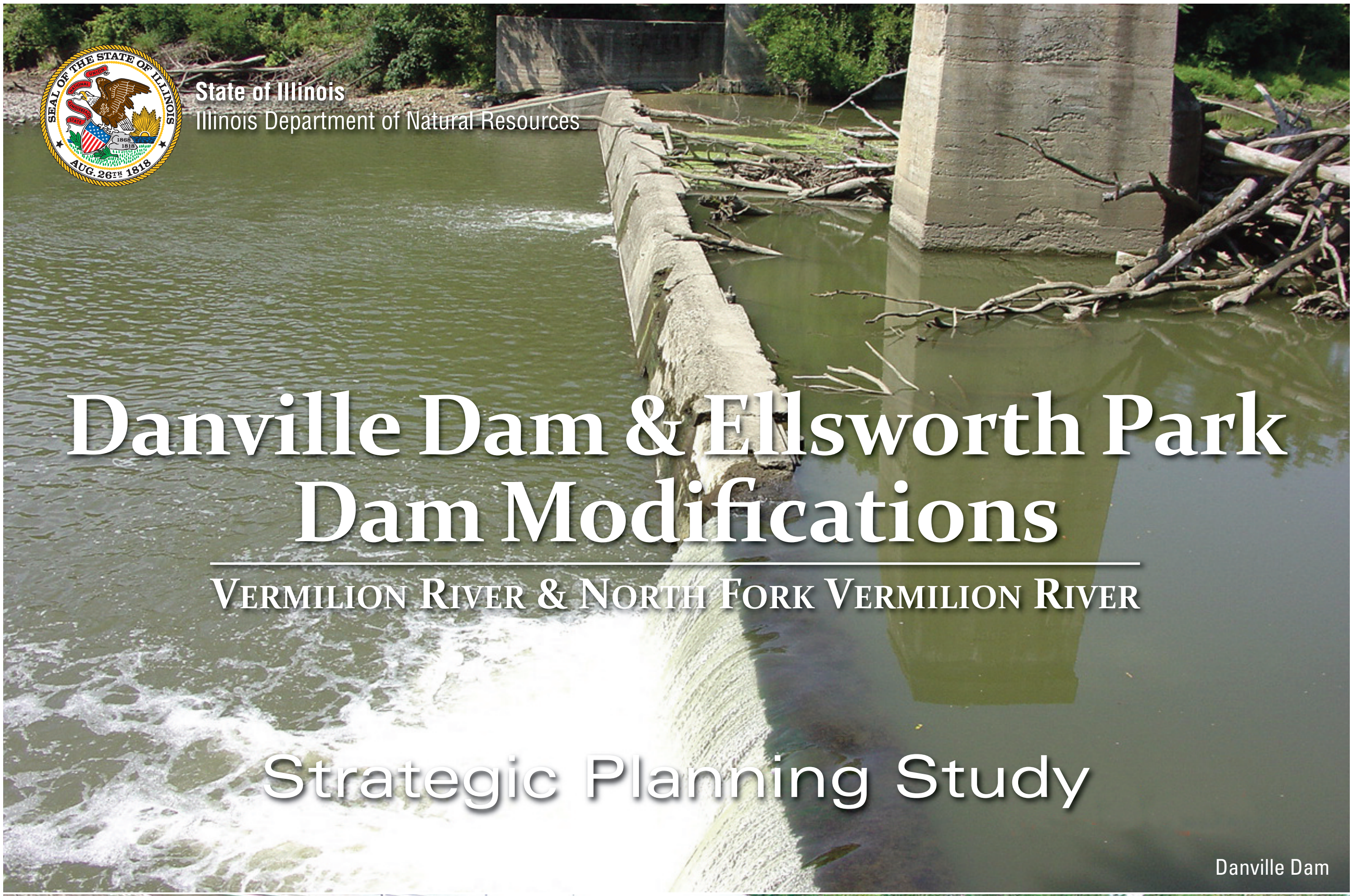
State of Illinois
Illinois Department of Natural Resources

Danville Dam & Ellsworth Park Dam Modifications

Vermilion River & North Fork Vermilion River

Strategic Planning Study



Danville Dam

Ellsworth Park Dam

Illinois Department of Natural Resources

Danville, Illinois
Vermilion County
August 2013

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Table of Contents

LIST OF APPENDIXES

LIST OF FIGURES

LIST OF TABLES

PURPOSE AND AUTHORITY

This report summarizes the findings of a strategic dam modification study for the Danville and Ellsworth Park Dams on the Vermilion River and North Fork of the Vermilion River to investigate providing environmental benefits through river connectivity, enhancing the recreational use of navigable rivers and reducing the public safety hazards associated with the dams. This study was prepared under the authorization granted to the Illinois Department of Natural Resources (IDNR) under the 20 ILCS 805/805-100 Conservation of Fish and Game; and 20 ILCS 805/805-105 Conservation of Fauna and Flora.

SCOPE

The scope of this study included the following elements:

- Conducting an engineering reconnaissance of the Danville and Ellsworth Park Dams and the surrounding areas;
- Conducting detailed field surveys of the Vermilion River and North Fork Vermilion River in the vicinity of the Danville Dam and Ellsworth Park Dam;
- Preparing maps and related drawings;
- Establishing low flow and flood discharge rates for the study and developing computer models to estimate corresponding water surface elevations at various locations in the watershed;
- Collecting river bank and river bed material samples to determine grain size distributions;
- Conducting chemical analysis on collected river material samples;
- Developing computer models to estimate erosion and deposition of channel material for existing and proposed conditions;
- Defining potential dam modification/dam removal safety improvements;
- Defining ecological, recreational and public safety benefits of each plan of improvements;
- Determining the costs of potential dam modification/dam removal safety improvements;
- Investigating archaeological and biological resources in the project vicinity for assessment of potential impacts of the various dam modifications;
- Estimating the impacts to cultural resources, wetlands, and threatened and endangered species;
- Preparing recommendations and a project report.

PREVIOUS DAM REMOVAL STUDIES

1. CTE AECOM. Evaluation of Public Safety at Run-of-River Dams. July 2007.

The purpose of this study was to evaluate the public safety of Illinois run-of-river dams and propose conceptual structural options to improve safety. This report included the Danville Dam, but excluded the Ellsworth Park Dam. The options investigated for the Danville Dam with their respective costs are listed below.

- Temporary Rock Fill $2,190,000
- Full Channel Bypass Deemed Infeasible
- Riffle Pool $7,220,000
- In-Stream Bypass Channel Deemed Infeasible
- Dam Face Modification $2,520,000
- Dam Removal $2,050,000

2. US Department of Agriculture – Natural Resource Conservation Service. Vermilion River Dam Removal or Modification. July 2005.

This report listed the public safety hazards at the dam due to the hydraulic roller, environmental considerations at the site, recreation near the site, sediment quality and quantity, hydrology and proposed alternatives to improve public safety. Alternatives recommended for the site included removing the dam, installing concrete steps, creating a downstream rock ramp and maintaining the existing dam.

INTRODUCTION

The Danville Dam is located on the Vermilion River approximately 22 miles upstream of the confluence with the Wabash River. The Ellsworth Park Dam is located on the North Fork of the Vermilion River approximately 0.53 miles upstream of the confluence of the Vermilion River. The Danville and Ellsworth Park Dams, shown in Figure 1, are both located in Section 8 of Township 19 North, Range 11 West of the 2nd Principal Meridian. The Danville Dam is at -87.631691, 40.122256 Decimal Degrees and the Ellsworth Park Dam is at -87.638788, 40.123888 Decimal Degrees. Both dams are run-of-river structures. The dams are located within the city limits of the City of Danville which has a population of 33,027 according to the 2010 census.

The ogee shaped Danville Dam has a spillway length of 220 feet at an elevation of 519.36 feet and a height of 11 feet. The sharp crested Ellsworth Park Dam has a spillway length of 90 feet at an elevation of 523.43 feet and a height of 6 feet. Figure 2 illustrates the drainage areas to the Danville and Ellsworth Park Dams, which are 1,286 and 304 square miles respectively.

The earliest documentation found on the Danville Dam is a September 1914 permit approval by the State of Illinois, River and Lakes Commission to the Danville Street Railway and Light Company for

Figure 1: Location Map

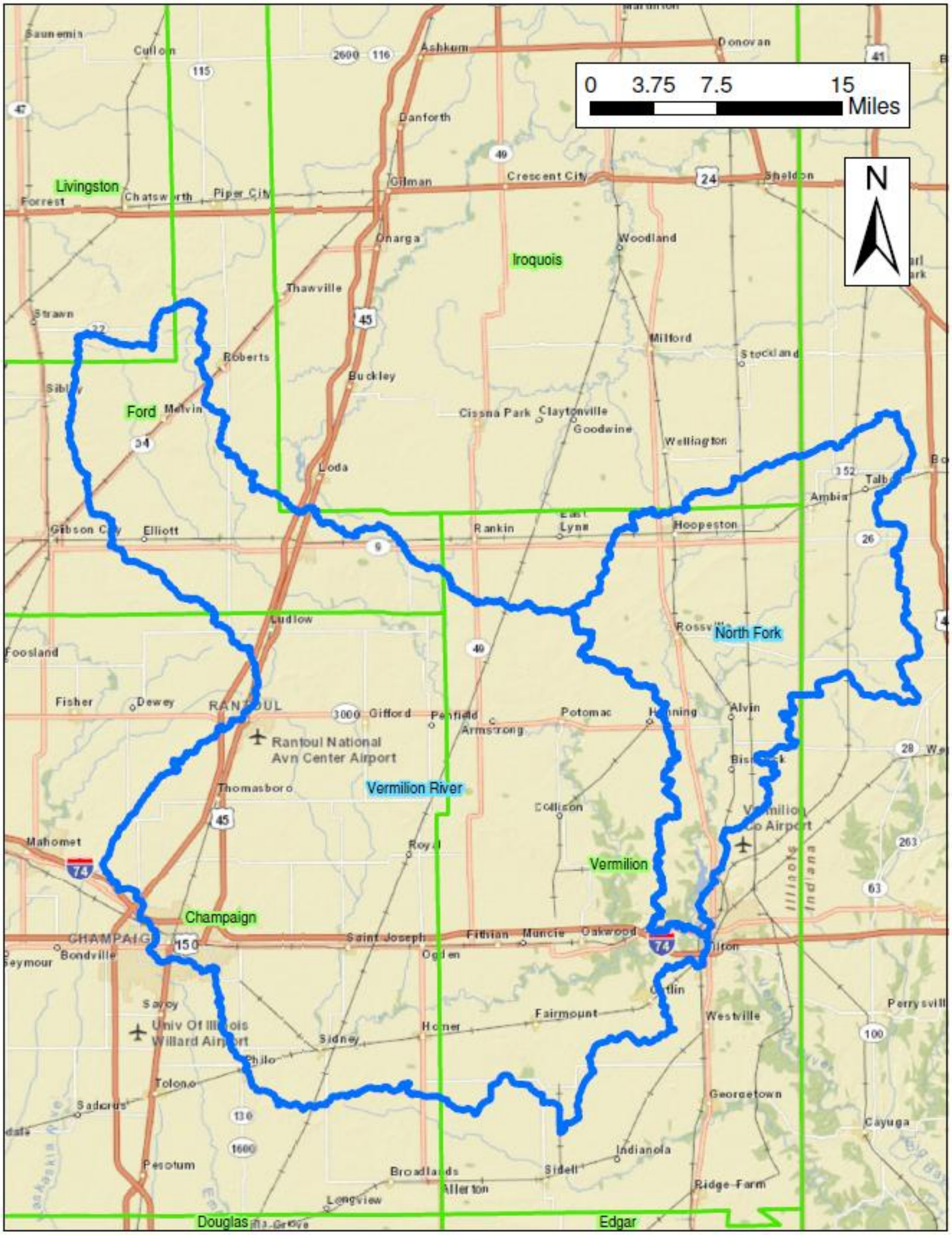

Figure 2: Watershed Map

the construction of the dam. The Danville Street Railway and Light Company later requested to increase the permitted dam height from seven feet to ten feet in October 1915, which was denied. The Danville Dam is provisionally classified as a Class III (low hazard) dam by the Department of Natural Resources based on the determination that failure of the dam would have little potential for causing loss of life or significant property damage.

The original purpose of the dam appears to have been for public steam for supplying heat to residents and companies, but was later identified in 1970 as necessary for industrial operations by the General Motors Corporation. Ownership of the dam was conveyed from Illinois Power Company to the City of Danville on March 20, 1972. The Danville Dam currently serves no utilitarian purpose other than to form a recreational pool above the dam. Both east and west abutments are being undermined by heavy erosion. A portion of the dam crest has eroded approximately one-foot down and the dam face is deteriorating allowing seepage to occur through the dam as shown in Figure 3.

Figure 3: Danville Dam Photograph

The Danville Dam site is often used by the public for recreation. A system of unofficial trails in the vicinity of the dam provide access to the site. Fishing is common in the scour hole located immediately downstream of the dam and also in the pool upstream. During low flow conditions fishermen will walk on dry sections of the dam to fish off of the exposed dam crest. Fishing boats and canoes are able to launch at the Ellsworth Park boat ramp in the Danville Dam pool to fish and boat immediately upstream of the dam. There is no public boat portage identified at either dam. Due to the proximity of the Danville Dam located downstream of a sharp bend in the river, the time to safely portage around the dam is limited for boaters boating on the Vermilion River. The dam has a history of boaters accidentally and deliberately boating over the dam. Swimmers have also been observed using the area immediately downstream of the dam. Three accidental deaths and multiple successful rescues by Danville rescue responders have been reported at this dam.

The Danville Dam currently fragments the Vermilion River, by creating a barrier that denies fish and other aquatic organisms, including threatened species, access to 175 river miles of quality spawning and rearing habitat in the Vermilion River, Salt Fork and Middle Fork channels upstream of the dam.

The Ellsworth Park Dam is a replacement of a dam that was previously located 100 feet downstream from its current location. The previous dam was removed in the 1920's and the new dam was constructed upstream after the removal. The Ellsworth Park Dam is provisionally classified as a Class III (low hazard) dam by the Department of Natural Resources based on the determination that failure of the dam would have little potential for causing loss of life or significant property damage. The dam is in good condition except for some minor erosion occurring around the west abutment, as shown in Figure 4.

Figure 4: Ellsworth Park Dam Photograph

The Ellsworth Park Dam is often visited by the public due to its location in a city park. Fishing is common in the scour hole located immediately downstream of the dam and occasionally in the pool upstream. Swimmers use the channel downstream of the dam. Fishing boats and canoes that launch at the Ellsworth Park boat ramp in the Danville Dam pool seldom boat upstream toward the Ellsworth Park Dam, especially during low flows, due to a riffle that impedes boat passage that is located downstream of the Ellsworth Park Dam.

The Ellsworth Park Dam currently fragments an additional 2.3 miles of the North Fork Vermilion River by creating a barrier that denies fish and other aquatic organisms, including threatened species, access to quality habitat upstream of the dam during normal flow conditions.

Due to the hydraulic spillway conditions, high tailwater and poor riverbed protection below each dam, a submerged hydraulic jump and roller occurs at the downstream face of each dam. The turbulent forces generated by the hydraulic roller has eroded a scour hole in the original bed material at the base of both dams. These rollers typically pull in and hold objects, including people, which often leads to emergency rescues or drownings. There have been multiple rescues and reported deaths at the Ellsworth Park Dam.

WATERSHED ASSESSMENT

The Vermilion River watershed is 1,286 square miles at the Danville Dam and runs south and east in Livingston, Iroquois, Ford, Champaign, and Vermilion Counties plus a portion of Indiana (see Figure 2). The watershed is approximately 48 miles long by 48 miles wide and consists primarily of agricultural land with some residential, commercial, industrial and open floodplain areas. The communities within the Vermilion River watershed include Danville, Champaign, Rantoul, Philo, Sidney, Rossville, Hoopeston and Melvin.

The river system contains many sections with tall bluff and rock outcroppings. The Middle Fork of the Vermilion River has the only National Scenic Waterway in the state of Illinois. There are four impoundment structures on the Vermilion River, one on the main stem and three on the North Fork. These structures include the two dams considered in this study for modification, and two others located upstream of the Ellsworth Park Dam. A small low head dam with a fish ladder is located 2.3 miles upstream of Ellsworth Park Dam which serves as impound water for supply within the City of Danville. The 1000 acre Lake Vermilion Dam is an additional 2.5 miles upstream and is primarily utilized for water supply and recreational use.

HYDROLOGY

The river system was divided into three sections to accurately model the flow changes, the Upper Vermilion River, Lower Vermilion and North Fork Vermilion Rivers. The Vermilion River was split into an Upper and Lower designation at it's confluence with the North Fork Vermilion River. Table 1 summarizes the existing conditions discharges, computed in cubic feet per second (cfs). These discharges were determined using multiple sources to adequately examine a full spectrum of flows from flood to drought condition. The 7-day 10-year (Q7-10) drought flowrates were obtained from the IDNR "Vermilion River Area Assessment" report published in 1999. Flows of 80%, 50% and 10% daily exceedence were determined from the daily flowrate recorded at the United States Geological Survey (USGS) gage #03339000 located at the Danville Sanitary District in Danville, Illinois since October 1914, the beginning of the period of record. High flows of the 10%, 2%, 1% and 0.02 annual events were determined for the Danville Flood Insurance Study published in 1983. Discharges for the 50%, 20% and 4% annual events were determined utilizing the USGS StreamStats website.

