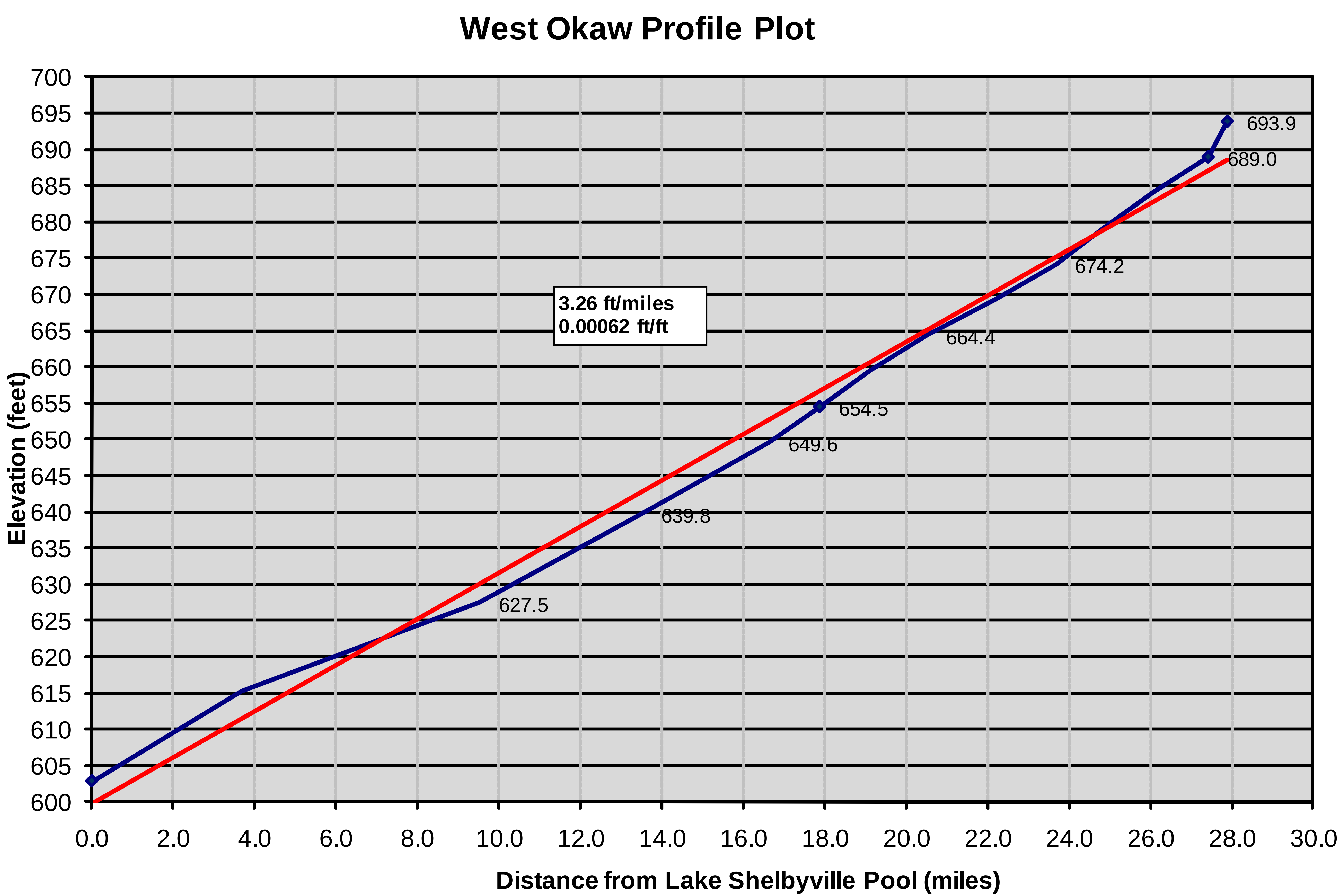
PLATE NUMBER
69



CHANNEL PROFILE
LAKE FORK
UPSTREAM OF KASKASKIA RIVER

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE
NUMBER
70



US Army Corps of Engineers
St. Louis District

CHANNEL PROFILE
WEST OKAW RIVER
UPSTREAM OF LAKE SHELBYVILLE

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
71

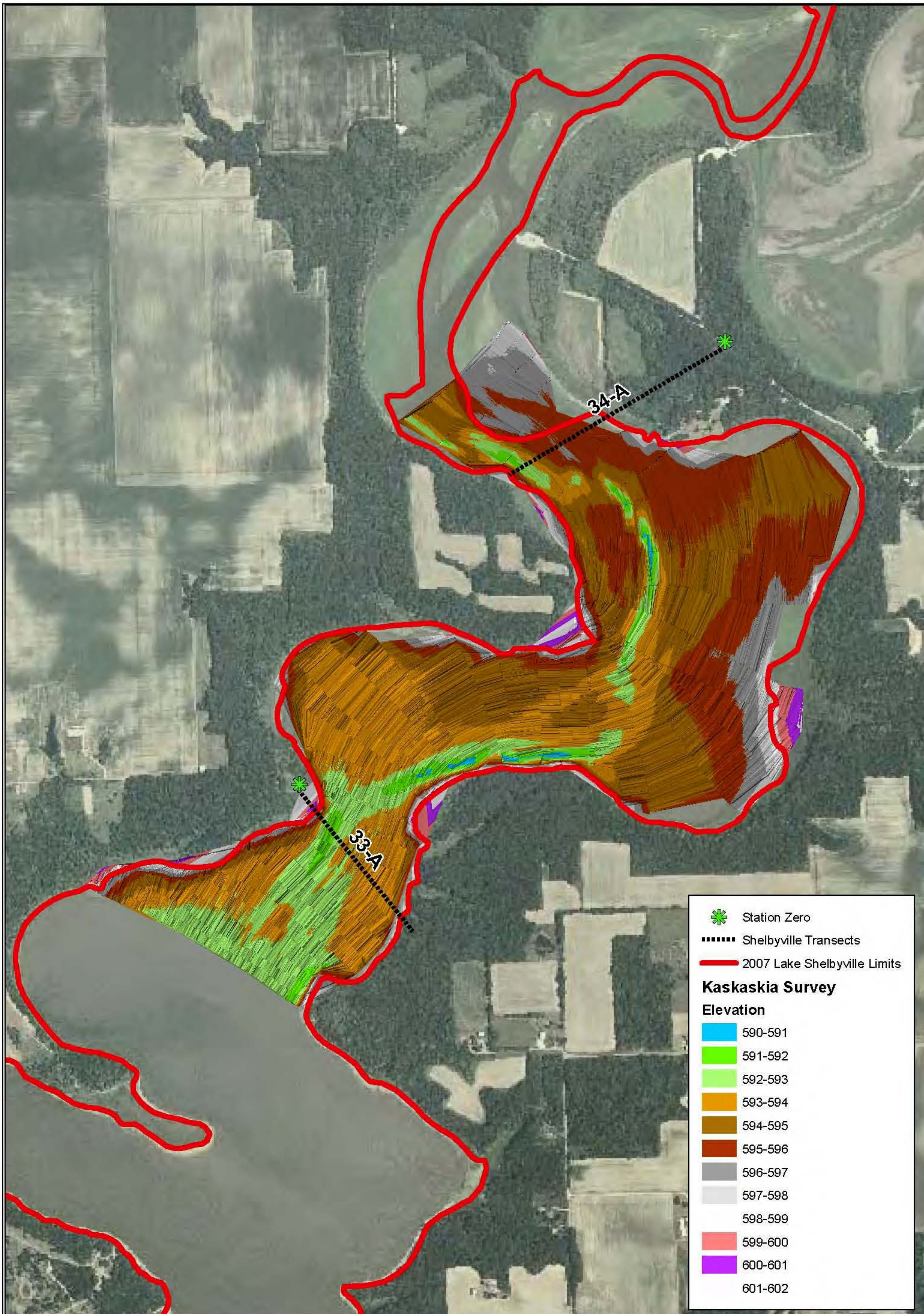


PLATE NUMBER 72

0 250 500 1,000 1,500 2,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

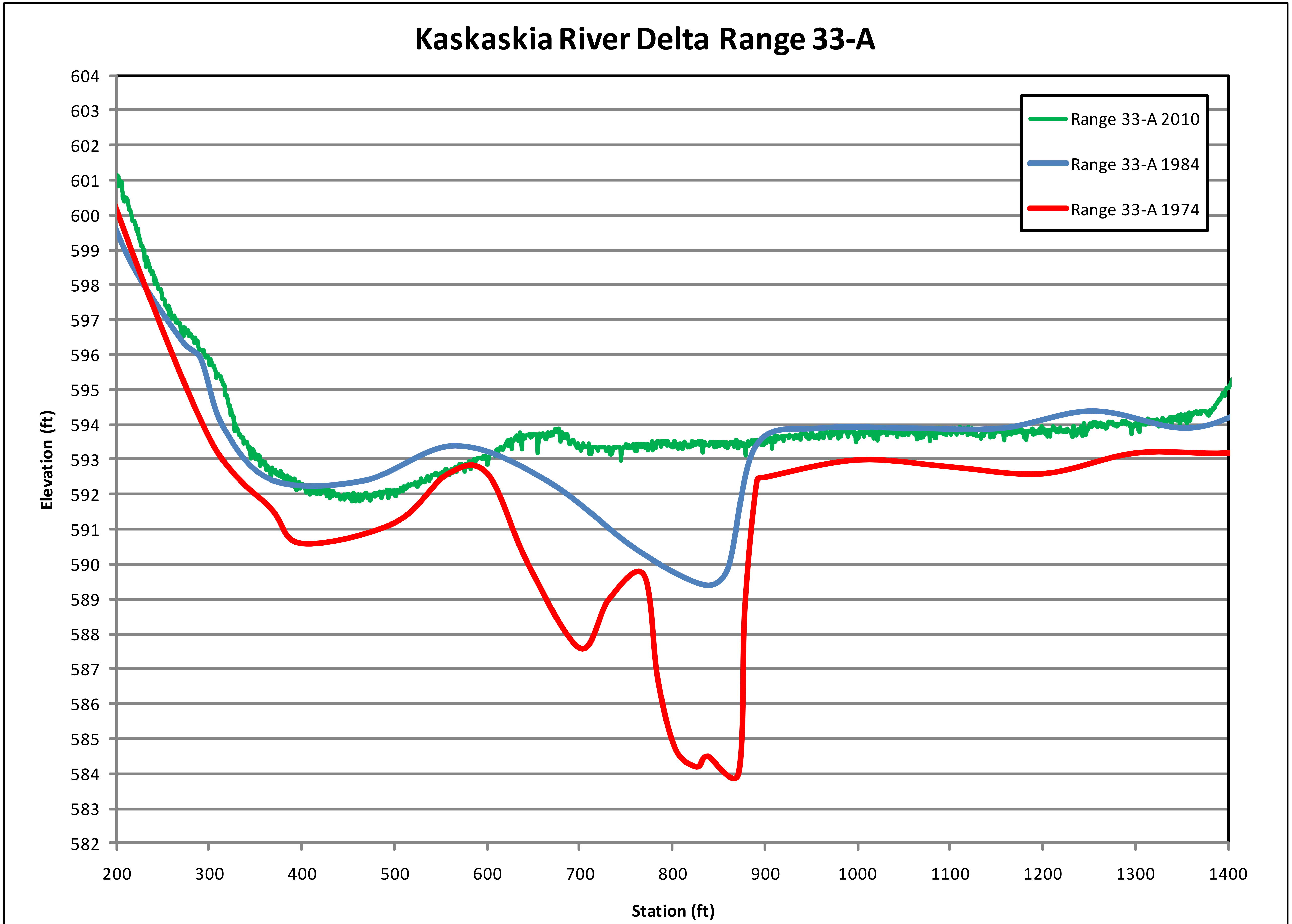
UPPER KASKASKIA RIVER STUDY

SEDIMENTATION OF LAKE SHELBYVILLE

LAKE SHELBYVILLE
KASKASKIA DELTA
JULY 2010 SURVEY

N W E S

US Army Corps of Engineers®
St. Louis District

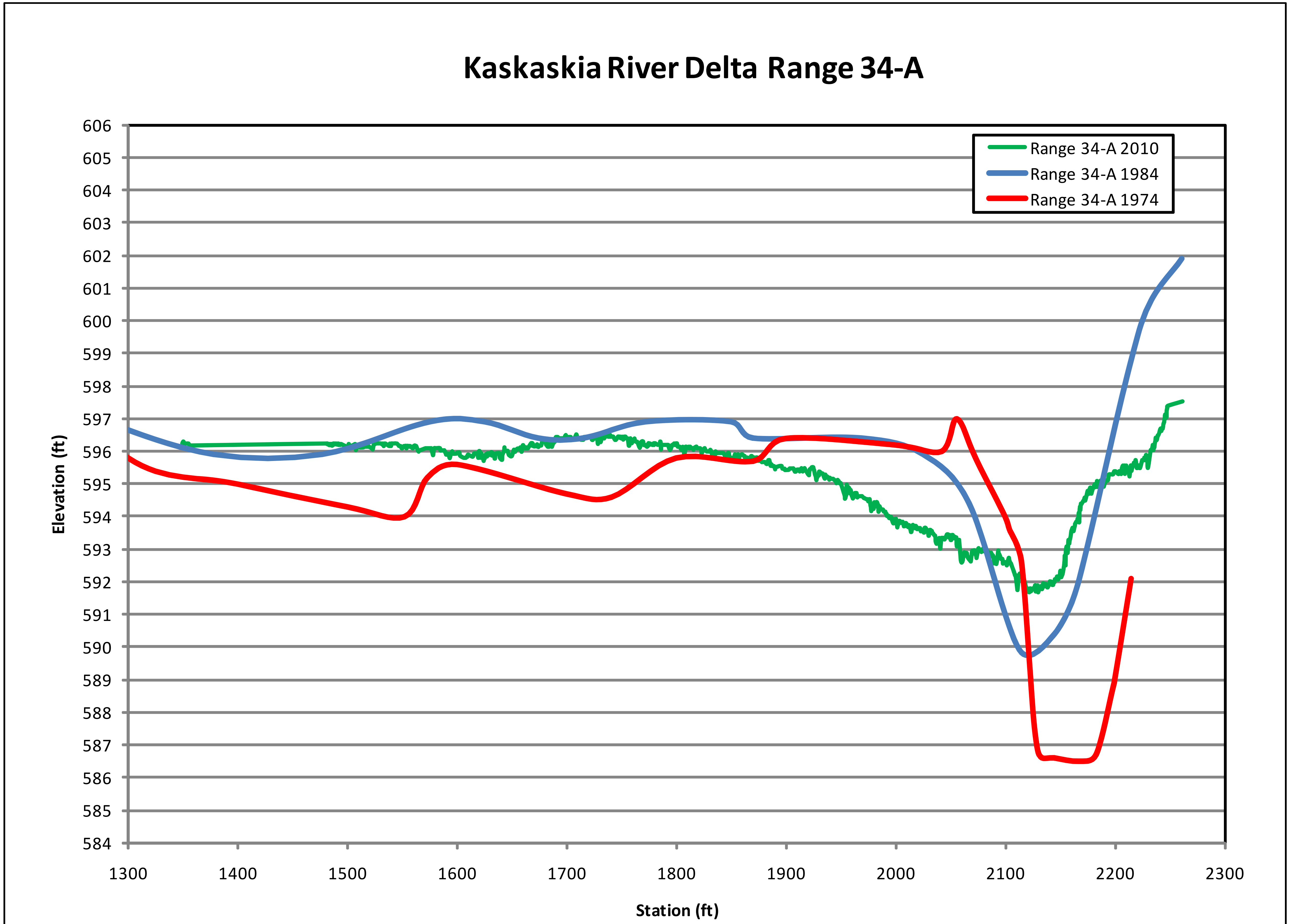


US Army Corps of Engineers
St. Louis District

KASKASKIA RIVER DELTA
LAKE SHELBYVILLE RESERVOIR

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
73



US Army Corps of Engineers
St. Louis District

KASKASKIA RIVER DELTA
LAKE SHELBYVILLE RESERVOIR

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
74

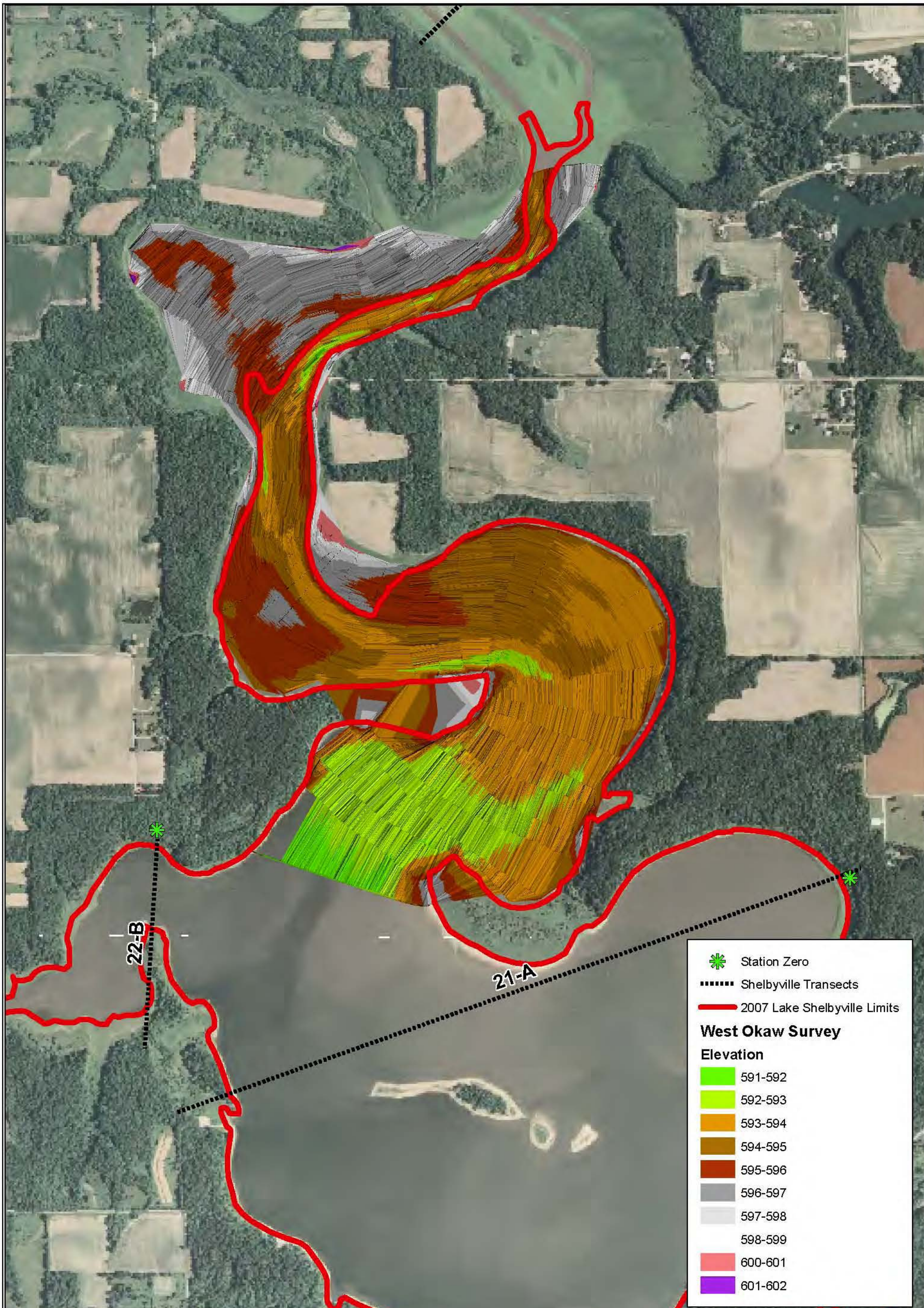


PLATE NUMBER 75

0 250 500 1,000 1,500 2,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

SEDIMENTATION OF LAKE SHELBYVILLE

LAKE SHELBYVILLE
WEST OKAW DELTA
JULY 2010 SURVEY

N W E S

US Army Corps of Engineers®
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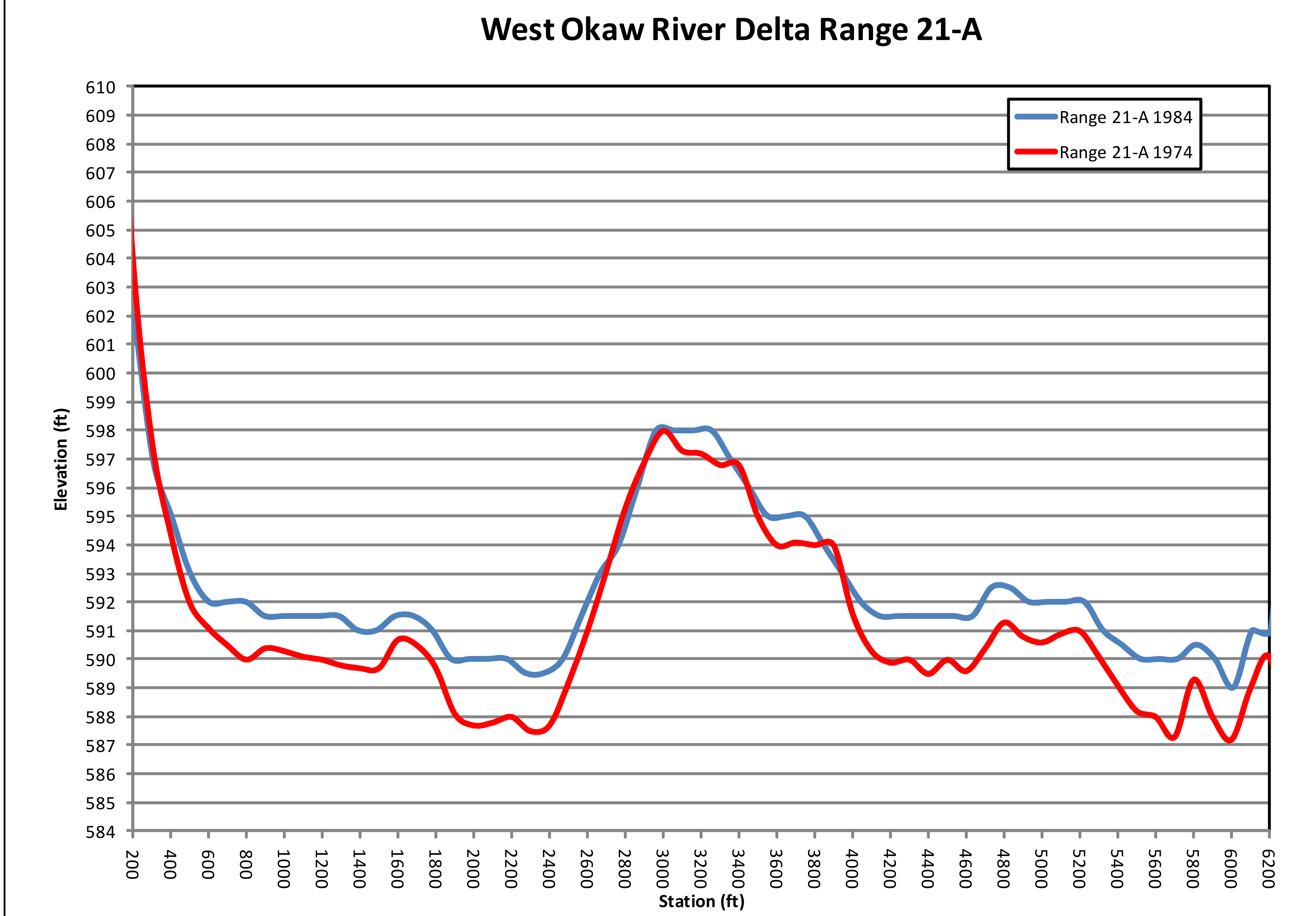
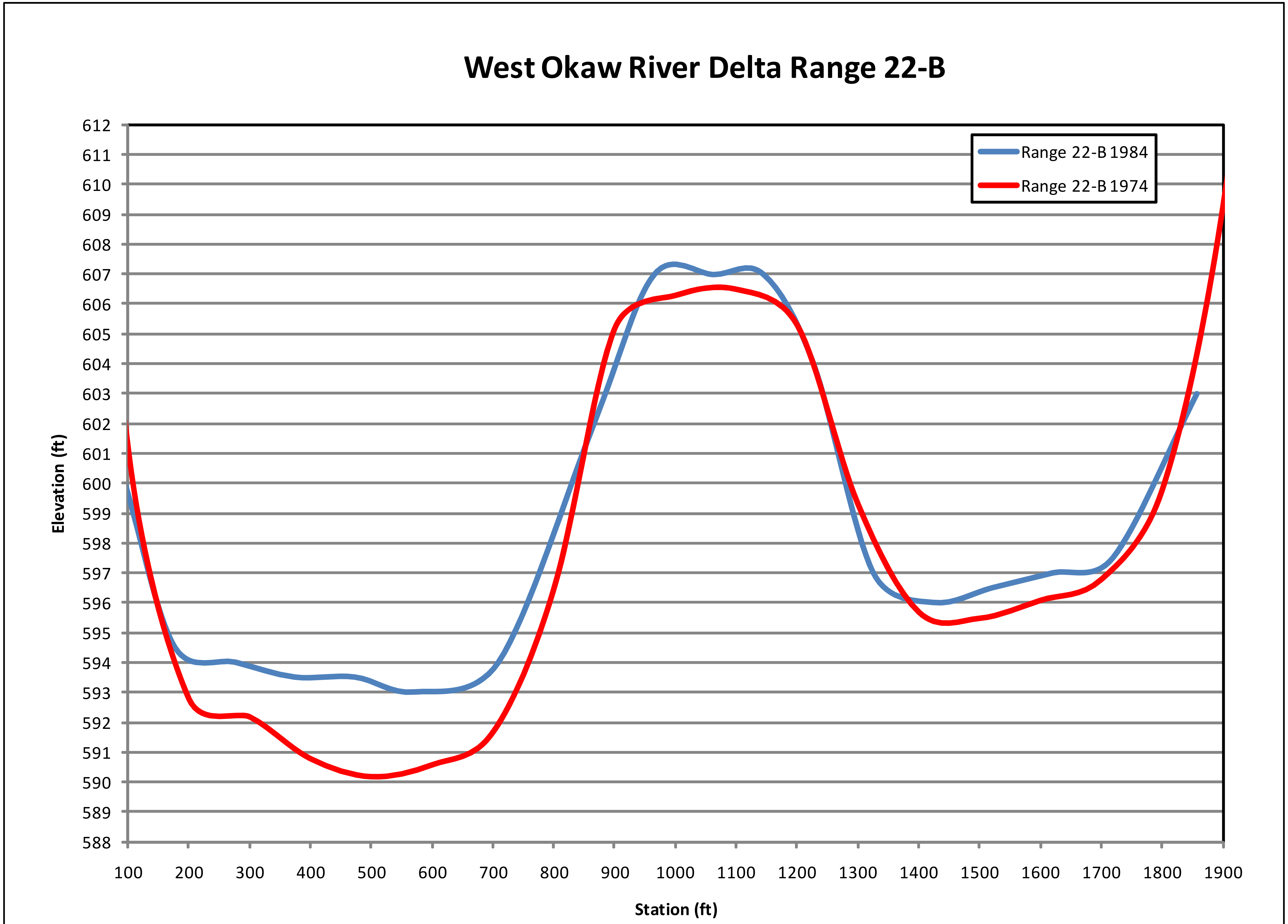


US Army Corps of Engineers
St. Louis District®

WEST OKAW RIVER DELTA
LAKE SHELBYVILLE RESERVOIR

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
76

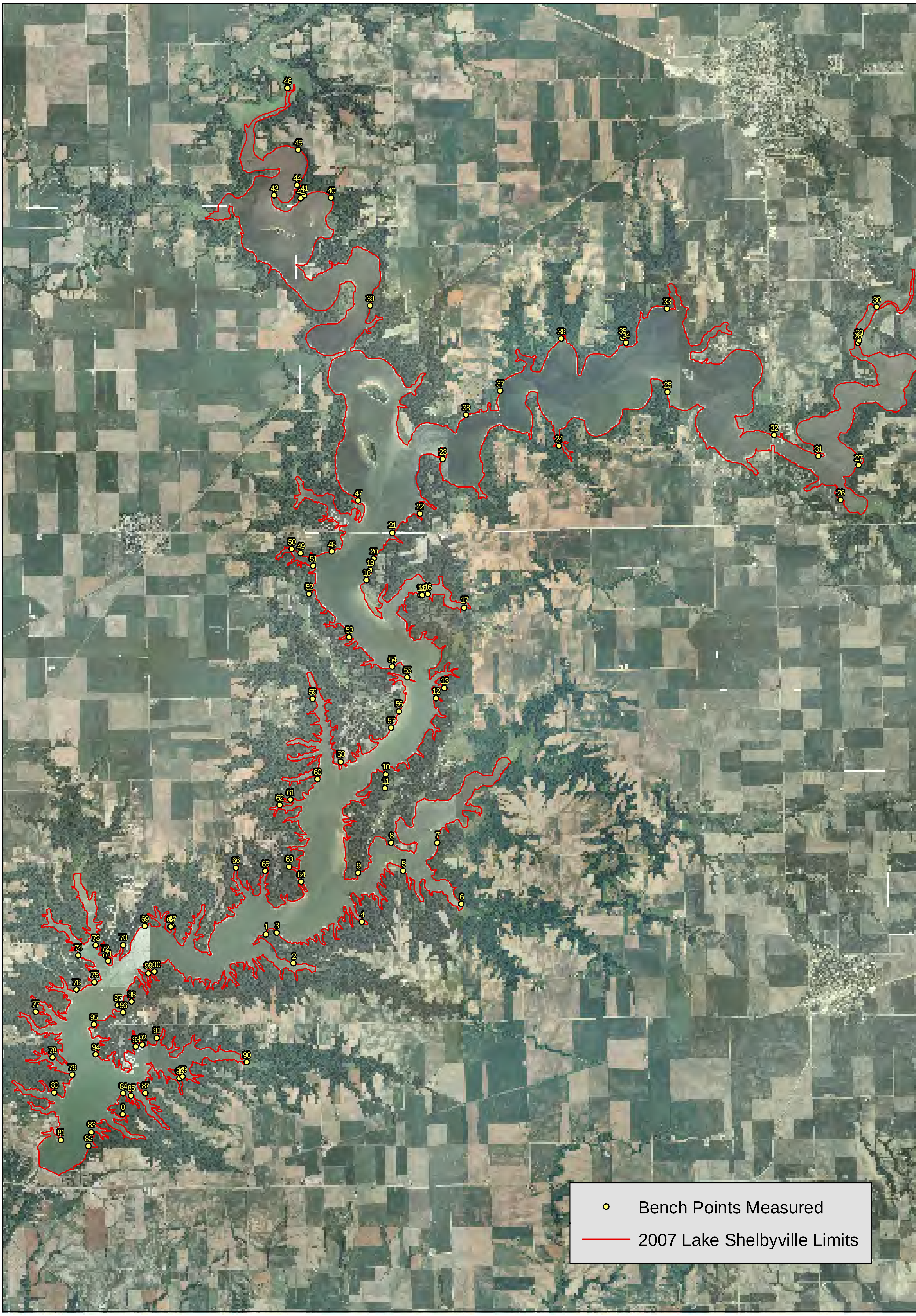


US Army Corps of Engineers
St. Louis District

WEST OKAW RIVER DELTA
LAKE SHELBYVILLE RESERVOIR

UPPER KASKASKIA RIVER STUDY
HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER
77



Miles
0 0.3 0.6 1.2 1.8 2.4

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

SEDIMENTATION OF LAKE SHELBYVILLE

LAKE SHELBYVILLE
BENCH LOCATIONS
SEDIMENTATION MEASUREMENTS

N
W E
S

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PLATE NUMBER
78

APPENDIX A

1821 KASKASKIA RIVER CHANNEL LOCATION

1821 KASKASKIA RIVER CHANNEL LOCATION

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER
A-1

1821 KASKASKIA RIVER CHANNEL LOCATION

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER

A-2

1821 KASKASKIA RIVER CHANNEL LOCATION

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER
A-3

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 KASKASKIA RIVER CHANNEL LOCATION

N W E S

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER
A-4

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

1821 KASKASKIA RIVER CHANNEL LOCATION

N E S W

US Army Corps of Engineers
St. Louis District®

PLATE NUMBER
A-5

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER A-6

1821 KASKASKIA RIVER CHANNEL LOCATION

US Army Corps of Engineers
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1821 KASKASKIA RIVER CHANNEL LOCATION

0 375 750 1,500 2,250 3,000 Feet

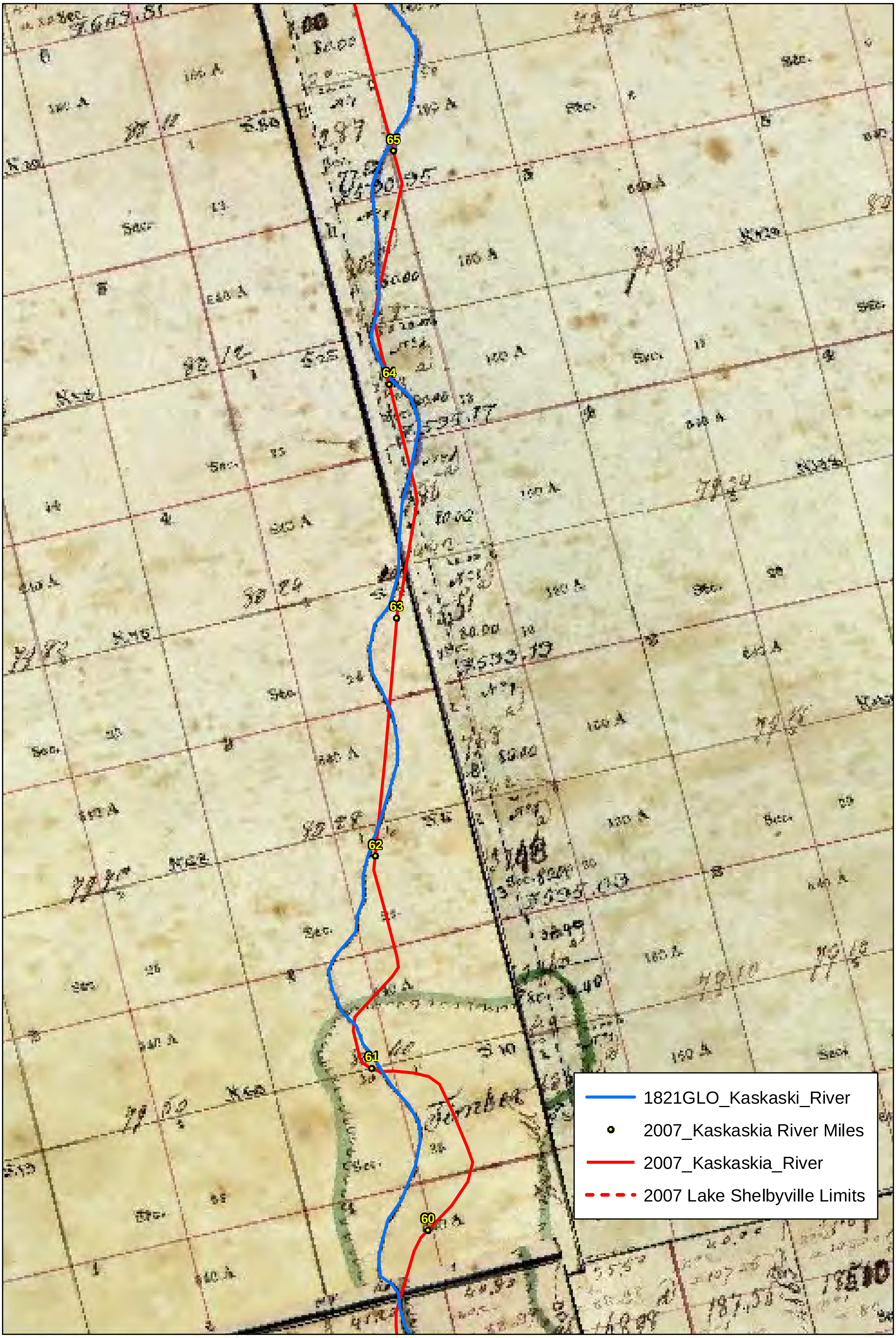
THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER

A-7



1821 KASKASKIA RIVER CHANNEL LOCATION

0 375 750 1,500 2,250 3,000 Feet

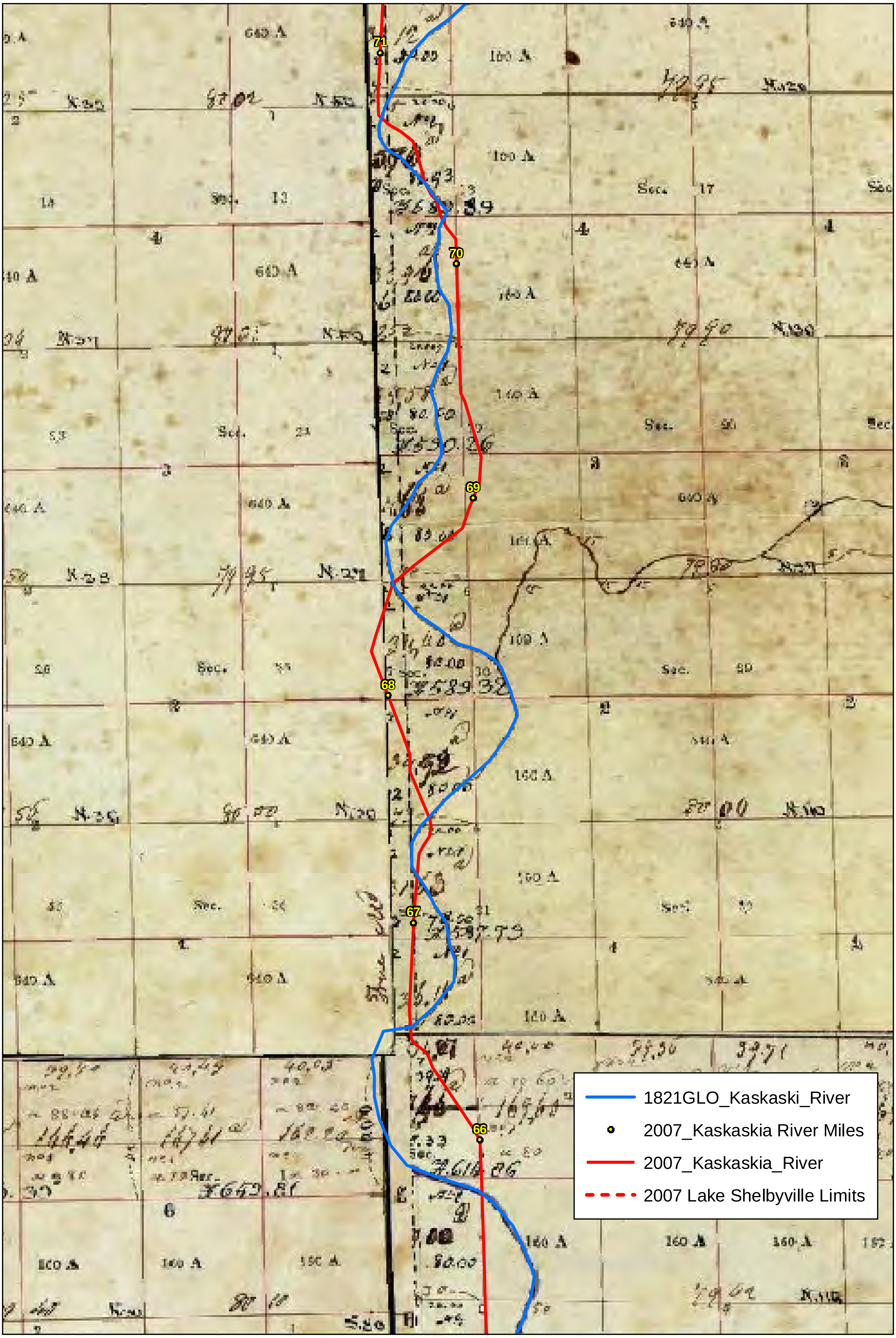
THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER A-8

US Army Corps of Engineers
St. Louis District



1821 KASKASKIA RIVER CHANNEL LOCATION

0 375 750 1,500 2,250 3,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

UPPER KASKASKIA RIVER STUDY

HEADWATERS TO LAKE SHELBYVILLE

PLATE NUMBER

A-9

US Army Corps of Engineers
St. Louis District®

APPENDIX B

CHANNEL CROSS SECTIONS

Stream Stabilization I & E Form

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

County	Champaign	T.	19n	R. 8e	Sec. sw 1/4 30
Date	5/21/2010	By	Mike Rodgers		
Stream Name	Kaski shelbyville to headwater	UTM Coord.			
Landowner Name	Cross-Section 1				
Drainage Area	36.7 sq. mi.			Clear Cells	

Regional Curve Predictions:

Bankfull dimensions	Width	61 ft.	Cross Sectional Area	259 sq. ft.
	Depth	4.3 ft.		

Reference Stream Gage:

Kaskaskia River near Pesotum	Station No.	05590400	Gage Q_2	1810 cfs
	Drainage Area	109 sq.mi	Regression	1790 cfs
Douglas County, IL	**REFERENCE STREAM DATA ONLY**			

USGS Flood-Peak Discharge Predictions:

Valley Slope:	9.9	ft./mi. (user-entered)				Regression Q_2	1316 cfs
		ft/mi (from worksheet)	Rainfall	3.00 in	(2 yr, 24 hr)	Adjusted Q_2	1331 cfs
	0.0019	ft./ft.	Regional Factor	1.057		Typical Range for Bankfull Discharge:	530 to 1070 cfs

Local Stream Morphology:

Channel Description: (a) Clean, straight, no deep pools

Manning's "n" 0.03

		Stream Length		ft.		
Basic Field Data:		Valley Length		ft.		
Bankfull Width	47 ft.	Contour Interval		feet		
Mean Bankfull Depth	4.04 ft.	Estimated Sinuosity				
Width/Depth Ratio	11.63					
		Channel Slope:			Bankfull Q from:	
Max. Bankfull Depth	4.6 ft.	Surveyed:	0.000657	ft./ft.	Cross-Section	586 cfs
Width at twice max. depth	56 ft.	Estimated:		ft./ft.	Basic field data	613 cfs
(9.2 ft.)					Selected Q	600 cfs
Entrenchment Ratio	1.19	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	3.09 *ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	3.23 *ft./sec.*
velocities from different sources.		Velocity from selected Q:	3.2 *ft./sec.*

Channel Evolution Stage: III — Stream Type (Rosgen) G6

Notes

Cross-section completed on 01/21/08

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	Cross-Section 1
Assisted by:	Mike Rodgers
Date:	4/15/2010
Channel Slope (***S***):	0.000657 *ft/ft*
Manning's ***n***:	0.030
Flow Depth:	5.1 *ft*

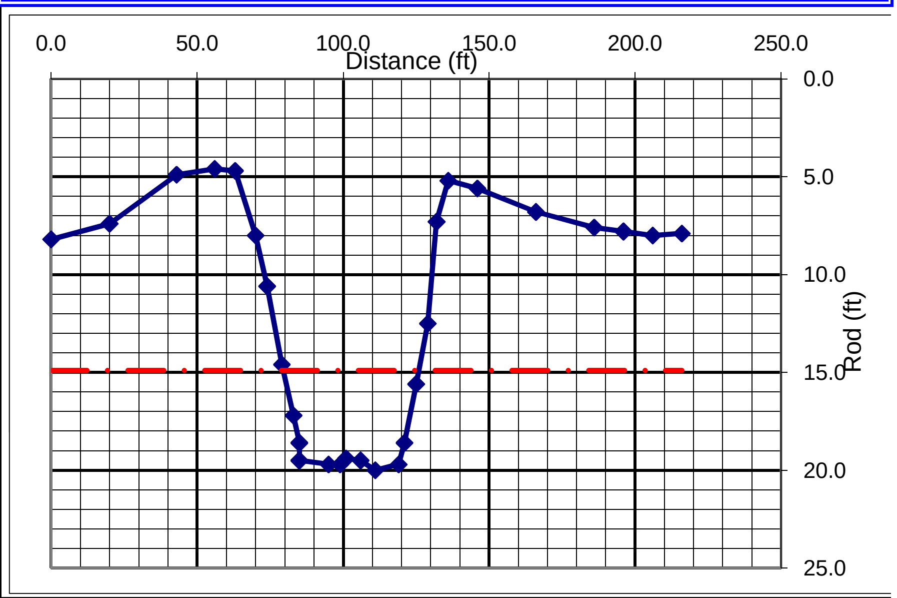
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	5.1 *ft*	14.8	
Channel Flow (***Q***):	586.0 *cfs*	3,325.3	
Channel Velocity:	3.1 *ft/sec*	3.1	
Cross-Sectional Area (***A***):	189.8 *sq.ft.*	1,066.4	
Hydraulic Radius (***R***):	3.8 *ft*	3.8	

Survey Data:

Rod *(ft)*	Distance *(ft)*
8.2	0.0
7.4	20.0
4.9	43.0
4.6	56.0
4.7	63.0
8.0	70.0
10.6	74.0
14.6	79.0
17.2	83.0
18.60	85
19.50	85
19.70	95
19.70	99
19.40	101
19.50	106
20.0	111
19.7	119
18.6	121
15.6	125
12.5	129
7.3	132
5.2	136
5.6	146
6.8	166
7.6	186
7.8	196
8.0	206
7.9	216



COMMENTS:

Stream Stabilization I & E Form

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

County Champaign | T. 19n | R. 8e | Sec. sw 1/4 30

Date 5/21/2010 | By Mike Rodgers

Stream Name: Kaski shelbyville to headwater | UTM Coord.

Landowner Name: Cross-Section 2

Drainage Area 61.5 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	74 ft.	Cross Sectional Area	367 sq. ft.
	Depth	4.9 ft.		

Reference Stream Gage:

Kaskaskia River near Pesotum	Station No.	05590400	Gage Q_2	1810 cfs
	Drainage Area	109 sq.mi	Regression	1790 cfs
Douglas County, IL	**REFERENCE STREAM DATA ONLY**			

USGS Flood-Peak Discharge Predictions:

Valley Slope:	5.1	*ft./mi. (user-entered)*		Regression Q_2	1438 cfs
		ft/mi (from worksheet)	Rainfall 3.00 in *(2 yr, 24 hr)*	Adjusted Q_2	1454 cfs
	0.0010	*ft./ft.*	Regional Factor 1.057	Typical Range for Bankfull Discharge:	580 to 1170 cfs

Local Stream Morphology:

Channel Description: (a) Clean, straight, no deep pools

Manning's "n" 0.03

			Stream Length	ft.
Basic Field Data:			Valley Length	ft.
Bankfull Width	45 ft.		Contour Interval	feet
Mean Bankfull Depth	5.1 ft.		Estimated Sinuosity	
Width/Depth Ratio	8.82			

		Channel Slope:	Bankfull Q from:	
Max. Bankfull Depth	6 ft.	Surveyed: 0.000657 *ft./ft.*	Cross-Section	796 *cfs*
Width at twice max. depth	1000 ft.	Estimated: *ft./ft.*	Basic field data	866 *cfs*
(12.0 ft.)			Selected Q	831 *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	3.46	*ft./sec.*
GOAL: Develop confidence by matching	Velocity from basic field data:	3.77	*ft./sec.*
velocities from different sources.	Velocity from selected Q:	3.6	*ft./sec.*

Channel Evolution Stage III | Stream Type (Rosgen) G6

Notes

Cross-section taken on 01/21/08

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	Cross-Section 2
Assisted by:	Mike Rodgers
Date:	4/14/2010
Channel Slope (***S***):	0.000657 ft/ft
Manning's ***n***:	0.030
Flow Depth:	6.0 ft

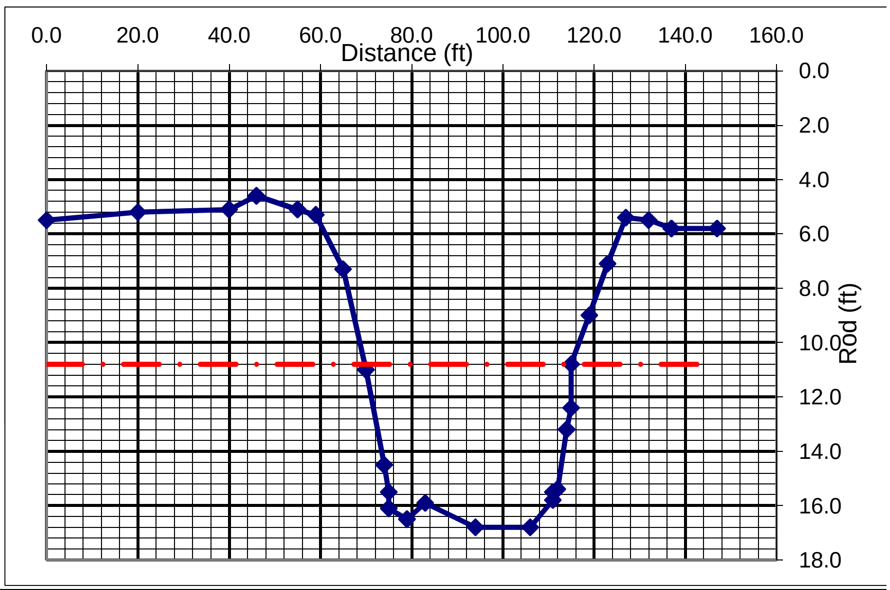
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	6.0 *ft*	11.4	
Channel Flow (***Q***):	795.8 *cfs*	1,927.2	
Channel Velocity:	3.5 *ft/sec*	3.6	
Cross-Sectional Area (***A***):	229.8 *sq.ft.*	536.8	
Hydraulic Radius (***R***):	4.5 *ft*	4.8	

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.5	0.0
5.2	20.0
5.1	40.0
4.6	46.0
5.1	55.0
5.3	59.0
7.3	65.0
11.0	70.0
14.5	74.0
15.50	75
16.10	75
16.50	79
15.90	83
16.80	94
16.80	106
15.8	111
15.5	111
15.4	112
13.2	114
12.4	115
10.8	115
9.0	119
7.1	123
5.4	127
5.5	132
5.8	137
5.8	147



COMMENTS:

Stream Stabilization I & E Form

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

County Douglas | T. 19n | R. 8e | Sec. sw 1/4 30

Date 5/21/2010 | By Mike Rodgers

Stream Name: Kaski shelbyville to headwater
Landowner Name: Cross-Section 3
UTM Coord.:

Drainage Area: 111.2 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	94 ft.	Cross Sectional Area	549 sq. ft.
	Depth	5.9 ft.		

Reference Stream Gage:

Kaskaskia River at Ficklin — Station No. 05590500 — Gage Q_2 1950 cfs
Drainage Area 127 sq.mi — Regression 1910 cfs
Douglas County, IL — **REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope: 3.3 *ft./mi. (user-entered)* — Regression Q_2 2103 cfs
ft/mi (from worksheet) — Rainfall 3.10 in *(2 yr, 24 hr)* — Adjusted Q_2 2147 cfs
0.0006 *ft./ft.* — Regional Factor 1.057 — Typical Range for Bankfull Discharge: 850 to 1720 cfs

Local Stream Morphology:

Channel Description: (a) Clean, straight, no deep pools
Manning's "n" 0.03

Basic Field Data:

Bankfull Width	69	*ft.*
Mean Bankfull Depth	6.76	*ft.*
Width/Depth Ratio	10.21	
Max. Bankfull Depth	8.7	*ft.*
Width at twice max. depth	1000	*ft.*
(17.4 ft.)		
Entrenchment Ratio	14.49	

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

Channel Slope:

Surveyed:	0.000241	*ft./ft.*
Estimated:		*ft./ft.*
Radius of Curvature (Rc)		ft.
Rc/Bankfull width:	0.00	

Bankfull Q from:

Cross-Section	1169	*cfs*
Basic field data	1287	*cfs*
Selected Q	1248	*cfs*

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	2.54	*ft./sec.*
Velocity from basic field data:	2.76	*ft./sec.*
Velocity from selected Q:	2.7	*ft./sec.*

Channel Evolution Stage: III — Stream Type (Rosgen):

Notes

Cross-section taken on 01/21/08

Natural Open Channel Flow

back to I&E form

Clear Cells

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

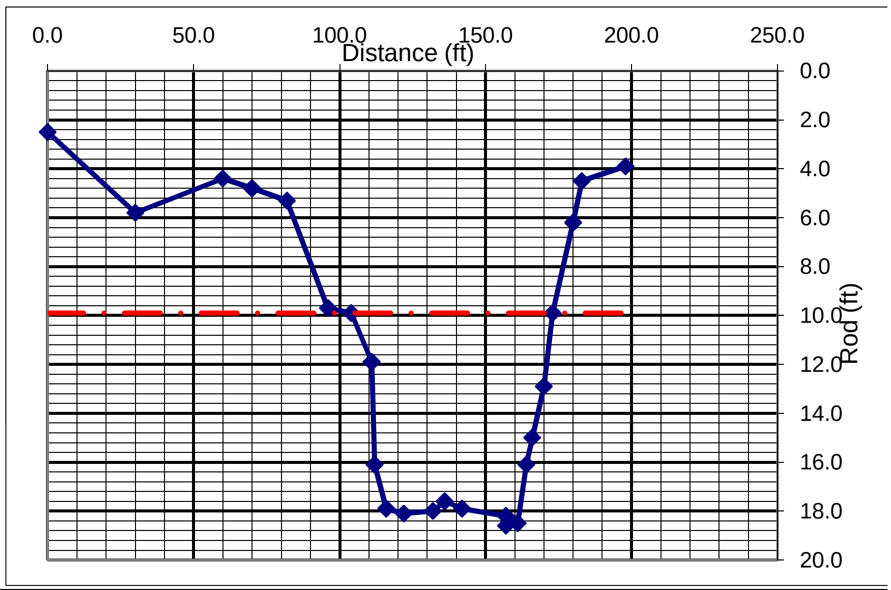
assuming uniform, steady flow

Project:	Cross-Section 3	
Assisted by:	Mike Rodgers	
Date:	4/14/2010	
Channel Slope (***S***):	0.000241	*ft/ft*
Manning's ***n*** :	0.030	
Flow Depth:	8.7	*ft*

		Trial Depth 2	Trial Depth 3
Selected Flow Depth:	8.7 *ft*	14.2	
Channel Flow (***Q***):	1,168.9 *cfs*	2,407.2	
Channel Velocity:	2.5 *ft/sec*	2.4	
Cross-Sectional Area (***A***):	459.4 *sq.ft.*	993.7	
Hydraulic Radius (***R***):	6.0 *ft*	5.6	

Survey Data:

Rod *(ft)*	Distance *(ft)*
2.5	0.0
5.8	30.0
4.4	60.0
4.8	70.0
5.3	82.0
9.7	96.0
9.9	104.0
11.9	111.0
16.1	112.0
17.90	116
18.10	122
18.00	132
17.60	136
17.90	142
18.20	157
18.6	157
18.5	161
16.1	164
15.0	166
12.9	170
9.9	173
6.2	180
4.5	183
3.9	198



COMMENTS:

Stream Stabilization I & E Form

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

County Douglas T. 19n R. 8e Sec. sw 1/4 30

Date 4/14/2010 By Mike Rodgers

Stream Name Kaski shelbyville to headwater UTM Coord.
Landowner Name Cross-Section 4

Drainage Area 122 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	97 ft.	Cross Sectional Area	584 sq. ft.
	Depth	6.0 ft.		

Reference Stream Gage:

Kaskaskia River at Ficklin
Douglas County, IL

Station No. 05590500 Gage Q_2 1950 cfs
Drainage Area 127 sq.mi Regression 1910 cfs

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 3.3 *ft./mi. (user-entered)* Regression Q_2 2250 cfs
ft/mi (from worksheet) Rainfall 3.10 in *(2 yr, 24 hr)* Adjusted Q_2 2297 cfs
0.0006 *ft./ft.* Regional Factor 1.057
Typical Range for Bankfull Discharge: 910 to 1840 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds
Manning's "n" 0.035

Basic Field Data:

Bankfull Width	80 ft.	Stream Length	ft.
Mean Bankfull Depth	6.84 ft.	Valley Length	ft.
Width/Depth Ratio	11.70	Contour Interval	feet
		Estimated Sinuosity	

Channel Slope:
Surveyed: 0.000241 *ft./ft.*
Estimated: *ft./ft.*

Bankfull Q from:
Cross-Section 1245 *cfs*
Basic field data 1304 *cfs*
Selected Q 1274 *cfs*

Max. Bankfull Depth 8.5 *ft.*
Width at twice max. depth 1000 *ft.*
(17.0 ft.)
Entrenchment Ratio 12.50

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 2.27 *ft./sec.*
GOAL: Develop confidence by matching Velocity from basic field data: 2.38 *ft./sec.*
velocities from different sources. Velocity from selected Q: 2.3 *ft./sec.*

Channel Evolution Stage IV Stream Type (Rosgen) G6

Notes

Cross-section taken 0n 01/21/08

Natural Open Channel Flow

back to I&E form

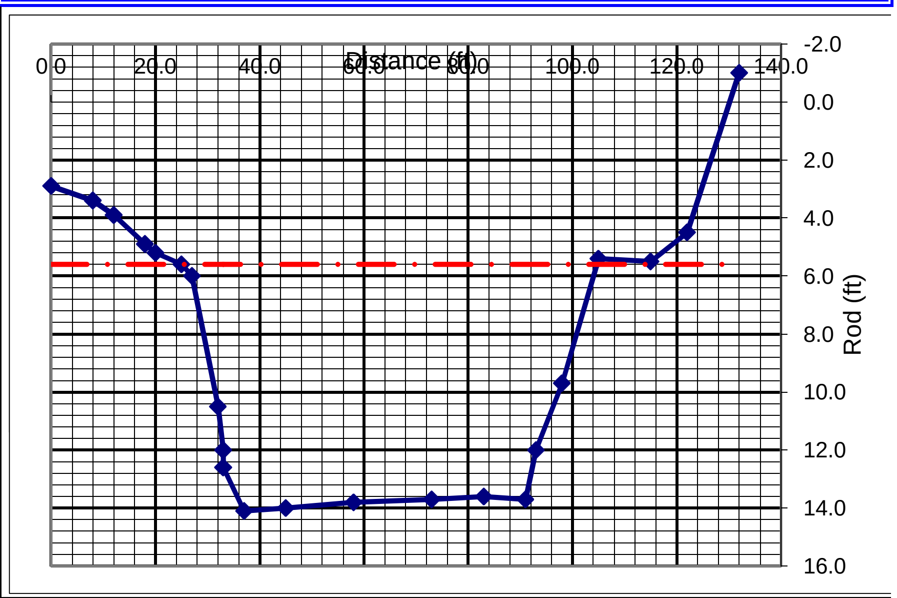
Project:	Cross-Section 4
Assisted by:	Mike Rodgers
Date:	4/14/2010
Channel Slope (***S***):	0.000241 *ft/ft*
Manning's ***n***:	0.035
Flow Depth:	8.5 *ft*

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

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	8.5 *ft*	11.2	
Channel Flow (***Q***):	1,244.9 *cfs*	1,895.0	
Channel Velocity:	2.3 *ft/sec*	2.3	
Cross-Sectional Area (***A***):	547.4 *sq.ft.*	836.7	
Hydraulic Radius (***R***):	6.4 *ft*	6.4	

Survey Data:

Rod *(ft)*	Distance *(ft)*
2.9	0.0
3.4	8.0
3.9	12.0
4.9	18.0
5.2	20.0
5.6	25.0
6.0	27.0
10.5	32.0
12.0	33.0
12.60	33
14.10	37
14.00	45
13.80	58
13.70	73
13.60	83
13.7	91
12.0	93
9.7	98
5.4	105
5.5	115
4.5	122
-1.0	132



COMMENTS:

Stream Stabilization I & E Form

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

County Douglas | T. 19n | R. 8e | Sec. sw 1/4 30

Date 4/14/2010 | By Mike Rodgers

Stream Name: Kaski shelbyville to headwater
Landowner Name: Cross-Section 5
UTM Coord.:

Drainage Area 129.8 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	99 ft.	Cross Sectional Area	609 sq. ft.
	Depth	6.1 ft.		

Reference Stream Gage:

Kaskaskia River at Ficklin
Douglas County, IL

Station No. 05590500
Drainage Area 127 sq.mi
Gage Q_2 1950 cfs
Regression 1910 cfs

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.7 *ft./mi. (user-entered)*
ft/mi (from worksheet)
0.0005 *ft./ft.*

Rainfall 3.10 in *(2 yr, 24 hr)*
Regional Factor 1.057

Regression Q_2 2158 cfs
Adjusted Q_2 2203 cfs
Typical Range for Bankfull Discharge: 880 to 1770 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds
Manning's "n" 0.035

Basic Field Data:

Bankfull Width	54	*ft.*
Mean Bankfull Depth	7.17	*ft.*
Width/Depth Ratio	7.53	
Max. Bankfull Depth	8.8	*ft.*
Width at twice max. depth	1000	*ft.*
(17.6 ft.)		
Entrenchment Ratio	18.52	

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

Channel Slope:
Surveyed: 0.000241 *ft./ft.*
Estimated: *ft./ft.*

Bankfull Q from:

Cross-Section	878	*cfs*
Basic field data	952	*cfs*
Selected Q	915	*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	2.27	*ft./sec.*
Velocity from basic field data:	2.46	*ft./sec.*
Velocity from selected Q:	2.4	*ft./sec.*

Channel Evolution Stage VI

Stream Type (Rosgen)

Notes

Cross-section taken on 01/22/08

Natural Open Channel Flow

back to I&E form

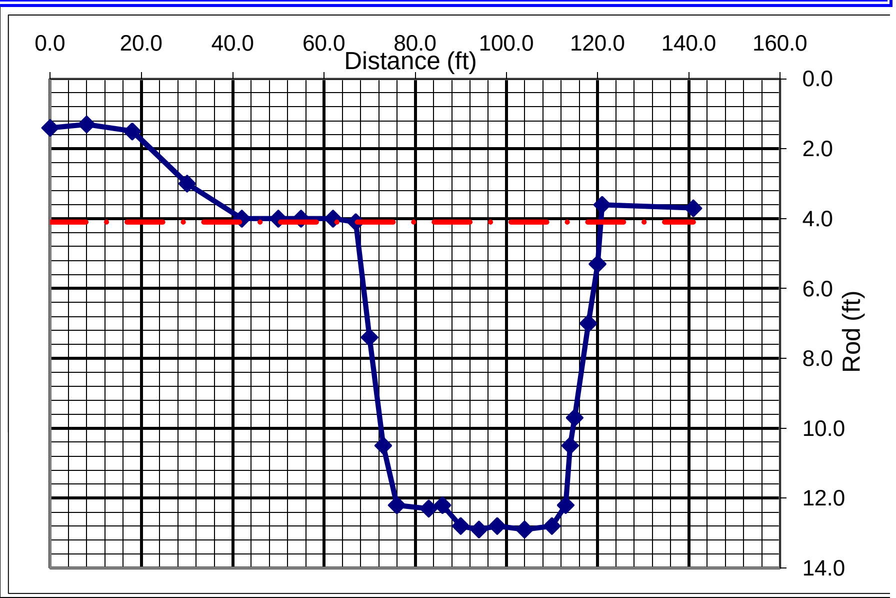
Project:	Cross-Section 5
Assisted by:	Mike Rodgers
Date:	4/14/2010
Channel Slope (***S***):	0.000241 *ft/ft*
Manning's ***n***:	0.035
Flow Depth:	8.8 *ft*

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

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	8.8 *ft*	9.3	
Channel Flow (***Q***):	877.9 *cfs*	673.9	
Channel Velocity:	2.3 *ft/sec*	1.6	
Cross-Sectional Area (***A***):	387.1 *sq.ft.*	426.4	
Hydraulic Radius (***R***):	6.4 *ft*	3.7	

Survey Data:

Rod *(ft)*	Distance *(ft)*
1.4	0.0
1.3	8.0
1.5	18.0
3.0	30.0
4.0	42.0
4.0	50.0
4.0	55.0
4.0	62.0
4.1	67.0
7.40	70
10.50	73
12.20	76
12.30	83
12.20	86
12.80	90
12.9	94
12.8	98
12.9	104
12.8	110
12.2	113
10.5	114
9.7	115
7.0	118
5.3	120
3.6	121
3.7	141



COMMENTS:

Stream Stabilization I & E Form

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

County Douglas | T. 19n | R. 8e | Sec. sw 1/4 30

Date 4/14/2010 | By Mike Rodgers

Stream Name: Kaski shelbyville to headwater | UTM Coord.
Landowner Name: Cross-Section 6

Drainage Area 137 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	101 ft.	Cross Sectional Area	632 sq. ft.
	Depth	6.2 ft.		

Reference Stream Gage:

Kaskaskia River at Ficklin

Station No. 05590500 | Gage Q_2 1950 cfs
Drainage Area 127 sq.mi | Regression 1910 cfs

Douglas County, IL

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.7 *ft./mi. (user-entered)* | Regression Q_2 2252 cfs

ft/mi (from worksheet) | Rainfall 3.10 in *(2 yr, 24 hr)* | Adjusted Q_2 2299 cfs

0.0005 *ft./ft.* | Regional Factor 1.057 | Typical Range for Bankfull Discharge: 910 to 1840 cfs

Local Stream Morphology:

Channel Description: (a) Clean, straight, no deep pools

Manning's "n" 0.03

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

Basic Field Data:

Bankfull Width	69 *ft.*		
Mean Bankfull Depth	4.34 *ft.*		
Width/Depth Ratio	15.90		
		Channel Slope:	Bankfull Q from:
Max. Bankfull Depth	6.4 *ft.*	Surveyed: 0.000179 *ft./ft.*	Cross-Section 359 *cfs*
Width at twice max. depth	1000 *ft.*	Estimated: *ft./ft.*	Basic field data 530 *cfs*
(12.8 ft.)			Selected Q 448 *cfs*
Entrenchment Ratio	14.49	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	1.20 *ft./sec.*
GOAL: Develop confidence by matching	Velocity from basic field data:	1.77 *ft./sec.*
velocities from different sources.	Velocity from selected Q:	1.5 *ft./sec.*

Channel Evolution Stage I | Stream Type (Rosgen)

Notes

Cross-section taken on 01/22/08

Natural Open Channel Flow

back to I&E form

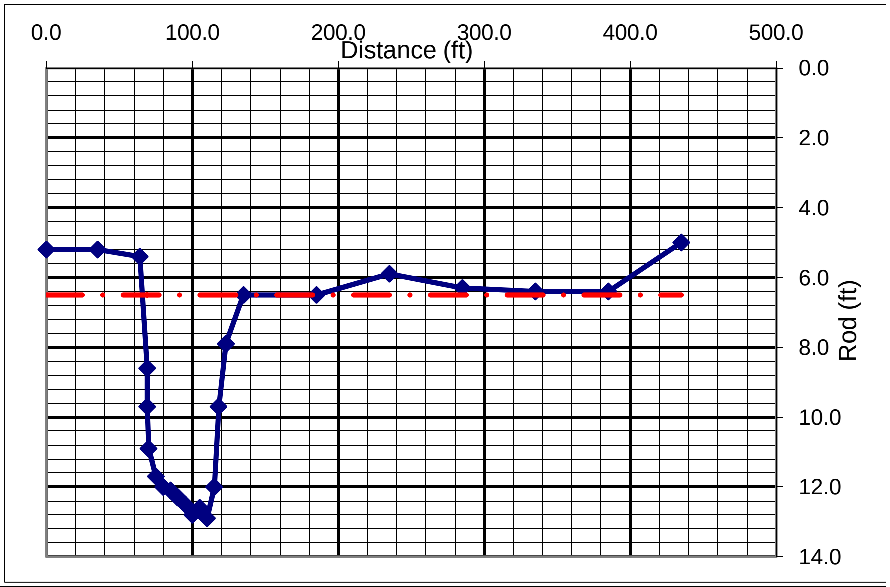
Project:	Cross-Section 6
Assisted by:	Mike Rodgers
Date:	4/14/2010
Channel Slope (***S***):	0.000179 *ft/ft*
Manning's ***n***:	0.030
Flow Depth:	6.4 *ft*

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

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	6.4 *ft*	7.5	
Channel Flow (***Q***):	359.3 *cfs*	592.7	
Channel Velocity:	1.2 *ft/sec*	1.0	
Cross-Sectional Area (***A***):	299.4 *sq.ft.*	622.0	
Hydraulic Radius (***R***):	2.4 *ft*	1.7	

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.2	0.0
5.2	35.0
5.4	64.0
8.6	69.0
9.7	69.0
10.9	70.0
11.7	75.0
12.0	80.0
12.1	85.0
12.30	90
12.50	95
12.80	100
12.60	105
12.90	110
12.00	115
9.7	118
7.9	123
6.5	135
6.5	185
5.9	235
6.3	285
6.4	335
6.4	385
5.0	435



COMMENTS:

Stream Stabilization I & E Form

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

County	Douglas	T.	19n	R.	8e	Sec.	sw 1/4 30
Date	4/14/2010	By	Mike Rodgers				

Stream Name: Kaski shelbyville to headwater

Landowner Name: Cross-Section 7 at Chesterville Gag

UTM Coord.:

Drainage Area: 362 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	148 ft.	Cross Sectional Area	1222 sq. ft.
	Depth	8.3 ft.		

Reference Stream Gage:

Kaskaskia River at Cooks Mills	Station No.	05591200	Gage Q_2	5090 cfs
	Drainage Area	473 sq.mi	Regression	4530 cfs
Coles County, IL	**REFERENCE STREAM DATA ONLY**			

USGS Flood-Peak Discharge Predictions:

Valley Slope:	1.4	*ft./mi. (user-entered)*	Regression Q_2	3537 cfs
		ft/mi (from worksheet) Rainfall 3.10 in *(2 yr, 24 hr)*	Adjusted Q_2	3975 cfs
	0.0003	*ft./ft.* Regional Factor 1.057	Typical Range for Bankfull Discharge:	1580 to 3180 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds

Manning's "n": 0.035

		Stream Length		*ft.*
Basic Field Data:		Valley Length		*ft.*
Bankfull Width	87 *ft.*	Contour Interval		feet
Mean Bankfull Depth	5.95 *ft.*	Estimated Sinuosity		
Width/Depth Ratio	14.62			

		Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	8.3 *ft.*	Surveyed: 0.00018 *ft./ft.*	Cross-Section	973 *cfs*
Width at twice max. depth	1000 *ft.*	Estimated: *ft./ft.*	Basic field data	971 *cfs*
(16.6 ft.)			Selected Q	972 *cfs*
Entrenchment Ratio	11.49	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	1.90 *ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	1.88 *ft./sec.*
velocities from different sources.		Velocity from selected Q:	1.9 *ft./sec.*

Channel Evolution Stage: I

Stream Type (Rosgen):

Notes

Cross-section taken on 01/22/08, approximately 190 yds downstream of the Chestreville gage

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	-Section 7 at Chesterville
Assisted by:	Mike Rodgers
Date:	4/14/2010
Channel Slope (***S***):	0.000180 *ft/ft*
Manning's ***n*** :	0.035
Flow Depth:	8.3 *ft*

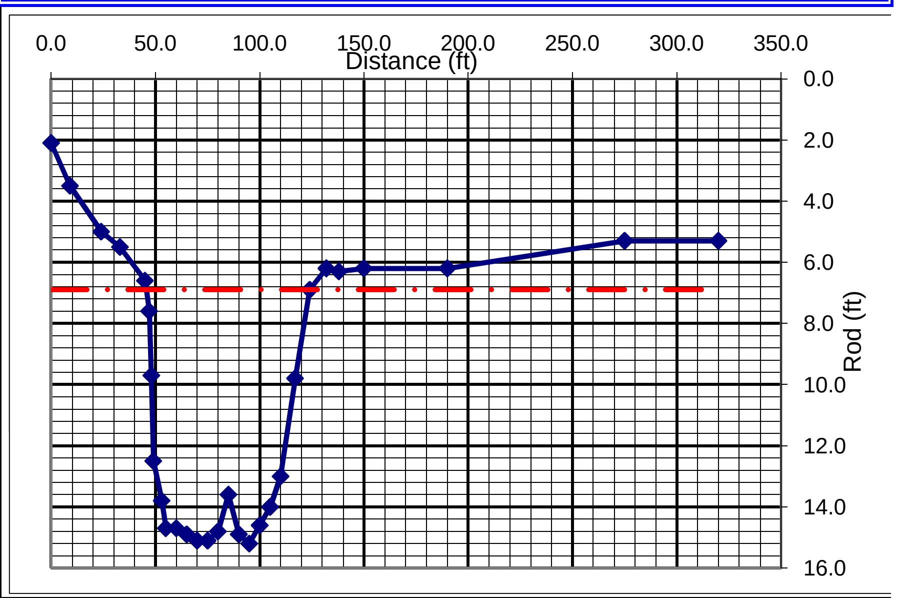
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	8.3 *ft*	9.2	
Channel Flow (***Q***):	973.0 *cfs*	781.7	
Channel Velocity:	1.9 *ft/sec*	1.3	
Cross-Sectional Area (***A***):	512.0 *sq.ft.*	603.8	
Hydraulic Radius (***R***):	6.1 *ft*	3.4	

Survey Data:

Rod *(ft)*	Distance *(ft)*
2.1	0.0
3.5	9.0
5.0	24.0
5.5	33.0
6.6	45.0
7.6	47.0
9.7	48.0
12.5	49.0
13.8	53.0
14.70	55
14.70	60
14.90	65
15.10	70
15.10	75
14.80	80
13.6	85
14.9	90
15.2	95
14.6	100
14.0	105
13.0	110
9.8	117
6.9	124
6.2	132
6.3	138
6.2	150
6.2	190
5.3	275
5.3	320



COMMENTS:

Stream Stabilization I & E Form

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

County Douglas | T. 19n | R. 8e | Sec. sw 1/4 30

Date 4/14/2010 | By Mike Rodgers

Stream Name: Kaski shelbyville to headwater | UTM Coord.
Landowner Name: Cross-Section 8

Drainage Area 406 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	155 ft.	Cross Sectional Area	1321 sq. ft.
	Depth	8.5 ft.		

Reference Stream Gage:

Kaskaskia River at Cooks Mills	Station No.	05591200	Gage Q_2	5090 cfs
	Drainage Area	473 sq.mi	Regression	4530 cfs
Coles County, IL		**REFERENCE STREAM DATA ONLY**		

USGS Flood-Peak Discharge Predictions:

Valley Slope:	1.3	*ft./mi. (user-entered)*		Regression Q_2	3737 cfs
		ft/mi (from worksheet)	Rainfall 3.10 in *(2 yr, 24 hr)*	Adjusted Q_2	4199 cfs
	0.0002	*ft./ft.*	Regional Factor 1.057	Typical Range for Bankfull Discharge:	1670 to 3360 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds

Manning's "n" 0.035

			Stream Length		*ft.*
Basic Field Data:			Valley Length		*ft.*
Bankfull Width	103	*ft.*	Contour Interval		feet
Mean Bankfull Depth	3.87	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	26.61				

			Channel Slope:			Bankfull Q from:	
Max. Bankfull Depth	7.5	*ft.*	Surveyed:	0.000179	*ft./ft.*	Cross-Section	562 *cfs*
Width at twice max. depth	400	*ft.*	Estimated:		*ft./ft.*	Basic field data	560 *cfs*
(15.0 ft.)						Selected Q	561 *cfs*
Entrenchment Ratio	3.88		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	1.41 *ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	1.40 *ft./sec.*
velocities from different sources.			Velocity from selected Q:	1.4 *ft./sec.*

Channel Evolution Stage VI | Stream Type (Rosgen)

Notes

Cross-section taken on 01/23/08. Very cold, channel was frozen

Natural Open Channel Flow

back to I&E form

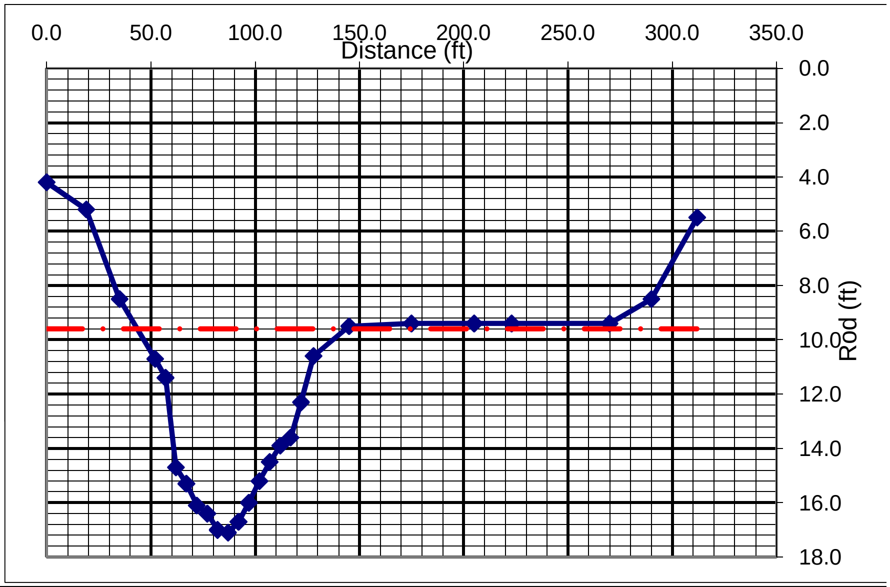
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

Project:	Cross-Section 8
Assisted by:	Mike Rodgers
Date:	4/14/2010
Channel Slope (***S***):	0.000179 *ft/ft*
Manning's ***n***:	0.035
Flow Depth:	7.5 *ft*

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	7.5 *ft*	11.6	
Channel Flow (***Q***):	562.0 *cfs*	2,406.9	
Channel Velocity:	1.4 *ft/sec*	1.7	
Cross-Sectional Area (***A***):	398.5 *sq.ft.*	1,457.6	
Hydraulic Radius (***R***):	3.9 *ft*	5.0	

Survey Data:

Rod *(ft)*	Distance *(ft)*
4.2	0.0
5.2	19.0
8.5	35.0
10.7	52.0
11.4	57.0
14.7	62.0
15.3	67.0
16.1	72.0
16.4	77.0
17.00	82
17.10	87
16.70	92
16.00	97
15.20	102
14.50	107
13.9	112
13.6	117
12.3	122
10.6	128
9.5	145
9.4	175
9.4	205
9.4	223
9.4	270
8.5	290
5.5	312



COMMENTS:

Stream Stabilization I & E Form

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

County Douglas | T. 19n | R. 8e | Sec. sw 1/4 30

Date 4/14/2010 | By Mike Rodgers

Stream Name: Kaski shelbyville to headwater
Landowner Name: Cross-Section 9 at Cooks Mill Gage
UTM Coord.:

Drainage Area 478 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	165 ft.	Cross Sectional Area	1475 sq. ft.
	Depth	8.9 ft.		

Reference Stream Gage:

Kaskaskia River at Cooks Mills
Coles County, IL

Station No. 05591200
Drainage Area 473 sq.mi
Gage Q_2 5090 cfs
Regression 4530 cfs

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 1.3 *ft./mi. (user-entered)*
ft/mi (from worksheet)
0.0002 *ft./ft.*

Rainfall 3.10 in *(2 yr, 24 hr)*
Regional Factor 1.057

Regression Q_2 4252 cfs
Adjusted Q_2 4778 cfs
Typical Range for Bankfull Discharge: 1910 to 3830 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds
Manning's "n" 0.035

Basic Field Data:

Bankfull Width	170	*ft.*
Mean Bankfull Depth	5.48	*ft.*
Width/Depth Ratio	31.02	
Max. Bankfull Depth	11	*ft.*
Width at twice max. depth	70	*ft.*
(22.0 ft.)		
Entrenchment Ratio	0.41	

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

Channel Slope:
Surveyed: 0.00018 *ft./ft.*
Estimated: *ft./ft.*

Bankfull Q from:
Cross-Section 1701 *cfs*
Basic field data 1655 *cfs*
Selected Q 1678 *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	1.82	*ft./sec.*
Velocity from basic field data:	1.78	*ft./sec.*
Velocity from selected Q:	1.8	*ft./sec.*

Channel Evolution Stage I

Stream Type (Rosgen)

Notes

Cross-section taken on 01/23/08. Very cold, channel was frozen

Natural Open Channel Flow

back to I&E form

Clear Cells

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

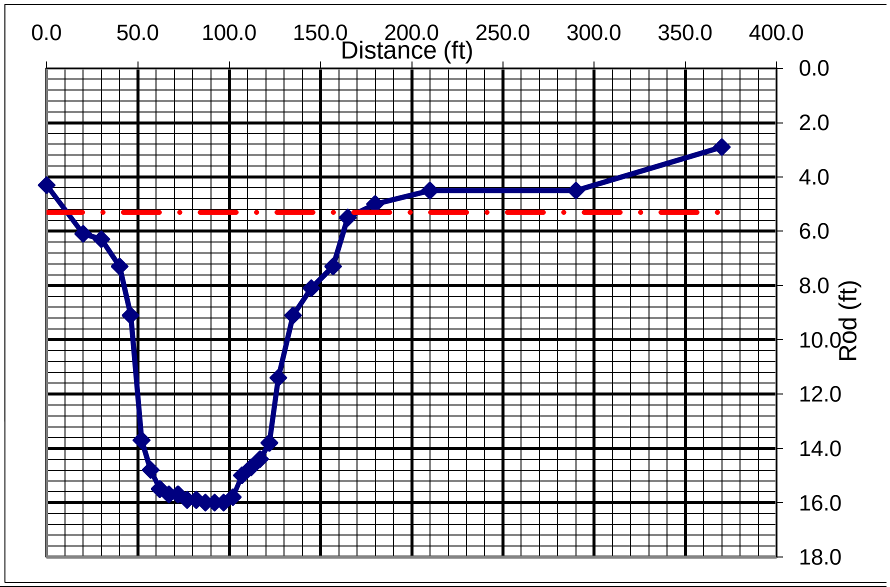
assuming uniform, steady flow

Project:	s-Section 9 at Cooks Mill (	
Assisted by:	Mike Rodgers	
Date:	4/14/2010	
Channel Slope (***S***):	0.000180	*ft/ft*
Manning's ***n*** :	0.035	
Flow Depth:	10.7	*ft*

		Trial Depth 2	Trial Depth 3
Selected Flow Depth:	10.7 *ft*	11.7	
Channel Flow (***Q***):	1,700.7 *cfs*	1,563.0	
Channel Velocity:	1.8 *ft/sec*	1.4	
Cross-Sectional Area (***A***):	933.6 *sq.ft.*	1,137.2	
Hydraulic Radius (***R***):	5.7 *ft*	3.7	

Survey Data:

Rod *(ft)*	Distance *(ft)*
4.3	0.0
6.1	20.0
6.3	30.0
7.3	40.0
9.1	46.0
13.7	52.0
14.8	57.0
15.5	62.0
15.7	67.0
15.70	72
15.90	77
15.90	82
16.00	87
16.00	92
16.00	97
15.8	102
15.0	107
14.7	112
14.4	117
13.8	122
11.4	127
9.1	135
8.1	145
7.3	157
5.5	165
5.0	180
4.5	210
4.5	290
2.9	370



COMMENTS:

Stream Stabilization I & E Form

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

County Coles T. 19n R. 8e Sec. sw 1/4 30

Date 4/15/2010 By Mike Rodgers

Stream Name Kaski shelbyville to headwater UTM Coord.
Landowner Name Cross-Section 10

Drainage Area 496 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	167 ft.	Cross Sectional Area	1512 sq. ft.
	Depth	9.0 ft.		

Reference Stream Gage:

Kaskaskia River at Cooks Mills — Station No. 05591200 — Gage Q_2 5090 cfs
Drainage Area 473 sq.mi — Regression 4530 cfs
Coles County, IL — **REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope: 1.3 *ft./mi. (user-entered)* — Regression Q_2 4378 cfs
ft/mi (from worksheet) — Rainfall 3.10 in *(2 yr, 24 hr)* — Adjusted Q_2 4919 cfs
0.0002 *ft./ft.* — Regional Factor 1.057 — Typical Range for Bankfull Discharge: 1960 to 3940 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds
Manning's "n" 0.035

Basic Field Data:

Bankfull Width	119 *ft.*	Stream Length		*ft.*
Mean Bankfull Depth	7.61 *ft.*	Valley Length		*ft.*
Width/Depth Ratio	15.64	Contour Interval		feet
		Estimated Sinuosity		

Channel Slope:

Max. Bankfull Depth	10.3 *ft.*	Surveyed: 0.000287 *ft./ft.*	Bankfull Q from: Cross-Section	2473 *cfs*
Width at twice max. depth	1000 *ft.*	Estimated: *ft./ft.*	Basic field data	2529 *cfs*
(20.6 ft.)			Selected Q	2508 *cfs*
Entrenchment Ratio	8.40	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	2.74 *ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	2.79 *ft./sec.*
velocities from different sources.		Velocity from selected Q:	2.8 *ft./sec.*

Channel Evolution Stage IV — Stream Type (Rosgen)

Notes

Cross-section taken on 01/23/08. Very cold, channel was frozen

Natural Open Channel Flow

back to I&E form

Clear Cells

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

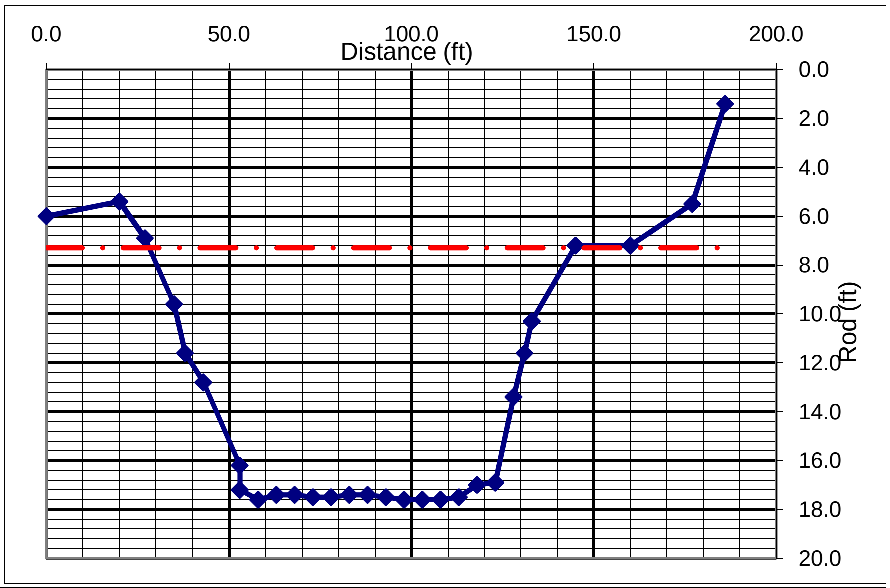
assuming uniform, steady flow

Project:	Cross-Section 10	
Assisted by:	Mike Rodgers	
Date:	4/15/2010	
Channel Slope (***S***):	0.000287	*ft/ft*
Manning's ***n***:	0.035	
Flow Depth:	10.3	*ft*

		Trial Depth 2	Trial Depth 3
Selected Flow Depth:	10.3 *ft*	12.2	
Channel Flow (***Q***):	2,473.3 *cfs*	2,949.6	
Channel Velocity:	2.7 *ft/sec*	2.5	
Cross-Sectional Area (***A***):	903.1 *sq.ft.*	1,181.4	
Hydraulic Radius (***R***):	7.4 *ft*	6.5	

Survey Data:

Rod *(ft)*	Distance *(ft)*
6.0	0.0
5.4	20.0
6.9	27.0
9.6	35.0
11.6	38.0
12.8	43.0
16.2	53.0
17.2	53.0
17.6	58.0
17.40	63
17.40	68
17.50	73
17.50	78
17.40	83
17.40	88
17.5	93
17.6	98
17.6	103
17.6	108
17.5	113
17.0	118
16.9	123
13.4	128
11.6	131
10.3	133
7.2	145
7.2	160
5.5	177
1.4	186



COMMENTS:

Stream Stabilization I & E Form

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

County Coles | T. 19n | R. 8e | Sec. sw 1/4 30

Date 4/15/2010 | By Mike Rodgers

Stream Name: Kaski shelbyville to headwater | UTM Coord.
Landowner Name: Cross-Section 10

Drainage Area 496 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	167 ft.	Cross Sectional Area	1512 sq. ft.
	Depth	9.0 ft.		