Table 1: Discharge Summary Table (in cfs)

	Drought	Daily Exceedence			Annual Exceedence						
River	Q7-10	80%	50%	10%	50%	20%	10%	4%	2%	1%	0.2%
North Fork	0	29	130	733	4,030	6,970	9,180	11,800	13,510	14,950	19,200
Upper Vermilion	30	63	291	1,787	10,000	17,300	19,800	29,200	29,300	33,200	42,850
Lower Vermilion	42	92	421	2,520	12,400	21,200	26,850	35,900	38,150	41,450	53,000

HYDRAULICS

The Hydrologic Engineering Center's HEC-RAS model, created by the U.S. Army Corps of Engineers, was utilized to create the computer model of the Vermilion River and the North Fork of the Vermilion River. This hydraulic computer model was created to replicate the Vermilion River and North Fork Vermilion River conditions that would physically occur during a specified flow event. An existing conditions scenario was developed in the model to ensure the model was accurately determining water surfaces used for the comparison of the alternatives. Multiple models were developed to predict water surface impacts of the various dam modification alternatives.

To create the HEC-RAS model, data such as ground cover, ground elevations and structure configurations were collected from the field and entered into the model. Additionally, water surface elevations collected throughout modeled stream reach and flow measurements were estimated from stream gage records to calibrate the computer model.

Model Configuration

The HEC-RAS model starts at the downstream side of the Danville Sanitary District Bridge (Station -12706) and extends 2.2 miles upstream of the Danville Dam (Station 12639) on the Vermilion River and 2.5 miles upstream on the North Fork from the confluence (Station 13160). Figure 5 shows the locations of the cross-sections used to model the river system. The HEC-RAS model contains 103 surveyed cross-sections over approximately 7.3 miles of river and contains 8 bridges and 1 culvert. The base model has 11 profiles corresponding to the various flow rates listed in Table 1. Existing condition water surface profiles for the noted channel reaches modeled, are illustrated in Figure 6 and Figure 7. The Vermilion River Dam is located at Main Channel Distance 14000 in Figure 6 and the Ellsworth Park Dam is located at Main Channel Distance 2800 in Figure 7. The mixed flow model boundary conditions used the Danville Sanitary District gage rating curve for the downstream starting water surface elevations and a normal depth slope of 0.0008 ft/ft for the upstream starting water surface elevations. The Danville and Ellsworth Park dams were modeled as inline structures with weir coefficients of 3.1 and 2.6 respectively. The manning's n-values utilized in the model were 0.065 for overbank to reflect the light to medium bush and trees and 0.03 to 0.08 for the channel values. See Appendix B for further existing and proposed hydraulic modeling information.

Field Measurements

Field measurements of the river's water surface elevations and flow were taken at various times and locations during the study to determine the hydraulic model's accuracy. The accuracy of the field measurement collection process determined the minimum accuracy limits of the model. Field measurement errors that can be accounted for include method of collection, instruments accuracy, time to obtain the data and determining location of the data. For water surfaces elevations, often two shots were taken at a single location, one on each side of the channel. From this data set it was determined that the maximum observed water surface difference was 0.1 feet. The maximum difference in these two shots reflects the accuracy of the water surface elevations collected.

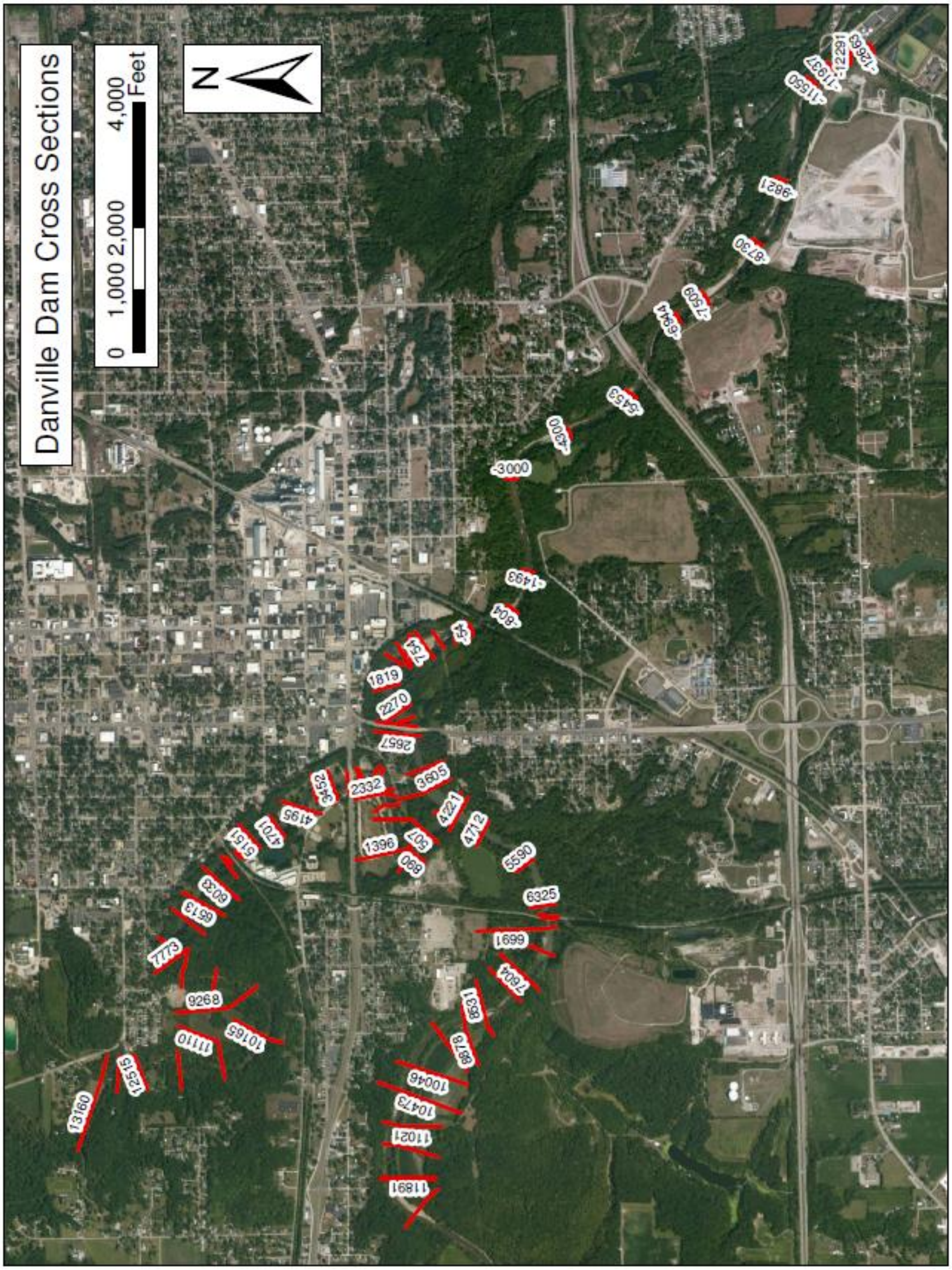

Figure 5: Cross Section Map

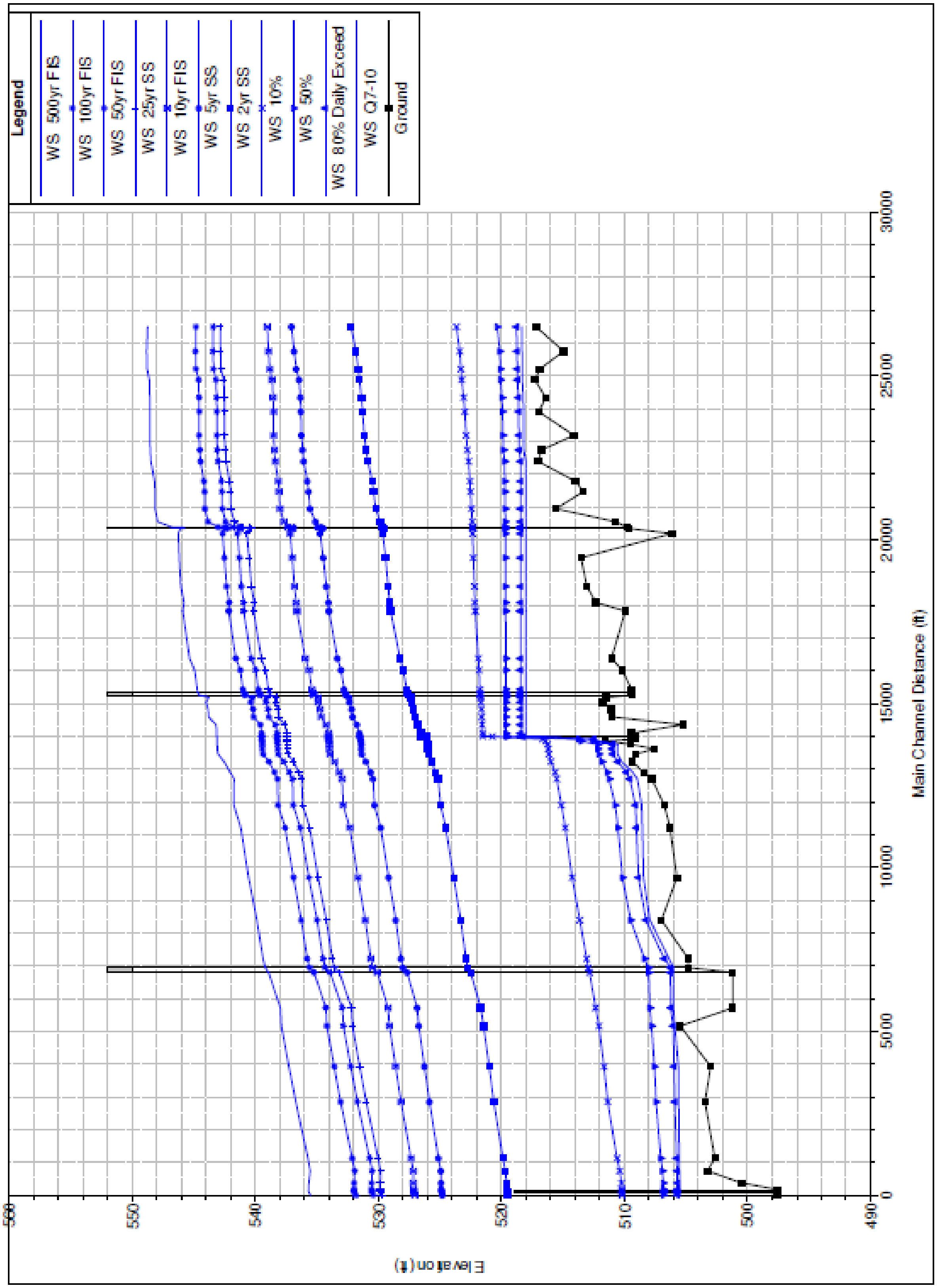

Figure 6: Vermilion River Water Profiles

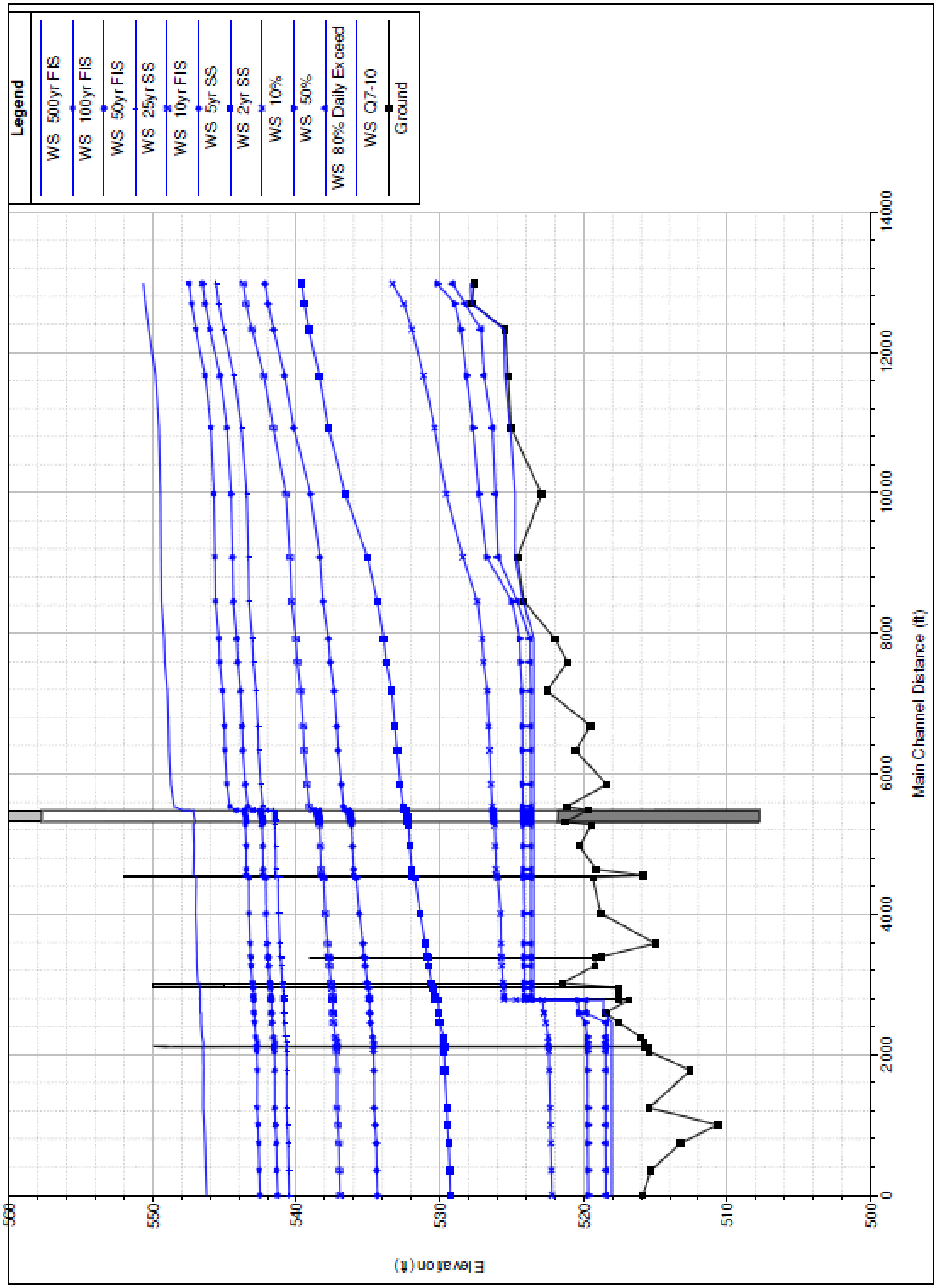

Figure 7: North Fork Water Profiles

The discharge measurements were obtained from the USGS gage at the time of water surface collection. The USGS performs calibrations and assigns an accuracy rating on individual gages. The Danville gage was given a rating of "fair" which means 95% of the recorded values are +/- 15% of the actual value. Additional error in discharge comes from a change in discharges up to 20% over the time that water surfaces were being measured, resulting in a possible +/- 10% timing error in the discharge measurement. The total discharge accuracy from the discharge for that time period would be 10% timing error plus the 15% potential gage recording error which would result in a change of +/-25% of the discharge. Therefore, the maximum observed error would be the water surface change at an observed location during a +/- 25% discharge change with an additional +/-0.1 foot for the water surface measurement accuracy. The upper and lower water surface limits in feet due to the field measurements discharge error are shown in Table 2. Tolerances were within +0.34, -0.33 feet with an average of +/-0.21 feet for flow ranges of 0.01-104 cfs on the North Fork and 61-1146 cfs on the Vermilion River.

Table 2: Field Measurement Tolerances

River	Station	Date	Flow (cfs)	Upper Tolerance (ft)	Lower Tolerance (ft)
North Fork	4585	6/19/2012	104	0.21	-0.27
North Fork	3561	6/29/2012	0.01	0.10	-0.10
North Fork	3207	6/19/2012	104	0.11	-0.11
North Fork	3207	6/29/2012	0.01	0.10	-0.10
North Fork	2825	6/19/2012	104	0.13	-0.11
North Fork	2825	6/29/2012	0.01	0.10	-0.10
North Fork	2475	6/19/2012	104	0.20	-0.25
North Fork	1396	6/19/2012	104	0.21	-0.27
North Fork	1396	6/29/2012	0.01	0.21	-0.21
Vermilion	2417	6/19/2012	319	0.21	-0.26
Vermilion	1327	3/1/2010	1157	0.34	-0.33
Vermilion	1327	6/29/2012	61	0.21	-0.20
Vermilion	1327	7/31/2012	32	0.28	-0.28
Vermilion	1146	6/19/2012	319	0.28	-0.29
Vermilion	1146	6/29/2012	61	0.17	-0.17
Vermilion	1146	7/31/2012	32	0.18	-0.21
Vermilion	525	6/19/2012	319	0.30	-0.30
Vermilion	525	6/29/2012	61	0.18	-0.18
Vermilion	-255	6/19/2012	319	0.32	-0.33
Vermilion	-255	6/29/2012	61	0.24	-0.25

Model Sensitivity Analysis

A model sensitivity analysis is used to determine the model precision, or the range of results that would occur given repeated measurement for identical conditions by adjusting a single parameter. The parameter considered in the analysis were Manning's 'n', Contraction & Expansion Coefficients and Weir Coefficients with variations of +/- 20%, 50% and 20% respectively. Parameters excluded from the analysis include surveyed elevations, channel bank location, culvert slopes, culvert loss coefficients, culvert length, culvert blocked area, bridge pier width, bridge modeling approach and various other computational methods and calculation tolerances. These excluded parameters often have minimal impacts to the results with the exception of a blocked culvert area. Blocked culvert area values can vary greatly during flood flows due to debris buildup on bridges and culverts and is a subjective parameter to estimate. Table 3 shows the maximum impact to the water surface in feet when each parameter was adjusted, giving guidance to what parameters to adjust to calibrate the model and which parameters have little effect. Manning's 'n' channel roughness values created the largest impact to the water surface while the weir coefficients had the most impact upstream of the dams during the lower flow events.

Table 3: Sensitivity Analysis Summary - Change in Water Surface Elevations in Feet

		Q7-10	80%	50%	10%	2yr	5yr	10yr	25yr	50yr	100yr	500yr
Mannings -20%	Average	-0.02	-0.03	-0.09	-0.30	-0.90	-1.24	-1.35	-1.49	-1.50	-1.51	-1.58
	Average Dev	0.03	0.04	0.09	0.17	0.27	0.25	0.25	0.25	0.25	0.24	0.25
	Min	-0.15	-0.20	-0.44	-0.77	-1.89	-1.63	-1.71	-1.91	-1.91	-1.94	-1.99
	Max	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mannings +20%	Average	0.02	0.04	0.09	0.30	1.00	1.17	1.30	1.43	1.45	1.47	1.56
	Average Dev	0.02	0.04	0.08	0.15	0.21	0.22	0.23	0.22	0.22	0.22	0.24
	Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Max	0.13	0.17	0.29	0.68	1.52	1.51	1.61	1.78	1.79	1.81	1.90
Expansion & Contraction Coefficients - 50%	Average	0.00	0.00	0.00	-0.02	-0.12	-0.21	-0.28	-0.40	-0.42	-0.46	-0.59
	Average Dev	0.00	0.00	0.01	0.01	0.05	0.07	0.09	0.13	0.13	0.15	0.20
	Min	-0.02	-0.05	-0.07	-0.05	-0.25	-0.42	-0.49	-0.75	-0.75	-0.85	-1.09
	Max	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Expansion & Contraction Coefficients +50%	Average	0.00	0.00	0.00	0.02	0.11	0.21	0.27	0.38	0.40	0.44	0.56
	Average Dev	0.00	0.00	0.01	0.01	0.04	0.07	0.08	0.12	0.12	0.14	0.19
	Min	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Max	0.02	0.02	0.06	0.06	0.24	0.41	0.48	0.70	0.69	0.79	1.00
Weir Coefficients - 20%	Average	-0.01	-0.03	-0.06	-0.13	-0.11	-0.03	0.00	0.00	0.00	0.00	0.00
	Average Dev	0.01	0.02	0.04	0.09	0.07	0.02	0.00	0.00	0.00	0.00	0.00
	Min	-0.03	-0.10	-0.11	-0.30	-0.34	-0.06	0.00	0.00	0.00	0.00	0.00
	Max	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weir Coefficients +20%	Average	0.01	0.04	0.07	0.20	0.29	0.14	0.10	0.00	0.00	0.00	0.01
	Average Dev	0.01	0.04	0.05	0.13	0.19	0.09	0.06	0.01	0.01	0.01	0.01
	Min	0.00	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Max	0.04	0.11	0.14	0.44	0.86	0.38	0.24	0.02	0.02	0.02	0.02

Model Calibration Analysis

A model calibration analysis determines the model accuracy or range from modeled result to the field measured value. The field measurement values are compared to the model scenario to determine the magnitude of variation between the two using the "mean absolute error" and the "root mean square" statistical measures.

The calibration of the model was completed by adjusting the Manning's 'n' value (0.03-0.12) and the dam weir coefficients (2.6-3.1) until differences between the model and the observed values were minimized. As a result, the mean absolute error and the root mean square values were 0.07 feet and 0.14 feet respectively. Both of these values are below the field measured average tolerance of 0.21 feet. As a dam modification project, the model was calibrated to low flows which will show larger profile variations than large flow events. Table 4 is a summary of the calibration results showing the modeled value versus the observed value. The model accuracy is determined from the maximum of the calibration difference or the field measure accuracy. Therefore the model is accurate to the maximum +/-0.34 feet determined from the field measurement accuracy.

Table 4: Calibration Summary

River	Station (ft)	Flow (cfs)	Observed (ft)	Modeled (ft)	Difference (ft)
North Fork	4585	104	524.07	524.05	-0.02
North Fork	3561	0.01	523.46	523.45	-0.01
North Fork	3207	104	524.09	524.02	-0.07
North Fork	3207	0.01	523.50	523.45	-0.05
North Fork	2825	104	520.22	520.20	-0.02
North Fork	2825	0.01	518.46	518.49	0.03
North Fork	2475	104	519.54	519.59	0.05
North Fork	1396	104	519.49	519.51	0.02
North Fork	1396	0.01	518.29	518.21	-0.08
Vermilion River	2417	319	519.43	519.46	0.03
Vermilion River	1327	1157	520.65	520.66	0.01
Vermilion River	1327	61	518.21	518.20	-0.01
Vermilion River	1327	32	517.87	517.87	0.00
Vermilion River	1146	319	513.47	513.41	-0.06
Vermilion River	1146	61	512.42	512.38	-0.04
Vermilion River	1146	32	512.20	512.20	0.00
Vermilion River	-255	319	510.46	510.72	0.26
Vermilion River	-255	61	509.22	509.09	-0.13

RIVER CHANNEL MATERIAL SAMPLING

The USGS, Illinois Water Science Center completed extensive river channel material sampling in 2011 to estimate river impacts resulting from potential dam modifications. This sampling revealed that the river bed material upstream of both dams is nearly all sand and gravel material. The sampling also determined that only a minimal amount of fine grained sediment, due to channel bank failure occurring in a localized area, is stored upstream of the Danville Dam. The bed material gradation is typically a sand to gravel mix with little to no fines. Three separate bed load measurements completed in the spring of 2011 indicate that the bedload is generally 3 percent or less of the suspended sediment load.

A total of 21 particle size, 32 sediment quality and 11 water supernatant samples were collected and analyzed. Figure 8 shows the locations of the samples collected. A chemical analysis was completed by Test America Laboratories, Inc. on the samples and was compared to Illinois Environmental Protection Agency Soil Remediation Objectives (SROs) outlined in the Tiered Approach to Corrective Action (TACO) Tier 1 standards. Results of this analysis and additional information about the material sampling are included in Appendix A. These results indicate that almost all of the constituents identified in the samples were at concentrations below the noted Tier 1 standards. Only one sampled site, located on the east bank of the Middle Fork, between the US 150 bridge and the Ellsworth Park Dam exceeded the TACO Tier 1 limits for pyro-benzene.

SEDIMENT MODELING

Sediment transport modeling was completed on the Vermilion River and the North Fork Vermilion River utilizing the sediment transport capabilities in the Hydrologic Engineering Center's HEC-RAS model, created by the U.S. Army Corps of Engineers. Particle size gradations were determined from a subset of the material samples collected in the field by the USGS, Illinois Water Science Center. These gradations were entered into the hydraulic model to perform the sediment transportation calculations. The boundary conditions for sediment concentrations were assumed to be in equilibrium for the most upstream cross sections. Three historic floods, January 3-20, 2008; March 9-19, 1990; and April 8-23, 1994, were modeled due to their close correlation to the 2-yr, 10-yr, and 100-yr events respectively. The sediment model was verified using a sediment monitoring gage operated at the Danville Sanitary District, and field measured suspended sediment concentration and bed load sampling.

The sediment modeling showed an increase in sediment loads from the existing conditions to the full removal alternative at the downstream extent of the model by 22%, 8.5% and 14% for 2-yr, 10-yr and 100-yr hydrographs respectively. Channel bed elevation changes were less than 1 foot in magnitude based on the current channel geometry. The actual sediment load increases would likely be less as a smaller event would cause some channel geometry change over time prior to a large event occurring. This sediment load would decrease over time as the river system continues to stabilize itself. More information on the sediment transport modeling can be found in Appendix A. Table 5 shows a summary of the tons of sediment transported for the existing and full removal conditions for the 2, 10 and 100-year events.

Table 5: Sediment Load Summary

Scenario	2-yr flood	10-yr flood	100-yr flood
Existing Conditions (in tons)	142,000	198,000	369,000
Full Removal Condition (in tons)	174,000	215,000	422,000
% Increase in Sediment Load	22%	8.5%	14%

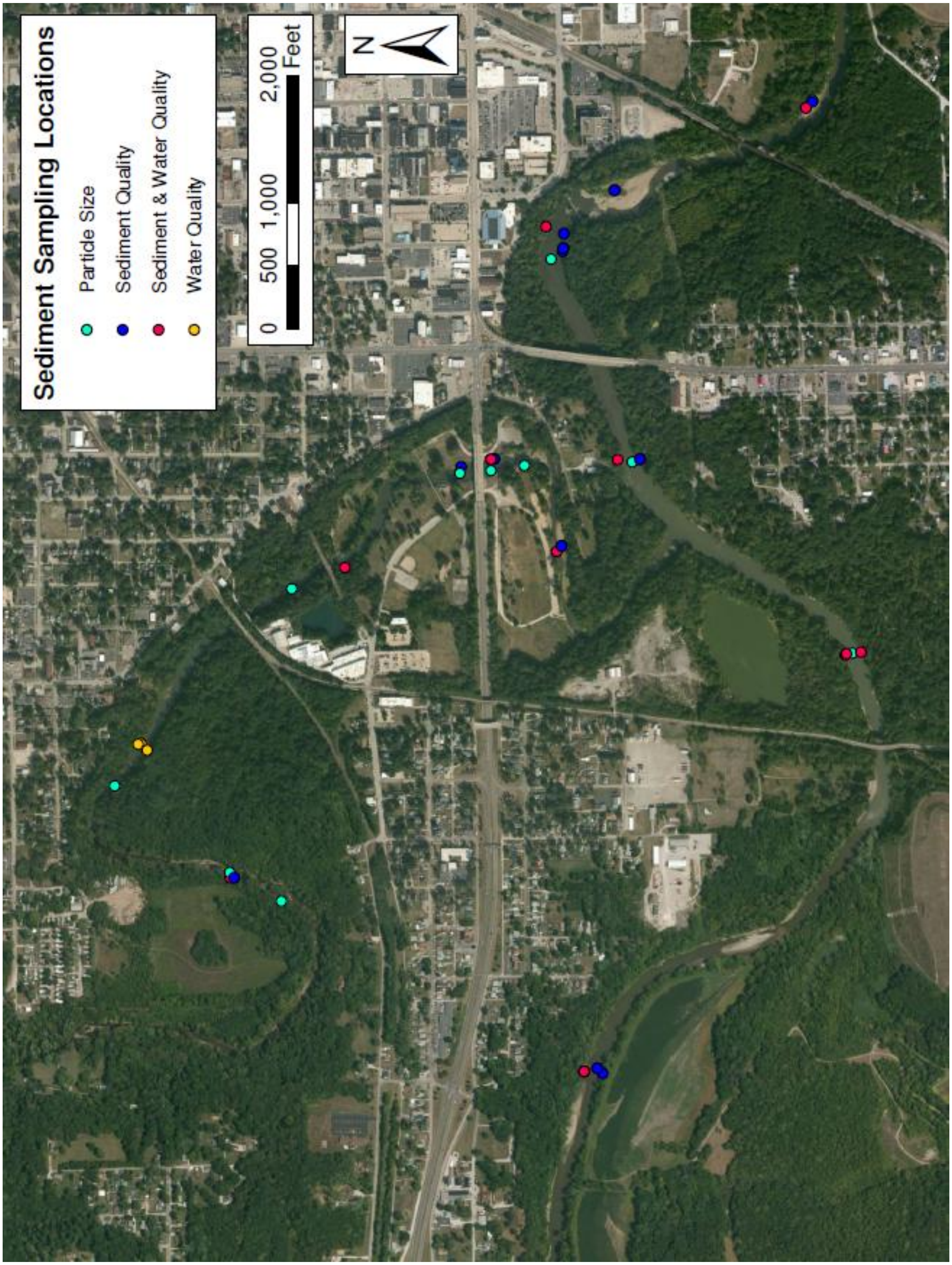

Figure 8: Sediment Sampling Location Map

IDENTIFYING ALTERNATIVES

Each dam modification alternative developed and evaluated addressed:

1. Public safety.
2. Ecological improvement to the river for fish passage and aquatic habitat.
3. Recreational opportunities including safe non-motorized boat passage.

Public Safety

The primary purpose for modifying the Danville Dam and Ellsworth Park Dam Modifications is to reduce or eliminate the public safety concerns related to the submerged hydraulic roller that forms at both dams under various flow conditions. All alternatives examined, except the “Dam Repair” alternative, address this concern and eliminates the potential loss of life from the roller for all flow conditions.

Ecological Integrity

To improve the ecological integrity of the dam sites and the river system connectivity, fish passage considerations were incorporated into each alternative. When possible, passages were designed to pass local fish species without inducing stress and/or discouraging migration, such as velocity barriers, turbulence barriers and the necessity to climb, jump and/or pass through hidden orifices.

Recreation

In developing alternatives, consideration was given to improve recreational activities by providing safe non-motorized boat passage, more fishing opportunities and greater accessibility to natural areas. Improvements to fish habitat upstream of each dam would be considered in further development of a selected alternative and are beyond the scope of this report.

It is IDNR policy to evaluate dam removal as an alternative anytime dam rehabilitation or reconstruction is considered. The City of Danville and U.S. Fish and Wildlife Service also requested that dam removal be investigated. For all alternatives that leave the Danville Dam in place, rehabilitation would be necessary to stabilize both abutments and prevent a channel from forming around the west side of the dam due to active erosion that is currently occurring at the dam site. For all removal alternatives, any remnants of the Old Gilbert Street bridge under the current bridge location would be removed either prior to or as part of a proposed removal project.

Study Alternatives

Five alternatives were developed for the Danville Dam and the Ellsworth Park Dam. Four of the alternatives include both dams being modified, although it may be an option to modify one of the dams alone. The five alternatives are:

1. Full Removal 2. Partial Removal 3. Stepped Spillway

4. Rock Ramp 5. Dam Repair

Alternative 1 – Full Dam Removal

This alternative includes the full dam removal of the Danville Dam and Ellsworth Park Dam, including the dam's west abutment, the west bank, center abandoned piers and debris pile immediately upstream of the Danville Dam. The full removal alternative deliberately excludes the removal of the Danville Dam's east abutment. Removal of this abutment would likely lead to further destabilization of the east bank at the location of the east abutment removal. Measures to adequately stabilize the severely eroding steep slope in the vicinity of the dam's east abutment requires a geotechnical soils and slope stability analysis beyond the scope of this study. Such a study would be conducted if this alternative is selected for further design and implementation. Due to the scoured out area downstream of the dams, grading downstream of each dam would be required to transition from the natural channel shape currently existing upstream of each dam. Figure 9 and Figure **10** show a cross section view while Figure 11 and Figure 12 show an aerial view of the Danville Dam and Ellsworth Park Dam layouts for this alternative.

This alternative decreases the water surface elevation upstream of the Danville and Ellsworth Park Dam by 5.9 and 3.8 feet during the 80% daily flow. The depth of water upstream of the Danville Dam is reduced by 51% during the 80% daily flow as shown in the inundation exhibits in Appendix C. The greatest impact to water velocity occurs as the velocity changes from 0.2 fps to 3.9 fps on the North Fork near the confluence of Vermilion River and on the North Fork (cross section 153) during an 80% exceedence event. The 80% exceedence event is used as a standard summer flow that typically results in the largest impact for dam removal scenarios.

The estimated total cost of this alternative is $1,739,800 based on Danville Dam removal costs of $1,464,300 and Ellsworth Dam removal costs of $275,500. The total construction cost for both dams is estimated at $1,364,600 with estimated design cost of $375,200. The additional construction costs to stabilize the bank need to be determined following a geotechnical investigation. See Appendix D for a detailed cost estimate for this alternative.