Reference Stream Gage:

Kaskaskia River at Cooks Mills | Station No. 05591200 | Gage Q_2 5090 cfs
Drainage Area 473 sq.mi | Regression 4530 cfs
Coles County, IL
REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 1.3 *ft./mi. (user-entered)* | Regression Q_2 4378 cfs
ft/mi (from worksheet) | Rainfall 3.10 in *(2 yr, 24 hr)* | Adjusted Q_2 4919 cfs
0.0002 *ft./ft.* | Regional Factor 1.057 | Typical Range for Bankfull Discharge: 1960 to 3940 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds
Manning's "n" 0.035

Basic Field Data:		Stream Length	*ft.*
		Valley Length	*ft.*
Bankfull Width	119 *ft.*	Contour Interval	feet
Mean Bankfull Depth	7.61 *ft.*	Estimated Sinuosity	
Width/Depth Ratio	15.64		

		Channel Slope:		Bankfull Q from:	
Max. Bankfull Depth	10.3 *ft.*	Surveyed:	0.000287 *ft./ft.*	Cross-Section	2473 *cfs*
Width at twice max. depth	1000 *ft.*	Estimated:	*ft./ft.*	Basic field data	2529 *cfs*
(20.6 ft.)				Selected Q	2508 *cfs*
Entrenchment Ratio	8.40	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	2.74 *ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	2.79 *ft./sec.*
velocities from different sources.		Velocity from selected Q:	2.8 *ft./sec.*

Channel Evolution Stage IV | Stream Type (Rosgen)

Notes

Cross-section taken on 01/23/08. Very cold, channel was frozen

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	Cross-Section 10
Assisted by:	Mike Rodgers
Date:	4/15/2010
Channel Slope (***S***):	0.000287 *ft/ft*
Manning's ***n***:	0.035
Flow Depth:	10.3 *ft*

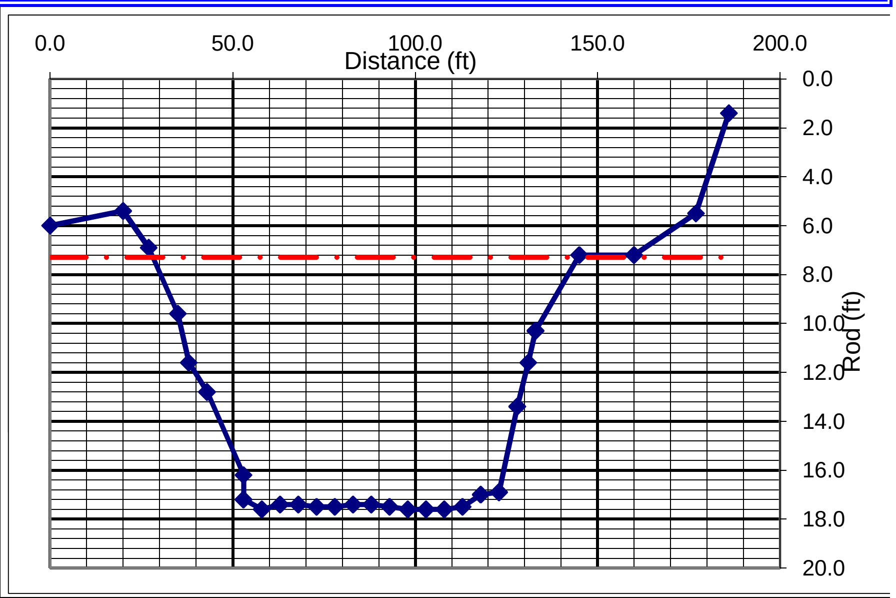
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	10.3 *ft*	12.2	
Channel Flow (***Q***):	2,473.3 *cfs*	2,949.6	
Channel Velocity:	2.7 *ft/sec*	2.5	
Cross-Sectional Area (***A***):	903.1 *sq.ft.*	1,181.4	
Hydraulic Radius (***R***):	7.4 *ft*	6.5	

Survey Data:

Rod *(ft)*	Distance *(ft)*
6.0	0.0
5.4	20.0
6.9	27.0
9.6	35.0
11.6	38.0
12.8	43.0
16.2	53.0
17.2	53.0
17.6	58.0
17.40	63
17.40	68
17.50	73
17.50	78
17.40	83
17.40	88
17.5	93
17.6	98
17.6	103
17.6	108
17.5	113
17.0	118
16.9	123
13.4	128
11.6	131
10.3	133
7.2	145
7.2	160
5.5	177
1.4	186



COMMENTS:

Stream Stabilization I & E Form

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

County Moultrie | T. 19n | R. 8e | Sec. sw 1/4 30

Date 4/14/2010 | By Mike Rodgers

Stream Name: Kaski shelbyville to headwater
Landowner Name: Cross-Section 11
UTM Coord.:

Drainage Area 504 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	168 ft.	Cross Sectional Area	1529 sq. ft.
	Depth	9.1 ft.		

Reference Stream Gage:

Kaskaskia River at Cooks Mills
Coles County, IL

Station No.	05591200	Gage Q_2	5090 cfs
Drainage Area	473 sq.mi	Regression	4530 cfs

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 1.3 *ft./mi. (user-entered)*
ft/mi (from worksheet)
0.0002 *ft./ft.*

Rainfall 3.20 in *(2 yr, 24 hr)*
Regional Factor 1.057

Regression Q_2 4914 cfs
Adjusted Q_2 5521 cfs
Typical Range for Bankfull Discharge: 2200 to 4420 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds
Manning's "n" 0.035

Basic Field Data:

Bankfull Width	92	*ft.*
Mean Bankfull Depth	8.06	*ft.*
Width/Depth Ratio	11.41	
Max. Bankfull Depth	7	*ft.*
Width at twice max. depth	70	*ft.*
(14.0 ft.)		
Entrenchment Ratio	0.76	

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

Channel Slope:

Surveyed:	0.00029	*ft./ft.*
Estimated:		*ft./ft.*

Radius of Curvature (Rc) ft.
Rc/Bankfull width: 0.00

Bankfull Q from:

Cross-Section	2030	*cfs*
Basic field data	2163	*cfs*
Selected Q	2096	*cfs*

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	2.74	*ft./sec.*
Velocity from basic field data:	2.92	*ft./sec.*
Velocity from selected Q:	2.8	*ft./sec.*

Channel Evolution Stage VI

Stream Type (Rosgen)

Notes

Cross-section taken on 01/23/08. Very cold, channel was frozen

Natural Open Channel Flow

[back to I&E form]

Clear Cells

Project:	Cross-Section 11
Assisted by:	Mike Rodgers
Date:	4/14/2010
Channel Slope (***S***):	0.000290 *ft/ft*
Manning's ***n***:	0.035
Flow Depth:	9.8 *ft*

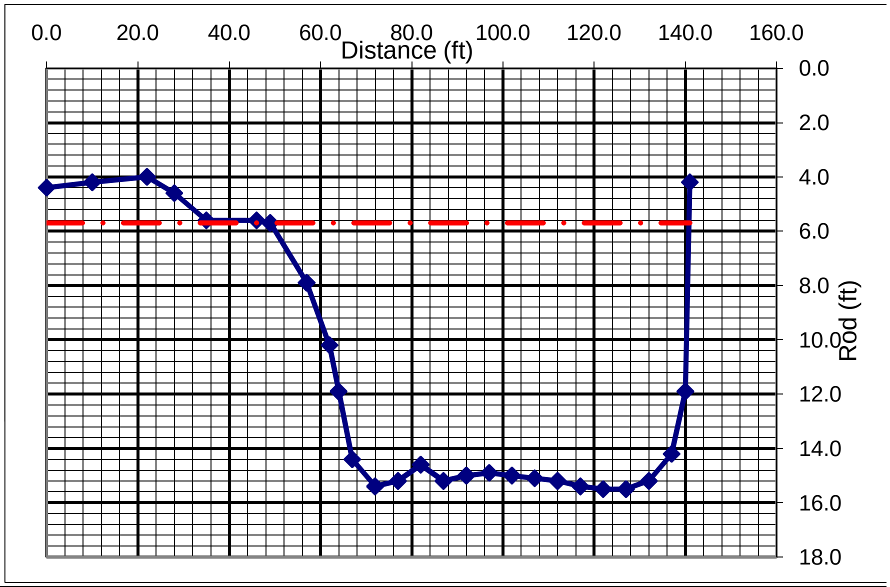
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	9.8 *ft*	11.3	
Channel Flow (***Q***):	2,030.4 *cfs*	2,310.6	
Channel Velocity:	2.7 *ft/sec*	2.5	
Cross-Sectional Area (***A***):	741.6 *sq.ft.*	907.4	
Hydraulic Radius (***R***):	7.4 *ft*	6.6	

Survey Data:

Rod *(ft)*	Distance *(ft)*
4.4	0.0
4.2	10.0
4.0	22.0
4.6	28.0
5.6	35.0
5.6	46.0
5.7	49.0
7.9	57.0
10.2	62.0
11.90	64
14.40	67
15.40	72
15.20	77
14.60	82
15.20	87
15.0	92
14.9	97
15.0	102
15.1	107
15.2	112
15.4	117
15.5	122
15.5	127
15.2	132
14.2	137
11.9	140
4.2	141



COMMENTS:

Stream Stabilization I & E Form

County Moultrie | T. 7N | R. 3W | Sec. 26

Date 5/20/2010 | By Wayne Kinney

Stream Name: Lake Fork | UTM Coord.:
Landowner Name: Lake Fork Cross-Section 1

Drainage Area 153 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	106 ft.	Cross Sectional Area	681 sq. ft.
	Depth	6.4 ft.		

Reference Stream Gage:

Lake Fork at Atwood
Piatt County, IL

Station No. 05590800 | Gage Q_2 2370 cfs
Drainage Area 149 sq.mi | Regression 2380 cfs

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 1.7 *ft./mi. (user-entered)*
ft/mi (from worksheet)
0.0003 *ft./ft.*

Rainfall 3.20 in *(2 yr, 24 hr)*
Regional Factor 1.057

Regression Q_2 2180 cfs
Adjusted Q_2 2171 cfs
Typical Range for Bankfull Discharge: 860 to 1740 cfs

Local Stream Morphology:

Channel Description: (a) Clean, straight, no deep pools
Manning's "n" 0.03

Basic Field Data:

Bankfull Width	75	ft.
Mean Bankfull Depth	5.2	ft.
Width/Depth Ratio	14.42	
Max. Bankfull Depth	9.6	ft.
Width at twice max. depth (19.2 ft.)	1000	ft.
Entrenchment Ratio	13.33	

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

Channel Slope:
Surveyed: 0.000187 *ft./ft.*
Estimated: *ft./ft.*

Bankfull Q from:
Cross-Section 714 *cfs*
Basic field data 795 *cfs*
Selected Q 755 *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	1.90	*ft./sec.*
Velocity from basic field data:	2.04	*ft./sec.*
Velocity from selected Q:	1.9	*ft./sec.*

Channel Evolution Stage II | Stream Type (Rosgen)

Notes

Cross-section completed on 1/22/08. Very cold, with most of the channel being frozen.

Natural Open Channel Flow

back to I&E form

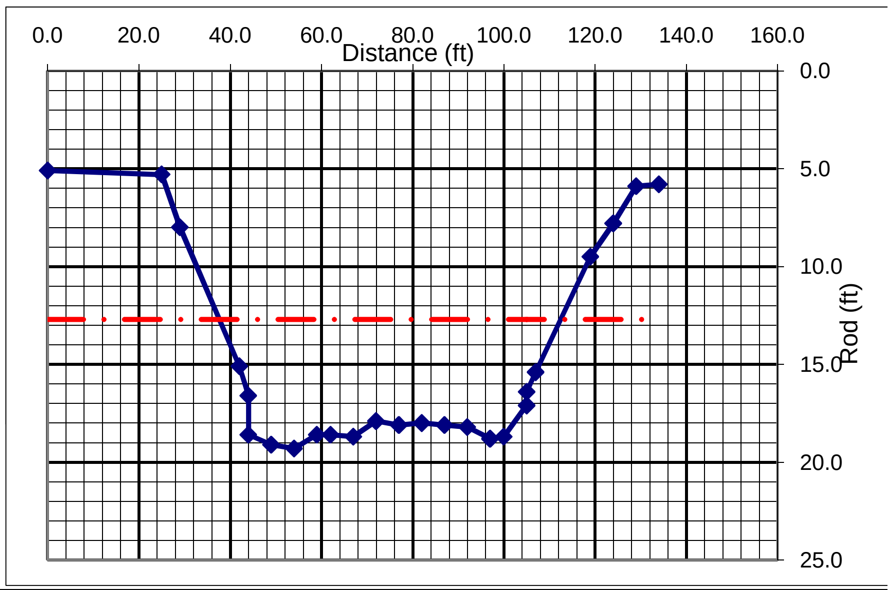
Project:	ake Fork Cross-Section 1	
Assisted by:	Wayne Kinney	
Date:	5/20/2010	
Channel Slope (***S***):	0.000187	*ft/ft*
Manning's ***n*** :	0.030	
Flow Depth:	6.6	*ft*

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

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	6.6 *ft*	10.2	
Channel Flow (***Q***):	713.8 *cfs*	1,659.2	
Channel Velocity:	1.9 *ft/sec*	2.5	
Cross-Sectional Area (***A***):	375.7 *sq.ft.*	670.4	
Hydraulic Radius (***R***):	4.7 *ft*	7.0	

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.1	0.0
5.3	25.0
8.0	29.0
15.1	42.0
16.6	44.0
18.6	44.0
19.1	49.0
19.3	54.0
18.6	59.0
18.60	62
18.70	67
17.90	72
18.10	77
18.00	82
18.10	87
18.2	92
18.8	97
18.7	100
17.1	105
16.4	105
15.4	107
9.5	119
7.8	124
5.9	129
5.8	134



COMMENTS:

Stream Stabilization I & E Form

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

County Douglas | T. 7N | R. 3W | Sec. 26

Date 5/20/2010 | By Mike Rodgers

Stream Name: Lake Fork
Landowner Name: Lake Fork Cross-Section 2
UTM Coord.:

Drainage Area 155.9 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	107 ft.	Cross Sectional Area	690 sq. ft.
	Depth	6.5 ft.		

Reference Stream Gage:

Lake Fork at Atwood	Station No.	05590800	Gage Q_2	2370 cfs
	Drainage Area	149 sq.mi	Regression	2380 cfs
Piatt County, IL	**REFERENCE STREAM DATA ONLY**			

USGS Flood-Peak Discharge Predictions:

Valley Slope:	1.5	ft./mi. (user-entered)		Regression Q_2	1880 cfs
		ft/mi (from worksheet)	Rainfall 3.10 in (2 yr, 24 hr)	Adjusted Q_2	1872 cfs
	0.0003	ft./ft.	Regional Factor 1.057	Typical Range for Bankfull Discharge:	740 to 1500 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds

Manning's "n" 0.035

			Stream Length		ft.
Basic Field Data:			Valley Length		ft.
Bankfull Width	78	ft.	Contour Interval		feet
Mean Bankfull Depth	5.6	ft.	Estimated Sinuosity		
Width/Depth Ratio	13.93				

			Channel Slope:			Bankfull Q from:	
Max. Bankfull Depth	6.9	ft.	Surveyed:	0.000187	ft./ft.	Cross-Section	767 cfs
Width at twice max. depth	1000	ft.	Estimated:		ft./ft.	Basic field data	802 cfs
(13.8 ft.)						Selected Q	785 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}	1 *in.*	Velocity required to move D_{90}:	2.1 *ft./sec.*
D_{50}	*in.*	Velocity from Cross-Section data	1.77 *ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	1.84 *ft./sec.*
velocities from different sources.		Velocity from selected Q:	1.8 *ft./sec.*

Channel Evolution Stage: I | Stream Type (Rosgen):

Notes

4.49 cfs/sq. mi.

Natural Open Channel Flow

[back to I&E form]

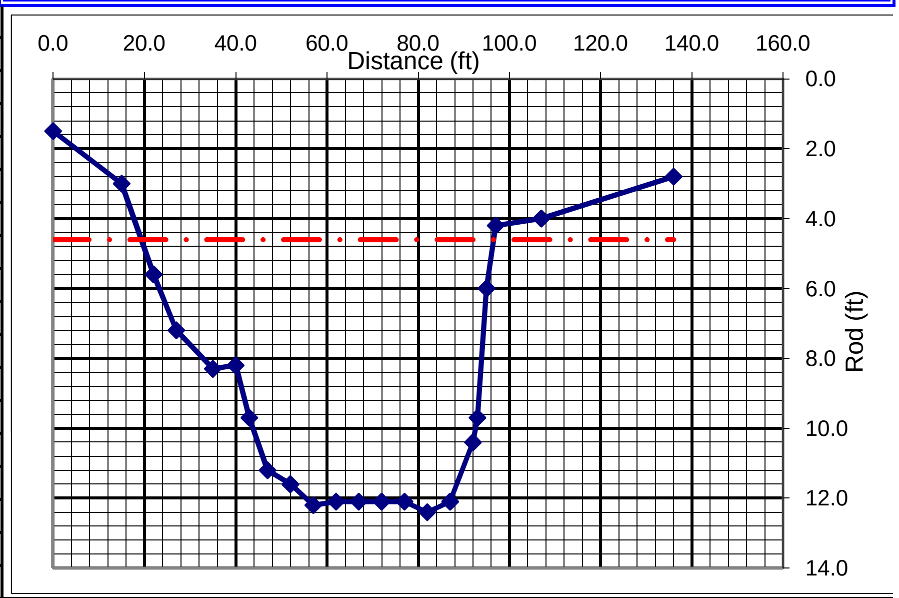
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

Project:	Lake Fork Cross-Section 2	
Assisted by:	Mike Rodgers	
Date:	5/20/2010	
Channel Slope (***S***):	0.000187	*ft/ft*
Manning's ***n***:	0.035	
Flow Depth:	7.8	*ft*

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	7.8 *ft*	12.0	
Channel Flow (***Q***):	766.5 *cfs*	1,596.0	
Channel Velocity:	1.8 *ft/sec*	1.5	
Cross-Sectional Area (***A***):	433.8 *sq.ft.*	1,066.3	
Hydraulic Radius (***R***):	5.3 *ft*	4.1	

Survey Data:

Rod *(ft)*	Distance *(ft)*
1.5	0.0
3.0	15.0
5.6	22.0
7.2	27.0
8.3	35.0
8.2	40.0
9.7	43.0
11.2	47.0
11.6	52.0
12.20	57
12.10	62
12.10	67
12.10	72
12.10	77
12.40	82
12.1	87
10.4	92
9.7	93
6.0	95
4.2	97
4.0	107
2.8	136



COMMENTS:

Stream Stabilization I & E Form

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

County Douglas | T. 7N | R. 3W | Sec. 26

Date 5/20/2010 | By Wayne Kinney

Stream Name: Lake Fork | UTM Coord.:
Landowner Name: Lake Fork Cross-Section 3

Drainage Area 162 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	108 ft.	Cross Sectional Area	708 sq. ft.
	Depth	6.5 ft.		

Reference Stream Gage:

Lake Fork at Atwood	Station No.	05590800	Gage Q_2	2370 cfs
	Drainage Area	149 sq.mi	Regression	2380 cfs
Piatt County, IL	**REFERENCE STREAM DATA ONLY**			

USGS Flood-Peak Discharge Predictions:

Valley Slope:	1.5	*ft./mi. (user-entered)*		Regression Q_2	1938 cfs
		ft/mi (from worksheet)	Rainfall 3.10 in *(2 yr, 24 hr)*	Adjusted Q_2	1929 cfs
	0.0003	*ft./ft.*	Regional Factor 1.057	Typical Range for Bankfull Discharge:	770 to 1550 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds

Manning's "n" 0.035

Basic Field Data:

Bankfull Width	120 *ft.*	Stream Length	*ft.*
Mean Bankfull Depth	4.8 *ft.*	Valley Length	*ft.*
Width/Depth Ratio	25.00	Contour Interval	feet
		Estimated Sinuosity	

Max. Bankfull Depth	7.1 *ft.*	*Channel Slope:* Surveyed: 0.000187 *ft./ft.*	Bankfull Q from: Cross-Section 896 *cfs*
Width at twice max. depth	1000 *ft.*	Estimated: *ft./ft.*	Basic field data 955 *cfs*
(14.2 ft.)			Selected Q 926 *cfs*
Entrenchment Ratio	8.33	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	1.48 *ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	1.66 *ft./sec.*
velocities from different sources.		Velocity from selected Q:	1.6 *ft./sec.*

Channel Evolution Stage I | Stream Type (Rosgen)

Notes

4.06 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

Clear Cells

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

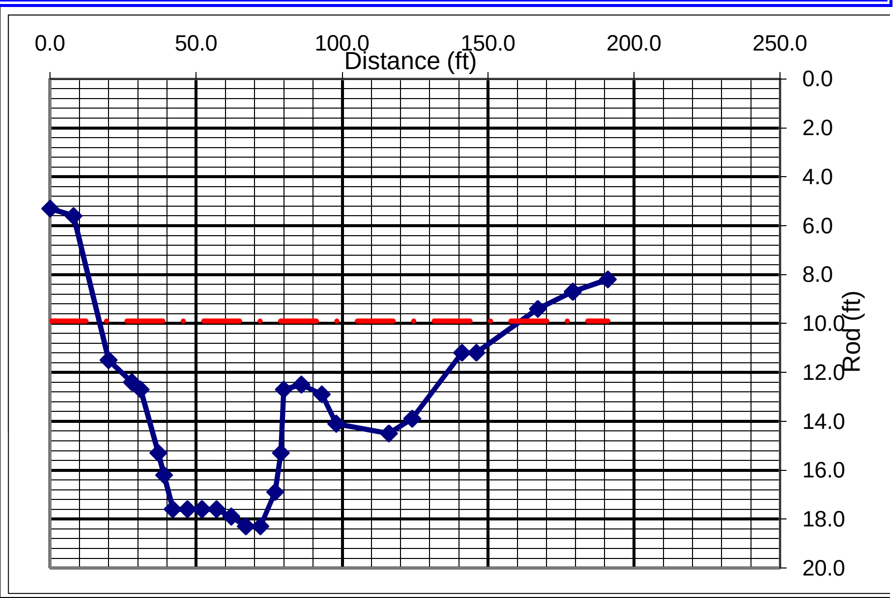
assuming uniform, steady flow

Project:	Lake Fork Cross-Section 3	
Assisted by:	Wayne Kinney	
Date:	5/20/2010	
Channel Slope (***S***):	0.000187	*ft/ft*
Manning's ***n***:	0.035	
Flow Depth:	8.4	*ft*

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	8.4 *ft*	11.5	
Channel Flow (***Q***):	896.3 *cfs*	2,019.1	
Channel Velocity:	1.5 *ft/sec*	1.8	
Cross-Sectional Area (***A***):	605.8 *sq.ft.*	1,149.5	
Hydraulic Radius (***R***):	4.1 *ft*	5.3	

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.3	0.0
5.6	8.0
11.5	20.0
12.4	28.0
12.7	31.0
15.3	37.0
16.2	39.0
17.6	42.0
17.6	47.0
17.60	52
17.60	57
17.90	62
18.30	67
18.30	72
16.90	77
15.3	79
12.7	80
12.5	86
12.9	93
14.1	98
14.5	116
13.9	124
11.2	141
11.2	146
9.4	167
8.7	179
8.2	191



COMMENTS:

Stream Stabilization I & E Form

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

County Moultrie | T. 19n | R. 8e | Sec. 30

Date 4/8/2010 | By Wayne Kinney

Stream Name West Okaw | UTM Coord.
Landowner Name Cross-section 1

Drainage Area 113 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	94 ft.	Cross Sectional Area	555 sq. ft.
	Depth	5.9 ft.		

Reference Stream Gage:

Lake Fork at Atwood

Piatt County, IL

Station No.	05590800	Gage Q_2	2370 cfs
Drainage Area	149 sq.mi	Regression	2380 cfs

REFERENCE STREAM DATA ONLY

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.7 *ft./mi. (user-entered)*

ft/mi (from worksheet)

0.0005 *ft./ft.*

Rainfall 3.20 in *(2 yr, 24 hr)*

Regional Factor 1.057

Regression Q_2 2143 cfs

Adjusted Q_2 2134 cfs

Typical Range for Bankfull Discharge: 850 to 1710 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds

Manning's "n" 0.035

Basic Field Data:

Bankfull Width	121	*ft.*
Mean Bankfull Depth	3.93	*ft.*
Width/Depth Ratio	30.79	
Max. Bankfull Depth	8.3	*ft.*
Width at twice max. depth (16.6 ft.)	1000	*ft.*
Entrenchment Ratio	8.26	

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

Channel Slope:

Surveyed:	0.000396	*ft./ft.*
Estimated:		*ft./ft.*

Radius of Curvature (Rc) ft.

Rc/Bankfull width: 0.00

Bankfull Q from:

Cross-Section	924	*cfs*
Basic field data	1004	*cfs*
Selected Q	968	*cfs*

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	2.03	*ft./sec.*
Velocity from basic field data:	2.11	*ft./sec.*
Velocity from selected Q:	2.0	*ft./sec.*

Channel Evolution Stage I

Stream Type (Rosgen)

Notes

Channel capacity of 968 cfs is 8.56 cfs/sq. mi. - slightly less than the 1.04 yr. return interval of 8.93 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

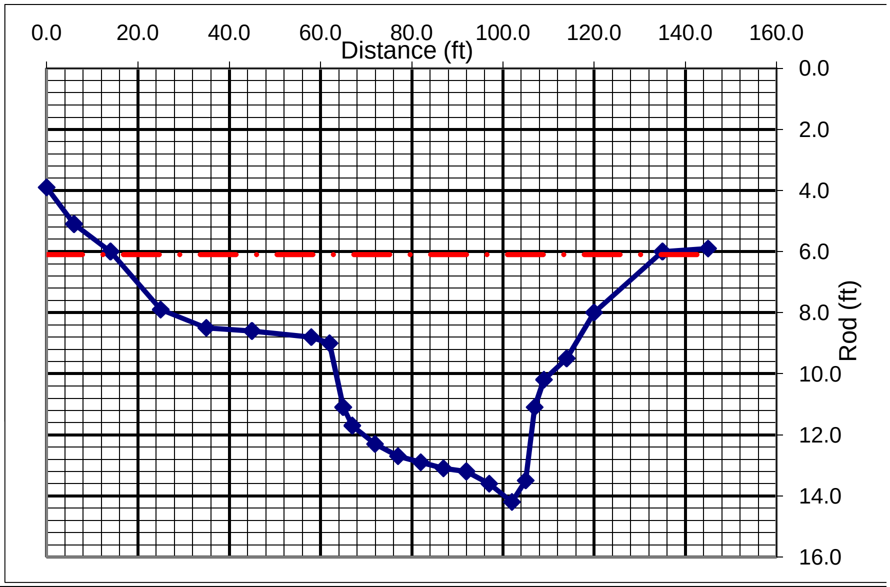
Project:	Cross-section 1
Assisted by:	Wayne Kinney
Date:	4/8/2010
Channel Slope (***S***):	0.000396 *ft/ft*
Manning's ***n***:	0.035
Flow Depth:	8.1 *ft*

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

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	8.1 *ft*		
Channel Flow (***Q***):	923.9 *cfs*		
Channel Velocity:	2.0 *ft/sec*		
Cross-Sectional Area (***A***):	455.5 *sq.ft.*		
Hydraulic Radius (***R***):	3.7 *ft*		

Survey Data:

Rod *(ft)*	Distance *(ft)*
3.9	0.0
5.1	6.0
6.0	14.0
7.9	25.0
8.5	35.0
8.6	45.0
8.8	58.0
9.0	62.0
11.1	65.0
11.70	67
12.30	72
12.70	77
12.90	82
13.10	87
13.20	92
13.6	97
14.2	102
13.5	105
11.1	107
10.2	109
9.5	114
8.0	120
6.0	135
5.9	145



COMMENTS:

Stream Stabilization I & E Form

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

County Moultrie T. 19n R. 8e Sec. 30

Date 4/8/2010 By Wayne Kinney

Stream Name West Okaw UTM Coord.
Landowner Name Cross-section 2

Drainage Area 137 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	101 ft.	Cross Sectional Area	632 sq. ft.
	Depth	6.2 ft.		

Reference Stream Gage:

Lake Fork at Atwood

Station No. 05590800 Gage Q_2 2370 cfs
Drainage Area 149 sq.mi Regression 2380 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.6 *ft./mi. (user-entered)* Regression Q_2 2451 cfs

ft/mi (from worksheet) Rainfall 3.20 in *(2 yr, 24 hr)* Adjusted Q_2 2440 cfs

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

970 to 1960 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds

Manning's "n" 0.035

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

Basic Field Data:

Bankfull Width 75 *ft.*
Mean Bankfull Depth 3.64 *ft.*
Width/Depth Ratio 20.60

Max. Bankfull Depth 7 *ft.*
Width at twice max. depth 1000 *ft.*
(14.0 ft.)
Entrenchment Ratio 13.33

Channel Slope:
Surveyed: 0.000396 *ft./ft.*
Estimated: *ft./ft.*

Bankfull Q from:
Cross-Section 542 *cfs*
Basic field data 547 *cfs*
Selected Q 545 *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.* Velocity required to move D_{90}: 2.1 *ft./sec.*
D_{50} *in.* Velocity from Cross-Section data 1.98 *ft./sec.*
GOAL: Develop confidence by matching Velocity from basic field data: 2.01 *ft./sec.*
velocities from different sources. Velocity from selected Q: 2.0 *ft./sec.*

Channel Evolution Stage I Stream Type (Rosgen)

Notes

545 cfs channel capacity cfs/sq. mi. - well below the 1.04 yr. return interval discharge of 8.93 cfs/sq. mi.

Natural Open Channel Flow

back to I&E form

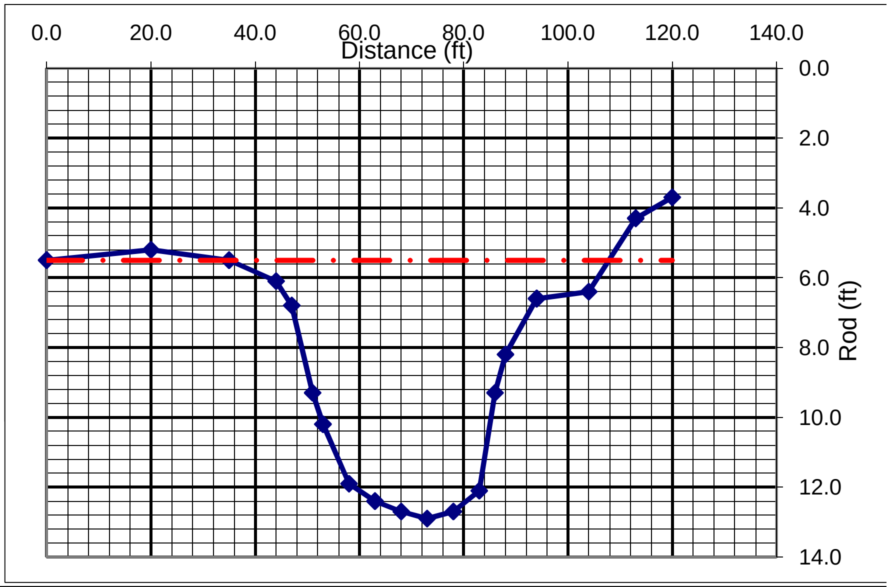
Project:	Cross-section 2
Assisted by:	Wayne Kinney
Date:	4/8/2010
Channel Slope (***S***):	0.000396 *ft/ft*
Manning's ***n***:	0.035
Flow Depth:	7.4 *ft*

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

		Trial Depth 2	Trial Depth 3
Selected Flow Depth:	7.4 *ft*	7.7	
Channel Flow (***Q***):	542.1 *cfs*	489.6	
Channel Velocity:	2.0 *ft/sec*	1.6	
Cross-Sectional Area (***A***):	273.2 *sq.ft.*	300.5	
Hydraulic Radius (***R***):	3.6 *ft*	2.7	

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.5	0.0
5.2	20.0
5.5	35.0
6.1	44.0
6.8	47.0
9.3	51.0
10.2	53.0
11.9	58.0
12.4	63.0
12.70	68
12.90	73
12.70	78
12.10	83
9.30	86
8.20	88
6.6	94
6.4	104
4.3	113
3.7	120



COMMENTS:

Stream Stabilization I & E Form

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

County Moultrie | T. 19n | R. 8e | Sec. sw 1/4 30

Date 4/8/2010 | By Wayne Kinney

Stream Name West Okaw | UTM Coord.
Landowner Name Cross-section 3

Drainage Area 163 sq. mi.

Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	109 ft.	Cross Sectional Area	711 sq. ft.
	Depth	6.6 ft.		

Reference Stream Gage:

Lake Fork at Atwood | Station No. 05590800 | Gage Q_2 2370 cfs
Drainage Area 149 sq.mi | Regression 2380 cfs
Piatt County, IL | **REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope: 2.5 *ft./mi. (user-entered)* | Regression Q_2 2759 cfs
ft/mi (from worksheet) | Rainfall 3.20 in *(2 yr, 24 hr)* | Adjusted Q_2 2747 cfs
0.0005 *ft./ft.* | Regional Factor 1.057 | Typical Range for Bankfull Discharge: 1090 to 2200 cfs

Local Stream Morphology:

Channel Description: (b) Same as (a), but more stones and weeds
Manning's "n" 0.035

Basic Field Data:

Bankfull Width	73 *ft.*	Stream Length	*ft.*		
Mean Bankfull Depth	5.65 *ft.*	Valley Length	*ft.*		
Width/Depth Ratio	12.92	Contour Interval	feet		
		Estimated Sinuosity			
		Channel Slope:		Bankfull Q from:	
Max. Bankfull Depth	7.3 *ft.*	Surveyed:	0.000396 *ft./ft.*	Cross-Section	1068 *cfs*
Width at twice max. depth	1000 *ft.*	Estimated:	*ft./ft.*	Basic field data	1109 *cfs*
(14.6 ft.)				Selected Q	1088 *cfs*
Entrenchment Ratio	13.70	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	2.59	*ft./sec.*
GOAL: Develop confidence by matching		Velocity from basic field data:	2.69	*ft./sec.*
velocities from different sources.		Velocity from selected Q:	2.6	*ft./sec.*

Channel Evolution Stage IV | Stream Type (Rosgen)

Notes

6.67 cfs/sq. mi. channel capacity is below the 8.93 cfs/sq. mi. of the 1.04 yr return interval

Natural Open Channel Flow

back to I&E form

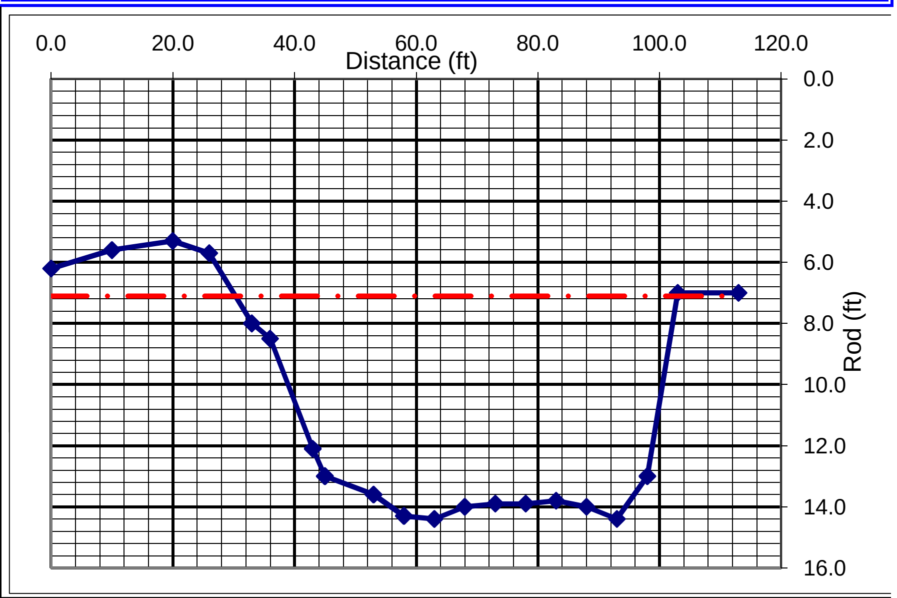
Project:	Cross-section 3
Assisted by:	Wayne Kinney
Date:	4/8/2010
Channel Slope (S):	0.000396 ft/ft
Manning's n:	0.035
Flow Depth:	7.3 ft

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

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	7.3 *ft*	7.4	
Channel Flow (Q):	1,067.7 *cfs*	1,009.8	
Channel Velocity:	2.6 *ft/sec*	2.4	
Cross-Sectional Area (A):	412.6 *sq.ft.*	419.9	
Hydraulic Radius (R):	5.4 *ft*	4.8	

Survey Data:

Rod *(ft)*	Distance *(ft)*
6.2	0.0
5.6	10.0
5.3	20.0
5.7	26.0
8.0	33.0
8.5	36.0
12.1	43.0
13.0	45.0
13.6	53.0
14.30	58
14.40	63
14.00	68
13.90	73
13.90	78
13.80	83
14.0	88
14.4	93
13.0	98
7.0	103
7.0	113



COMMENTS:

APPENDIX C

LAKE SHELBYVILLE BENCH MEASUREMENTS

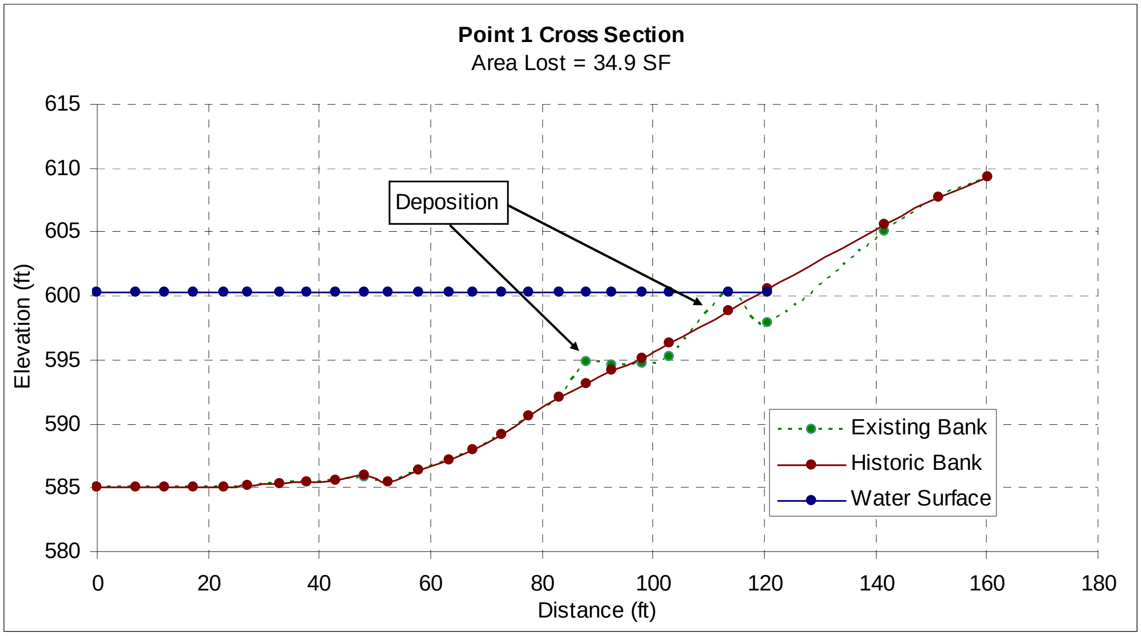
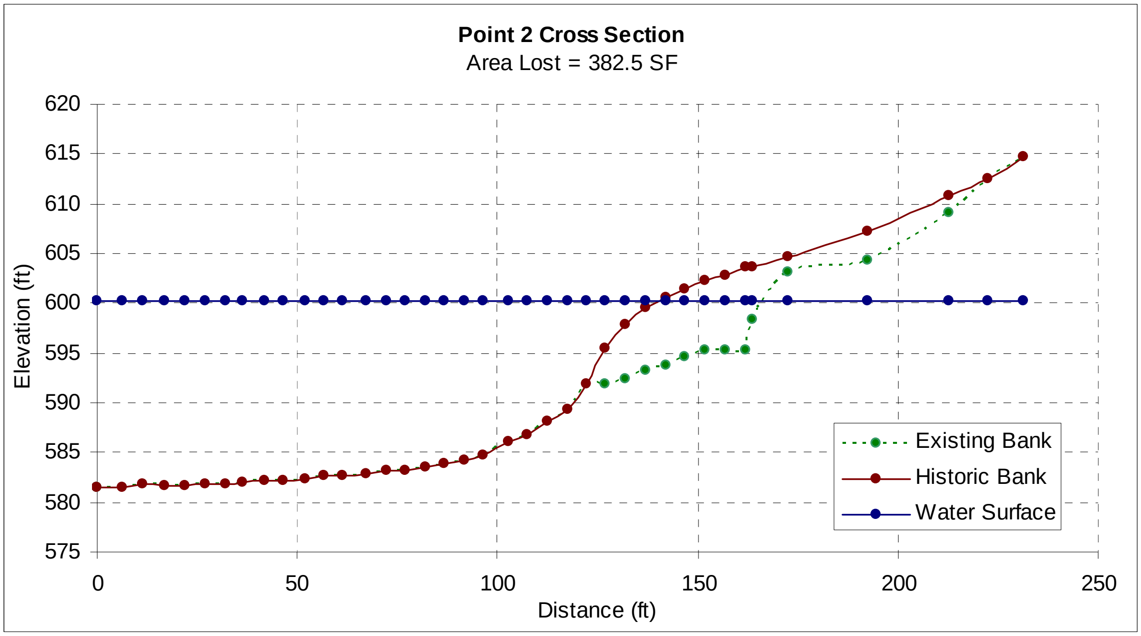

Point 1 Cross Section
Area Lost = 34.9 SF
Deposition
Elevation (ft)
Distance (ft)
615
610
605
600
595
590
585
580
0
20
40
60
80
100
120
140
160
180
Existing Bank
Historic Bank
Water Surface


Photo 2282
Pt. #1
Lake Shelbyville


Point 2 Cross Section
Area Lost = 382.5 SF
Elevation (ft)
Distance (ft)
620
615
610
605
600
595
590
585
580
575
0
50
100
150
200
250
Existing Bank
Historic Bank
Water Surface

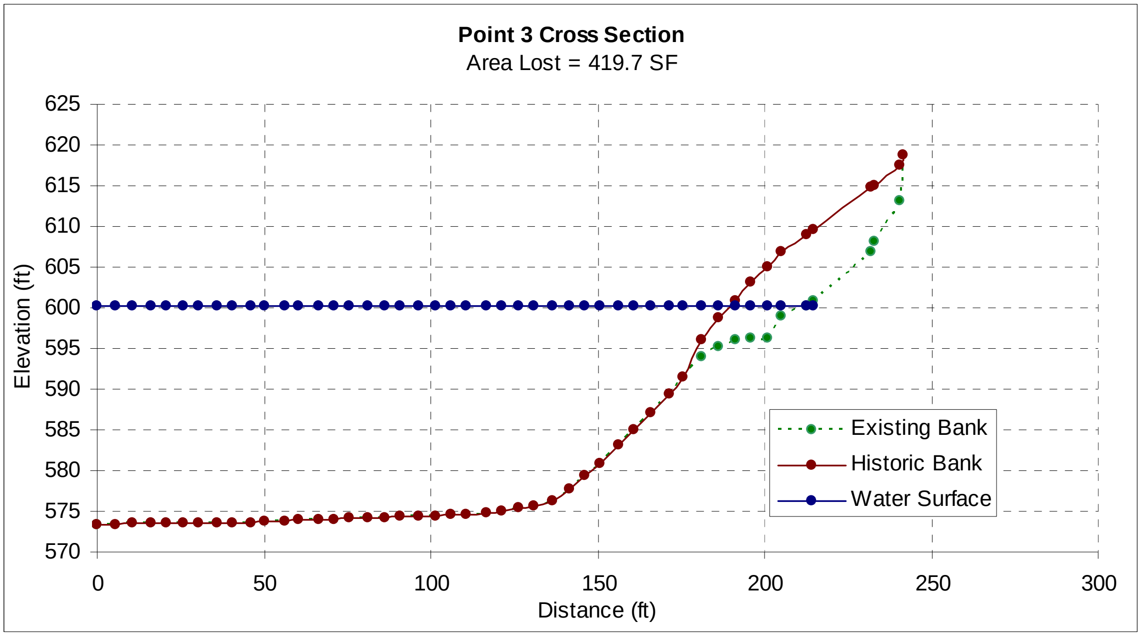

Point 3 Cross Section
Area Lost = 419.7 SF
Elevation (ft)
625
620
615
610
605
600
595
590
585
580
575
570
0
50
100
150
200
250
300
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2283
Pt. # 3
Lake Shelbyville

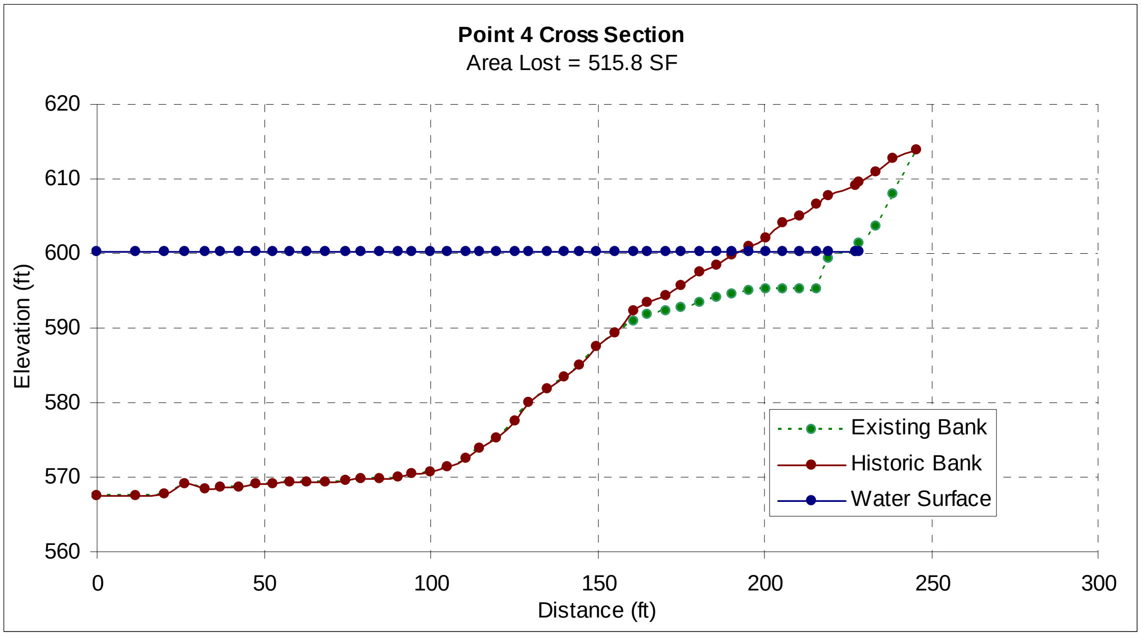

Point 4 Cross Section
Area Lost = 515.8 SF
620
610
600
590
580
570
560
Elevation (ft)
0
50
100
150
200
250
300
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2200
Pt. # 4
Lake Shelbyville

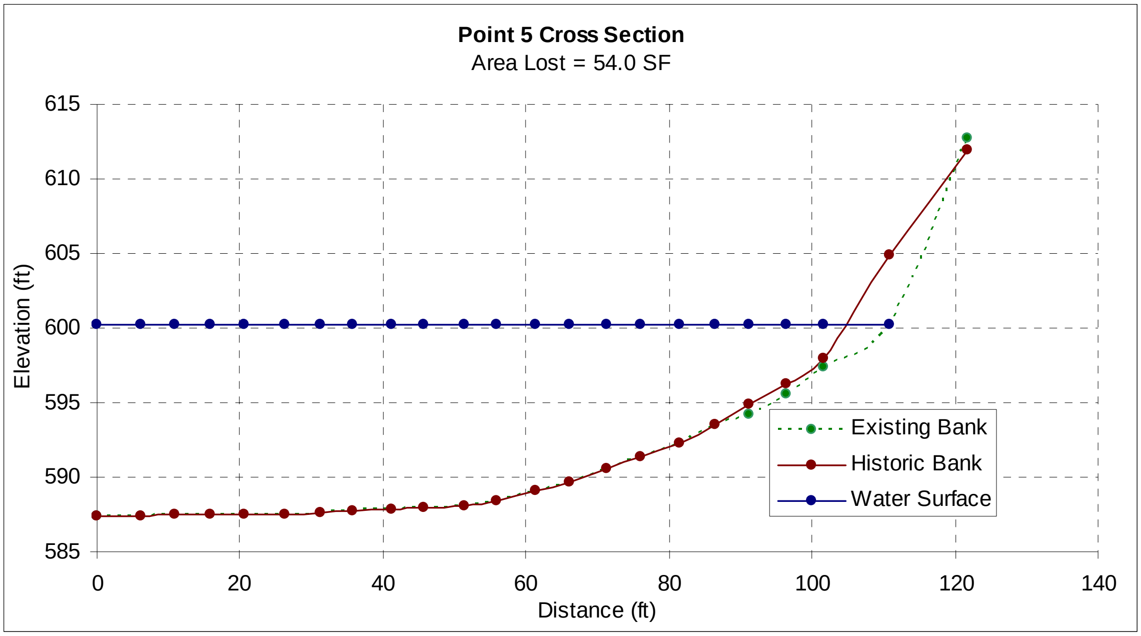

Point 5 Cross Section
Area Lost = 54.0 SF
615
610
605
600
595
590
585
Elevation (ft)
0
20
40
60
80
100
120
140
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2284
Pt. # 5
Lake Shelbyville

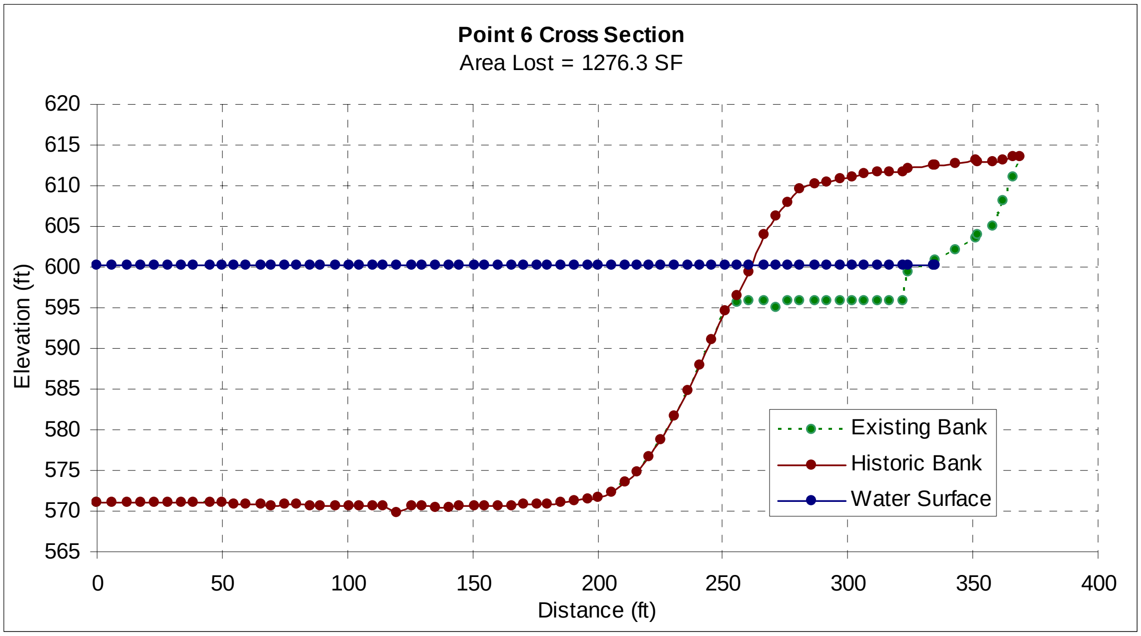

Point 6 Cross Section
Area Lost = 1276.3 SF
Elevation (ft)
620
615
610
605
600
595
590
585
580
575
570
565
0
50
100
150
200
250
300
350
400
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2274
Pt. # 6
Lake Shelbyville

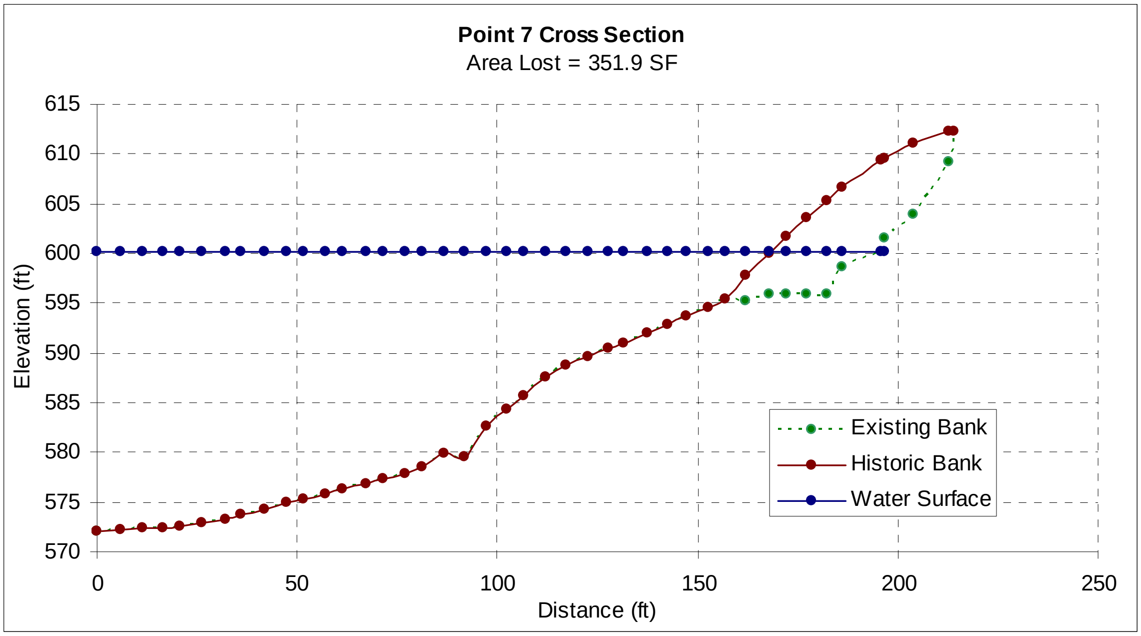

Point 7 Cross Section
Area Lost = 351.9 SF
Elevation (ft)
615
610
605
600
595
590
585
580
575
570
0
50
100
150
200
250
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2275
Pt. # 7
Lake Shelbyville

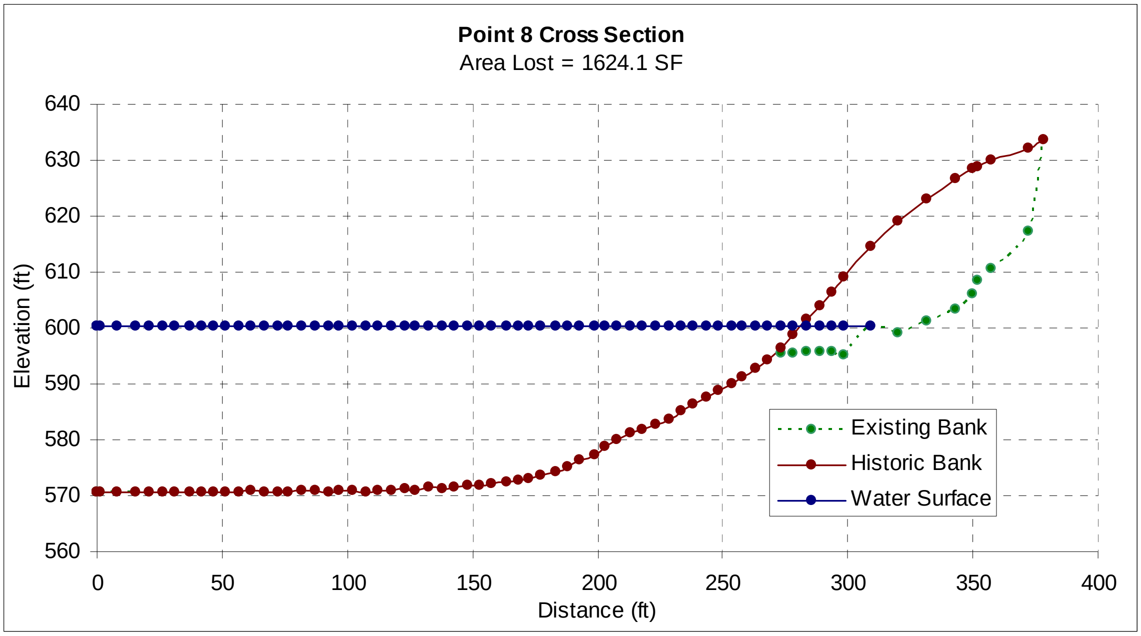

Point 8 Cross Section
Area Lost = 1624.1 SF
Elevation (ft)
640
630
620
610
600
590
580
570
560
0
50
100
150
200
250
300
350
400
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2276
Pt. # 8
Lake Shelbyville

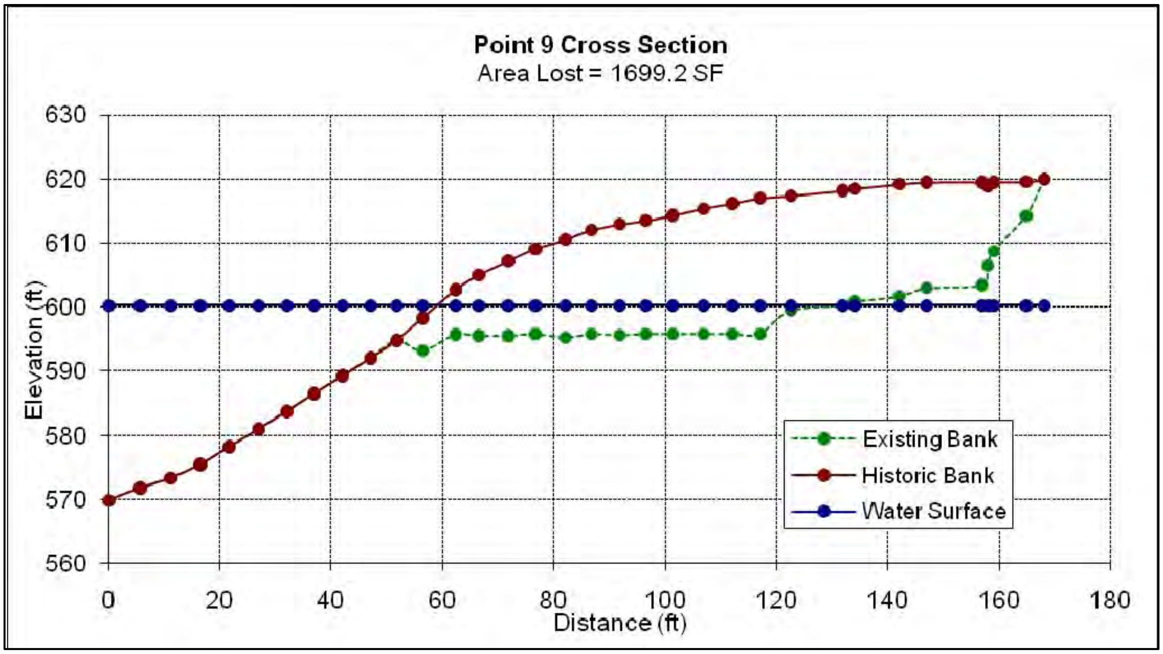
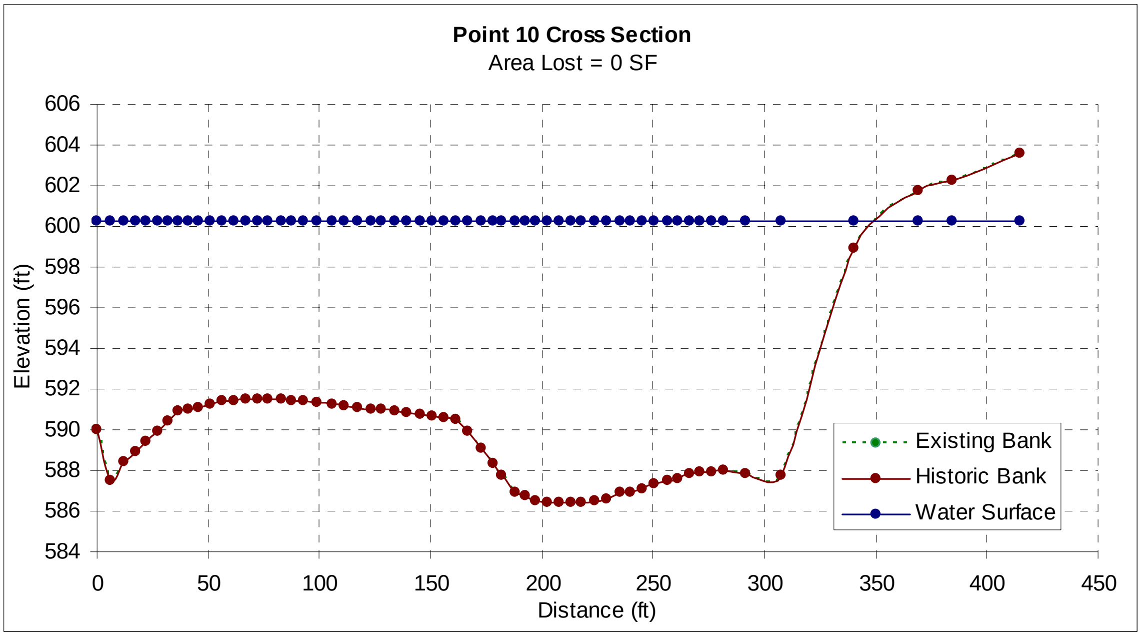

Point 9 Cross Section
Area Lost = 1699.2 SF
Elevation (ft)
Distance (ft)
Existing Bank
Historic Bank
Water Surface
630
620
610
600
590
580
570
560
0
20
40
60
80
100
120
140
160
180


Photo 2277
Pt. # 9
Lake Shelbyville



Point 10 Cross Section
Area Lost = 0 SF
Elevation (ft)
606
604
602
600
598
596
594
592
590
588
586
584
0
50
100
150
200
250
300
350
400
450
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2279
Pt. # 10
Lake Shelbyville

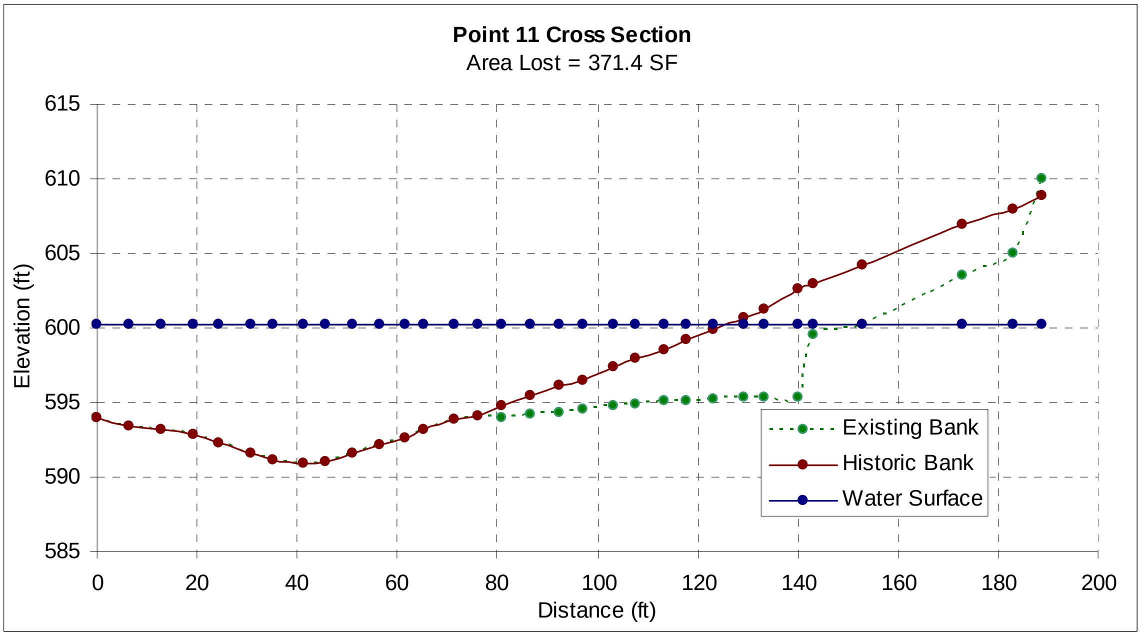

Point 11 Cross Section
Area Lost = 371.4 SF
Elevation (ft)
Distance (ft)
615
610
605
600
595
590
585
0
20
40
60
80
100
120
140
160
180
200
Existing Bank
Historic Bank
Water Surface


Photo 2278
Pt. # 11
Lake Shelbyville

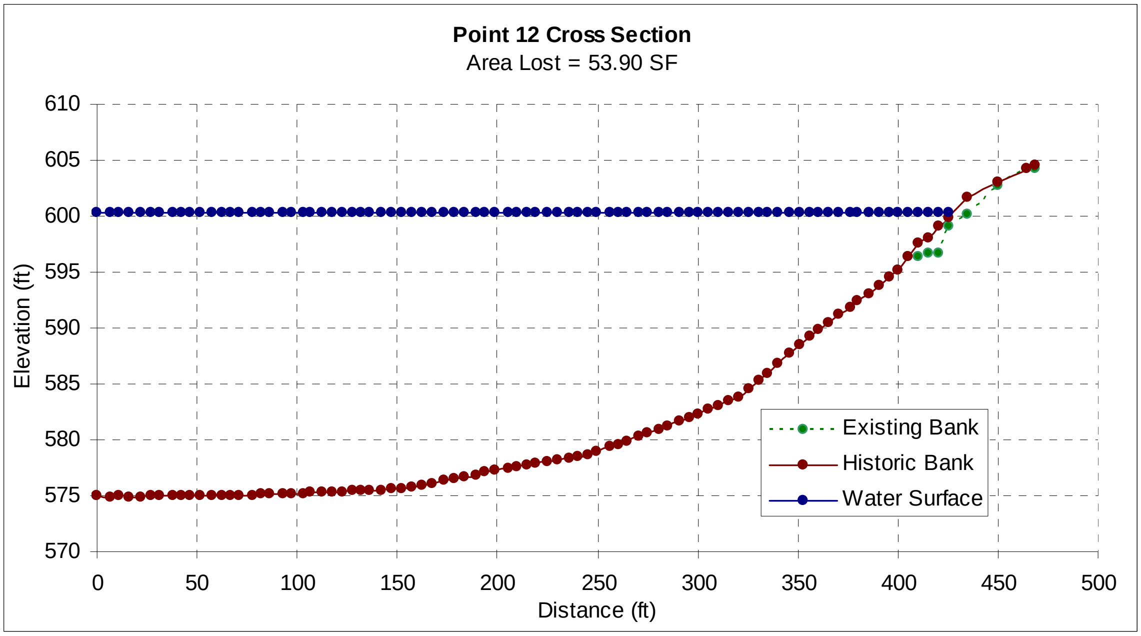

Point 12 Cross Section
Area Lost = 53.90 SF
Elevation (ft)
610
605
600
595
590
585
580
575
570
0
50
100
150
200
250
300
350
400
450
500
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2304
Pt. # 12
Lake Shelbyville

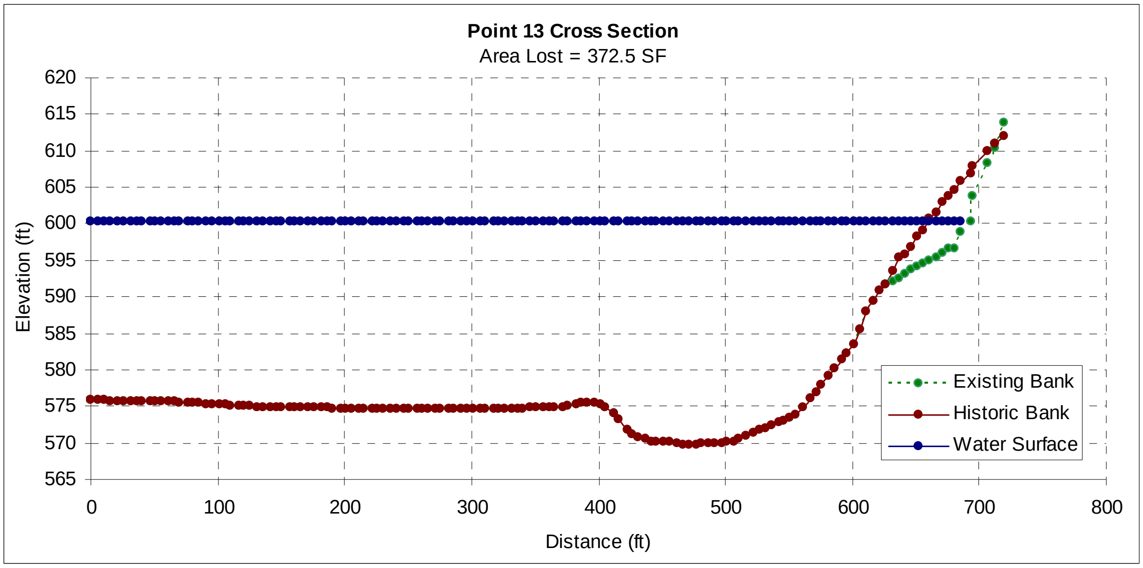

Point 13 Cross Section
Area Lost = 372.5 SF
Elevation (ft)
620
615
610
605
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700
800
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2303
PL # 13
Lake Shelbyville

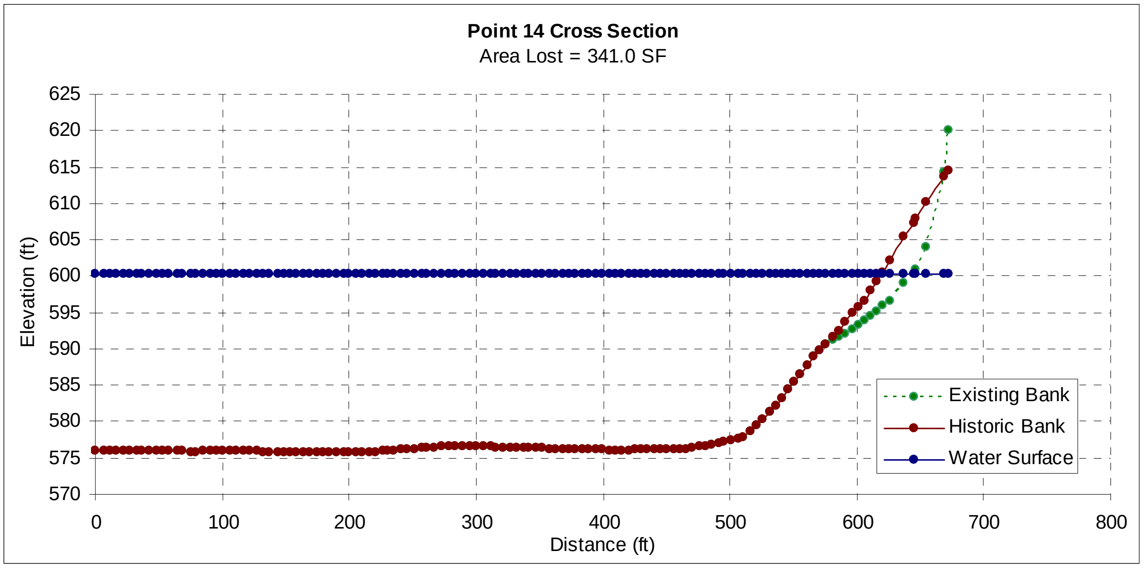

Point 14 Cross Section
Area Lost = 341.0 SF
Elevation (ft)
625
620
615
610
605
600
595
590
585
580
575
570
0
100
200
300
400
500
600
700
800
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2302
Pt. # 14
Lake Shelbyville

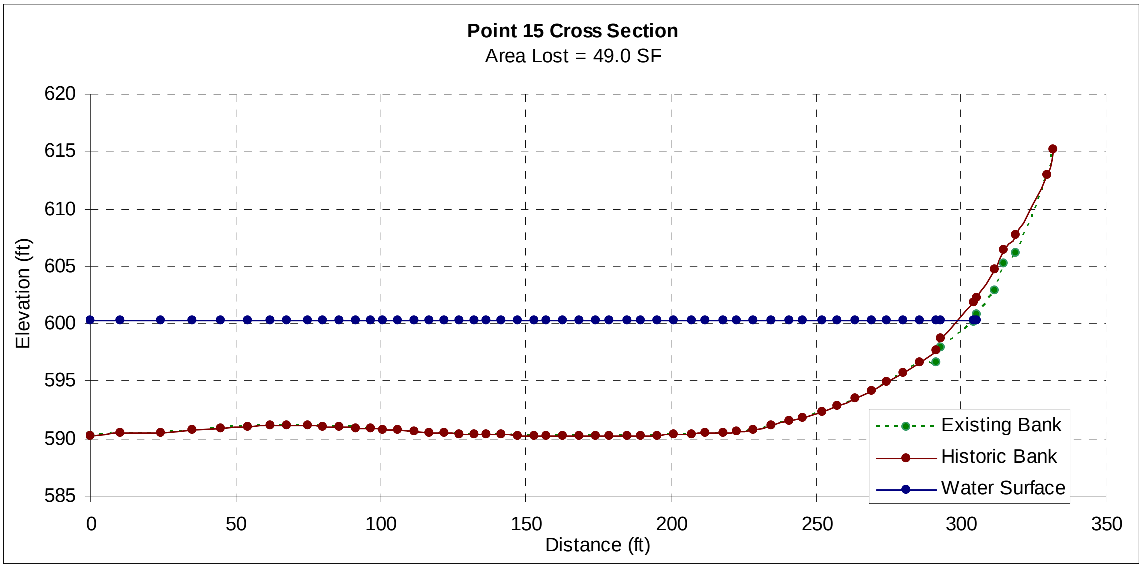

Point 15 Cross Section
Area Lost = 49.0 SF
Elevation (ft)
620
615
610
605
600
595
590
585
0
50
100
150
200
250
300
350
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2301
Pt. # 15
Lake Shelbyville

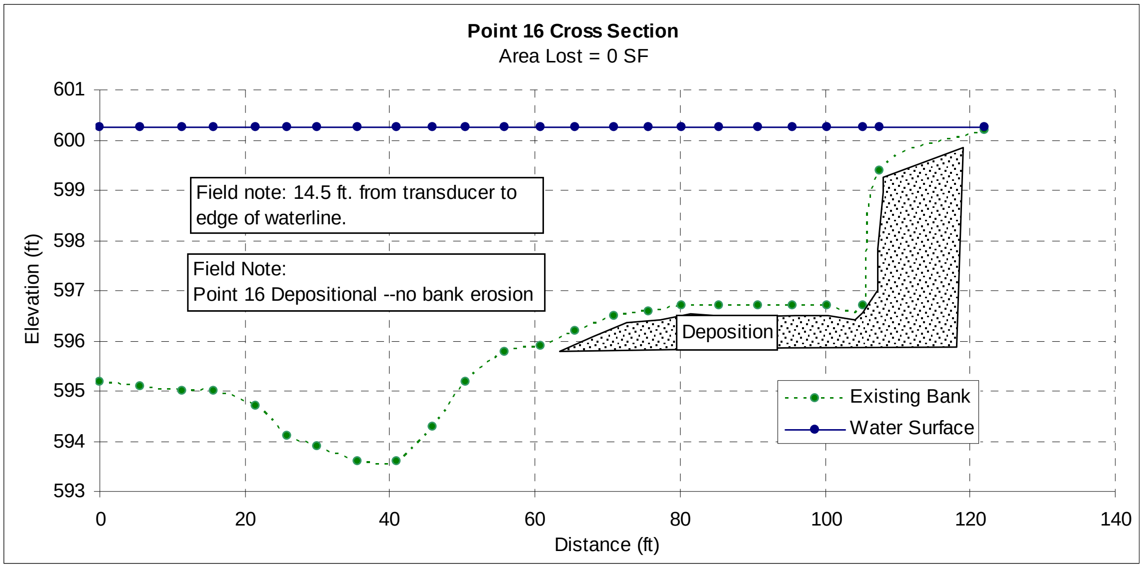

Point 16 Cross Section
Area Lost = 0 SF
Field note: 14.5 ft. from transducer to edge of waterline.
Field Note:
Point 16 Depositional --no bank erosion
Deposition
Existing Bank
Water Surface
Elevation (ft)
Distance (ft)
601
600
599
598
597
596
595
594
593
0
20
40
60
80
100
120
140


Photo 2300
Pt. # 16
Lake Shelbyville

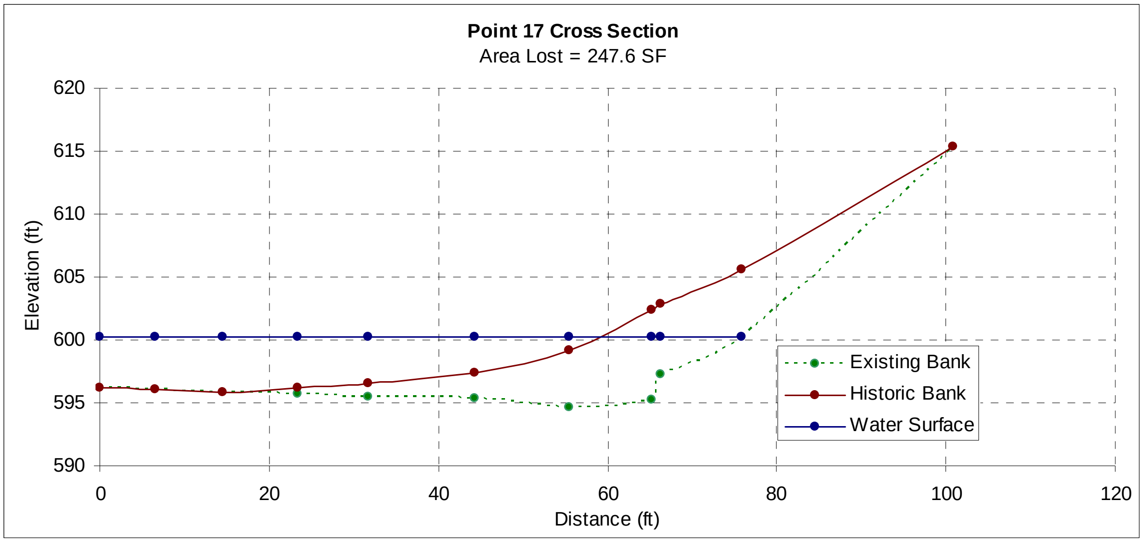

Point 17 Cross Section
Area Lost = 247.6 SF
620
615
610
605
600
595
590
Elevation (ft)
0
20
40
60
80
100
120
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2299
Pt. # 17
Lake Shelbyville

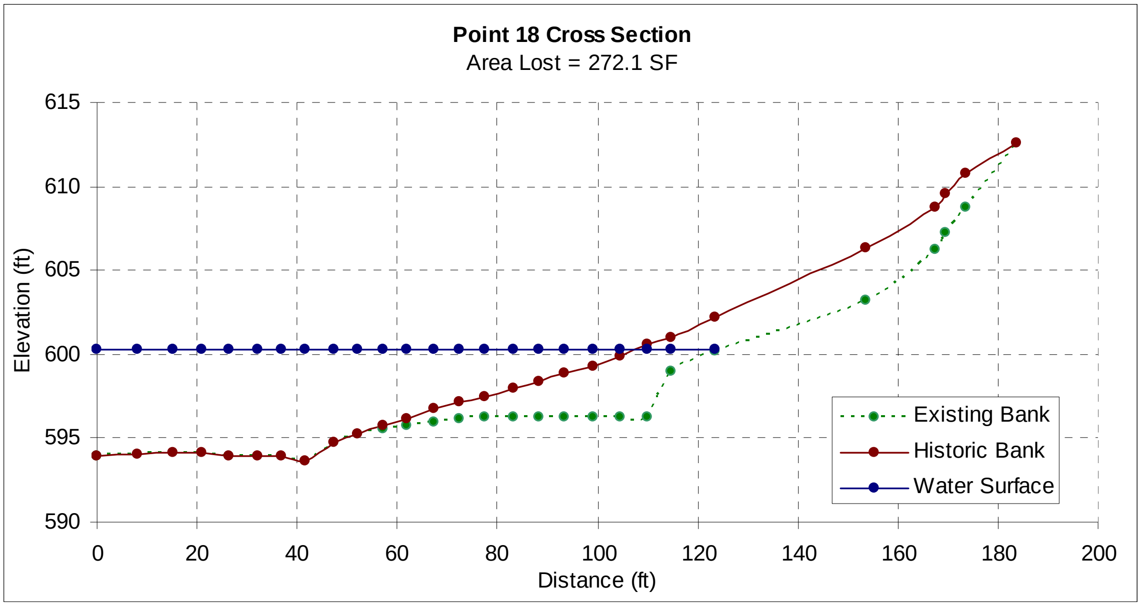
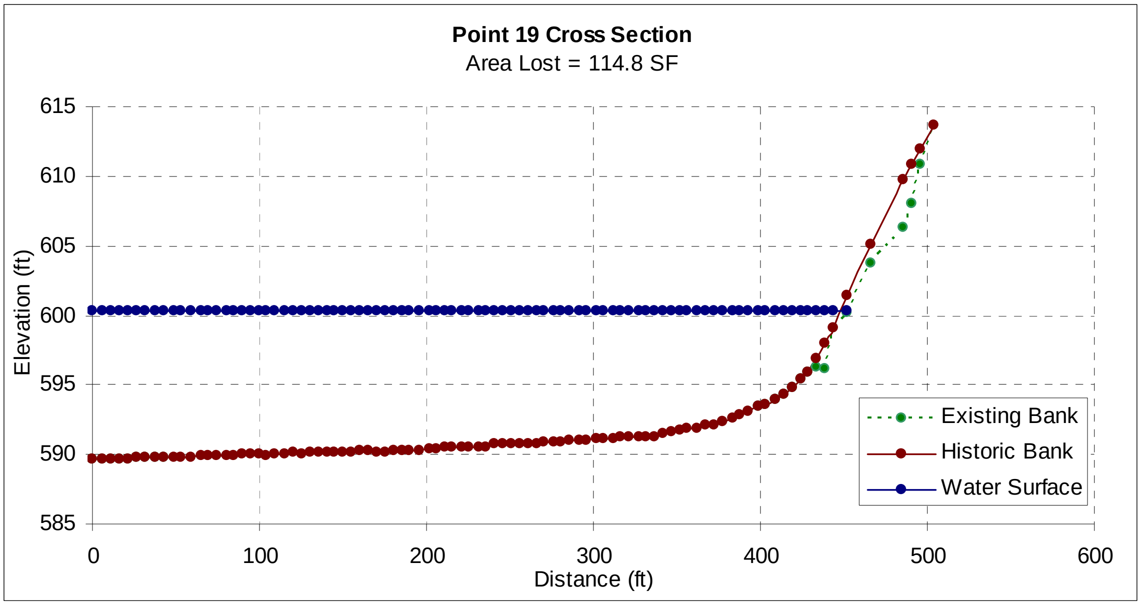

Point 18 Cross Section
Area Lost = 272.1 SF
Elevation (ft)
Distance (ft)
615
610
605
600
595
590
0
20
40
60
80
100
120
140
160
180
200
Existing Bank
Historic Bank
Water Surface


Photo 2298
Pt. # 18
Lake Shelbyville



Point 19 Cross Section
Area Lost = 114.8 SF
Elevation (ft)
615
610
605
600
595
590
585
0
100
200
300
400
500
600
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2296
Pt. # 19
Lake Shelbyville

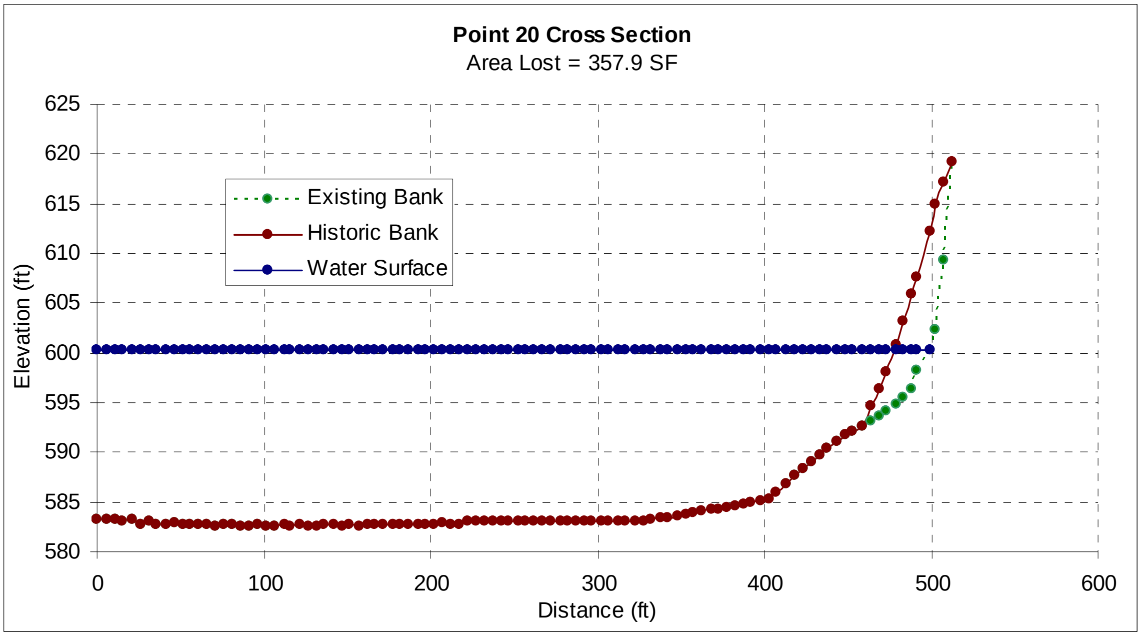

Point 20 Cross Section
Area Lost = 357.9 SF
Existing Bank
Historic Bank
Water Surface
Elevation (ft)
625
620
615
610
605
600
595
590
585
580
0
100
200
300
400
500
600
Distance (ft)


Photo 2297
Pt. # 20
Lake Shelbyville

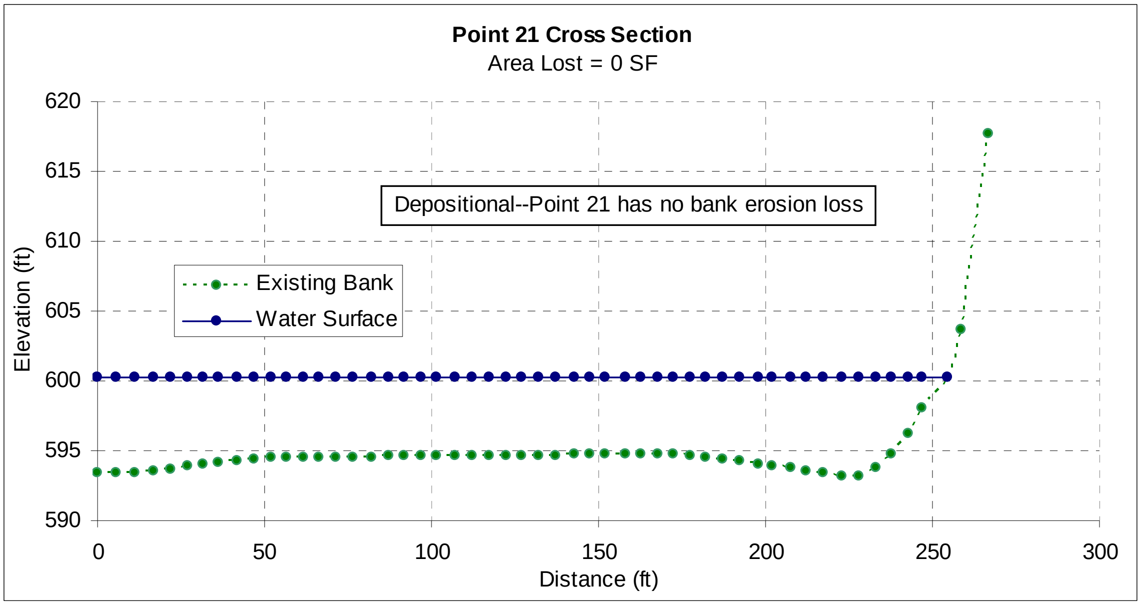

Point 21 Cross Section
Area Lost = 0 SF
Depositional--Point 21 has no bank erosion loss
Existing Bank
Water Surface
Elevation (ft)
Distance (ft)
620
615
610
605
600
595
590
0
50
100
150
200
250
300