Pro's

- Restores public safety at the dam
- Restores fish passage & aquatic ecosytem
- Allows for boating opportunities below the Danville dam
- Minimal impact to the river during construction

Con's

- Reduces the use of Ellsworth Park boat ramp
- Reduces motorized boating above the dam

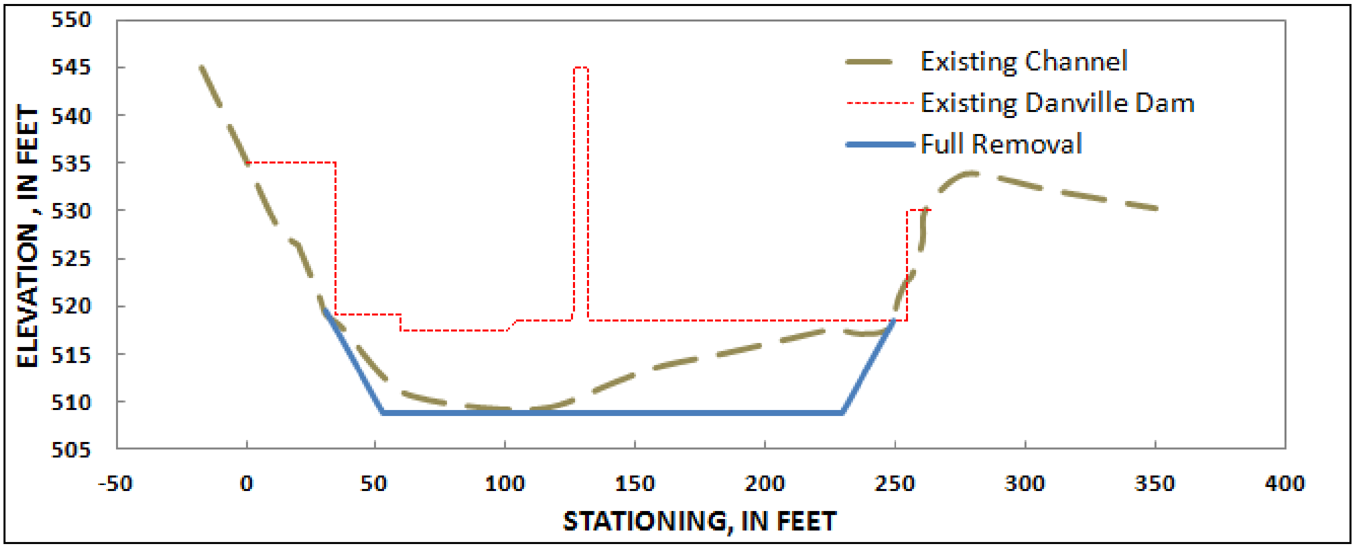

Figure 9: Danville Dam Full Removal Cross Section

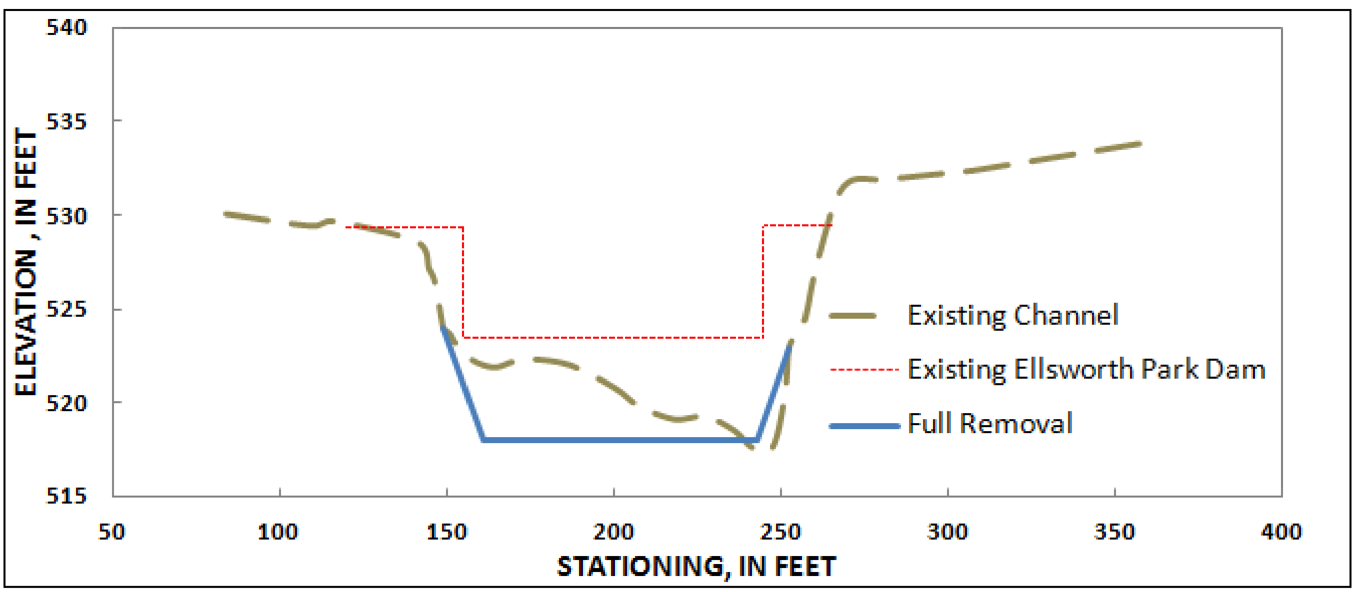

Figure 10**: Ellsworth Park Dam Full Removal Cross Section**

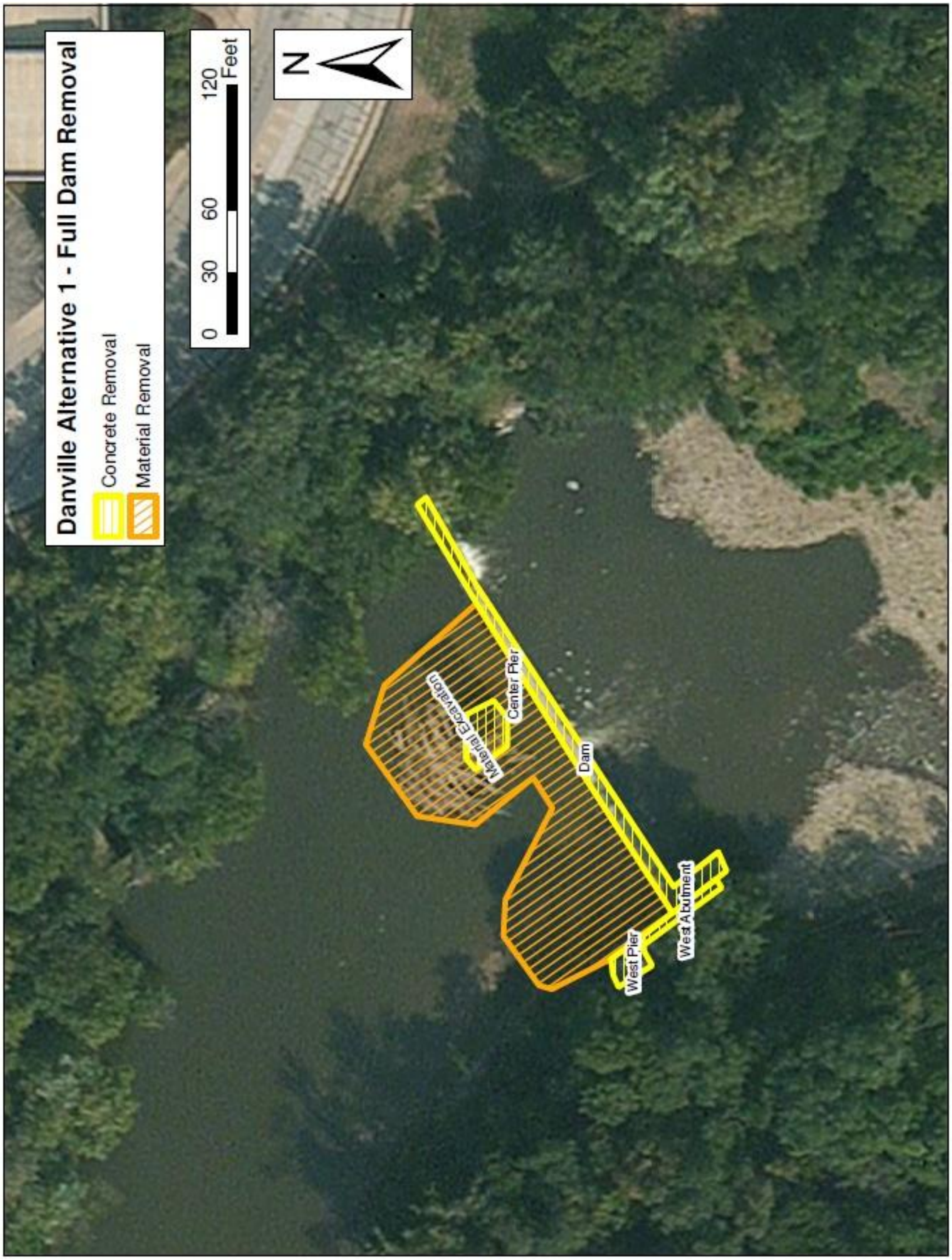

Figure 11: Danville Dam Full Dam Removal Overview

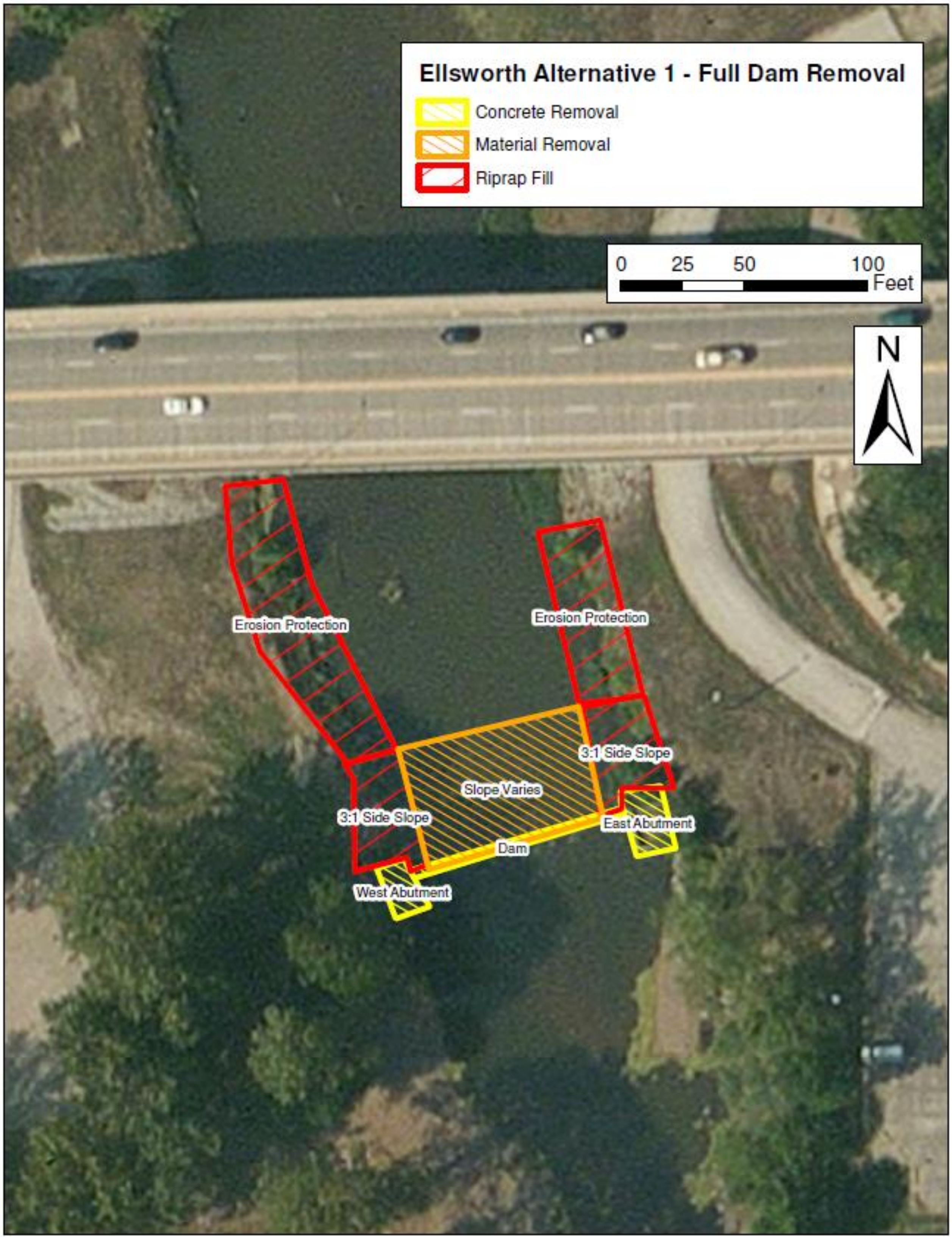

Figure 12: Ellsworth Park Dam Full Removal Overview

Alternative 2 – Partial Dam Removal

This alternative involves notching the Danville and Ellsworth Park Dams. Partial removal of the Danville Dam would include removing a 120-foot wide bottom trapezoidal notch in the dam at the spillway apron elevation of 509 ft. This notching includes a 5:1 west side slope and a 3:1 east side slope. Portions of the dam will remain to serve as a channel jetty for west bank stability and to help provide east bank stabilization. The upstream center and western abandoned piers and debris will be removed to the spillway apron elevation. Ellsworth Park Dam will have a 35-foot wide top trapezoidal cut to an elevation of 517 feet, with 1:1 side slopes. A portion of each dam will remain to stabilize the bed material upstream of the dam. Due to the scoured area downstream of the dams, grading downstream is required to transition from the natural channel shape currently existing upstream. Figure 13 and Figure 14 show a cross section view while Figure 15 and Figure 16 show an aerial view of the Danville Dam and Ellsworth Park Dam layouts for this alternative.

This alternative decreases the water surface elevations upstream of the Danville and Ellsworth Park Dam by 5.9 and 0.5 feet during the 80% daily flow. The depth of water upstream of the Danville Dam is reduced by 51% during the 80% daily flow as shown in the inundation exhibits in C. The greatest impact to water velocity occurs as the velocity changes from 0.2 fps to 3.87 fps near the confluence (Cross Section 153) of the North Fork during an 80% exceedence flow event.

The estimated total cost of this alternative is $2,030,900 based on Danville Dam costs of $1,832,000 and Ellsworth Park Dam costs of $198,900. The construction cost total for both dams is estimated at $1,592,800 with estimated design costs of $438,100. See Appendix D for a detailed cost estimate for this alternative.

Pro's

- Restores public safety at the dam
- Restores fish passage & aquatic ecosytem
- Allows for boating opportunities below the Danville Dam
- Minimal impact to the river during construction
- Lowest cost alternative

Con's

- Reduces the use of Ellsworth Park boat ramp
- Reduces motorized boating above the dam

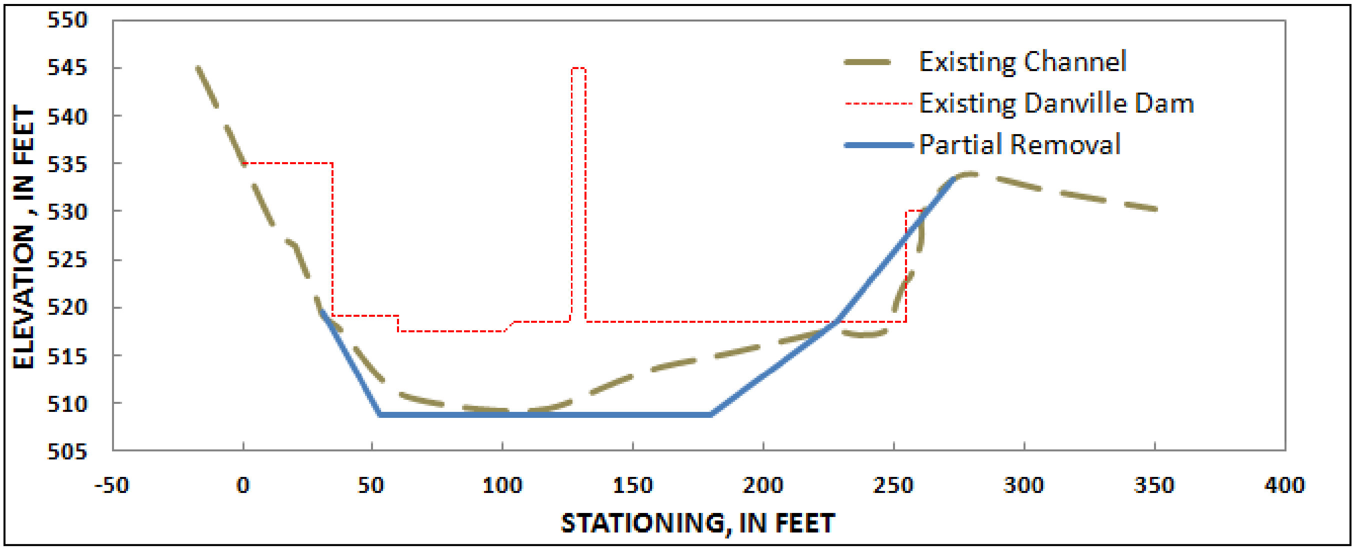

Figure 13: Danville Dam Partial Removal Cross Section

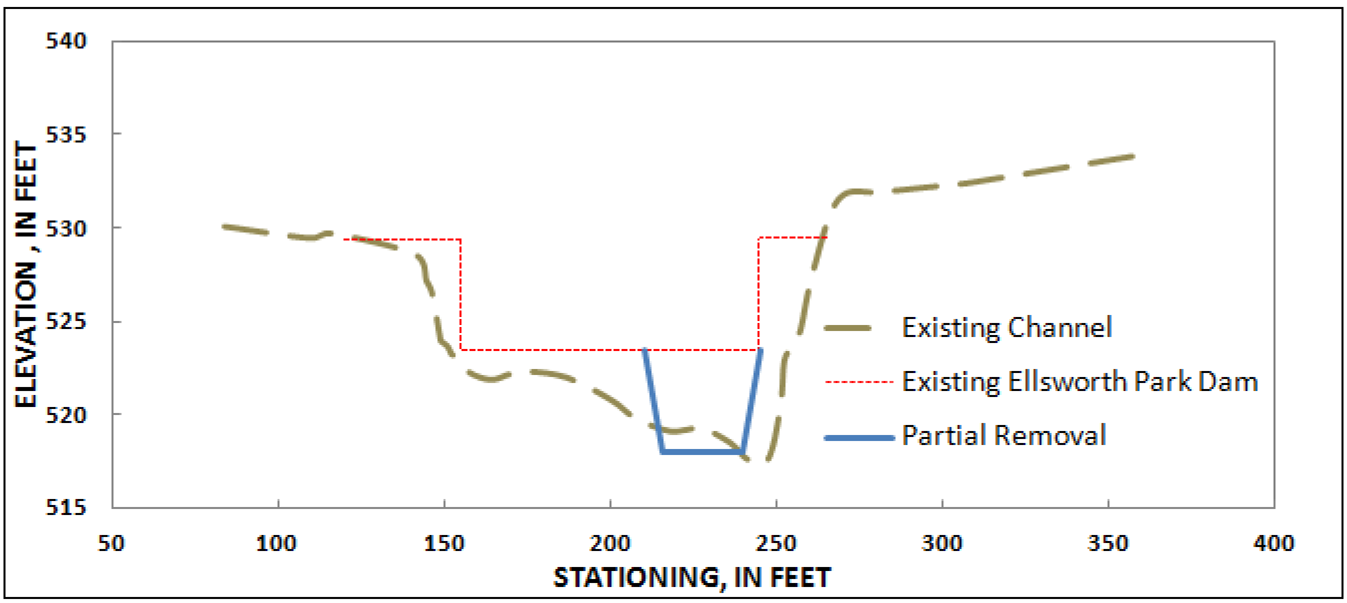

Figure 14: Ellsworth Park Dam Partial Removal Cross Section

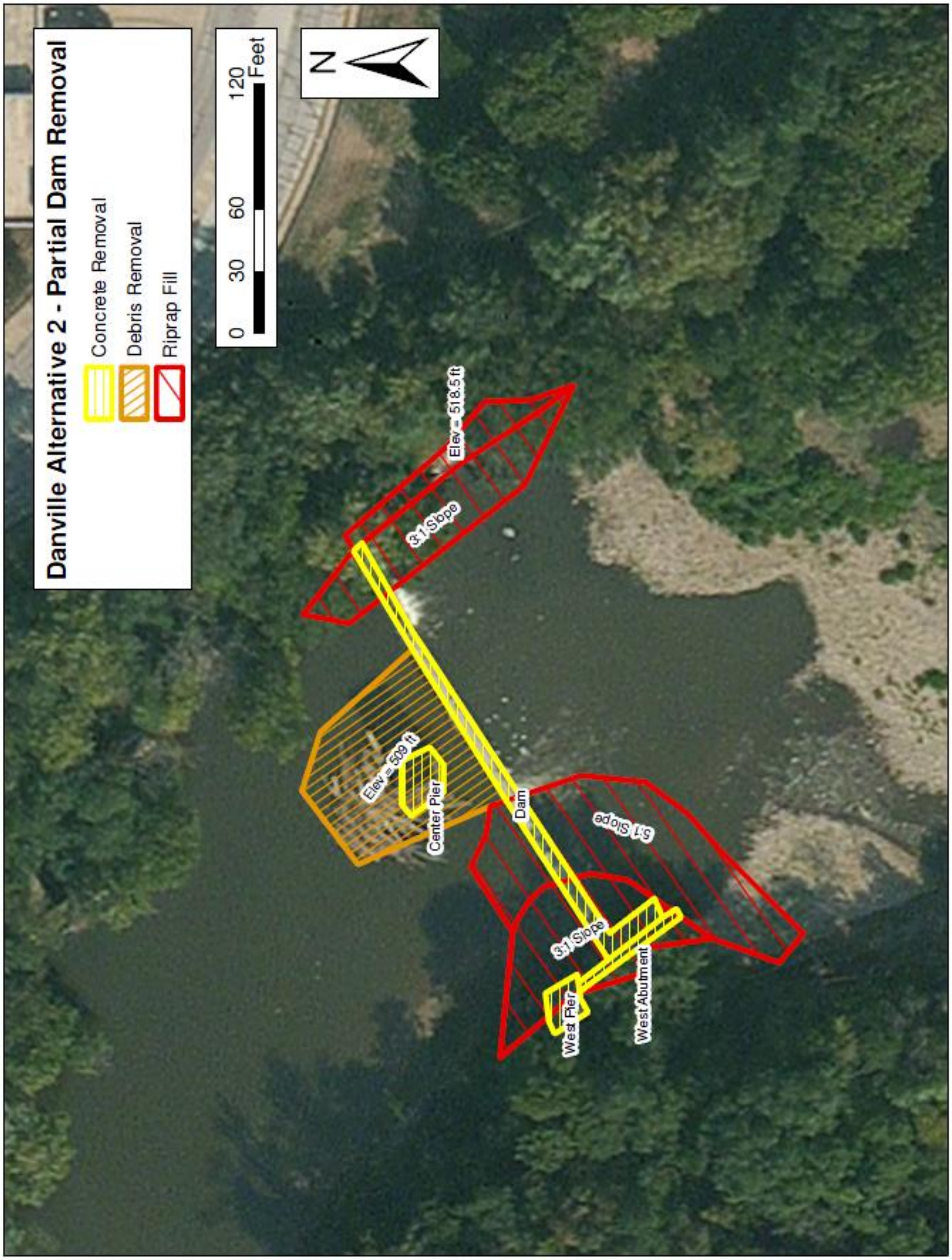

Figure 15: Danville Dam Partial Removal Overview

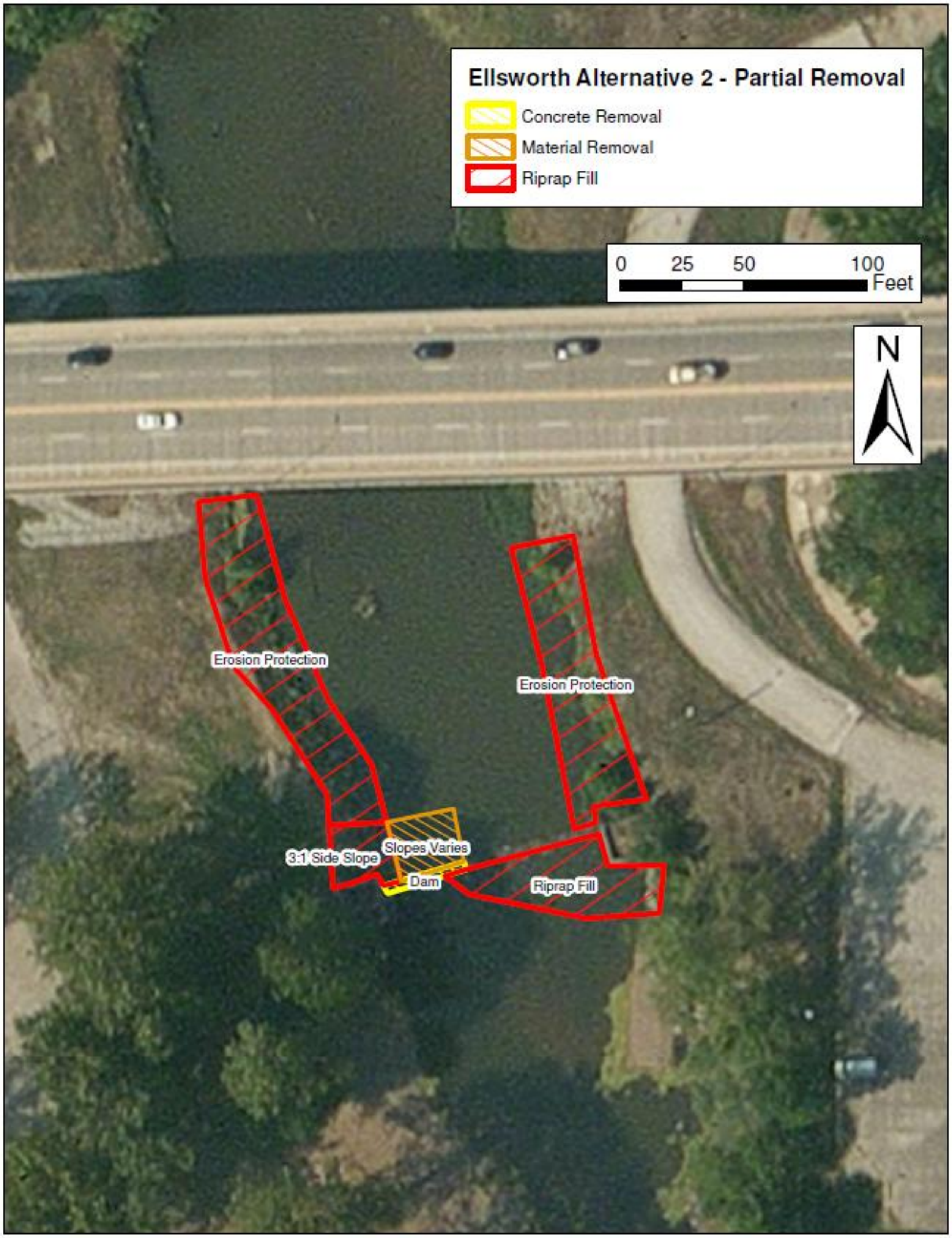

Figure 16: Ellsworth Park Dam Partial Removal Overview

Alternative 3 – Stepped Spillway

Similar to dam modifications recently completed on the Glen D. Palmer Dam spillway on the Fox River in Yorkville, Illinois, this alternative places concrete steps on the downstream face of each dam as shown on Figure 17 to 21. All steps have a 1.125 foot vertical change with a 5.625 foot horizontal change. The Danville dam crest will be lowered 1 foot to elevation 518.3 with 6 steps that drop to an elevation of 512.7 and extend downstream 28 feet with grouted riprap placed at an elevation of 511.5. The west and center abandoned pier will be removed near the Danville Dam. The Ellsworth Park Dam top step will be 1.6 feet below the 523.4 foot dam crest elevation and will drop to an elevation of 519.6 extending downstream 17 feet with grouted riprap at an elevation of 518.5. A Denil fish ladder will be constructed around the west abutment of the Danville Dam and around the east abutment of the Ellsworth Park Dam. Figure 18 and Figure 19 shows a profile view of the Danville and Ellsworth Park Dams. Similar to this alternative, Figure 17 shows the Yorkville step spillway with the Denil fish ladder shown in the foreground of the photo. A canoe portage pathway will be constructed west of each dam. Additional rehabilitation measures will be implemented to stabilize the east and west abutments of the Danville Dam.

This alternative slightly decreases the water surface elevation upstream of the Danville and Ellsworth Park Dams by 0.7 and 1.3 feet during the 80% daily flow. The impacts to water velocity are minimal except immediately below both spillway steps. Two acres of trees are required to be cleared to allow adequate flow conveyance just north and west of the Danville Dam to meet state regulatory standards. Additionally, 60 acres of flood easements are required upstream of the Ellsworth Park Dam to mitigate water surface increases upstream of the dam generated by construction of the steps.

The estimated total cost of this alternative is $4,768,700 based on Danville Dam modification costs of $3,725,600 and Ellsworth Dam modification costs of $1,043,100. The total construction cost for both dams is estimate at $3,551,900, with estimated design costs of $976,800 and land rights costs of $240,000. See Appendix D for a detailed cost estimate for this alternative.

Pro's

- Improves public safety at the dam
- Improves fish passage
- Maintains pools

Con's

- Most expensive alternative
- Requires portage around dams
- Reduces ability of motorized boating above the dams during low flows
- Extensive maintenance of Denil fish ladder
- Requires 60 acres of flood easements upstream of Ellsworth Park
- Requires 2 acres of tree clearing upstream of Danville Dam
- Perpetuates low dissolved oxygen levels in the pools above the dams