Photo 2292
Pt. # 21
Lake Shelbyville

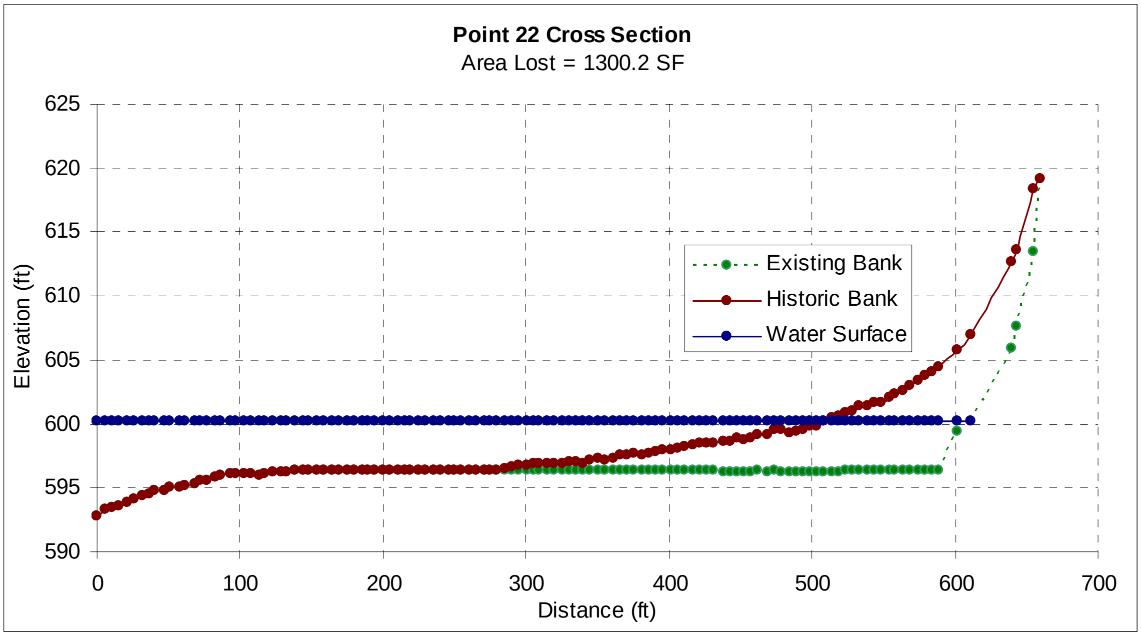

Point 22 Cross Section
Area Lost = 1300.2 SF
625
620
615
610
605
600
595
590
Elevation (ft)
0
100
200
300
400
500
600
700
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2291
PL # 22
Lake Shelbyville

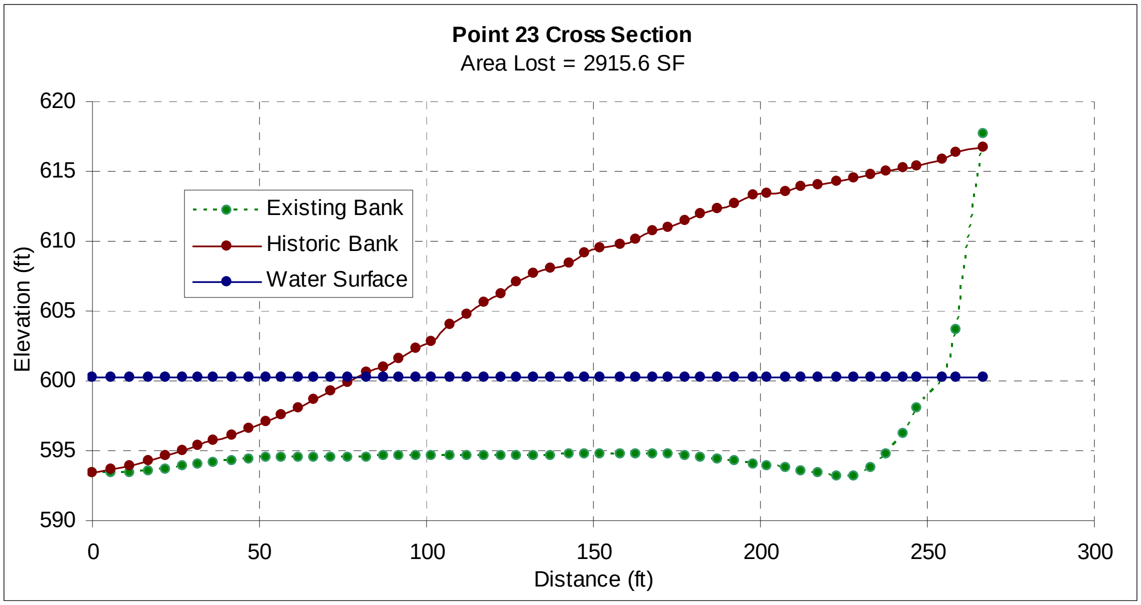

Point 23 Cross Section
Area Lost = 2915.6 SF
Elevation (ft)
Distance (ft)
Existing Bank
Historic Bank
Water Surface
620
615
610
605
600
595
590
0
50
100
150
200
250
300


Photo 2293
Pt. # 23
Lake Shelbyville

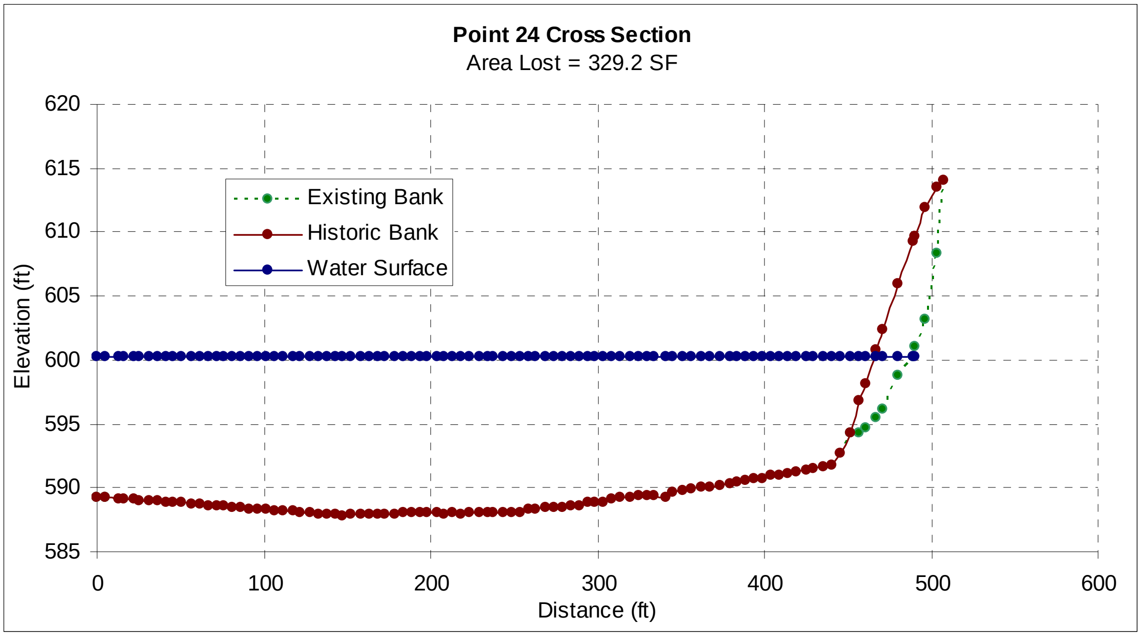
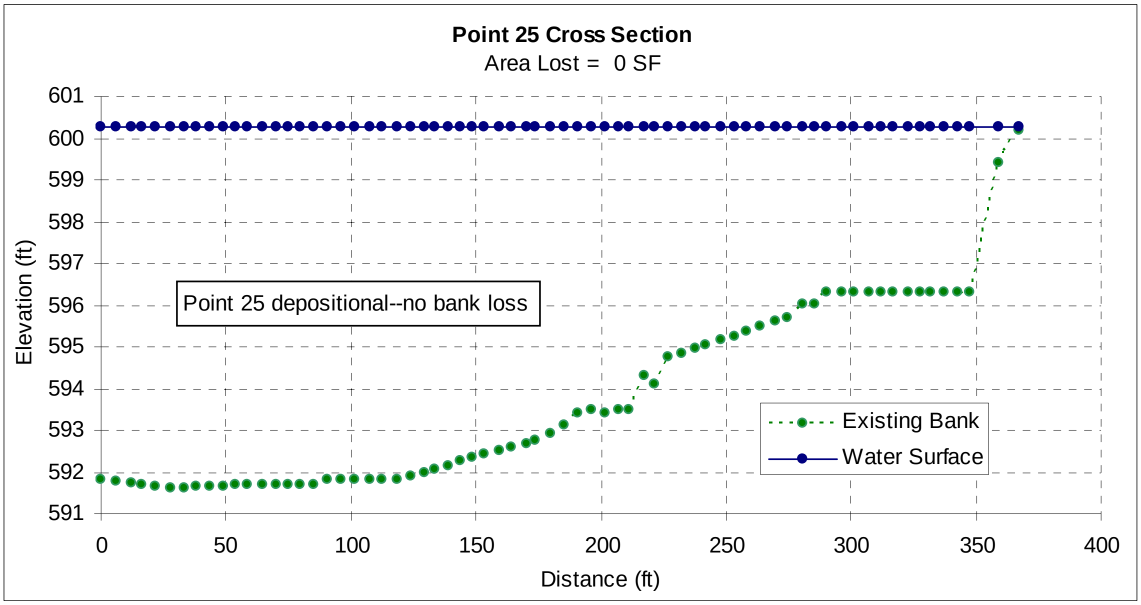

Point 24 Cross Section
Area Lost = 329.2 SF
Existing Bank
Historic Bank
Water Surface
Elevation (ft)
620
615
610
605
600
595
590
585
0
100
200
300
400
500
600
Distance (ft)


Photo 2268
Pt. # 24
Lake Shelbyville


Point 25 Cross Section
Area Lost = 0 SF
Elevation (ft)
Distance (ft)
Point 25 depositional--no bank loss
Existing Bank
Water Surface
601
600
599
598
597
596
595
594
593
592
591
0
50
100
150
200
250
300
350
400

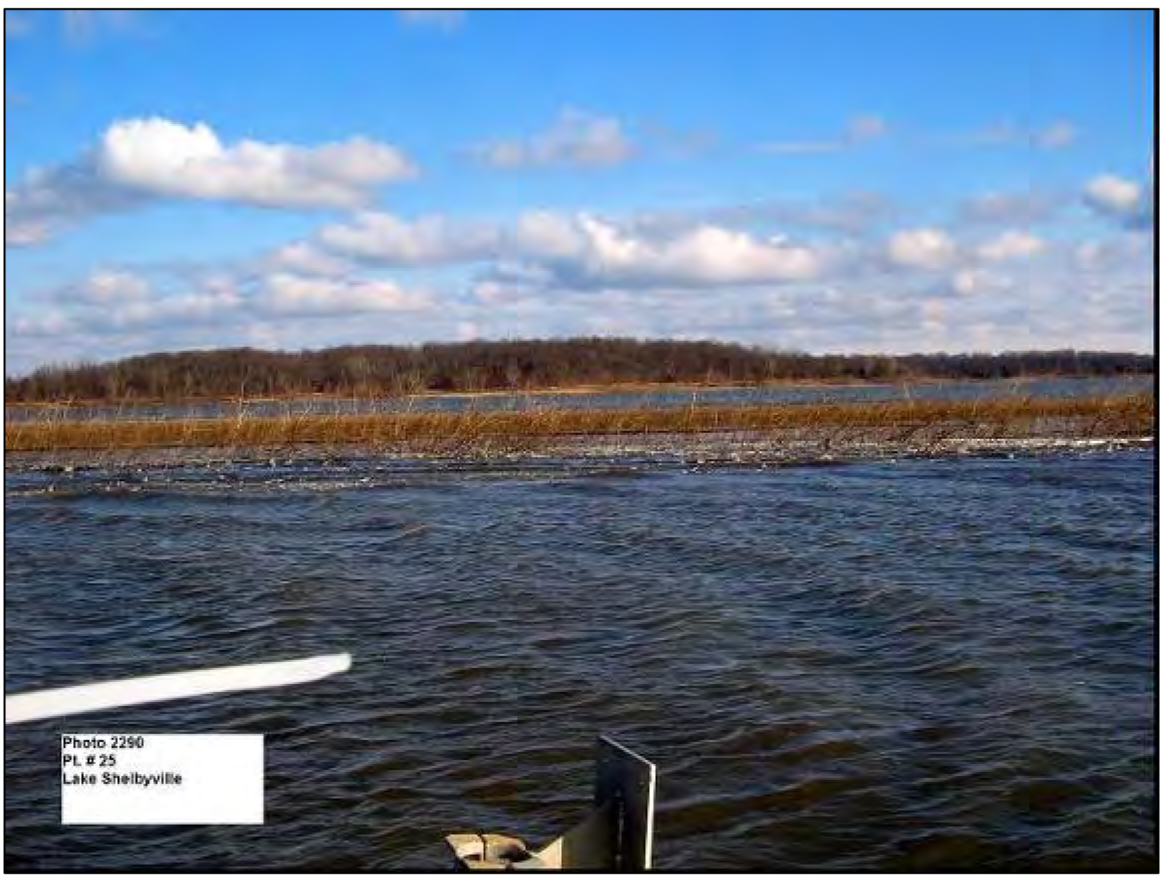
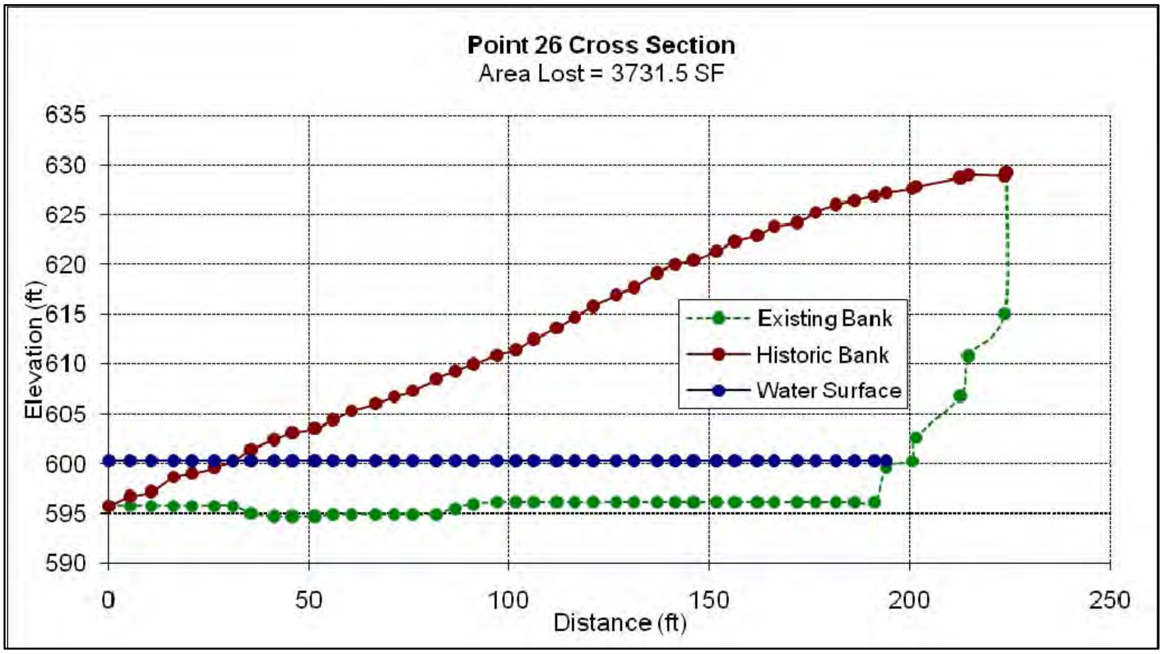


Photo 2290
PL # 25
Lake Shelbyville



Point 26 Cross Section
Area Lost = 3731.5 SF
635
630
625
620
615
610
605
600
595
590
Elevation (ft)
0
50
100
150
200
250
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2294
Pt. # 26
Lake Shelbyville

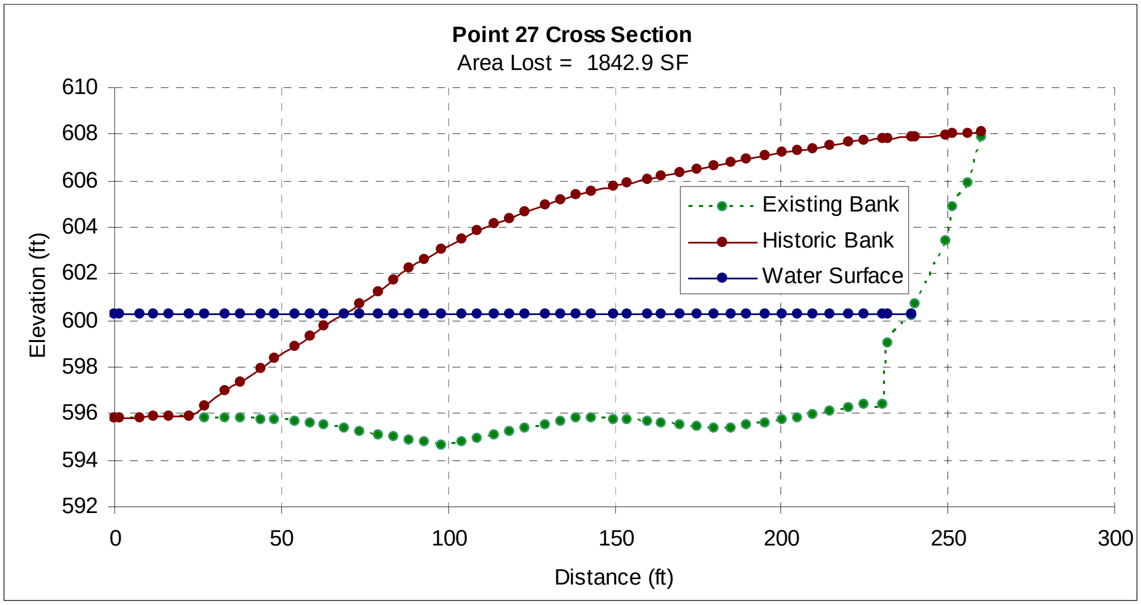
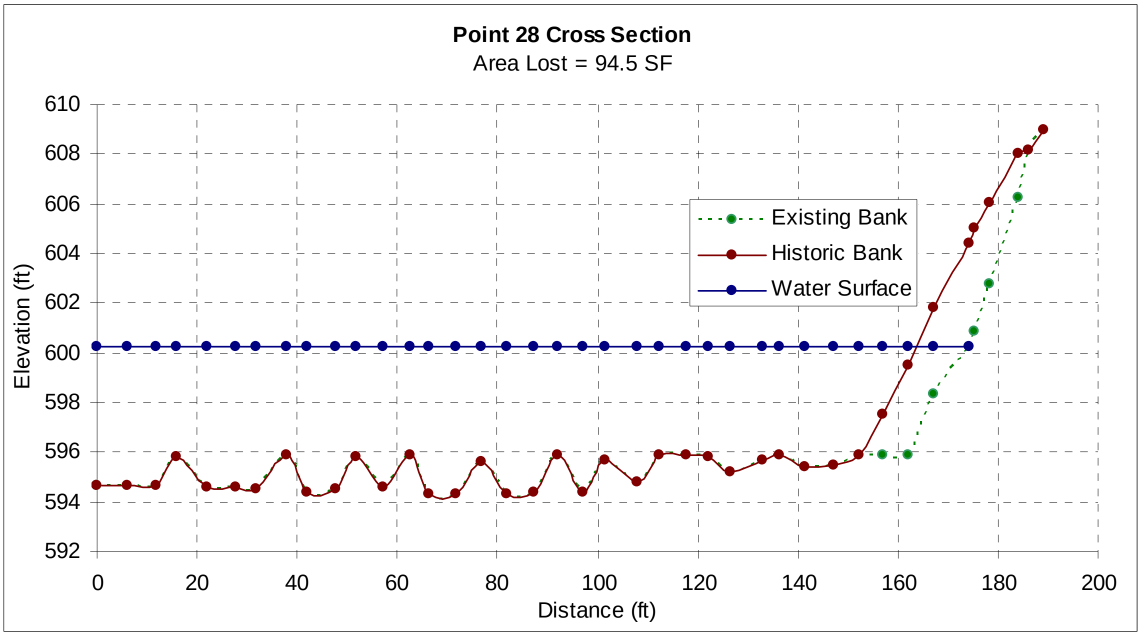

Point 27 Cross Section
Area Lost = 1842.9 SF
Elevation (ft)
Distance (ft)
Existing Bank
Historic Bank
Water Surface
610
608
606
604
602
600
598
596
594
592
0
50
100
150
200
250
300


Photo 2295
Pt. # 27
Lake Shelbyville



Point 28 Cross Section
Area Lost = 94.5 SF
Elevation (ft)
Distance (ft)
Existing Bank
Historic Bank
Water Surface
610
608
606
604
602
600
598
596
594
592
0
20
40
60
80
100
120
140
160
180
200

Photo 2273
Pt. # 28
Lake Shelbyville

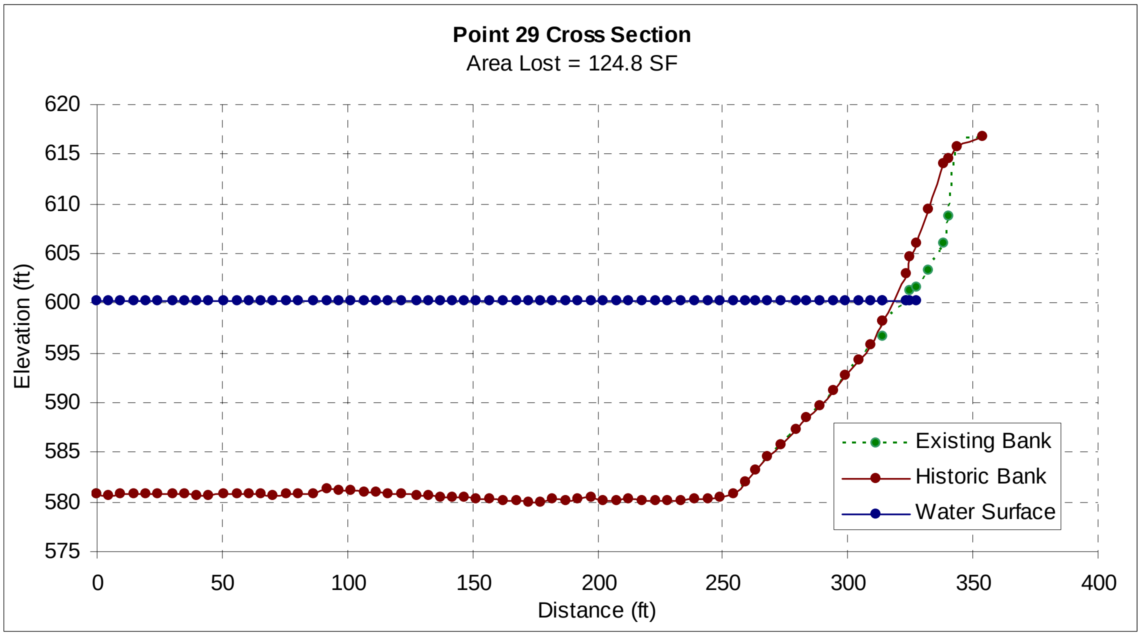

Point 29 Cross Section
Area Lost = 124.8 SF
Elevation (ft)
Distance (ft)
620
615
610
605
600
595
590
585
580
575
0
50
100
150
200
250
300
350
400
Existing Bank
Historic Bank
Water Surface


Photo 2305
Pt. # 29
Lake Shelbyville

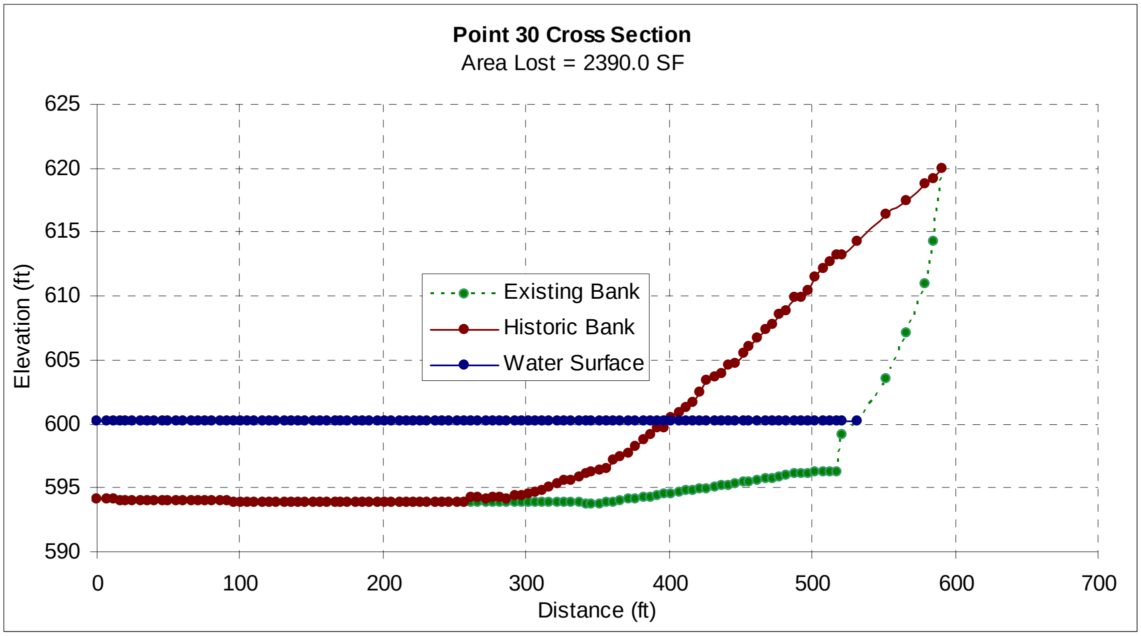

Point 30 Cross Section
Area Lost = 2390.0 SF
Elevation (ft)
Distance (ft)
Existing Bank
Historic Bank
Water Surface
625
620
615
610
605
600
595
590
0
100
200
300
400
500
600
700


Photo 2311
Pt. # 30
Lake Shelbyville

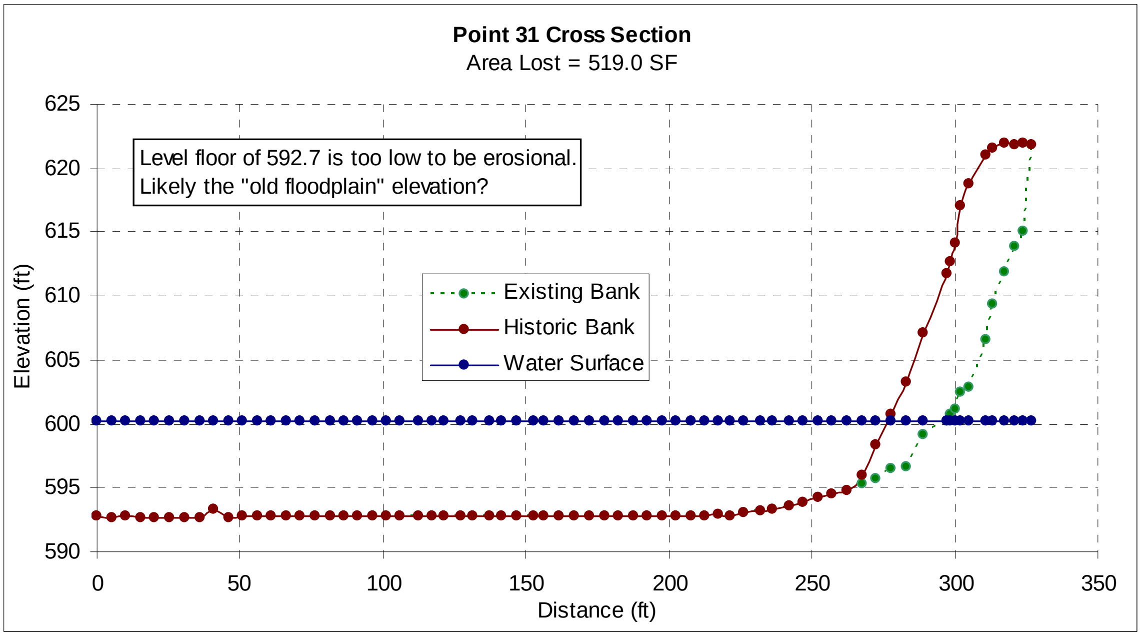
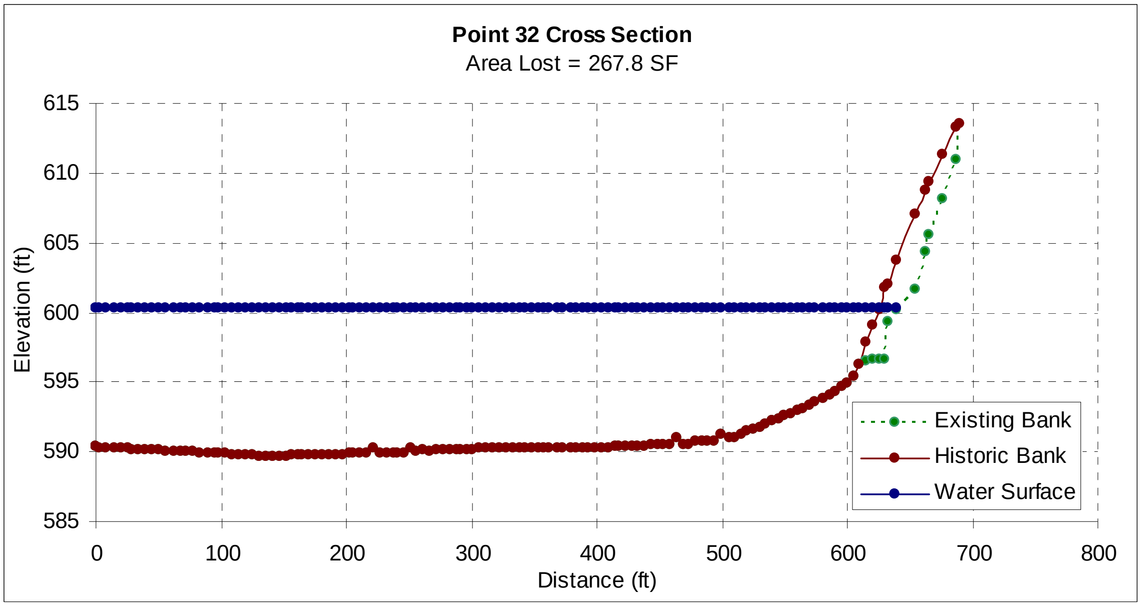

Point 31 Cross Section
Area Lost = 519.0 SF
Level floor of 592.7 is too low to be erosional.
Likely the "old floodplain" elevation?
Existing Bank
Historic Bank
Water Surface
Elevation (ft)
Distance (ft)
625
620
615
610
605
600
595
590
0
50
100
150
200
250
300
350


Photo 2309
Pt. # 31
Lake Shelbyville



Point 32 Cross Section
Area Lost = 267.8 SF
615
610
605
600
595
590
585
Elevation (ft)
0
100
200
300
400
500
600
700
800
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2307
Pt. # 32
Lake Shelbyville

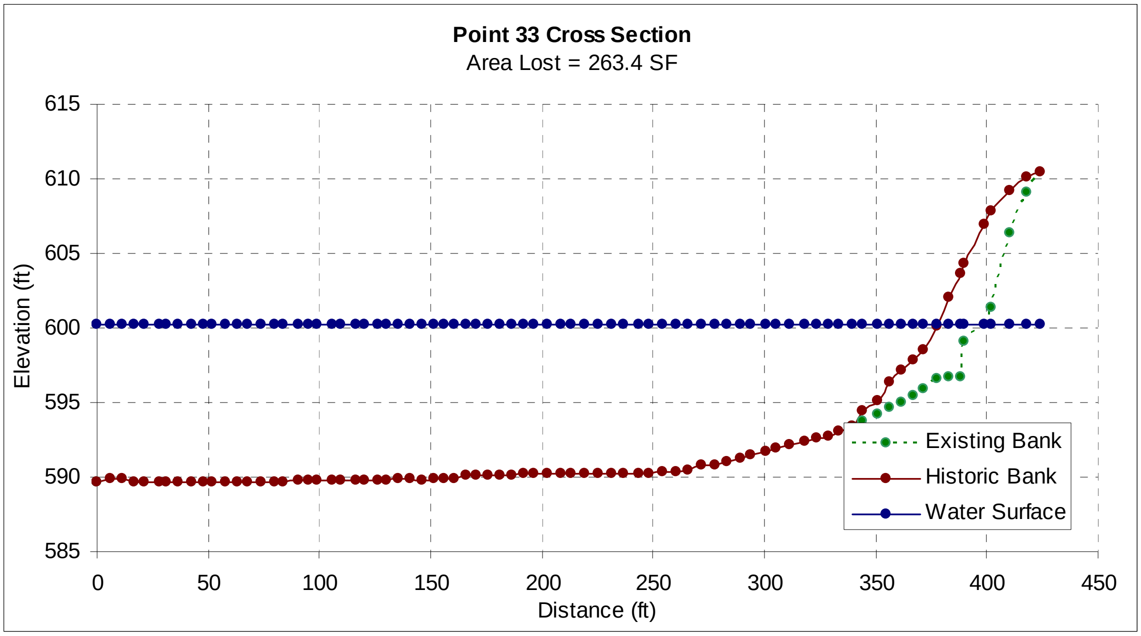

Point 33 Cross Section
Area Lost = 263.4 SF
Elevation (ft)
Distance (ft)
615
610
605
600
595
590
585
0
50
100
150
200
250
300
350
400
450
Existing Bank
Historic Bank
Water Surface


Photo 2308
Pt. # 33
Lake Shelbyville

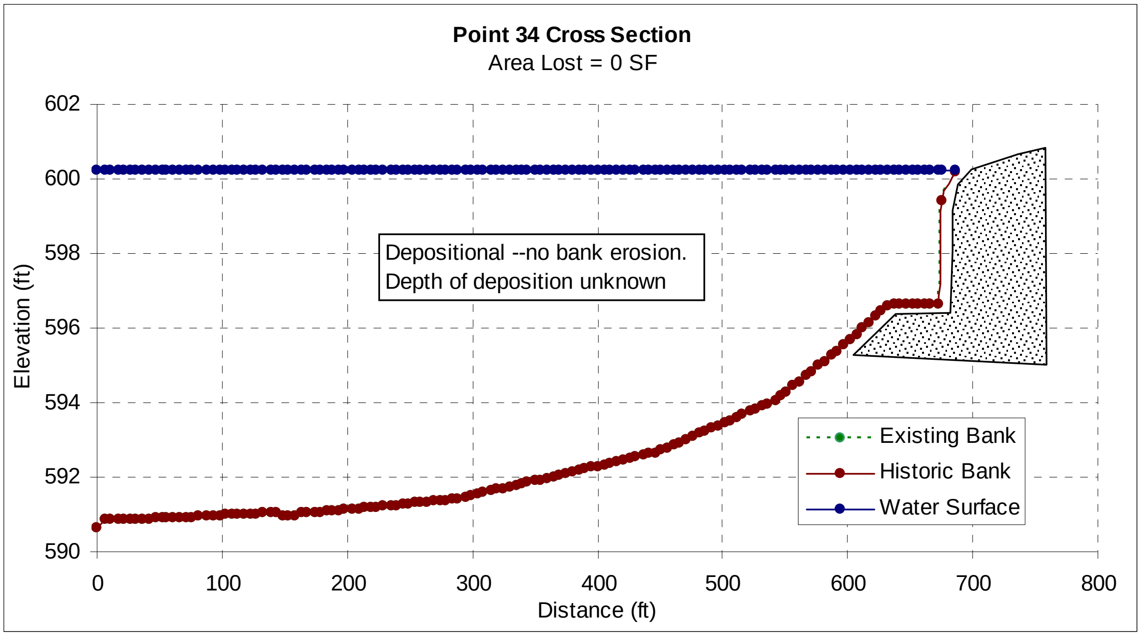

Point 34 Cross Section
Area Lost = 0 SF
Depositional --no bank erosion.
Depth of deposition unknown
Elevation (ft)
Distance (ft)
Existing Bank
Historic Bank
Water Surface
602
600
598
596
594
592
590
0
100
200
300
400
500
600
700
800


Photo 2306
PL # 34
Lake Shelbyville

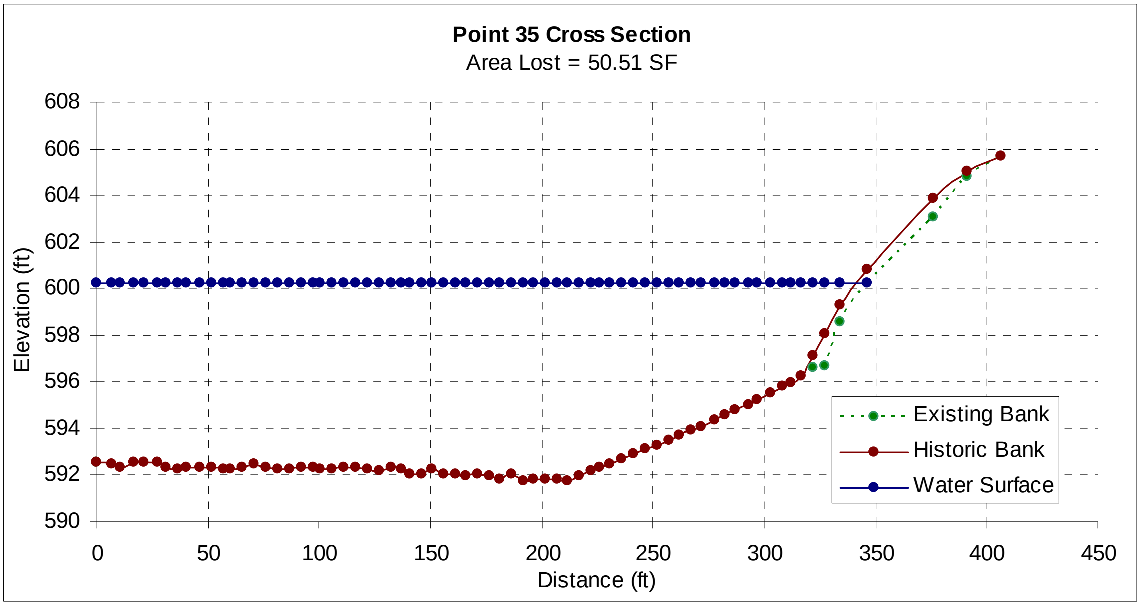

Point 35 Cross Section
Area Lost = 50.51 SF
Elevation (ft)
608
606
604
602
600
598
596
594
592
590
0
50
100
150
200
250
300
350
400
450
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2312
Pt. # 35
Lake Shelbyville

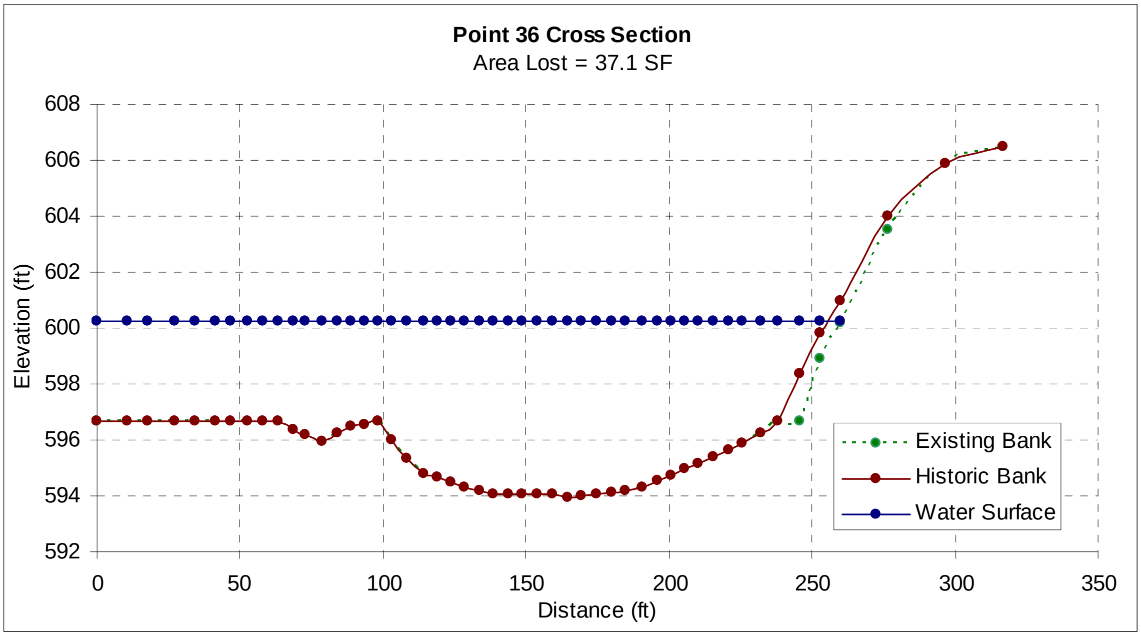

Point 36 Cross Section
Area Lost = 37.1 SF
Elevation (ft)
608
606
604
602
600
598
596
594
592
0
50
100
150
200
250
300
350
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2210
Pt. # 36
Lake Shelbyville

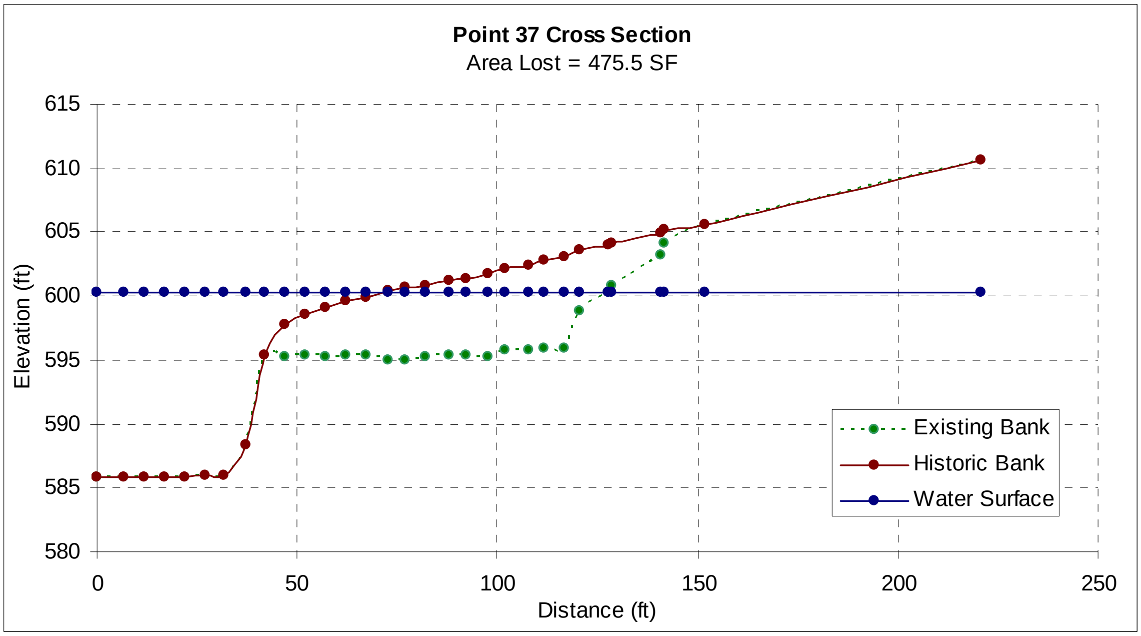

Point 37 Cross Section
Area Lost = 475.5 SF
615
610
605
600
595
590
585
580
Elevation (ft)
0
50
100
150
200
250
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2272
Pt. # 37
Lake Shelbyville