Figure 17: Yorkville Stepped Spillway and Denil Fish Ladder Photograph

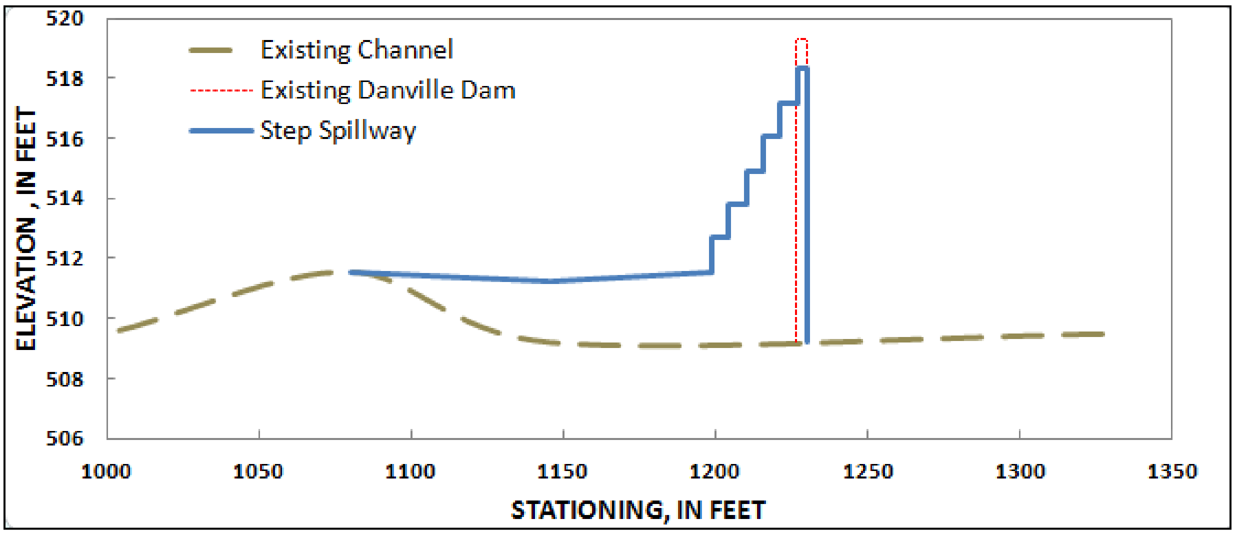

Figure 18: Danville Dam Stepped Spillway Profile

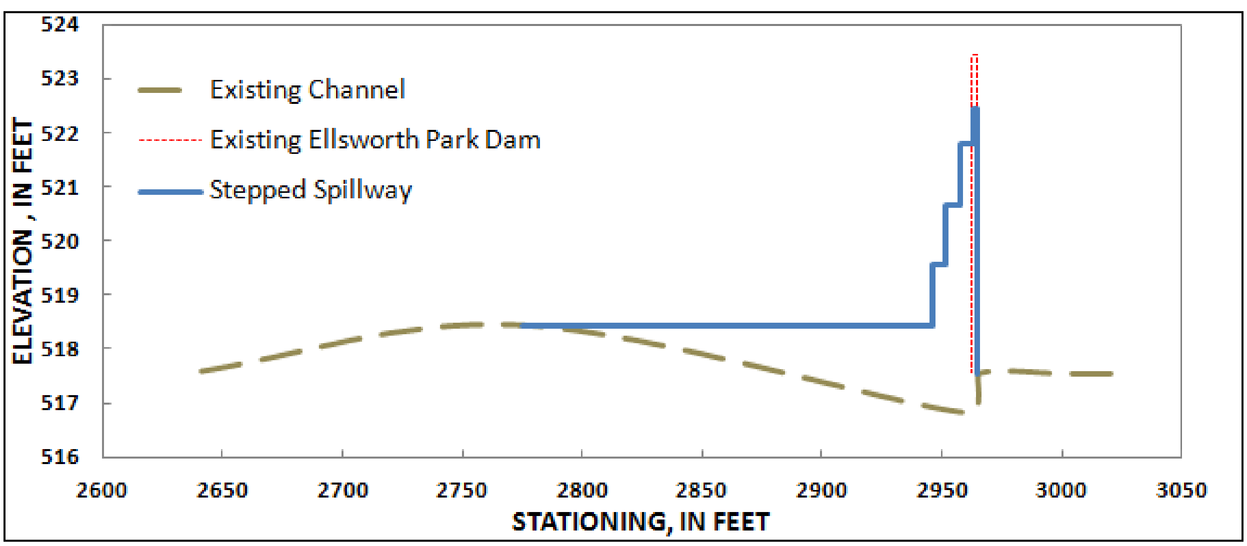

Figure 19: Ellsworth Park Dam Stepped Spillway Profile

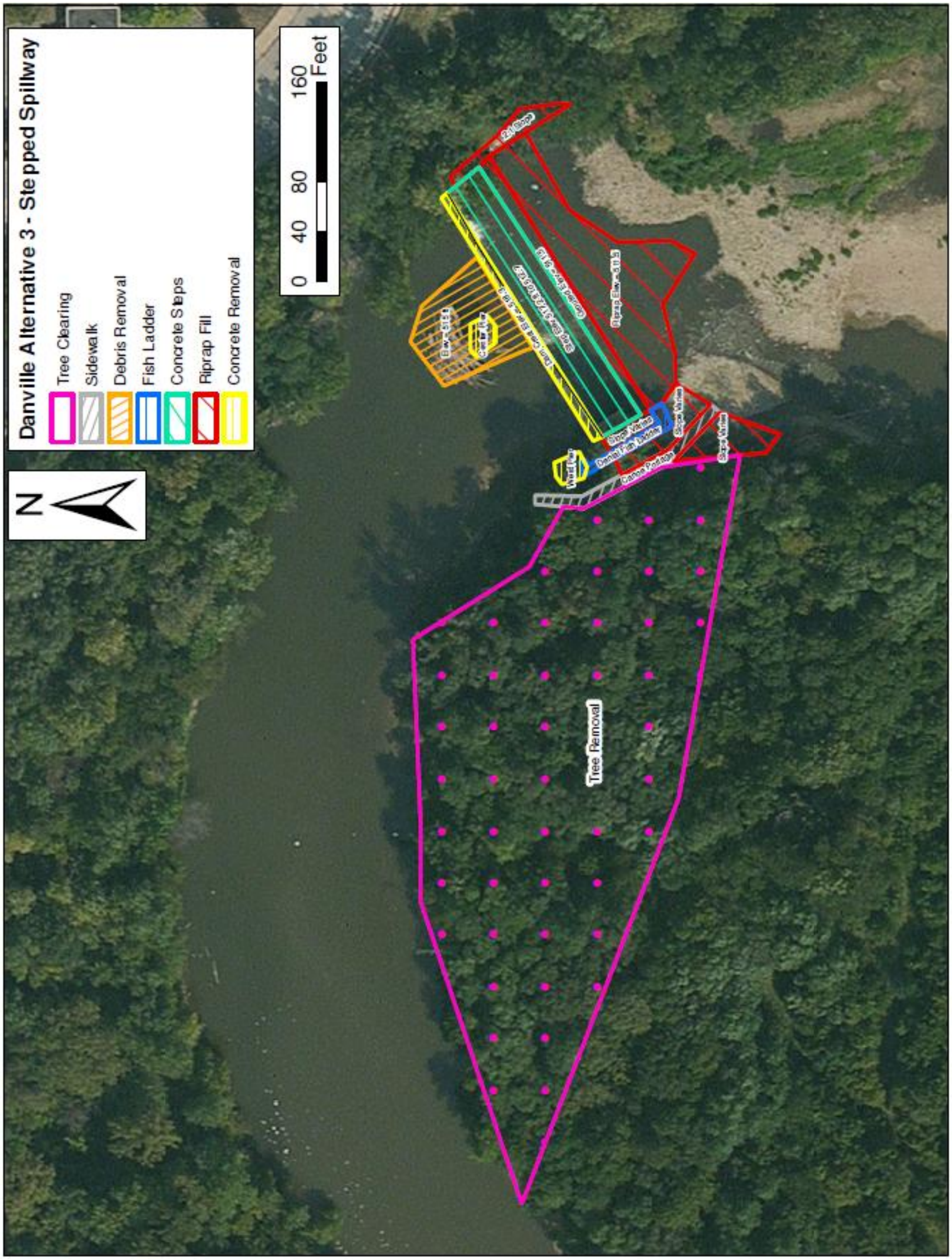

Figure 20: Danville Dam Stepped Spillway Overview

Figure 21: Ellsworth Park Dam Stepped Spillway Overview

Alternative 4 – Rock Ramp

This alternative consists of placing a rock ramp downstream of each dam. Figure 25 shows the extents of Danville rock ramp at 5% slope extending downstream 135 feet from dam. The dam crest will be lowered 1 foot to elevation 518.3. A 25' wide, 1' deep notch will be created at the center of the dam and ramp for improved fish passage. The center abandoned pier will be removed and a canoe portage pathway constructed around the west abutment and ramp. Additional rock fill rehabilitation measures are necessary to stabilize the east and west abutments of the Danville Dam. Figure 26 shows the extents of Ellsworth Park Dam rock ramp at a 4% sloped rock ramp extending downstream 125 feet to the existing channel bottom. The dam crest and ramp have an 8' wide, 1' deep notch at the center for improved fish passage. Both dams have a 3:1 riprap slope formed between the channel banks and the rock ramp. Figure 22 shows an existing rock ramp that is an example of a smaller scale rock ramp.

This alternative slightly decreases the water surface elevation upstream of the Ellsworth Park Dams by 0.1 feet and has no impacts to at the Danville Dam during the 80% daily flow. The greatest impact to water velocity occurs as the velocity changes from 1.2 fps to 1.9 fps at cross section 8531 of the North Fork during a 50% daily exceedence event. Two acres of trees are required to be cleared to allow adequate conveyance just northwest of the Danville Dam for the Danville modification to meet state regulatory standards. This clearing mitigates the increase in water surface due to the rock ramp construction. Additionally, 34 acres of flood easements are required upstream of the Ellsworth Park Dam for the Ellsworth Park Dam modification to mitigate water surface increases upstream of the dam caused by the rock ramp.

Figure 22: Example Rock Ramp Photograph

The estimated total cost of this alternative is $3,787,100 based on Danville Dam modification costs of $2,706,700 and Ellsworth Dam modification costs of $1,080,400. The total construction cost for both dams is estimated at $2,863,600, with estimated design costs of $787,500 and land rights costs of $136,000. See Appendix D for a detailed cost estimate for this alternative.

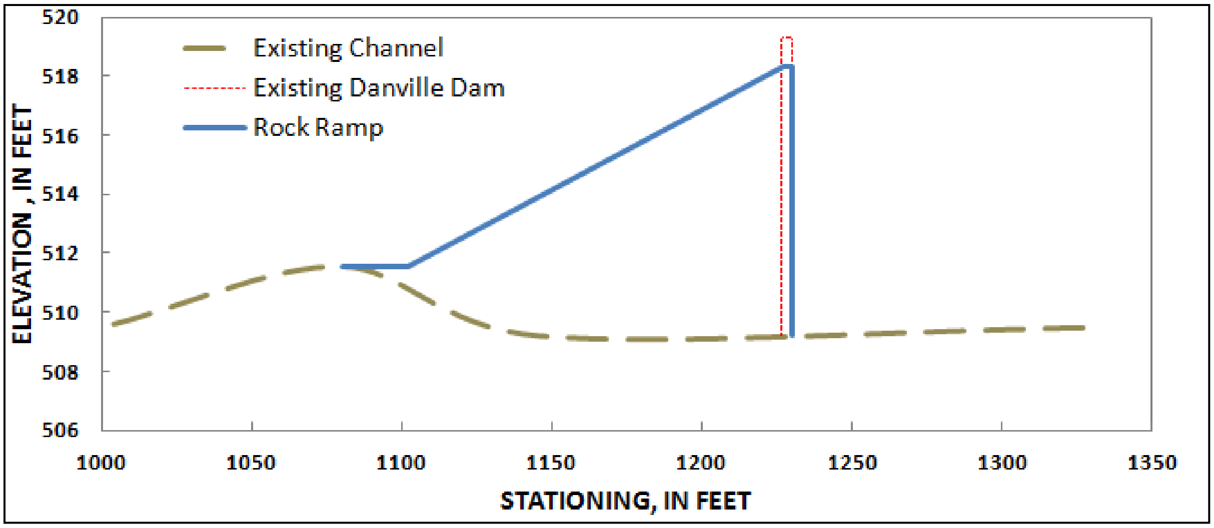

Figure 23: Danville Dam Rock Ramp Profile

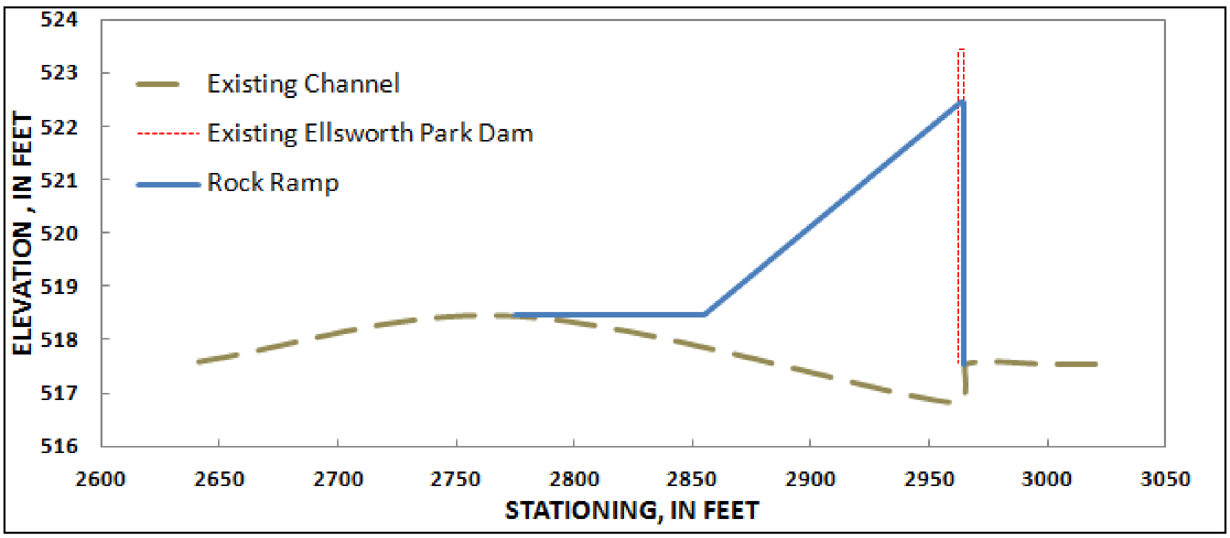

Figure 24: Ellsworth Park Dam Rock Ramp Profile

Pro's

- Improves public safety at the dam
- Improves fish passage
- Maintains pool

Con's

- Requires portage around dams
- Reduces ability of motorized boating above the dams during low flows
- Requires 34 acres of flood easements upstream of Ellsworth Park
- Requires 2 acres of tree clearing upstream of Danville Dam
- Perpetuates low dissolved oxygen levels in the pools above the dams

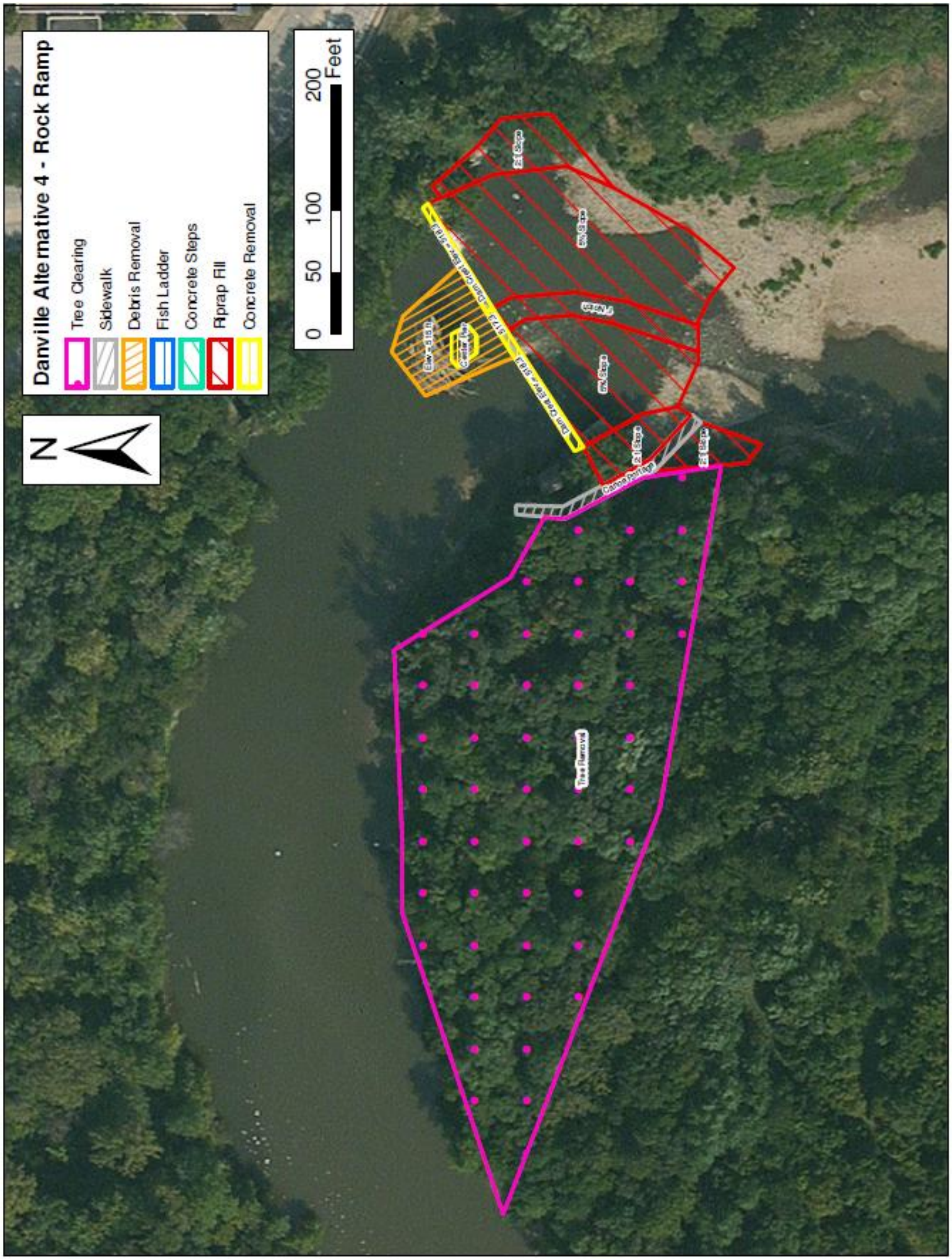

Figure 25: Danville Dam Rock Ramp Overview

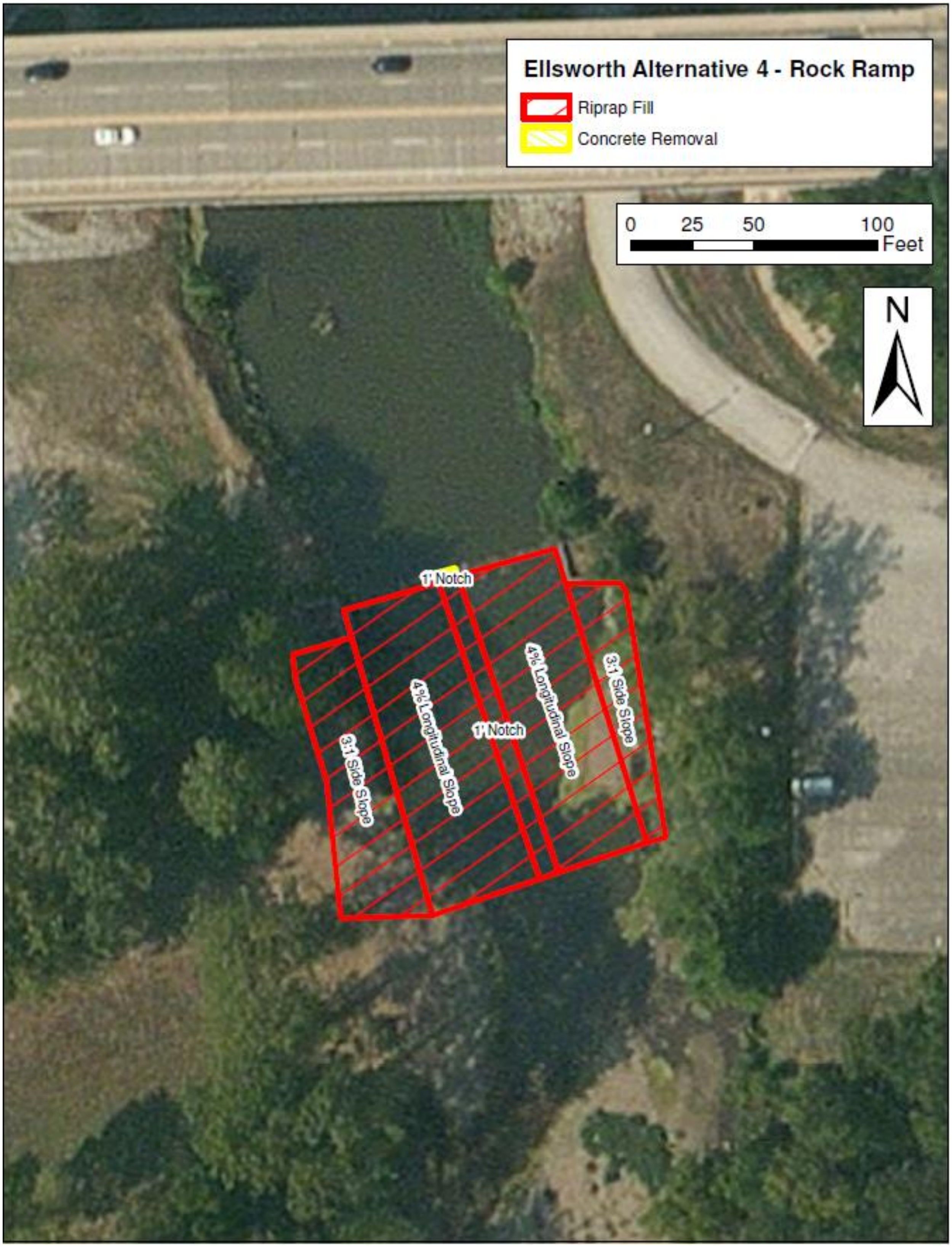

Figure 26: Ellsworth Park Dam Rock Ramp Overview

Alternative 5 – Dam Repair

This alternative includes stabilizing the banks downstream of the dam and repairing the abutments, dam face and eroded dam crest for the Danville Dam. The channel banks will be stabilized by placing riprap downstream of the dam face along the channel bank slope walls. The eroded crest will be repaired by placing new concrete where the concrete crest has eroded away. The dam face will be repaired by removing all deteriorating sections of the dam and replacing it with new concrete. The bridge piers and debris will not be removed. No repairs are needed at the Ellsworth Park Dam.

The repair increases water surfaces upstream of the Danville Dam by 1.15 feet when compared to the existing deterioration conditions during the 80% daily flow. The greatest impact to water velocity occurs as the velocity changes from 3.1 fps to 0.4 fps at Cross Section 2635 of the North Fork during an 80% daily exceedence event. This alternative would continue to perpetuate the ongoing public safety concerns and liabilities at both dams. The Dam repair will not provide any environmental enhancements to the river.

The estimated total cost of this alternative is $1,164,700. The total construction cost is estimated at $913,500, with estimated design costs of $251,200 and no required land rights costs. See Appendix C for a detailed cost estimate for this alternative.

Pro's

- Reduce possibility of catastrophic dam failure

Con's

- No reduction in public safety at the dams
- No environmental enhancement benefits
- Requires portage around dams

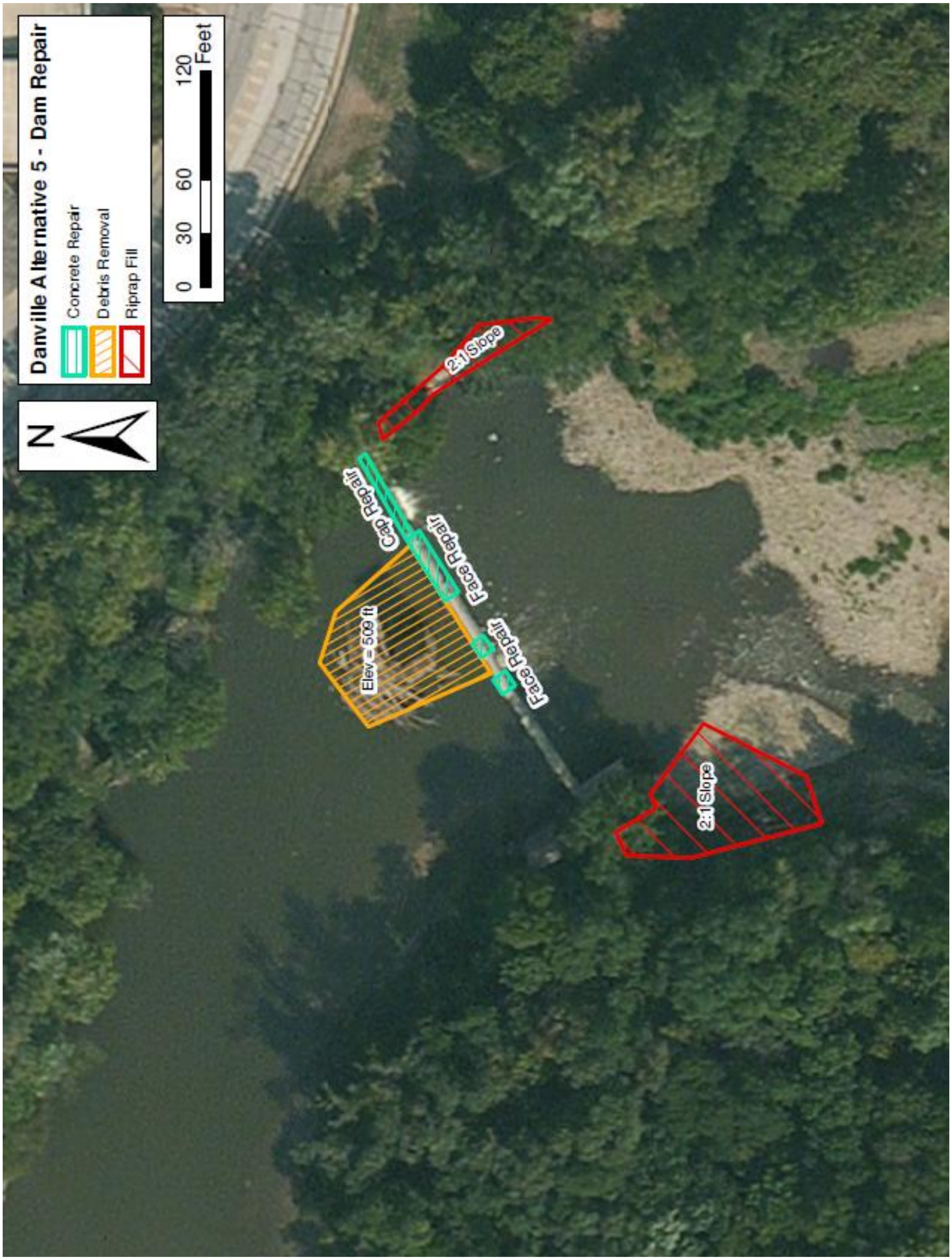

Figure 27: Danville Dam Repair

Summary of Alternatives

The summary tables below provide a comparison of estimated cost and public impacts for the various alternatives.

Table 6: Summary of Alternative Costs

Alternative	Danville Dam Alt. Costs	Ellsworth Park Dam Alt. Costs	Combined Alternative Costs	Combined Construction Costs	Combined Design Costs	Land Rights Costs
1 - Full Removal	$1,464,300	$275,500	$1,739,800	$1,364,600	$375,200	$0
2 - Partial Removal	$1,832,000	$198,900	$2,030,900	$1,592,800	$438,100	$0
3 - Stepped Spillway	$3,725,600	$1,043,100	$4,768,700	$3,551,900	$976,800	$240,000
4 - Rock Ramp	$2,706,700	$1,080,400	$3,787,100	$2,863,600	$787,500	$136,000
5 - Dam Repair	$1,164,700	$0	$1,164,700	$913,500	$251,200	$0

Table 7: Summary of Alternative Components

Alternative	Removes Pool	Public Safety	Safe Canoe Passage	Fish Passage	Acres of Easements	Tree Removal (Acres)
1 - Full Removal	Yes	Restored	Yes	Restored	0	0.52
2 - Partial Removal	Yes	Restored	Yes	Restored	0	0.52
3 - Stepped Spillway	No	Improved	Portage	Improved	60	2.52
4 - Rock Ramp	No	Improved	Portage	Improved	34	2.52
5 - Dam Repair	No	None	No	None	0	0.52

ENVIRONMENTAL INVENTORY AND ASSESSMENT

As part of the Strategic Planning Study, environmental resources including fisheries, wetlands, endangered species and cultural resources were assessed. To assure compliance with Illinois environmental regulations, a Comprehensive Environmental Review Process (CERP) was conducted by the Department of Natural Resources to identify all environmental resources in the vicinity of the dams and to highlight any environmental concerns that could potentially be associated with dam modifications. This section provides a summary of the environmental resources assessed.

Fish Sampling

IDNR conducted fish sampling in 2004 and 2011 immediately upstream of Danville Dam and approximately 100 feet downstream of the dam. The 2004 survey was conducted using 60 minutes of altered current electro-shocking. The 2011 survey was conducted using 30 minutes of direct current electro-shocking. The fish sampling results indicate a greater abundance and diversity of fish species exist below the dam than above. Table 8 shows the results of the fish sampling.

Table 8: Fish Sampling

Sampling	2004 Upstream	2004 Downstream	2011 Upstream	2011 Downstream
#Species	23	37	22	39
Largemouth Bass	1	10	6	1
Smallmouth Bass	0	5	2	8
Spotted Bass	1	0	0	0
Crappie	1	17	0	8
Bluegill	7	38	3	7
Channel Catfish	2	13	0	23
Flathead Catfish	3	6	1	1
Walleye	0	3	0	1
Big Eye Cub	0	1	0	0
River Redhorse	0	2	0	7
Eastern Sand Darter	0	0	0	2
Fish Abundance	258	677	554	1,000

Wetlands

A copy of the National Wetland Inventory Map is included as Figure 28, which shows the wetland within the project area. Although the dam removal modifications impact the pooled wetlands upstream of the dam modifications, such modifications will improve the quality of wetland by increasing oxygen levels and reducing sediment deposition.

Endangered Species

Within the project area, six species of fish or mussels have been identified as a threatened or endangered species within the State of Illinois by the Illinois Endangered Species Protection Board, as documented in their February 22, 2011 report. These species are the Bluebreast Darter (Etheostoma camurum), the Eastern Sand Darter (Ammocrypta pellucidum), the Bigeye Chub (Hybopsis amblops), the River Redhorse (Moxostoma carinatum), the Wavy-rayed Lampmussel (Lampsilis fasciola) and the Black Sandshell (Ligumia recta). None of the outlined alternatives are believed to have a negative impact on the species and will likely have a positive impact of mobility restoration with the dam modifications. A conservation plan for the care and handling of threatened or endangered species during project implementation must be developed after an alternative is selected by the City of Danville.

Cultural Resources

Based on review of the project area by Departments' Cultural Resources Coordinator, completion of any of these alternatives are not anticipated to adversely impact any known cultural resources.

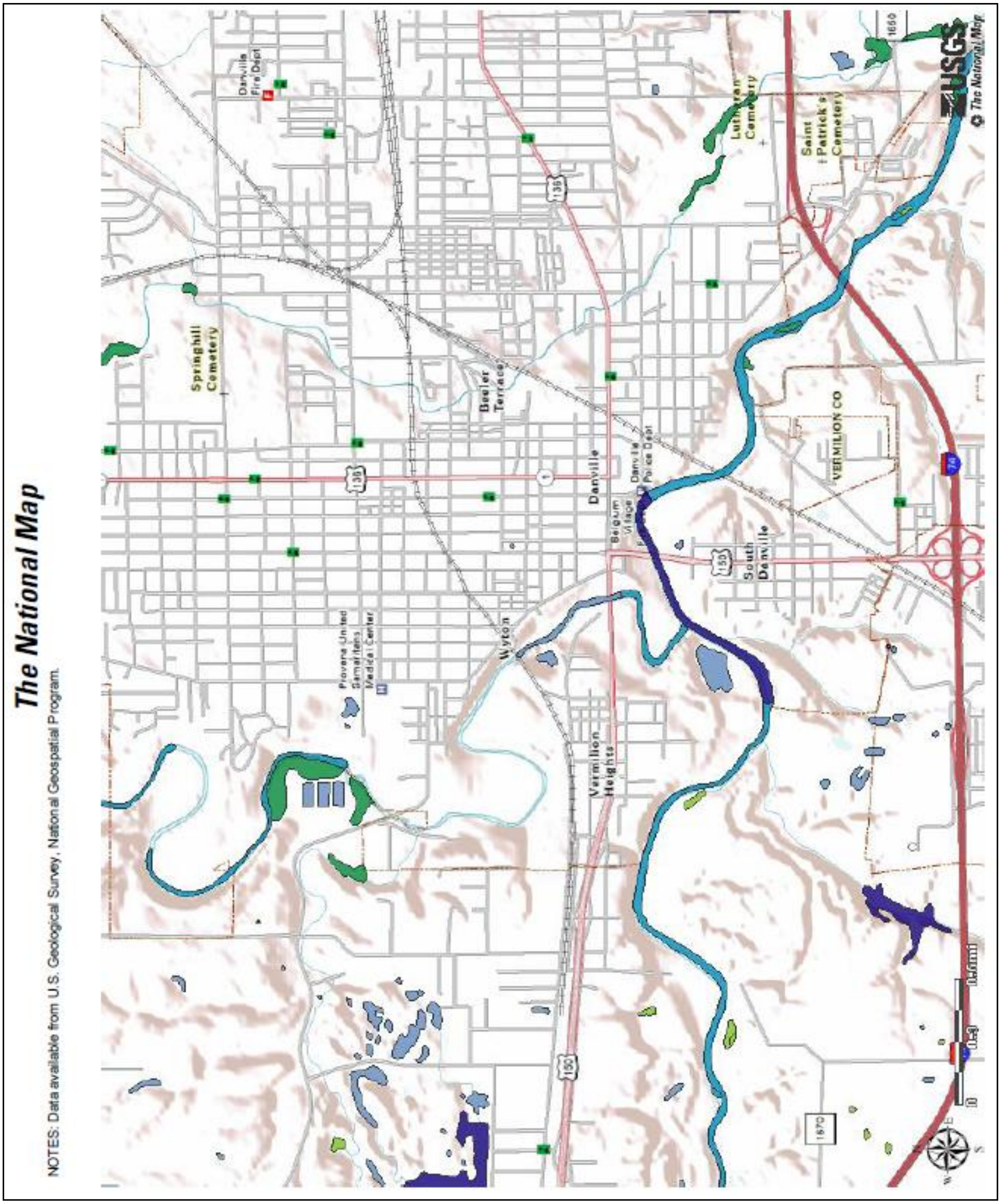

Figure 28: Wetlands Map

RECOMMENDATIONS

Recommended Alternatives

The Illinois Department of Natural Resources, Office of Water Resources (IDNR/OWR) recommends Partial Dam Removal (alternative #2) for the Danville Dam on the Vermilion River, and Full Dam Removal (alternative #1) for the Ellsworth Park Dam on the North Fork Vermilion River. This recommendation is based on the Department's established policies for state owned or controlled dams which indicate high preferences for public safety, ecological improvements and development of recreational opportunities, while giving full attention to economics and recognition of the bank stability issues at the existing Danville Dam site. These recommended measures will eliminate public safety liability concerns created by these dams, restore ecological connectivity to these rivers, improve recreational use of these rivers, and essentially eliminate the city's future dam maintenances costs.

Monitoring

The state of Illinois keeps a database of all documented locations and quantities of threatened or endangered species. IDNR fisheries biologist have sampled fish upstream and downstream of both dams. Additionally, Eastern Illinois University (EIU) is conducting fish, mussels and macroinvertebrates monitoring upstream of both dams. Fish and macroinvertebrates will be monitored twice per year through 2015 while mussels will be monitored annually. Sampling will be conducted in the spring and/or fall. Monitoring which began in October 2012 and will continue until in the spring of 2015. A final report is planned for June 30, 2015.

PROJECT SPONSORSHIP DETAILS

Prior to implementation of any jointly funded dam modification measures, a local sponsor must agree to participate in the project with IDNR, Office of Water Resources. The City of Danville could be such a sponsor. As a potential project sponsor, the city of Danville will be requested to obtain all local permits necessary to construct the project, acquire all land rights required for the construction, pay for any utility relocations required by the project, operate and maintain the project, and pay any construction cost of enhancements requested by the City. The IDNR/OWR is prepared to commit to finalizing all planning, design and construction documents, oversee the bid process, supervise construction, obtain all state and federal permits and pay for all construction costs directly related to the recommended modifications of these dams.

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Appendix A: Sediment Sampling and Transportation Modeling Report by the USGS

In cooperation with the Illinois Department of Natural Resources

Sediment and Hydraulic Modeling of Danville Dam on the Vermilion River and Ellsworth Park Dam on the North Fork Vermilion River at Danville, Illinois

Interim Draft Summary

By Timothy D. Straub

U.S. Department of the Interior
U.S. Geological Survey

Contents

Figures

Tables

Introduction

Two dams exist in close proximity to each other at Danville, Illinois in the Vermilion River watershed (Figure 2 and 2). The larger of the two, Danville Dam is a 90-year-old, 11-ft high, concrete run-of-river dam located on the Vermilion River. This dam has caused three drowning deaths. The second dam, Ellsworth Park Dam, is located upstream on the North Fork Vermilion River. The area upstream of this dam was formerly used for swimming and has been the location of at least one drowning death. To remedy the public safety hazards caused by the dams, the City of Danville and State of Illinois are planning modification of each structure. In 2011 the U.S. Geological Survey, Illinois Water Science Center (USGS) in cooperation with the Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR) began a study to characterize sediment transport, hydraulics, and sediment properties of the Vermilion and North Fork Vermilion Rivers upstream and downstream of both dams. The objectives of the project were 1) collect sediment cores, 2) have cores analyzed for potential contaminants, 3) perform sediment transport modeling for pre- and post-dam removal, and 4) conduct pre-dam removal monitoring of sediment transport and streamflow downstream of the Danville Dam.

Purpose and Scope

The purpose of this report is to document the sediment transport and hydraulic modeling on the Vermilion and North Fork Vermilion River for both existing and proposed conditions. Additionally, this report summarizes over 60 analytes that were tested on 32 sediment cores and 11 supernatant samples. Also, 21 particle-size analyses were completed on a subset of the cores and bed material samples and are summarized in the report.

The modeled hydraulic and sediment impacts of the proposed conditions on the flow depths and top widths for various flows (up to and including the 100-year flood), the predicted channel bathymetric changes, and the sediment transport capacities are also summarized in this report. The flow velocity and channel shear stresses changes are summarized in this report along with the inferences of the impacts on channel stability.