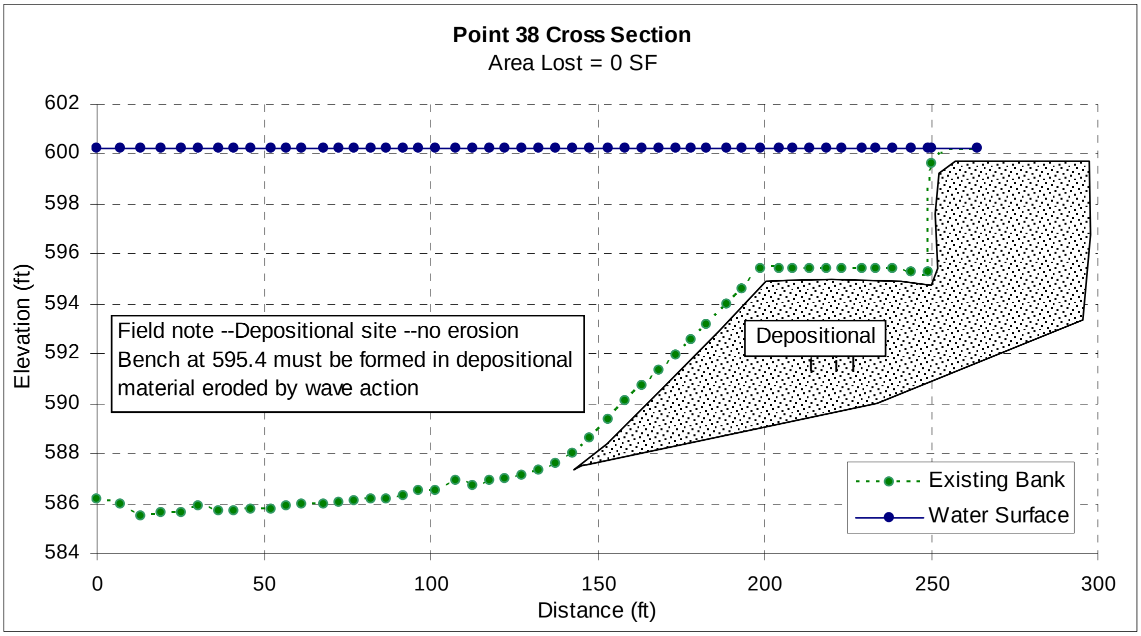

Point 38 Cross Section
Area Lost = 0 SF
602
600
598
596
594
592
590
588
586
584
Elevation (ft)
0
50
100
150
200
250
300
Distance (ft)
Field note --Depositional site --no erosion
Bench at 595.4 must be formed in depositional
material eroded by wave action
Depositional
Existing Bank
Water Surface


Photo 2271
Pt. # 38
Lake Shelbyville

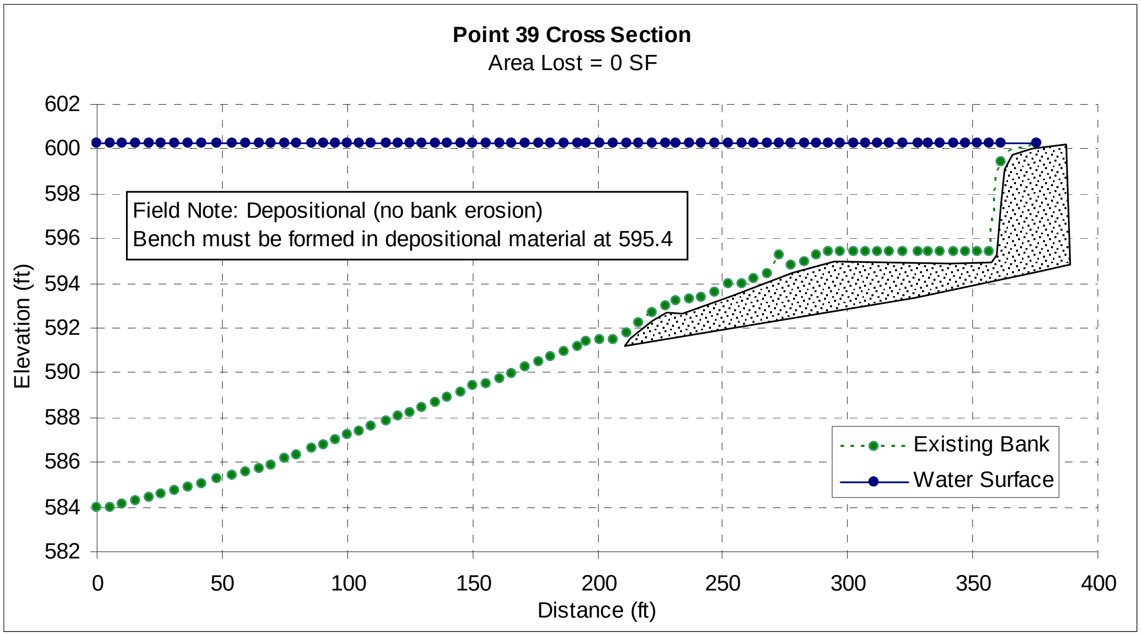

Point 39 Cross Section
Area Lost = 0 SF
Field Note: Depositional (no bank erosion)
Bench must be formed in depositional material at 595.4
Elevation (ft)
Distance (ft)
602
600
598
596
594
592
590
588
586
584
582
0
50
100
150
200
250
300
350
400
Existing Bank
Water Surface


Photo 2270
Pt. # 39
Lake Shelbyville

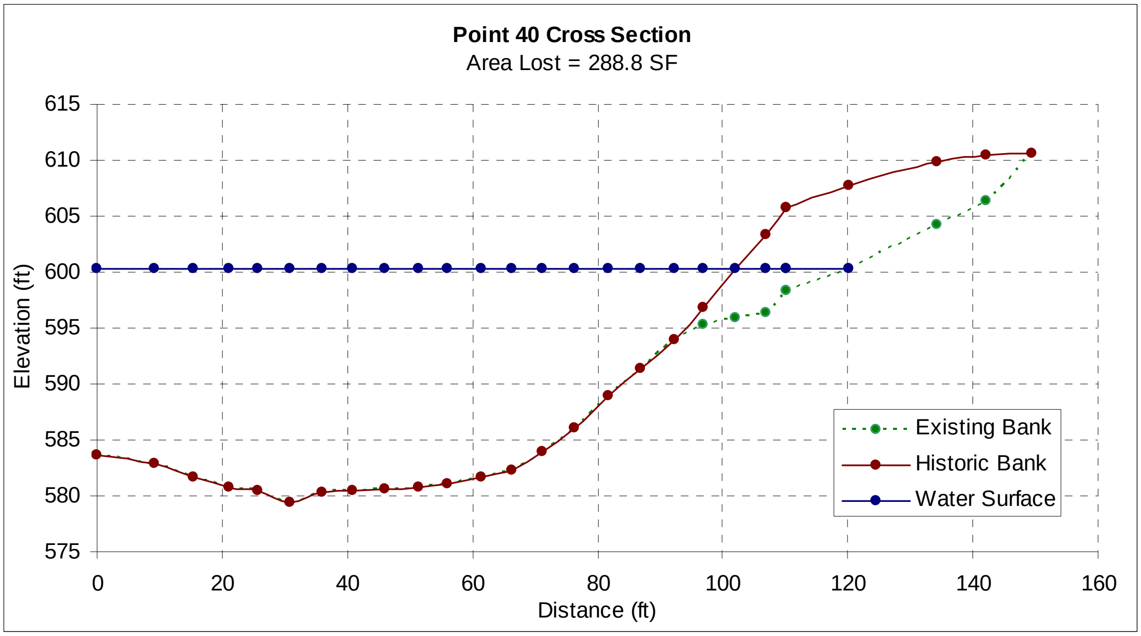

Point 40 Cross Section
Area Lost = 288.8 SF
Elevation (ft)
615
610
605
600
595
590
585
580
575
0
20
40
60
80
100
120
140
160
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2285
Pt. # 40
Lake Shelbyville

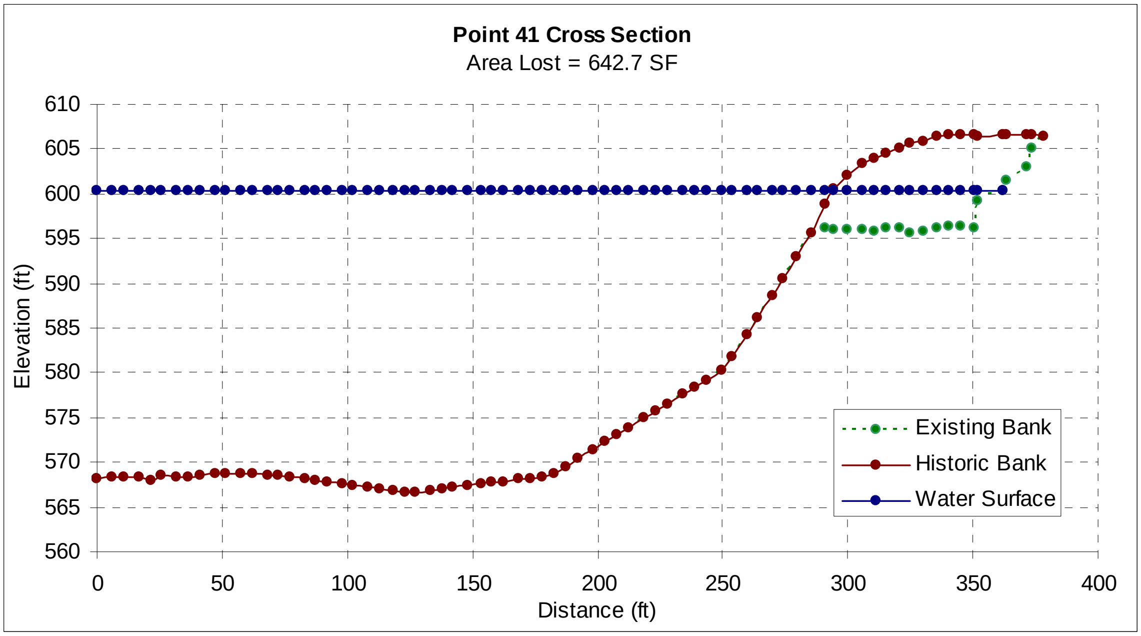
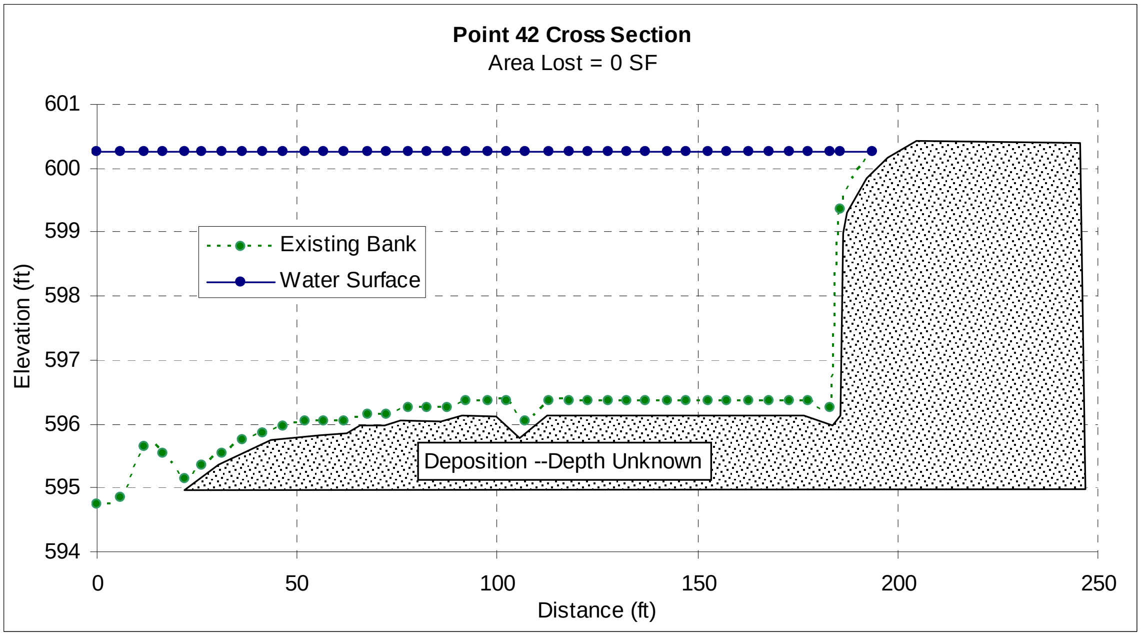

Point 41 Cross Section
Area Lost = 642.7 SF
Elevation (ft)
610
605
600
595
590
585
580
575
570
565
560
0
50
100
150
200
250
300
350
400
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2286
Pt. # 41
Lake Shelbyville



Point 42 Cross Section
Area Lost = 0 SF
Existing Bank
Water Surface
Deposition --Depth Unknown
Elevation (ft)
Distance (ft)
601
600
599
598
597
596
595
594
0
50
100
150
200
250

Photo 2287
Pt. # 42
Lake Shelbyville

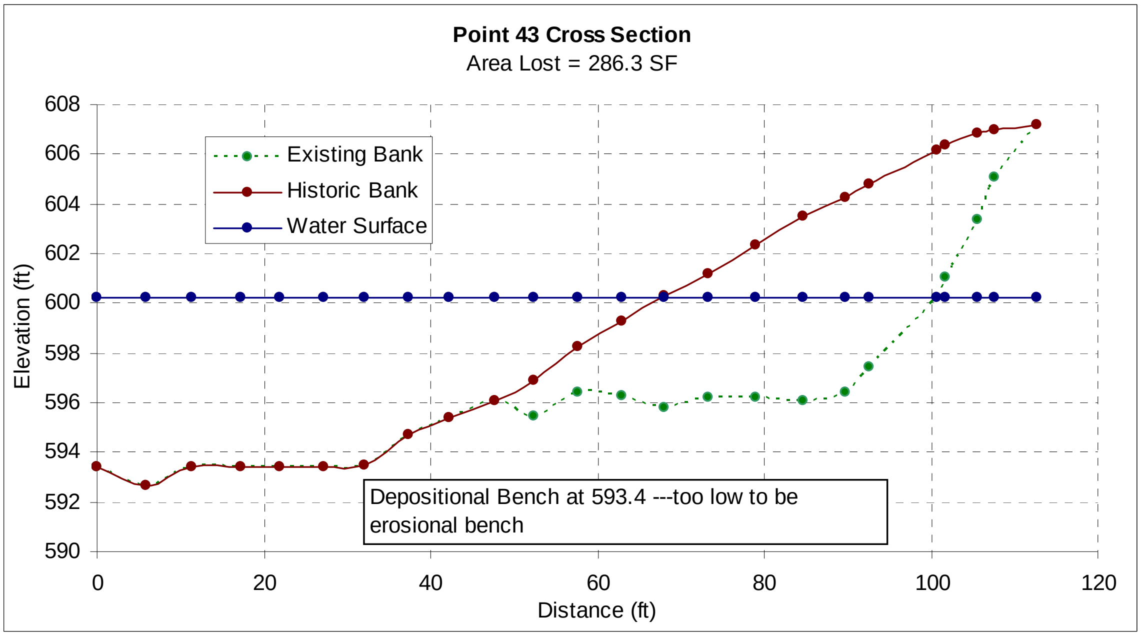
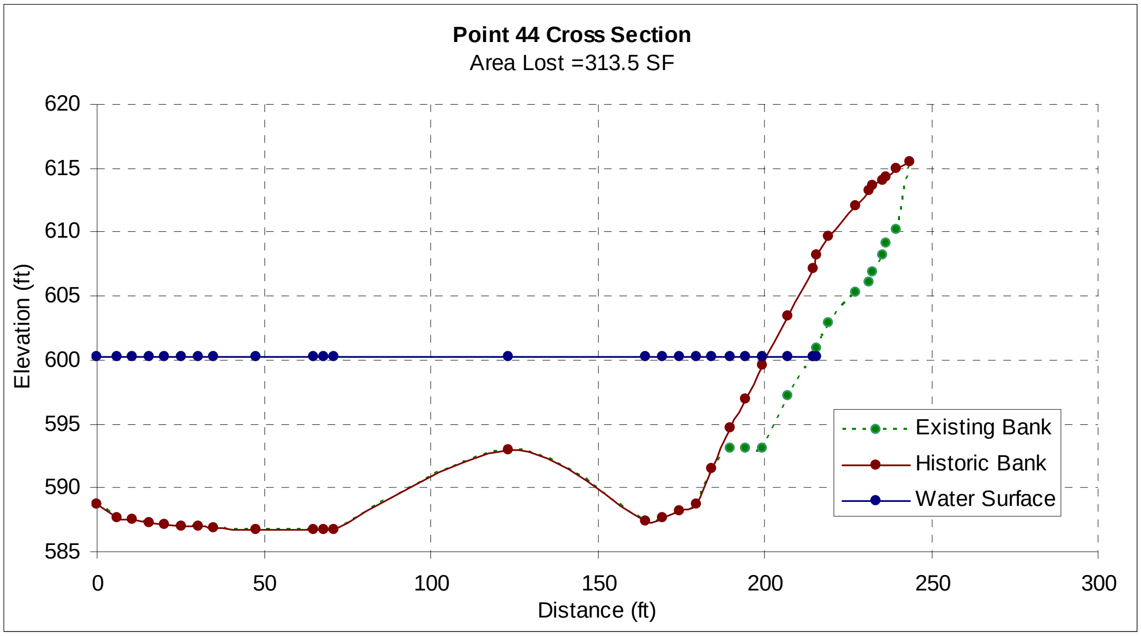

Point 43 Cross Section
Area Lost = 286.3 SF
Existing Bank
Historic Bank
Water Surface
Depositional Bench at 593.4 ---too low to be erosional bench
Elevation (ft)
Distance (ft)
608
606
604
602
600
598
596
594
592
590
0
20
40
60
80
100
120

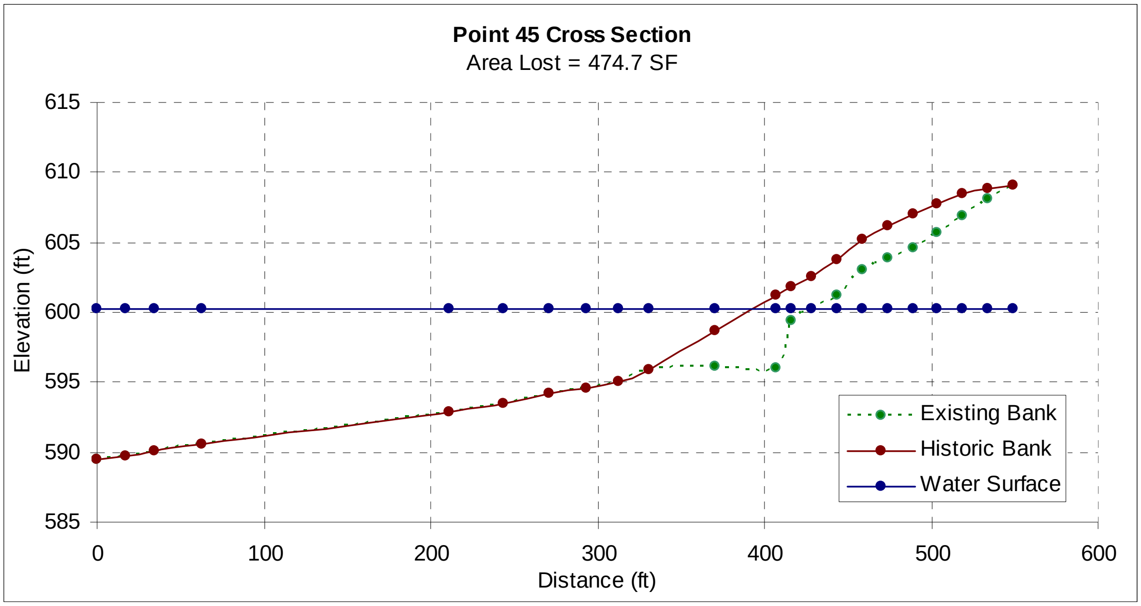

Photo 2269
Pt. # 43
Lake Shelbyville



Point 44 Cross Section
Area Lost =313.5 SF
Elevation (ft)
Distance (ft)
620
615
610
605
600
595
590
585
0
50
100
150
200
250
300
Existing Bank
Historic Bank
Water Surface

.

Photo 2268
Pt. # 44
Lake Shelbyville


Point 45 Cross Section
Area Lost = 474.7 SF
Elevation (ft)
615
610
605
600
595
590
585
0
100
200
300
400
500
600
Distance (ft)
Existing Bank
Historic Bank
Water Surface

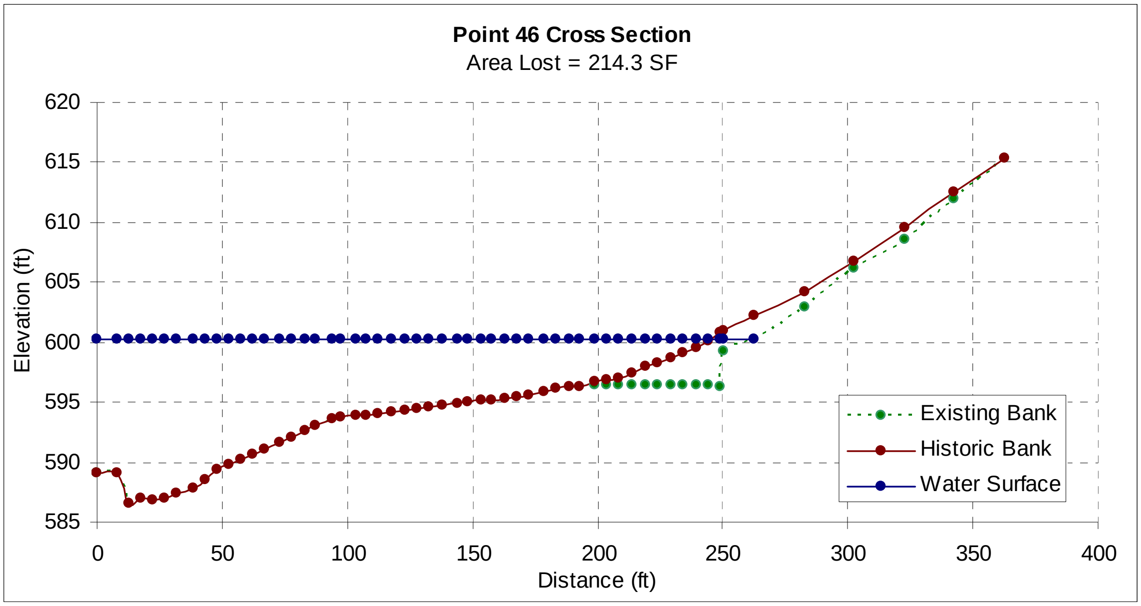

Point 46 Cross Section
Area Lost = 214.3 SF
Elevation (ft)
620
615
610
605
600
595
590
585
0
50
100
150
200
250
300
350
400
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2253
Pt. # 46
Lake Shelbyville

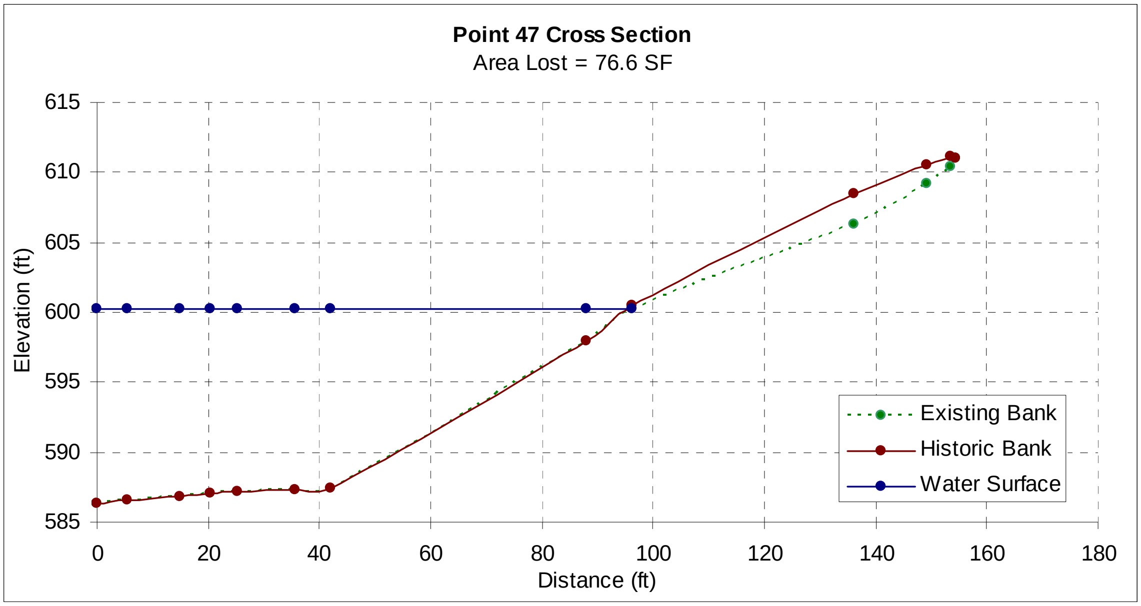

Point 47 Cross Section
Area Lost = 76.6 SF
Elevation (ft)
615
610
605
600
595
590
585
0
20
40
60
80
100
120
140
160
180
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2259
Pt. # 47
Lake Shelbyville

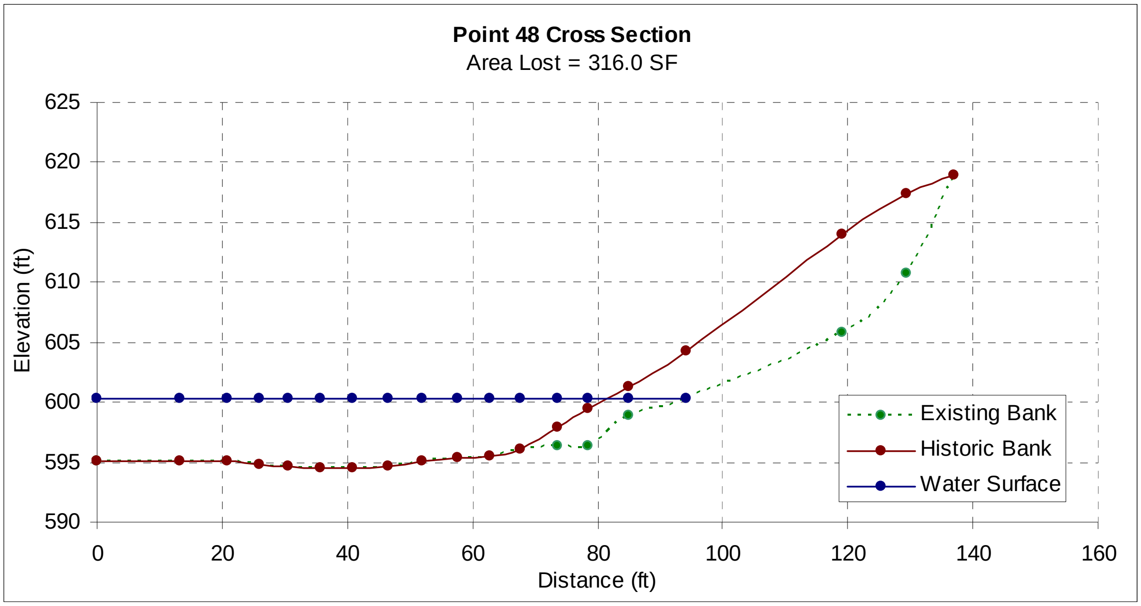

Point 48 Cross Section
Area Lost = 316.0 SF
Elevation (ft)
625
620
615
610
605
600
595
590
0
20
40
60
80
100
120
140
160
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2260
Pt. # 48
Lake Shelbyville

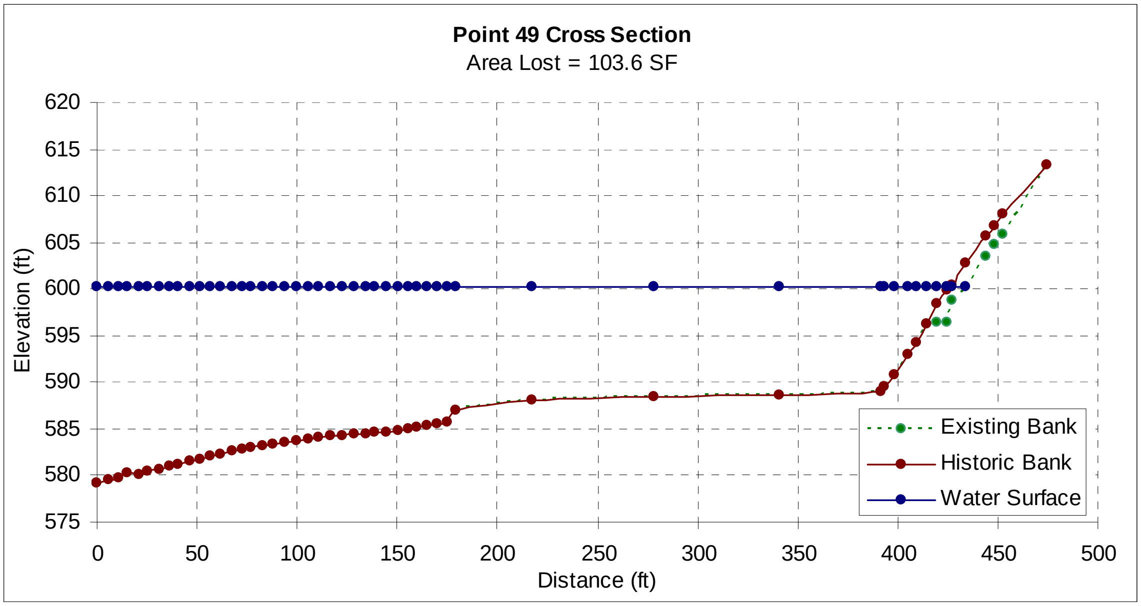

Point 49 Cross Section
Area Lost = 103.6 SF
Elevation (ft)
Distance (ft)
620
615
610
605
600
595
590
585
580
575
0
50
100
150
200
250
300
350
400
450
500
Existing Bank
Historic Bank
Water Surface


Photo 2267
Pt. # 49
Lake Shelbyville

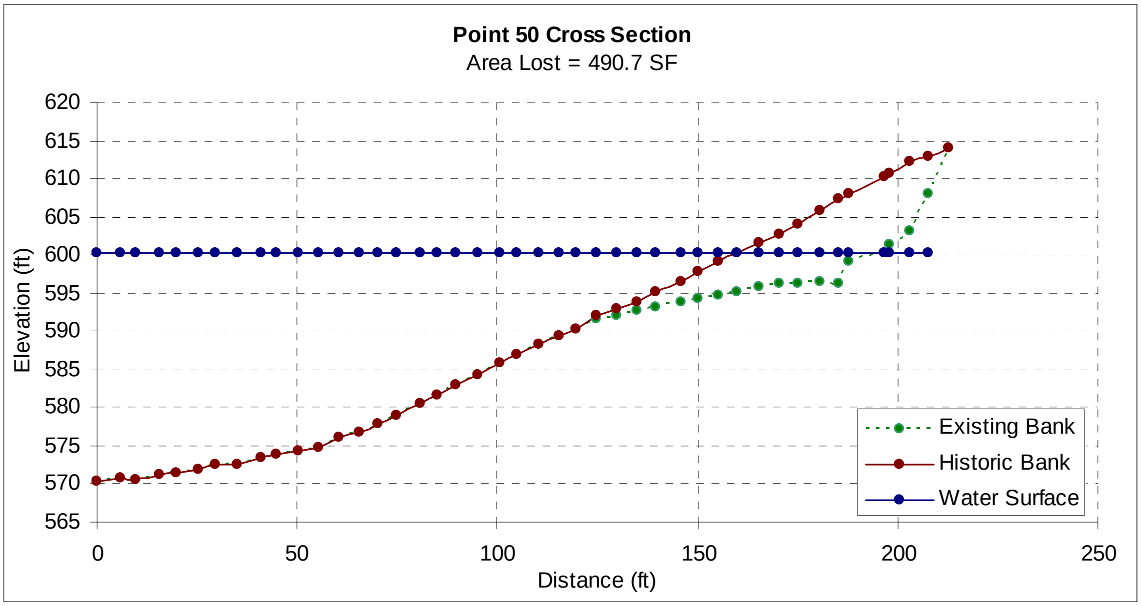

Point 50 Cross Section
Area Lost = 490.7 SF
620
615
610
605
600
595
590
585
580
575
570
565
Elevation (ft)
0
50
100
150
200
250
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2261
Pt. # 50
Lake Shelbyville

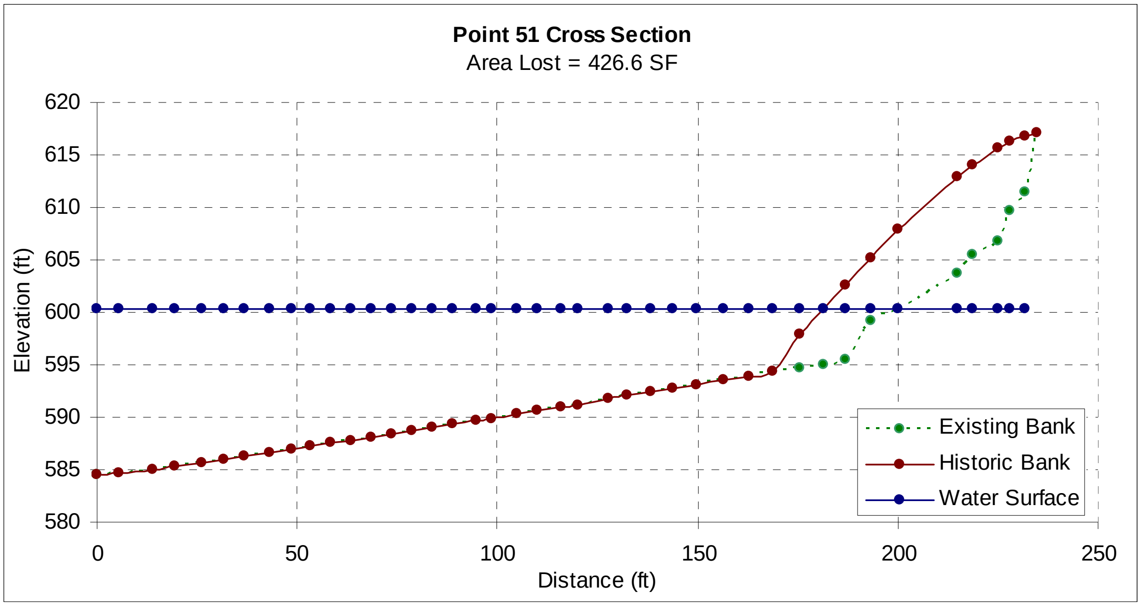
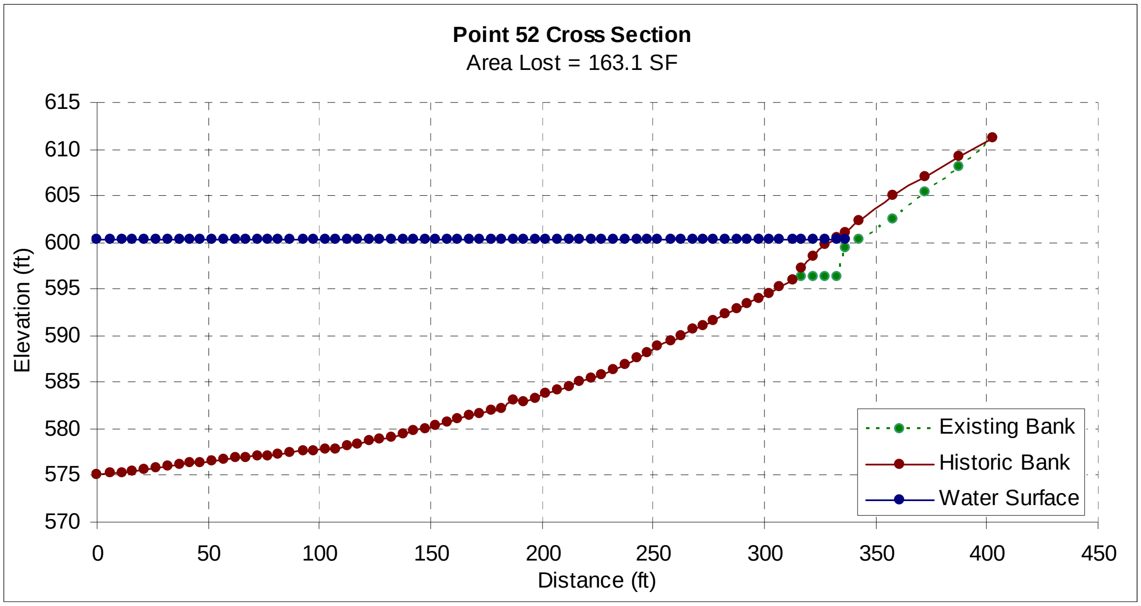

Point 51 Cross Section
Area Lost = 426.6 SF
Elevation (ft)
620
615
610
605
600
595
590
585
580
0
50
100
150
200
250
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2266
Pt. # 51
Lake Shelbyville



Point 52 Cross Section
Area Lost = 163.1 SF
615
610
605
600
595
590
585
580
575
570
Elevation (ft)
0
50
100
150
200
250
300
350
400
450
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2236
Pt. # 52
Lake Shelbyville

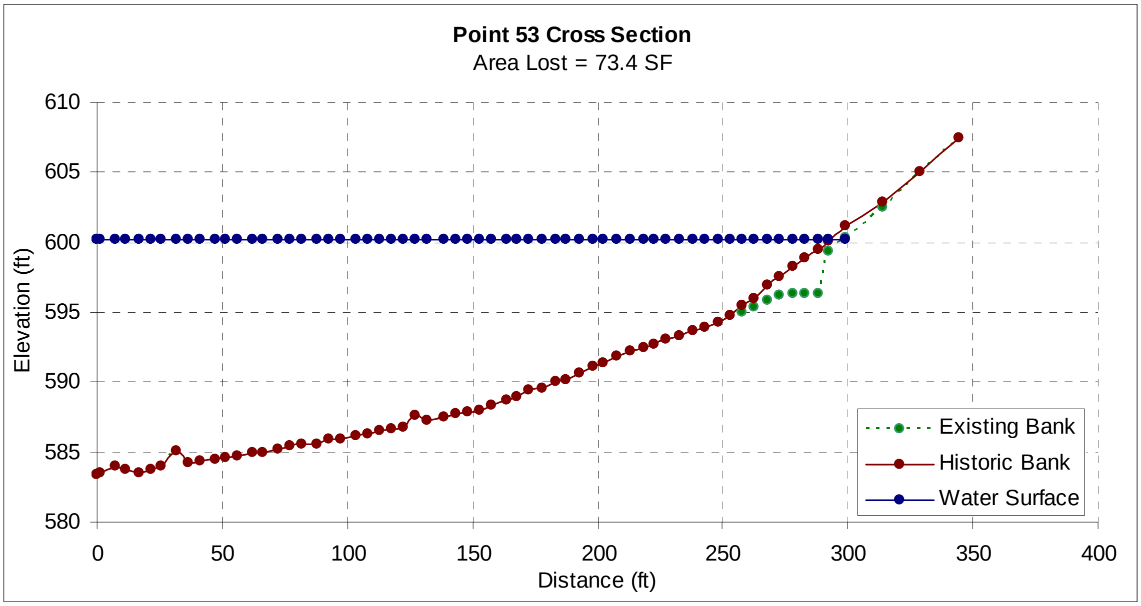

Point 53 Cross Section
Area Lost = 73.4 SF
Elevation (ft)
Distance (ft)
610
605
600
595
590
585
580
0
50
100
150
200
250
300
350
400
Existing Bank
Historic Bank
Water Surface


Photo 2235
Pt. # 53
Lake Shelbyville

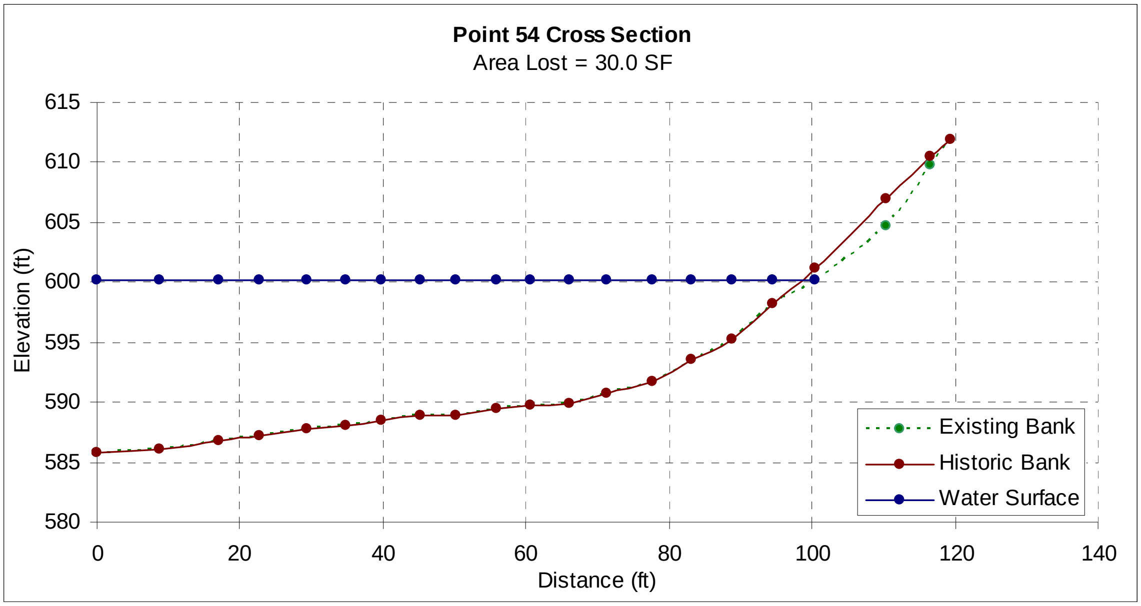

Point 54 Cross Section
Area Lost = 30.0 SF
Elevation (ft)
615
610
605
600
595
590
585
580
0
20
40
60
80
100
120
140
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2264
Pt. # 54
Lake Shelbyville

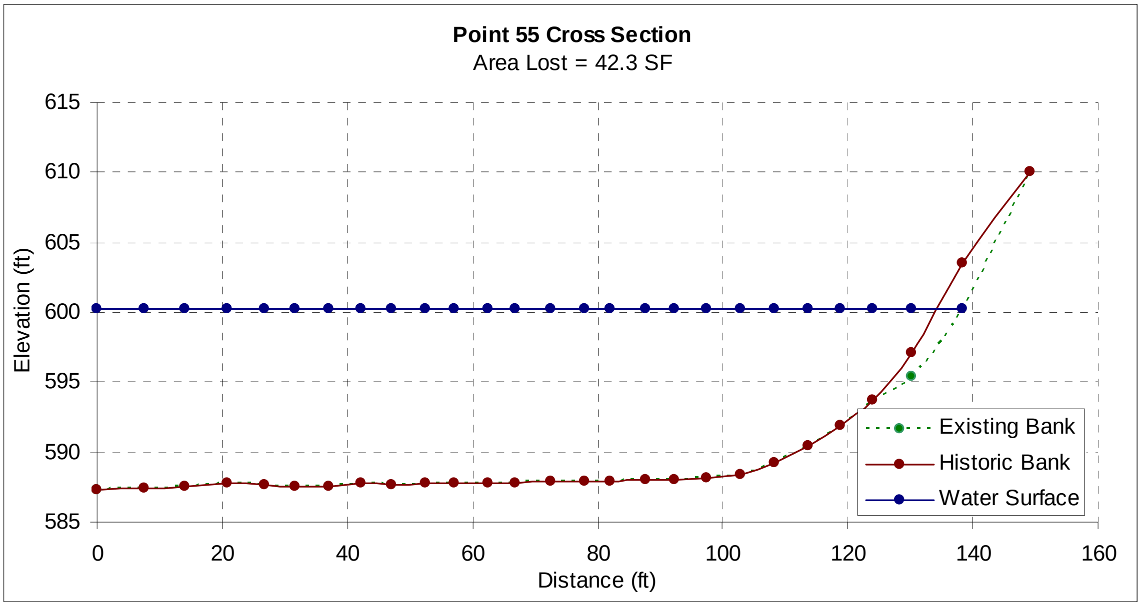

Point 55 Cross Section
Area Lost = 42.3 SF
Elevation (ft)
615
610
605
600
595
590
585
0
20
40
60
80
100
120
140
160
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2265
Pt. # 55
Lake Shelbyville

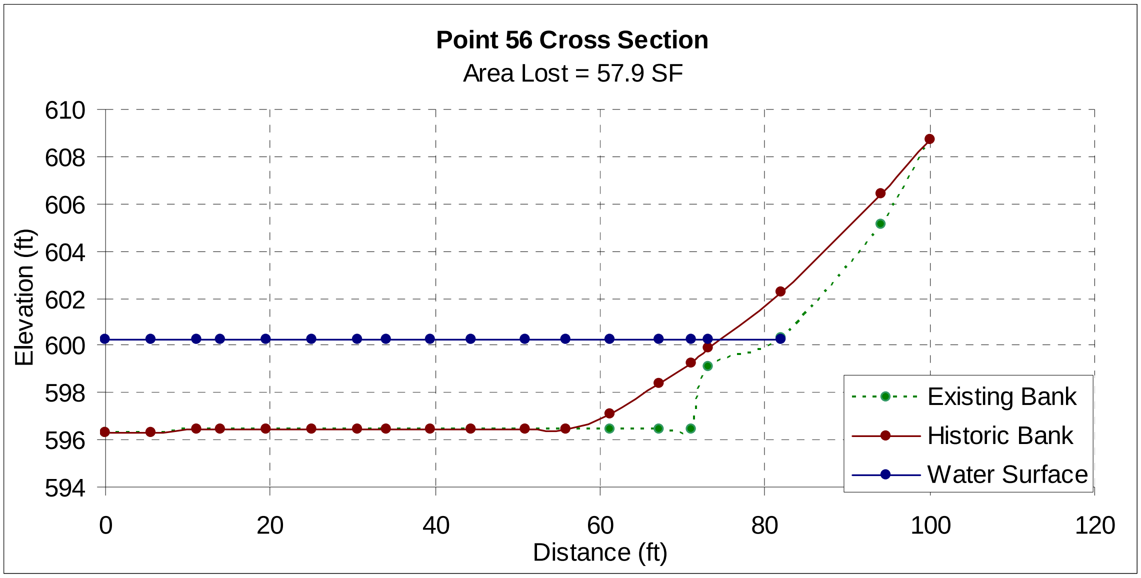

Point 56 Cross Section
Area Lost = 57.9 SF
Elevation (ft)
610
608
606
604
602
600
598
596
594
0
20
40
60
80
100
120
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2241
PL # 56
Lake Shelbyville

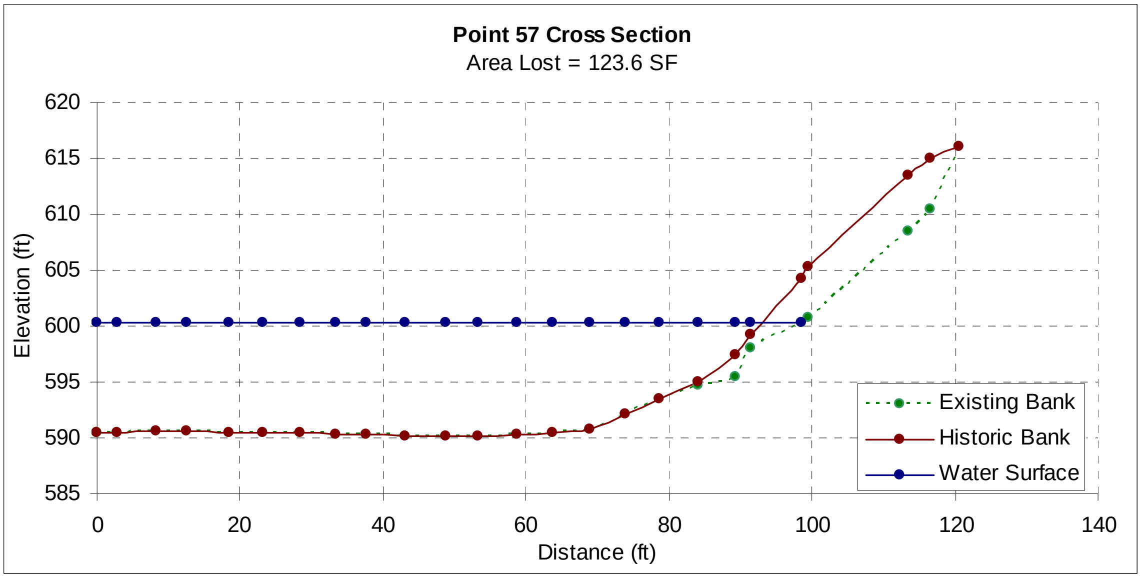

Point 57 Cross Section
Area Lost = 123.6 SF
Elevation (ft)
620
615
610
605
600
595
590
585
0
20
40
60
80
100
120
140
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2240
Pt. # 57
Lake Shelbyville

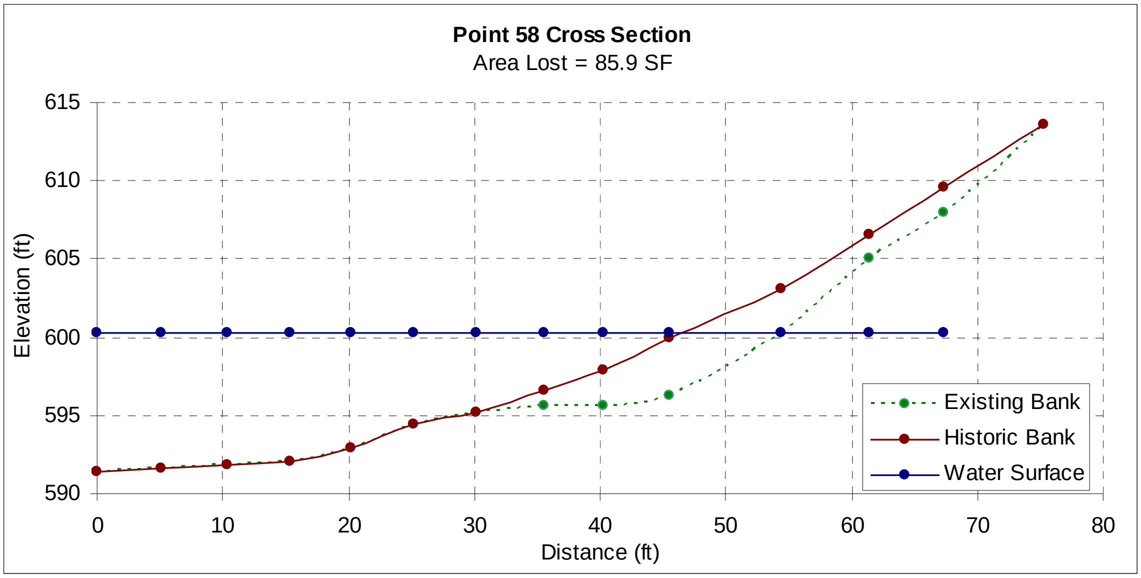
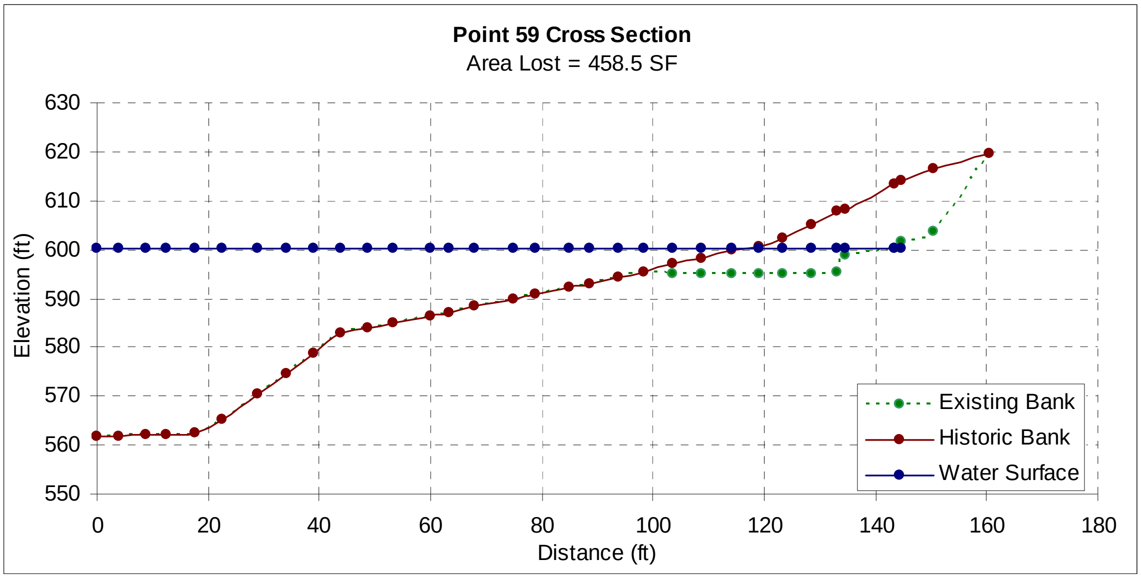

Point 58 Cross Section
Area Lost = 85.9 SF
Elevation (ft)
615
610
605
600
595
590
0
10
20
30
40
50
60
70
80
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2238
Pt. # 58
Lake Shelbyville



Point 59 Cross Section
Area Lost = 458.5 SF
Elevation (ft)
630
620
610
600
590
580
570
560
550
0
20
40
60
80
100
120
140
160
180
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2239
Pt. # 59
Lake Shelbyville

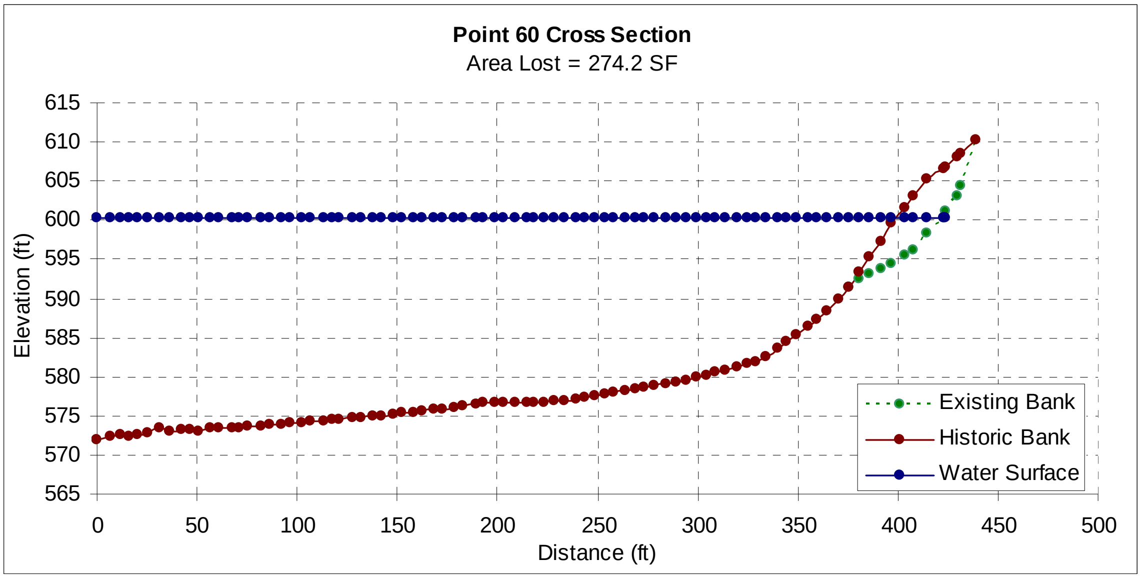
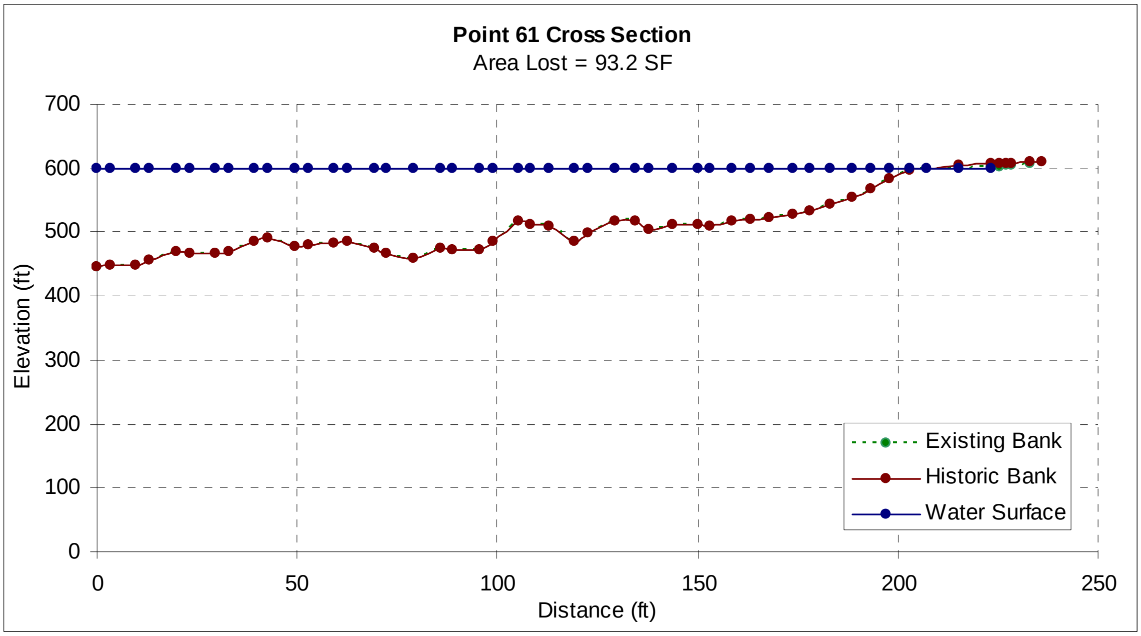
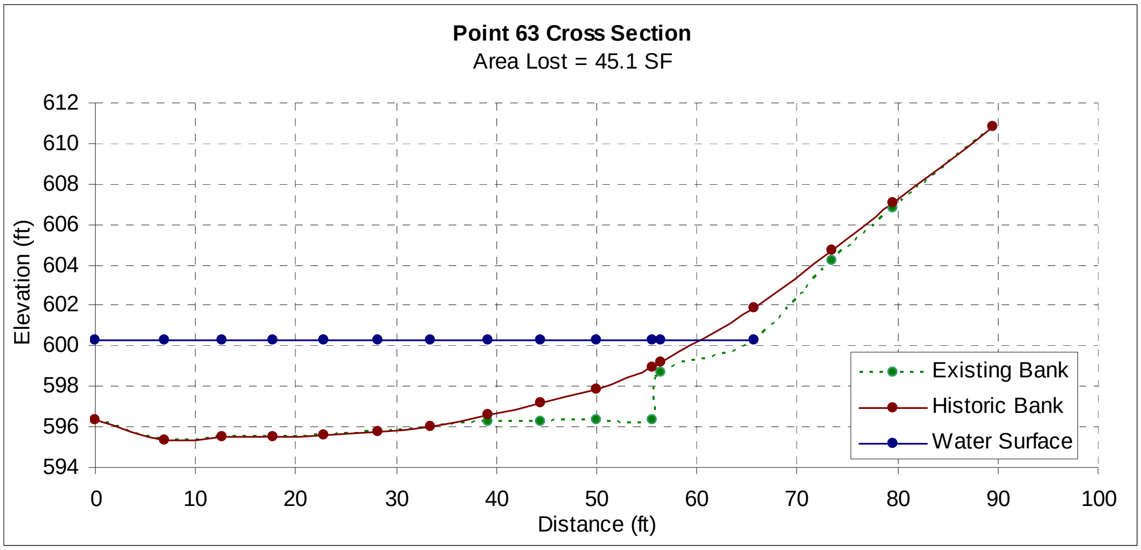

Point 60 Cross Section
Area Lost = 274.2 SF
Elevation (ft)
615
610
605
600
595
590
585
580
575
570
565
0
50
100
150
200
250
300
350
400
450
500
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2237
Pt. # 60
Lake Shelbyville



Point 61 Cross Section
Area Lost = 93.2 SF
700
600
500
400
300
200
100
0
Elevation (ft)
0
50
100
150
200
250
Distance (ft)
Existing Bank
Historic Bank
Water Surface



Point 63 Cross Section
Area Lost = 45.1 SF
Elevation (ft)
612
610
608
606
604
602
600
598
596
594
0
10
20
30
40
50
60
70
80
90
100
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2232
Pt. # 63
Lake Shelbyville

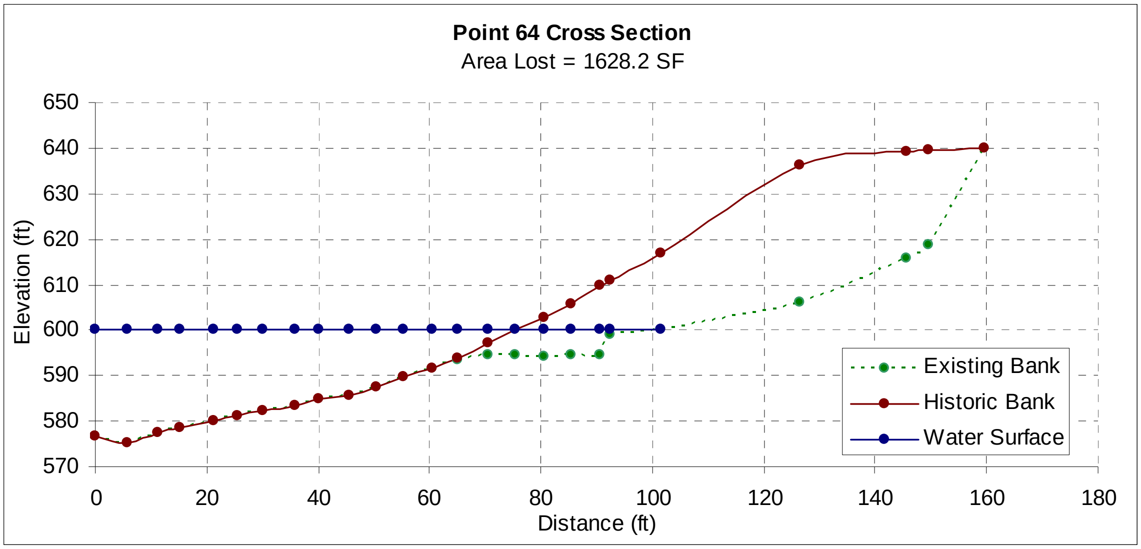

Point 64 Cross Section
Area Lost = 1628.2 SF
650
640
630
620
610
600
590
580
570
Elevation (ft)
0
20
40
60
80
100
120
140
160
180
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2231
PL # 64
Lake Shelbyville

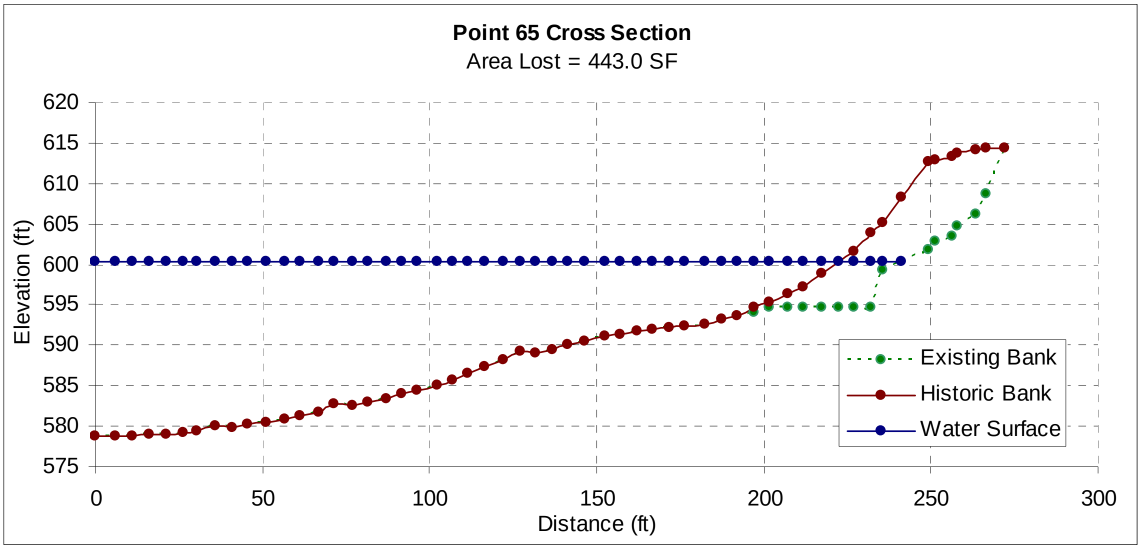

Point 65 Cross Section
Area Lost = 443.0 SF
Elevation (ft)
620
615
610
605
600
595
590
585
580
575
0
50
100
150
200
250
300
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2230
Pt. # 65
Lake Shelbyville

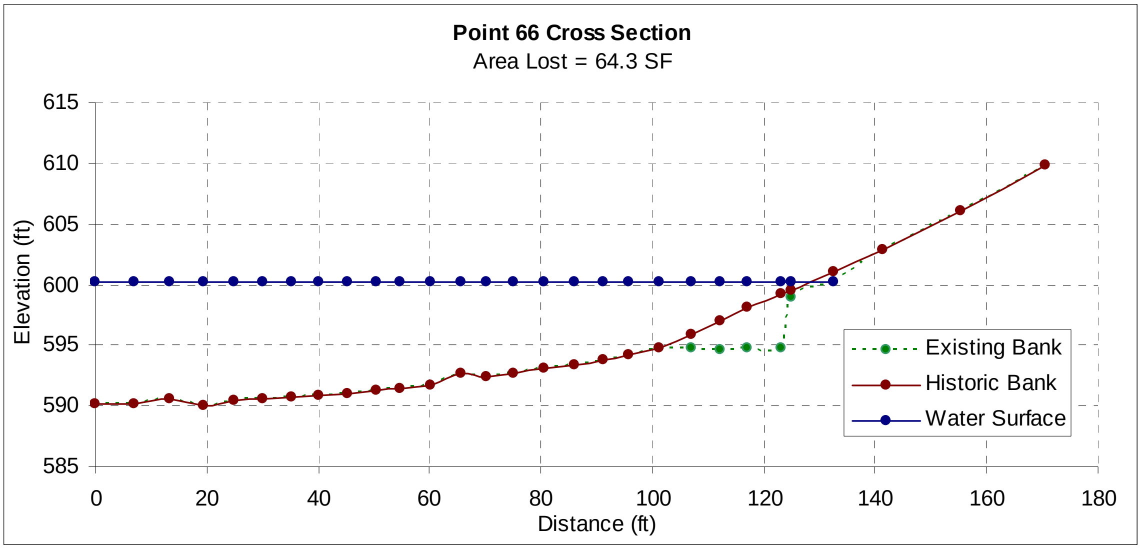
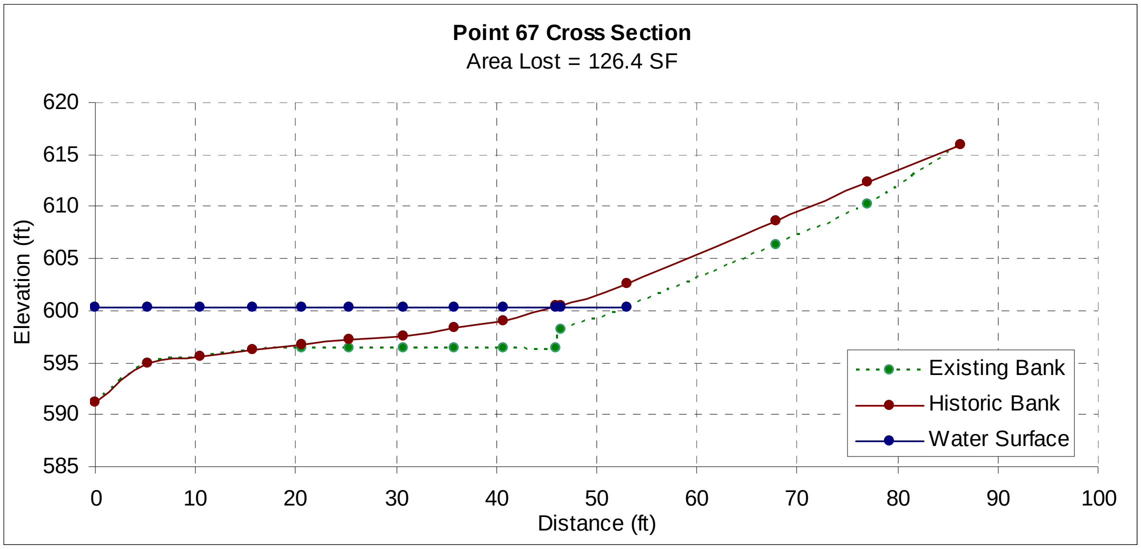

Point 66 Cross Section
Area Lost = 64.3 SF
Elevation (ft)
615
610
605
600
595
590
585
0
20
40
60
80
100
120
140
160
180
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2229
Pt. # 66
Lake Shelbyville



Point 67 Cross Section
Area Lost = 126.4 SF
Elevation (ft)
620
615
610
605
600
595
590
585
0
10
20
30
40
50
60
70
80
90
100
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2243
Pt. # 67
Lake Shelbyville

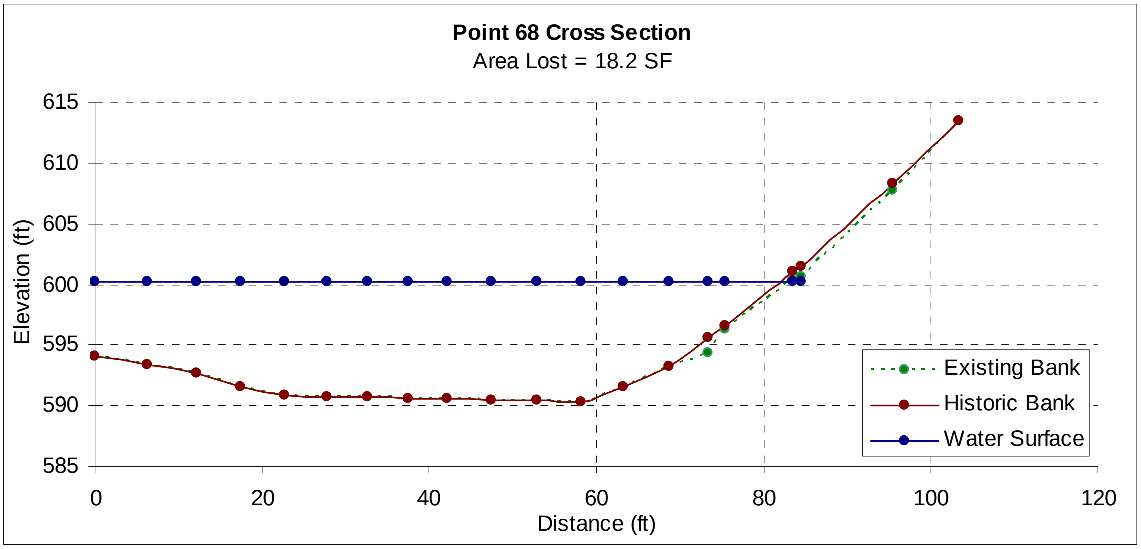

Point 68 Cross Section
Area Lost = 18.2 SF
615
610
605
600
595
590
585
Elevation (ft)
0
20
40
60
80
100
120
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2242
Pt. # 68
Lake Shelbyville

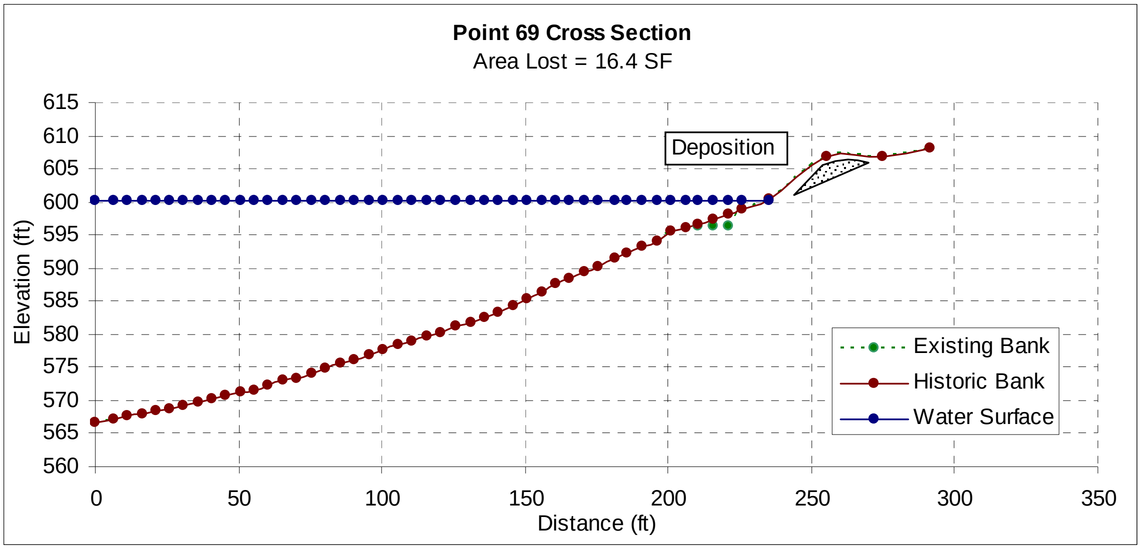

Point 69 Cross Section
Area Lost = 16.4 SF
Deposition
Elevation (ft)
615
610
605
600
595
590
585
580
575
570
565
560
0
50
100
150
200
250
300
350
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2245
Pt. # 69
Lake Shelbyville

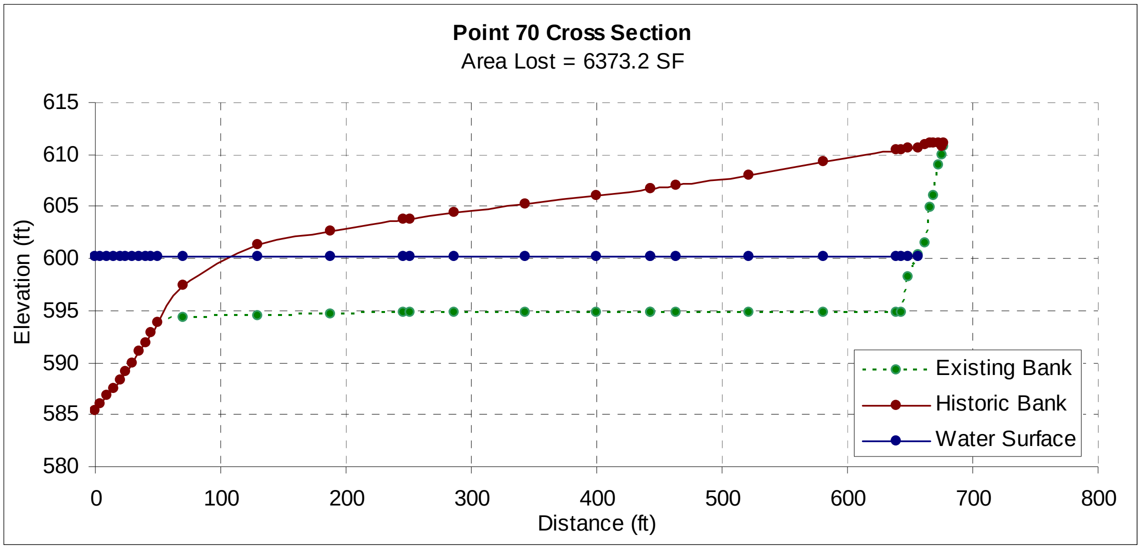

Point 70 Cross Section
Area Lost = 6373.2 SF
615
610
605
600
595
590
585
580
Elevation (ft)
0
100
200
300
400
500
600
700
800
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2228
Pt. # 70
Lake Shelbyville

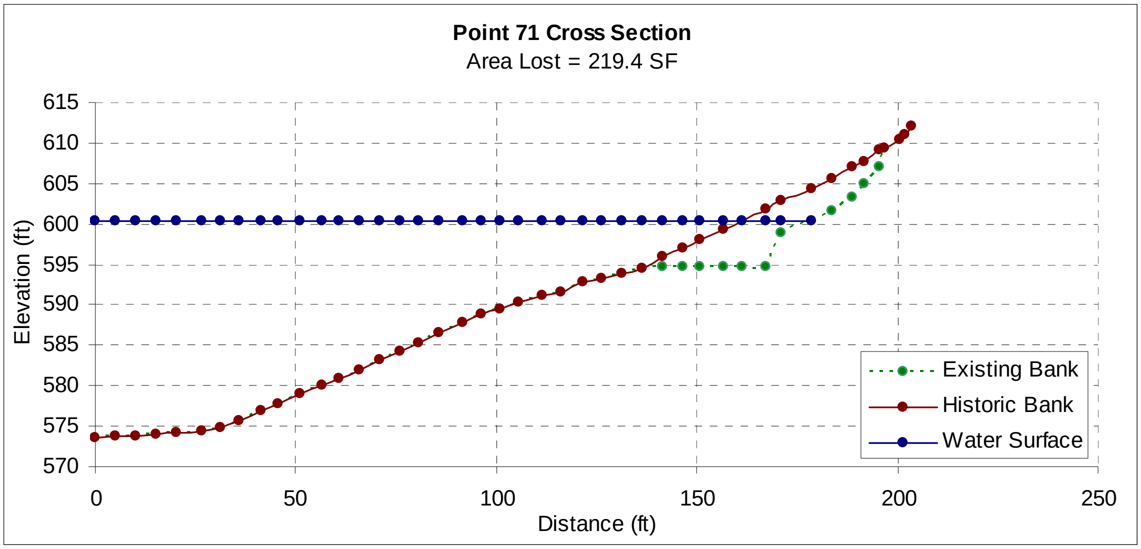

Point 71 Cross Section
Area Lost = 219.4 SF
Elevation (ft)
Distance (ft)
615
610
605
600
595
590
585
580
575
570
0
50
100
150
200
250
Existing Bank
Historic Bank
Water Surface


Photo 2227
Pt. # 71
Lake Shelbyville

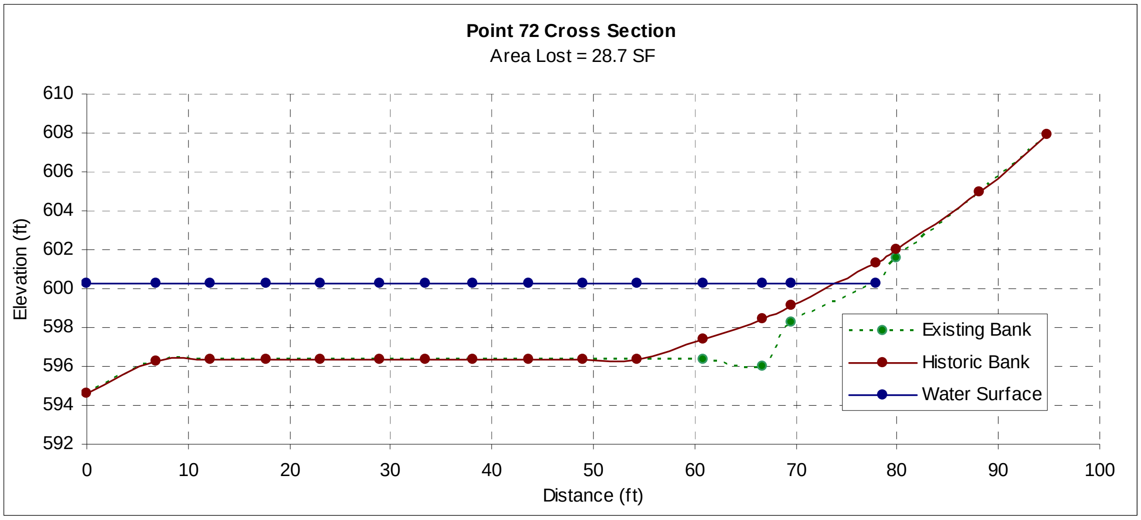

Point 72 Cross Section
Area Lost = 28.7 SF
Elevation (ft)
610
608
606
604
602
600
598
596
594
592
0
10
20
30
40
50
60
70
80
90
100
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2246
Pt. # 72
Lake Shelbyville

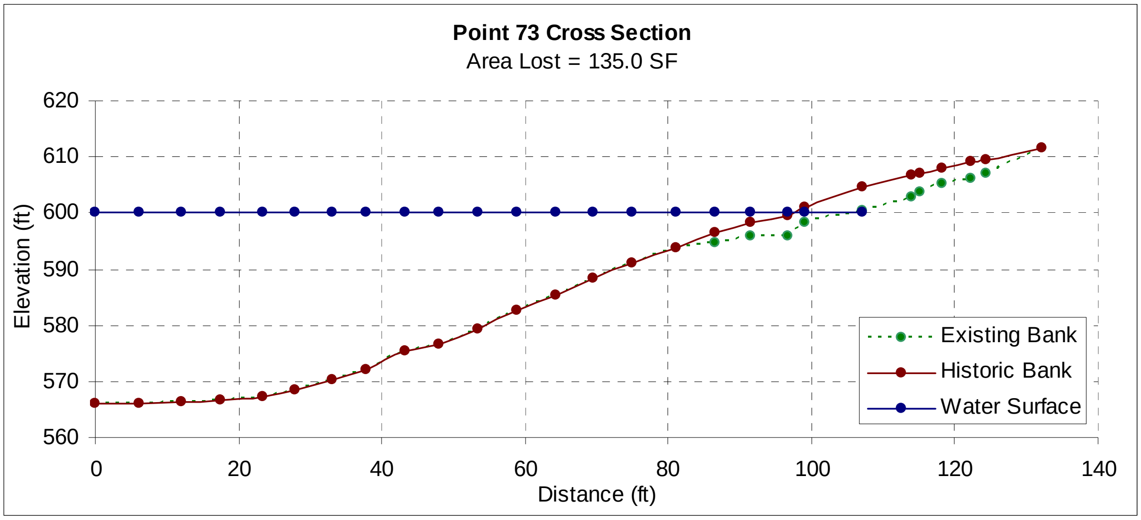
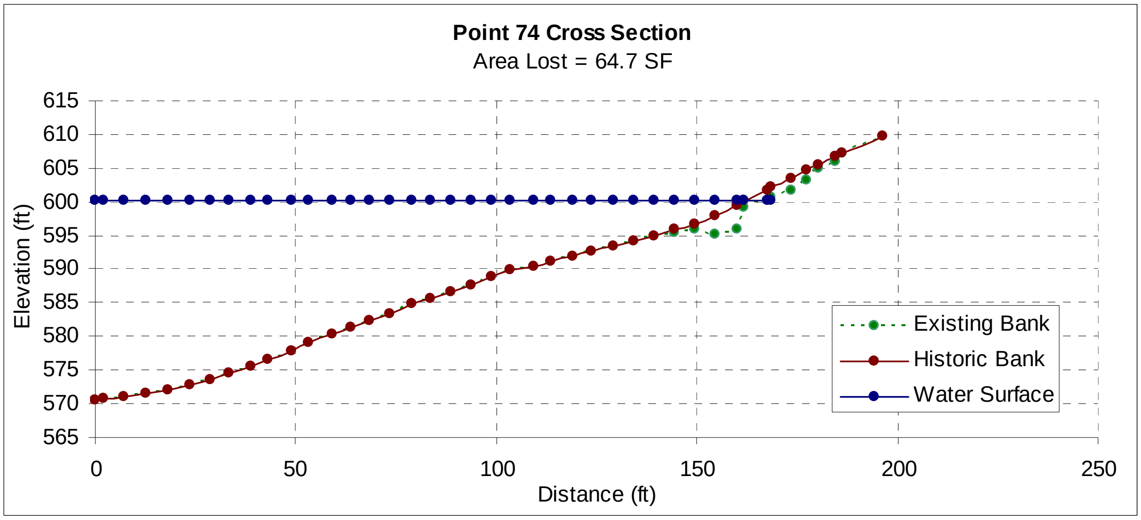

Point 73 Cross Section
Area Lost = 135.0 SF
620
610
600
590
580
570
560
Elevation (ft)
0
20
40
60
80
100
120
140
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2249
Pt. # 73
Lake Shelbyville



Point 74 Cross Section
Area Lost = 64.7 SF
Elevation (ft)
615
610
605
600
595
590
585
580
575
570
565
0
50
100
150
200
250
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2250
Pt. # 74
Lake Shelbyville

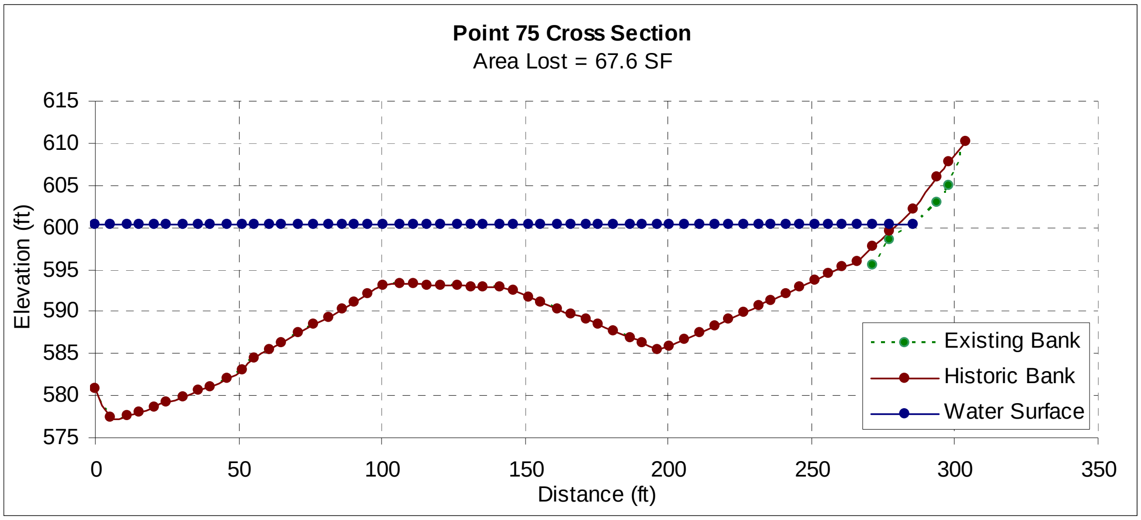
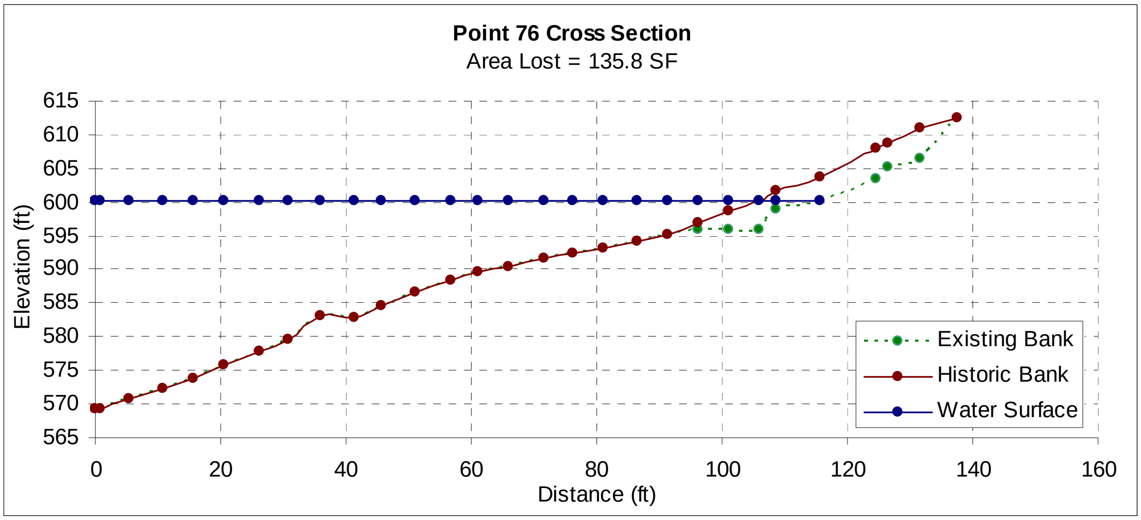
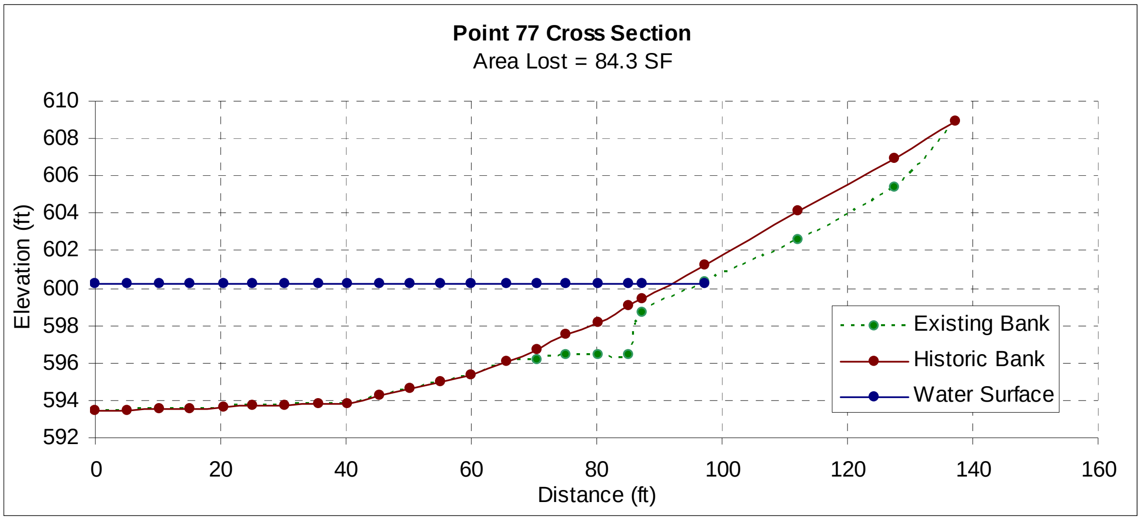

Point 75 Cross Section
Area Lost = 67.6 SF
615
610
605
600
595
590
585
580
575
Elevation (ft)
0
50
100
150
200
250
300
350
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2248
Pt. # 75
Lake Shelbyville



Point 76 Cross Section
Area Lost = 135.8 SF
Elevation (ft)
Distance (ft)
615
610
605
600
595
590
585
580
575
570
565
0
20
40
60
80
100
120
140
160
Existing Bank
Historic Bank
Water Surface

Photo 2247
Pt. # 76
Lake Shelbyville



Point 77 Cross Section
Area Lost = 84.3 SF
Elevation (ft)
610
608
606
604
602
600
598
596
594
592
0
20
40
60
80
100
120
140
160
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2251
Pt. # 77
Lake Shelbyville

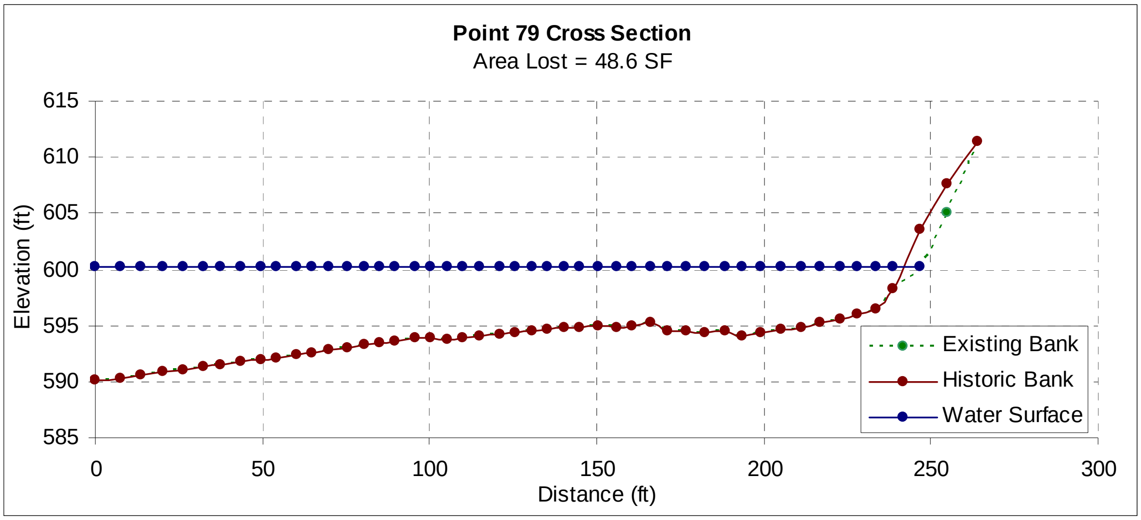

Point 79 Cross Section
Area Lost = 48.6 SF
Elevation (ft)
615
610
605
600
595
590
585
0
50
100
150
200
250
300
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2253
Pt. # 79
Lake Shelbyville

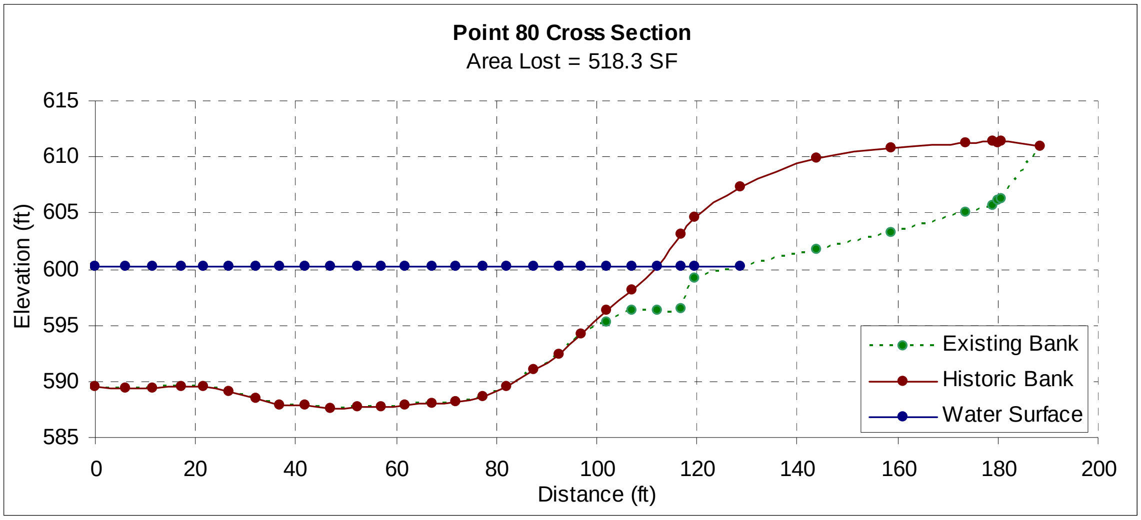
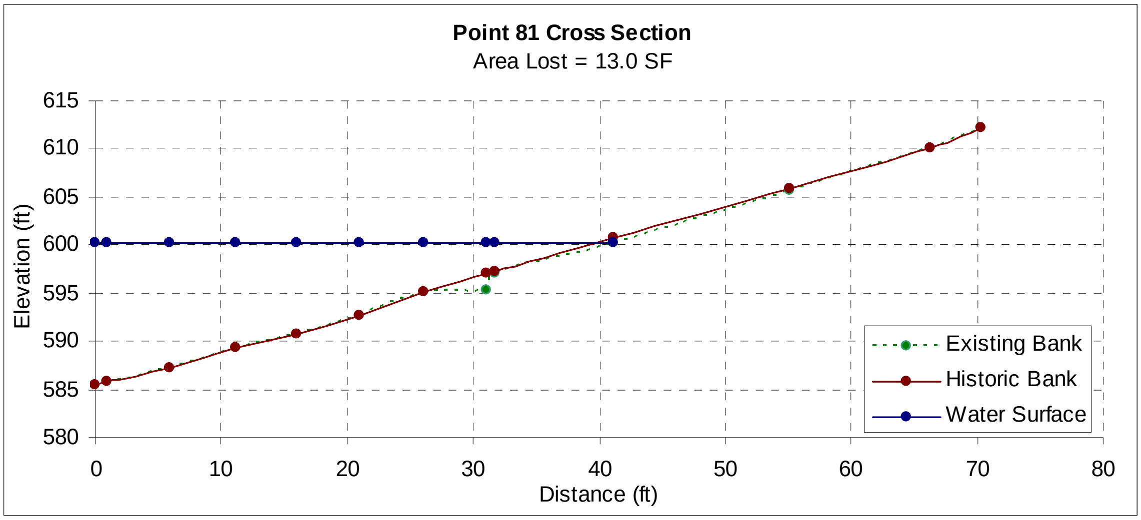

Point 80 Cross Section
Area Lost = 518.3 SF
Elevation (ft)
615
610
605
600
595
590
585
0
20
40
60
80
100
120
140
160
180
200
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2223
Pt. #80
Lake Shelbyville



Point 81 Cross Section
Area Lost = 13.0 SF
Elevation (ft)
615
610
605
600
595
590
585
580
0
10
20
30
40
50
60
70
80
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2224
Pt. # 81
Lake Shelbyville

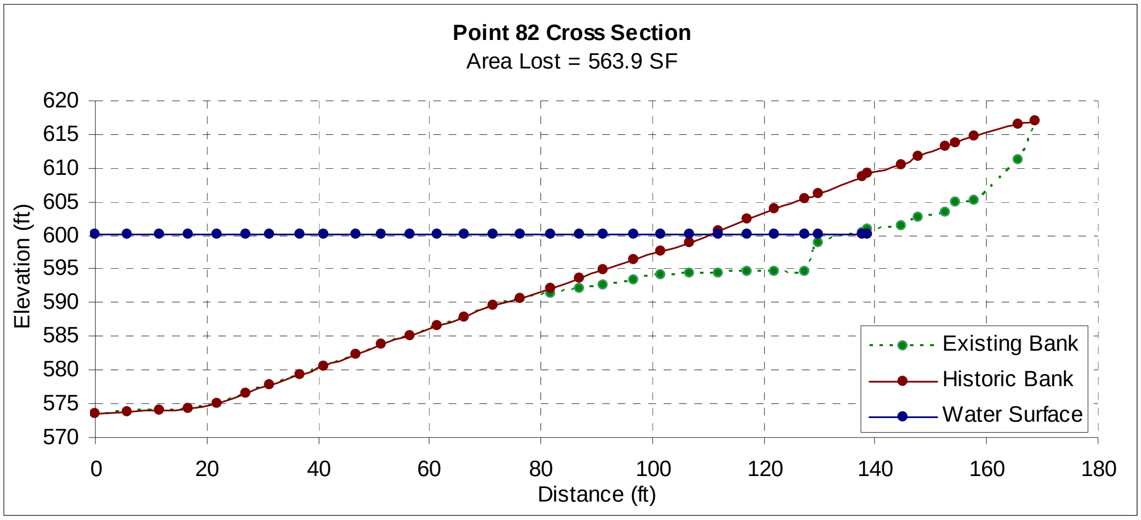

Point 82 Cross Section
Area Lost = 563.9 SF
Elevation (ft)
620
615
610
605
600
595
590
585
580
575
570
0
20
40
60
80
100
120
140
160
180
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2225
Pt. # 82
Lake Shelbyville

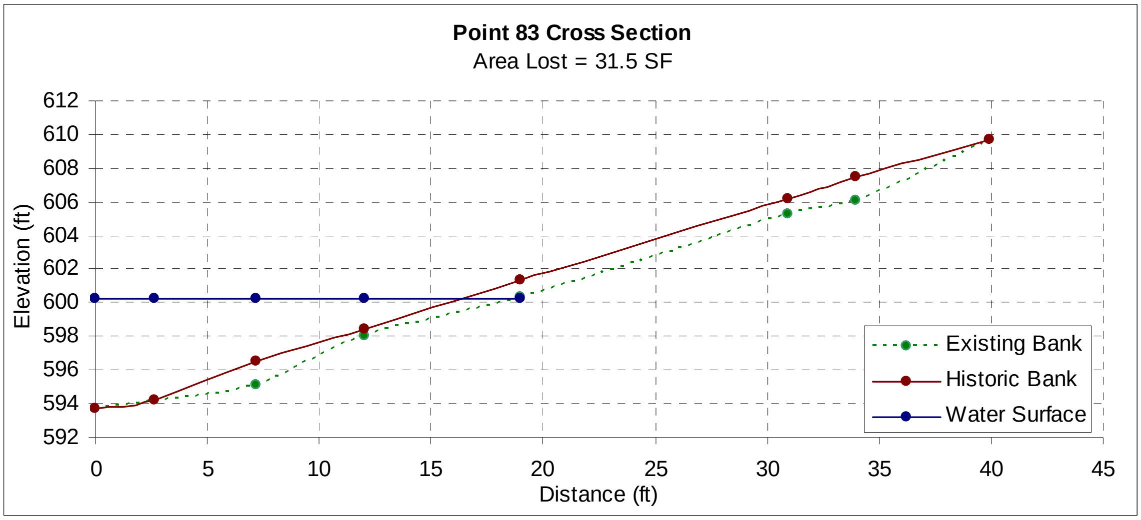

Point 83 Cross Section
Area Lost = 31.5 SF
Elevation (ft)
Distance (ft)
612
610
608
606
604
602
600
598
596
594
592
0
5
10
15
20
25
30
35
40
45
Existing Bank
Historic Bank
Water Surface


Photo 2226
Pt. # 83
Lake Shelbyville

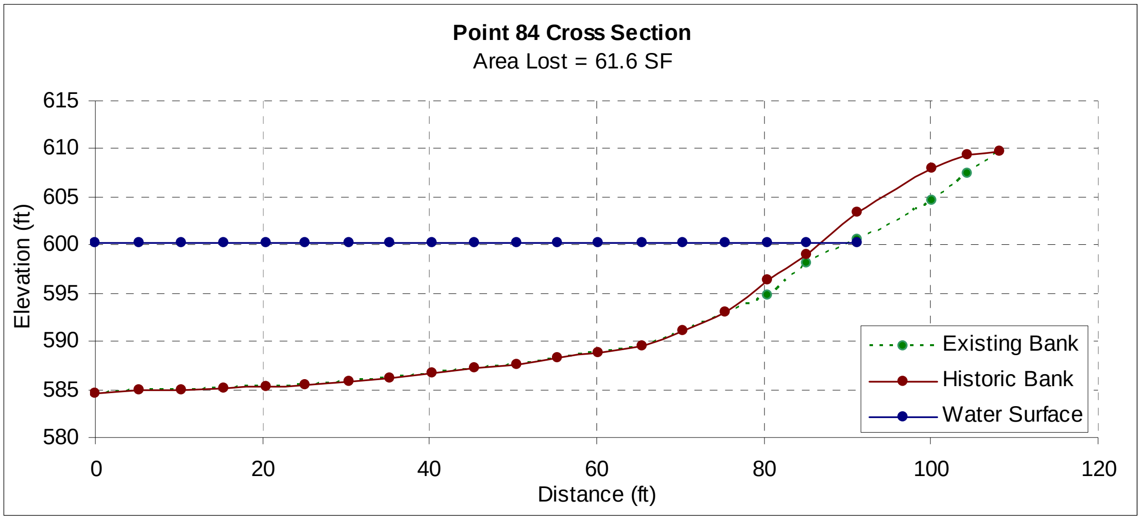

Point 84 Cross Section
Area Lost = 61.6 SF
615
610
605
600
595
590
585
580
Elevation (ft)
0
20
40
60
80
100
120
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2219
Pt. # 84
Lake Shelbyville

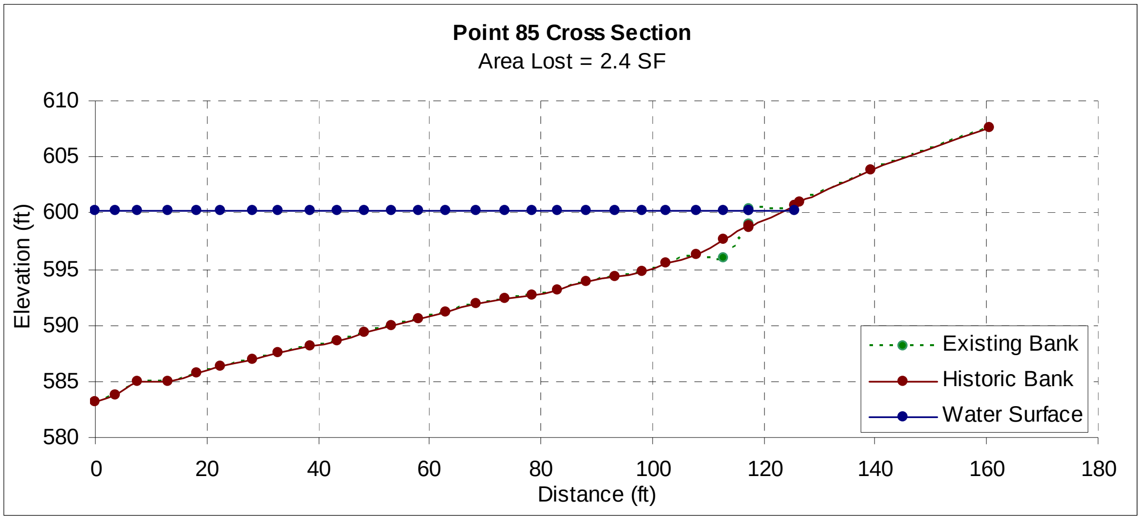

Point 85 Cross Section
Area Lost = 2.4 SF
610
605
600
595
590
585
580
Elevation (ft)
0
20
40
60
80
100
120
140
160
180
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2220
Pt. # 85
Lake Shelbyville

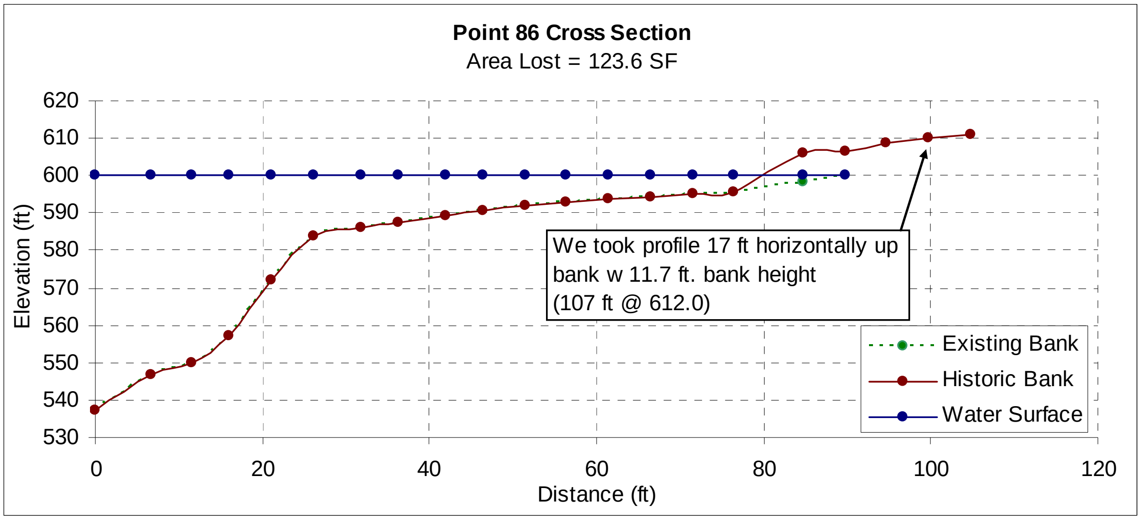

Point 86 Cross Section
Area Lost = 123.6 SF
620
610
600
590
580
570
560
550
540
530
Elevation (ft)
0
20
40
60
80
100
120
Distance (ft)
We took profile 17 ft horizontally up bank w 11.7 ft. bank height (107 ft @ 612.0)
Existing Bank
Historic Bank
Water Surface


Photo 2221
Pt. # 86
Lake Shelbyville

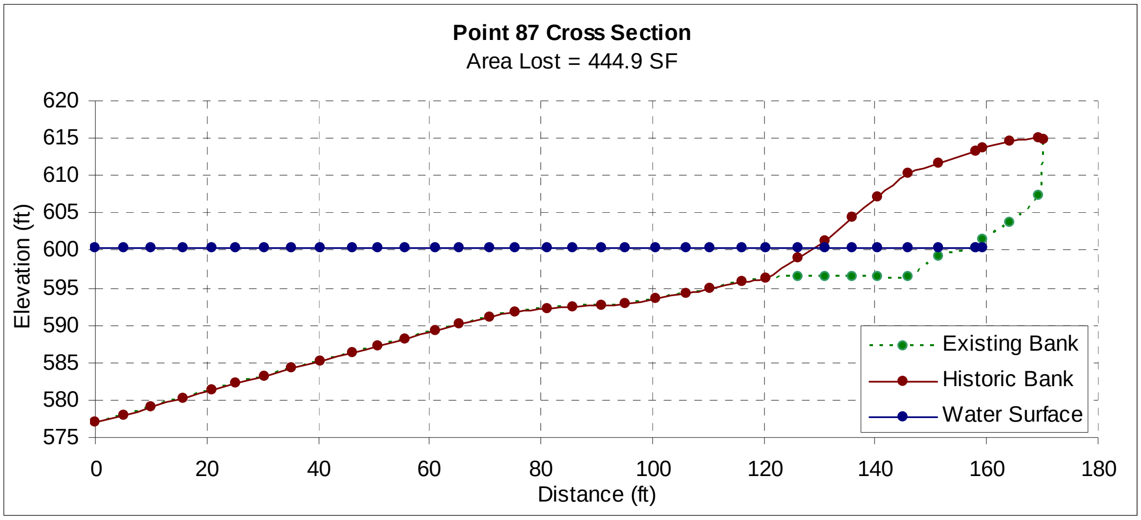

Point 87 Cross Section
Area Lost = 444.9 SF
Elevation (ft)
620
615
610
605
600
595
590
585
580
575
0
20
40
60
80
100
120
140
160
180
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2222
Pt. # 87
Lake Shelbyville

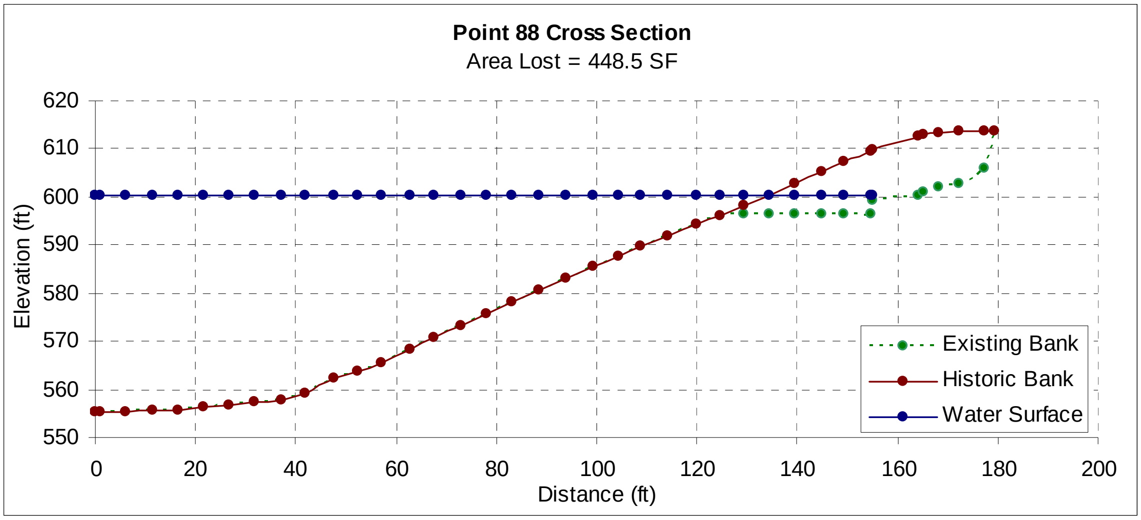

Point 88 Cross Section
Area Lost = 448.5 SF
Elevation (ft)
620
610
600
590
580
570
560
550
0
20
40
60
80
100
120
140
160
180
200
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2255
Pt. # 88
Lake Shelbyville

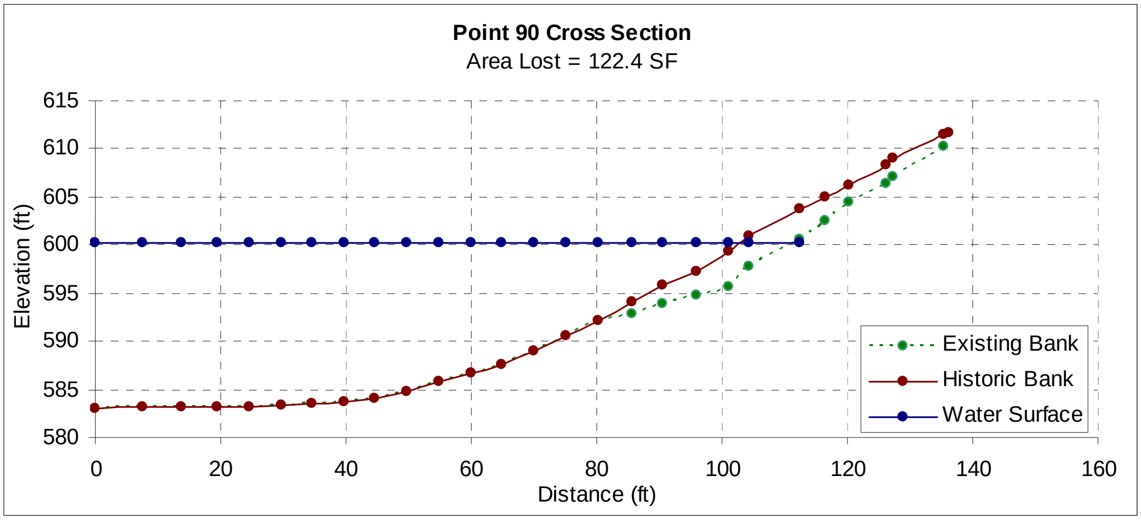

Point 90 Cross Section
Area Lost = 122.4 SF
Elevation (ft)
615
610
605
600
595
590
585
580
0
20
40
60
80
100
120
140
160
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2216
Pt. # 90
Lake Shelbyville

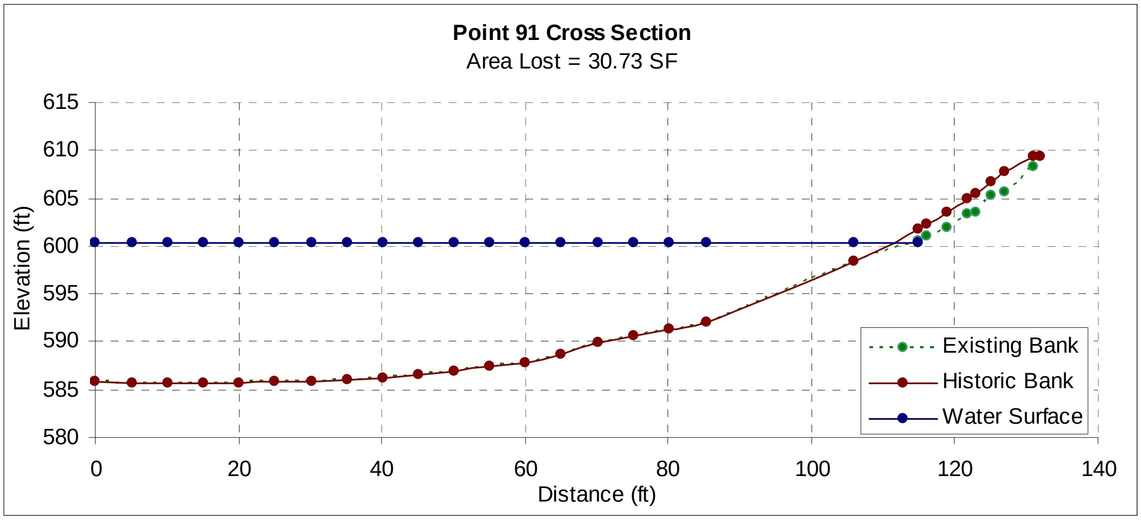

Point 91 Cross Section
Area Lost = 30.73 SF
615
610
605
600
595
590
585
580
Elevation (ft)
0
20
40
60
80
100
120
140
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2217
Pt. # 91
Lake Shelbyville

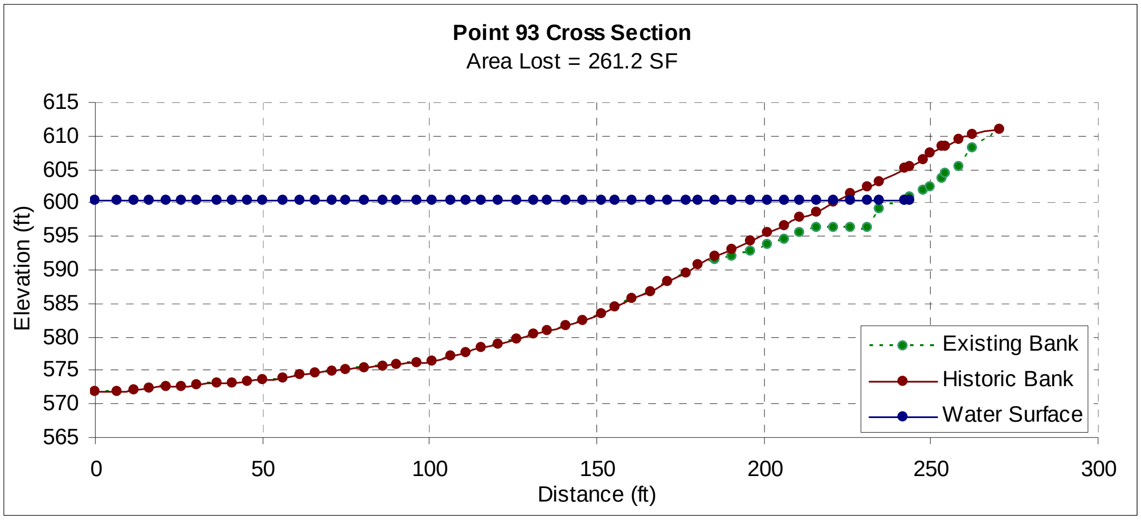

Point 93 Cross Section
Area Lost = 261.2 SF
615
610
605
600
595
590
585
580
575
570
565
Elevation (ft)
0
50
100
150
200
250
300
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2256
Pt. #93
Lake Shelbyville

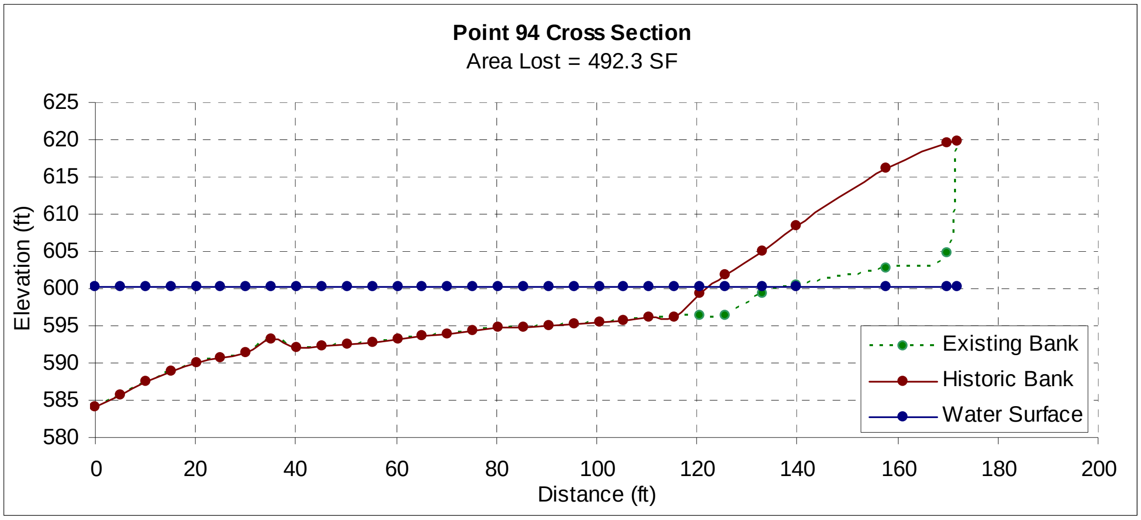

Point 94 Cross Section
Area Lost = 492.3 SF
Elevation (ft)
Distance (ft)
Existing Bank
Historic Bank
Water Surface
625
620
615
610
605
600
595
590
585
580
0
20
40
60
80
100
120
140
160
180
200


Photo 2213
Pt. # 94
Lake Shelbyville

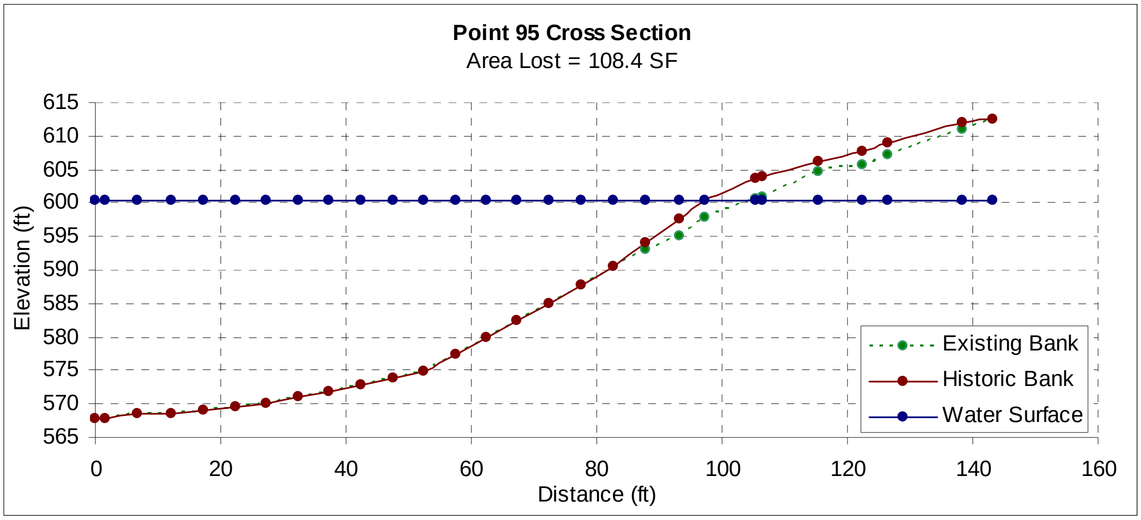
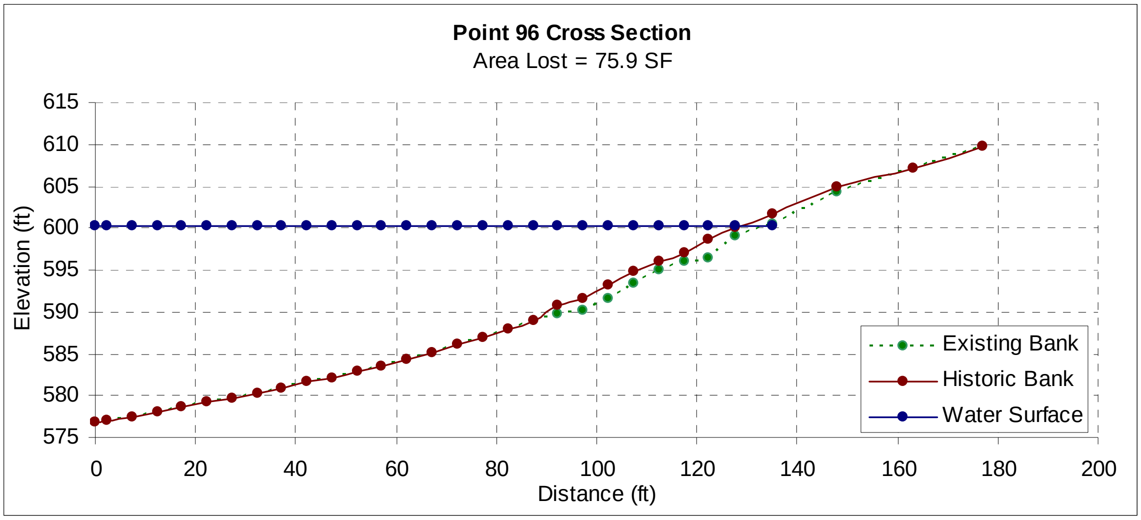

Point 95 Cross Section
Area Lost = 108.4 SF
Elevation (ft)
615
610
605
600
595
590
585
580
575
570
565
0
20
40
60
80
100
120
140
160
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo 2214
Pt. # 95
Lake Shelbyville



Point 96 Cross Section
Area Lost = 75.9 SF
Elevation (ft)
615
610
605
600
595
590
585
580
575
0
20
40
60
80
100
120
140
160
180
200
Distance (ft)
Existing Bank
Historic Bank
Water Surface

Photo 2215
Pt. # 96
Lake Shelbyville

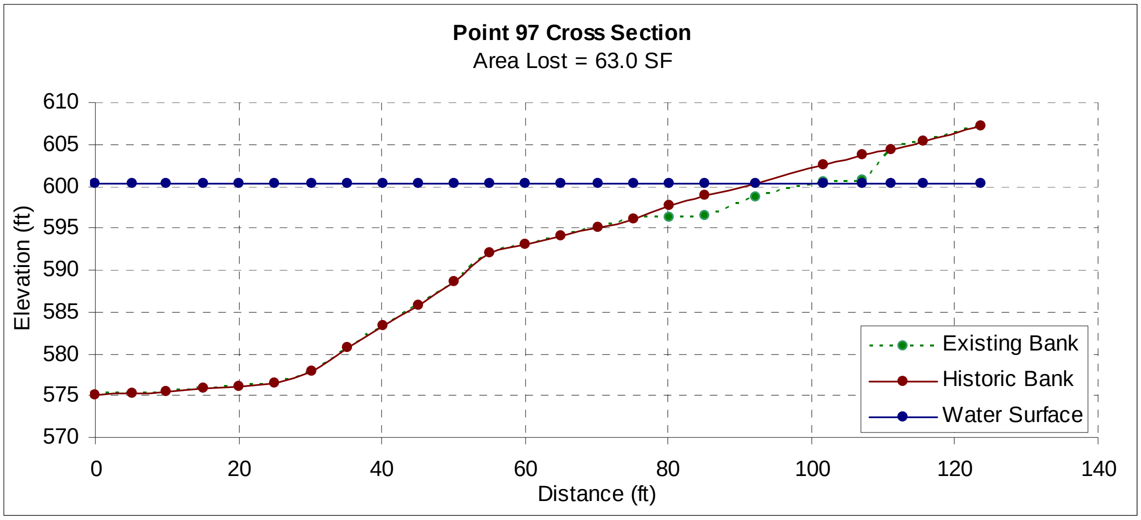

Point 97 Cross Section
Area Lost = 63.0 SF
Elevation (ft)
Distance (ft)
610
605
600
595
590
585
580
575
570
0
20
40
60
80
100
120
140
Existing Bank
Historic Bank
Water Surface


Photo # 2212
Pt. 97
Lake Shelbyville

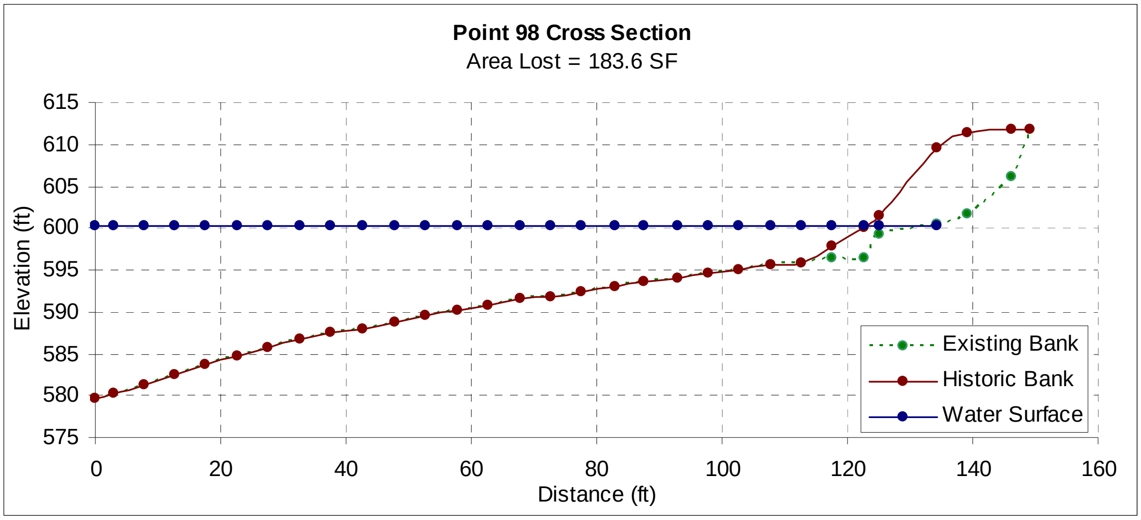

Point 98 Cross Section
Area Lost = 183.6 SF
Elevation (ft)
615
610
605
600
595
590
585
580
575
0
20
40
60
80
100
120
140
160
Distance (ft)
Existing Bank
Historic Bank
Water Surface


Photo # 2212
Pt. 97
Lake Shelbyville

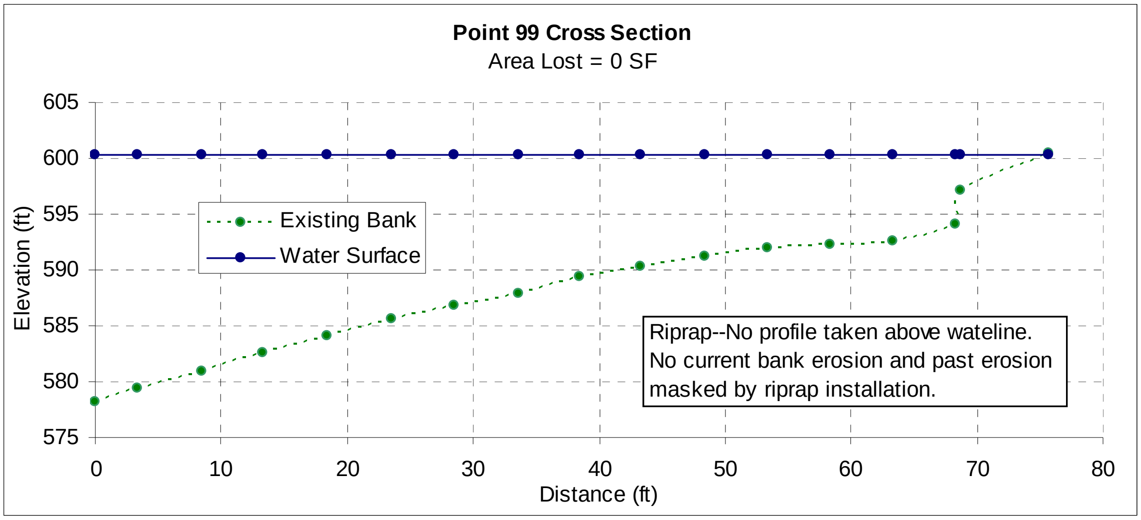

Point 99 Cross Section
Area Lost = 0 SF
605
600
595
590
585
580
575
Elevation (ft)
Existing Bank
Water Surface
Riprap--No profile taken above wateline.
No current bank erosion and past erosion
masked by riprap installation.
0
10
20
30
40
50
60
70
80
Distance (ft)


Photo 2210
Pt. # 99
Lake Shelbyville

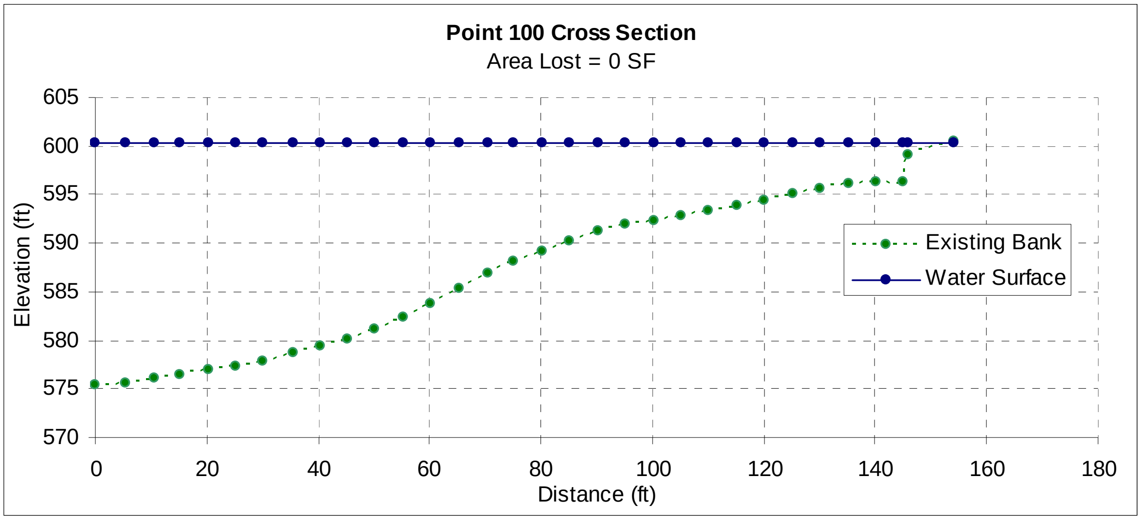

Point 100 Cross Section
Area Lost = 0 SF
Elevation (ft)
605
600
595
590
585
580
575
570
0
20
40
60
80
100
120
140
160
180
Distance (ft)
Existing Bank
Water Surface


Photo #2209
Pt. # 100
Lake Shelbyville