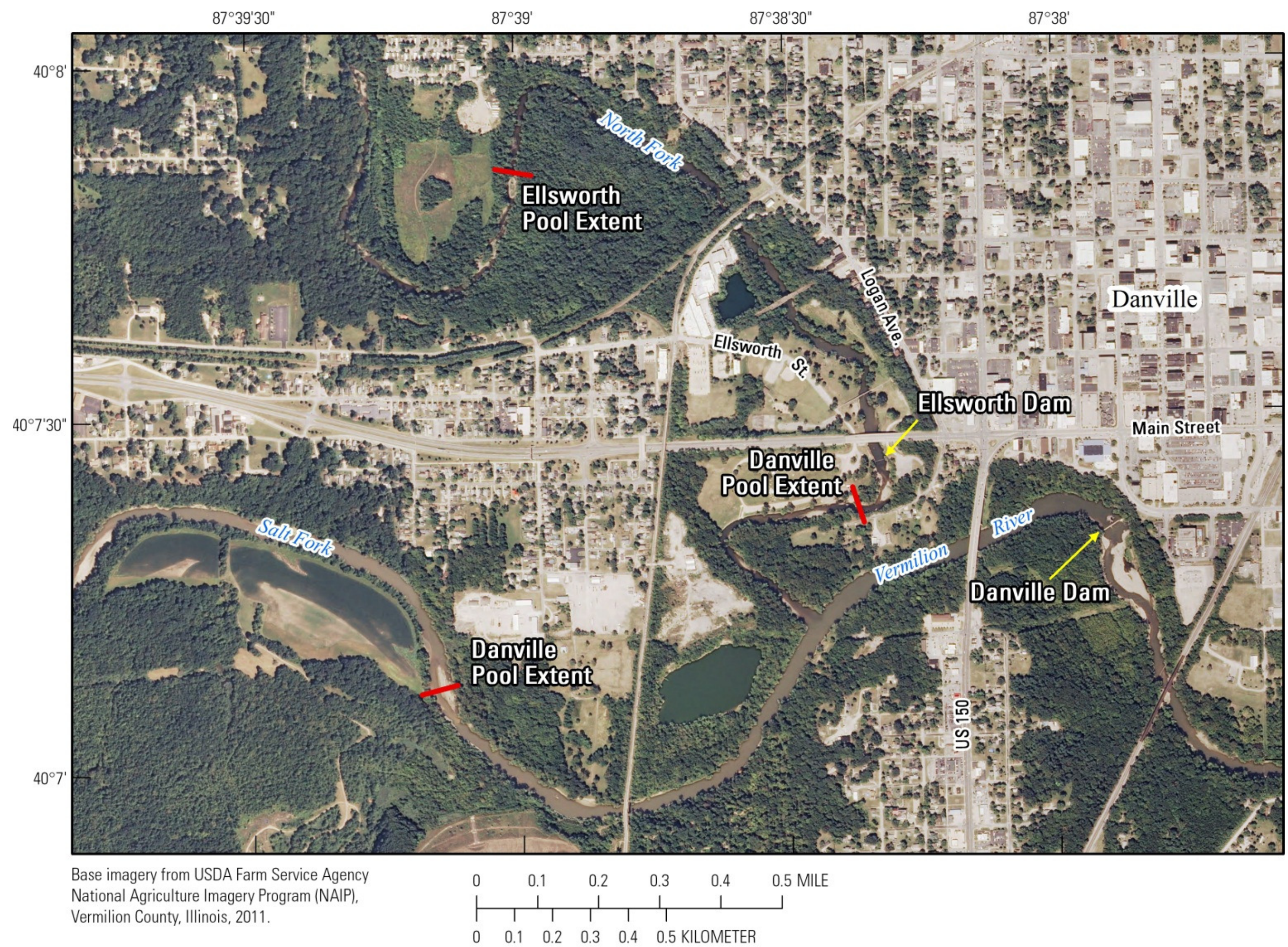


Figure 1. Location of Danville and Ellsworth Dams and pool extents on the Vermilion and North Fork of the Vermilion Rivers at Danville, Illinois

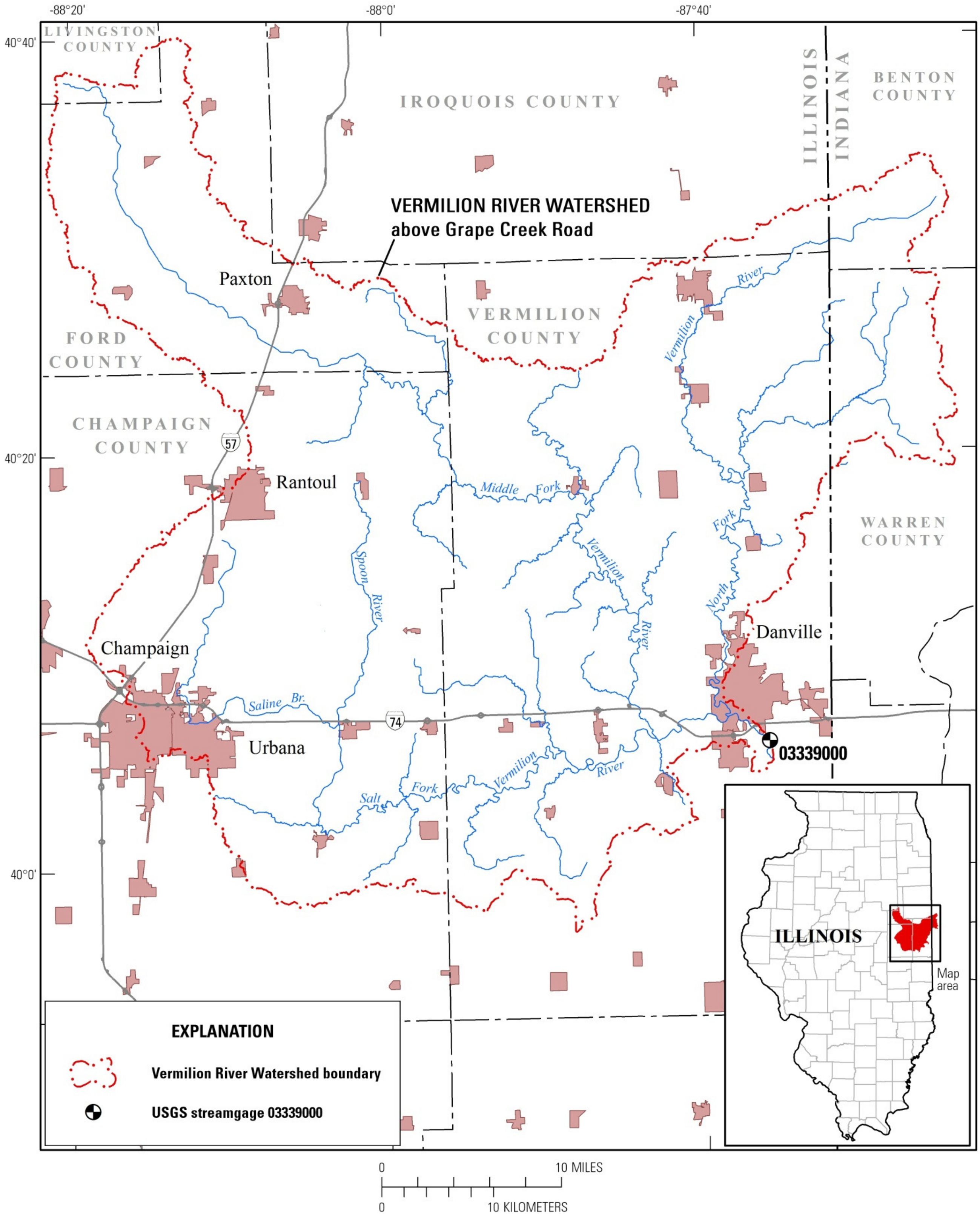


Figure 2. Location of the Vermilion River Watershed above Grape Creek Road near Danville, Illinois

Data Collection

Thirty-two sediment cores were taken with an Ogeechee corer and the samples were analyzed by TestAmerica Laboratories, Inc. Over 60 analytes were tested on the 32 sediment cores and 11 supernatant samples. Fine sediments for analyte testing were primarily cored at the fringe of the channel as the majority of the channel was sands and gravels. Particle-size analysis was completed on a subset of the sediment cores and on bed material samples (21 particle-size analyses total). Bed material samples in the center of the channel were primarily taken with a ponar for particle-size analysis.

The analyte data were summarized similar to a U.S. Environmental Protection Agency summary of the watershed in 1997, which is included in appendix A for comparison to the data collected in the current study. The locations and summaries of all the analyte and particle size data are presented in appendix B, C, and D. The locations just upstream of each dam (VR-US-1 and NF-US-1) are each summarized in a separate table. The remaining sites are summarized together.

In the spring of 2011 sediment transport monitoring was added to the gage to determine both suspended and bedload sediment transport. Measurement and lab methods are outlined in the following reports: Field Methods for Measurement of Fluvial Sediment (Edwards and Glysson, 1999) and Analysis of Fluvial Sediment by the Northeastern Region, Kentucky Science Center Sediment Lab [Sholar and Shreve, 1998]. Suspended sediment daily loads were computed by the subdivided-day method (time-discharge weighted average) (Guy, 1970 and Porterfield, 1972). Bedload measurements were limited to three measurements in existing conditions. The bedload measurements from April 20, 2011; June 16, 2011; and June 27, 2011 show that the bedload is generally 3 percent or less of the suspended sediment load. The existing conditions sediment transport model was verified using sediment transport and streamflow data at the gage. The suspended-sediment load was adjusted by three percent to obtain the total load for comparison.

Cross Section Comparison and Longitudinal Thalweg Profile

Comparing the cross sections upstream and downstream of a dam can give initial insight into the amount of sediment trapped behind a dam. Upstream and downstream of Danville Dam, the shape and area of the cross sections are similar (Figure 3), giving an initial indication that minimal sediment is trapped behind the dam. Additional evidence is summarized in the Sediment Transport and Hydraulic Modeling section.

The surveyed longitudinal thalweg profile is shown in Figure 4 and adds to the knowledge gained from the cross sectional comparison about the Vermilion River system upstream and downstream of Danville Dam. There are no discontinuities or apparent deposition caused by the dam. Instead of deposition, a scour hole can be observed upstream of the dam in the meander bend.

In contrast, comparing the upstream and downstream cross sections for the Ellsworth Park Dam shows that sediment has been trapped behind the dam (Figure 5). To obtain an approximate amount of sediment trapped, the cross section 633 ft downstream of the dam was used as reference to compare the cross sections 55, 242, and 487 ft upstream of the dam. Using a simple cross section area and representative reach length approach shows that approximately 6,000 yd^3 is trapped behind the dam.

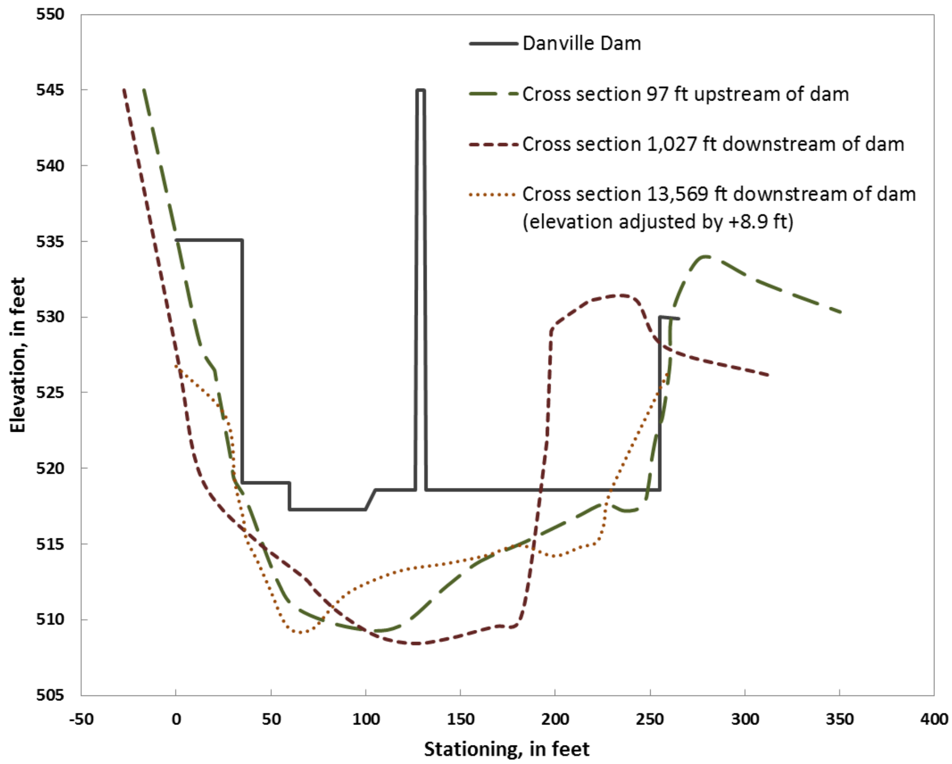


Figure 3. Surveyed cross section data upstream and downstream of Danville Dam near Danville, Illinois

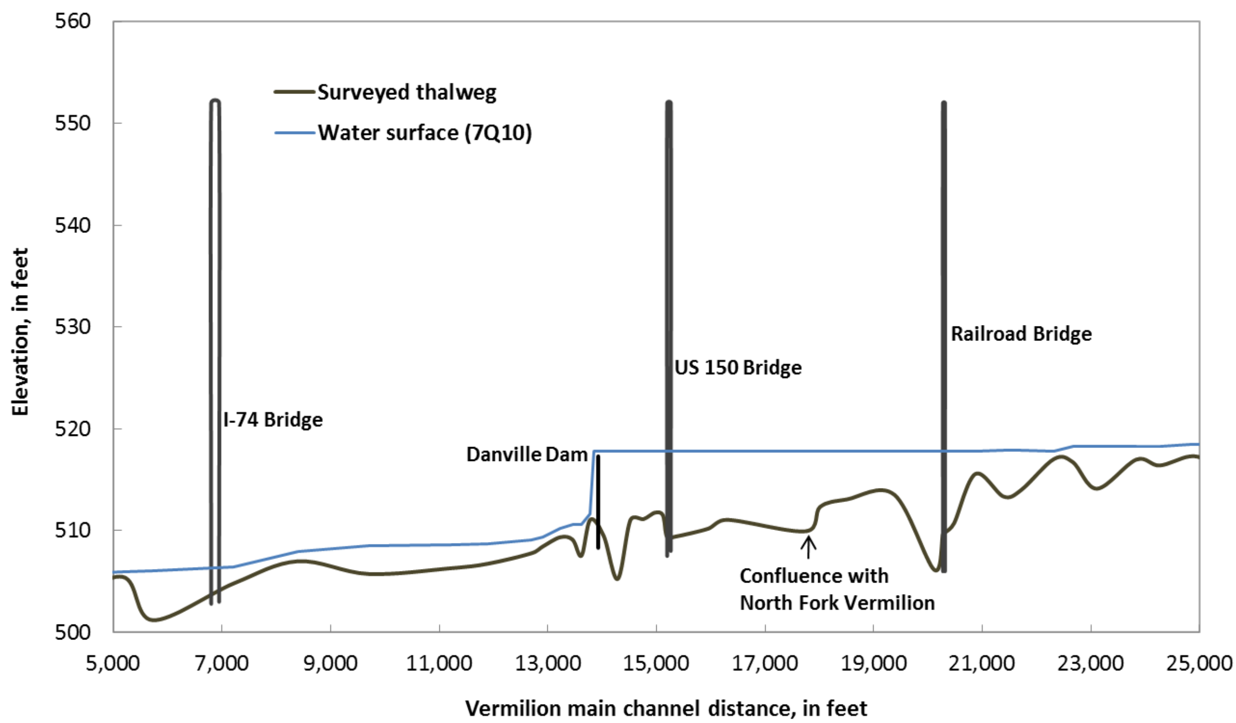


Figure 4. Longitudinal thalweg profile and 7Q10 water surface of existing conditions on the Vermilion River upstream and downstream of Danville Dam

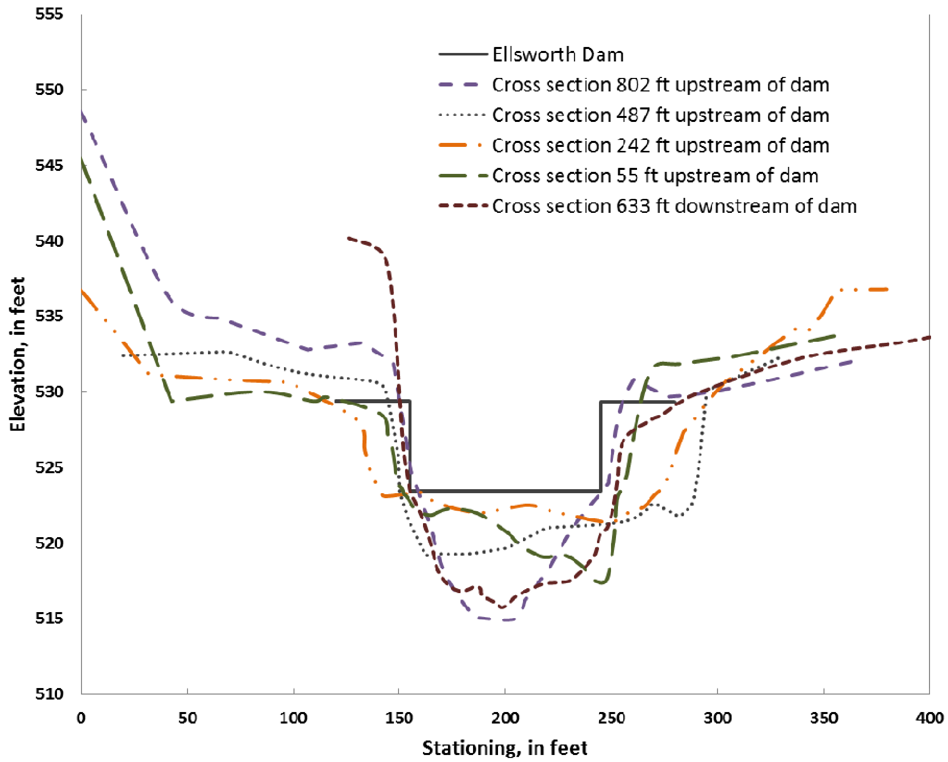


Figure 5. Surveyed cross section data upstream and downstream of Ellsworth Dam near Danville, Illinois

Proposed Conditions

The IDNR-OWR has proposed plans for modification of both the Danville and Ellsworth Park Dams. At the Danville Dam the proposed conditions are to lower the dam to an elevation of 508 ft (1 ft below the existing channel thalweg at the dam). Rock bank protection is proposed on both banks in the vicinity and just upstream of the dam. The right bank protection upstream of the dam would be in the form of rock bank protection and a rock jetty with slope similar to the upstream banks (5:1 to an elevation around 520 ft and 3:1 to an elevation of 530 ft). The left bank protection is proposed to be rock at a 3:1 slope until the existing ground banks are met. As a worst case scenario, these conditions were modeled with the inline weir completely removed from the model and the stream elevation set to 508 ft and sloped banks for the bank protection.

At the Ellsworth Park Dam, the estimated trapped sediment combined with the proximity of the bridge upstream of the dam help in determining the proposed plan for the structure. For these reasons, a rock ramp is proposed at this structure. The elevation of the ramp at the location of the existing dam is proposed to be 520 ft. The ramp is proposed to have approximately a 30:1 slope upstream and downstream from the center of the dam. The ramp will extend to an approximate elevation of 522.3 ft (only approximately 1 ft lower than the existing structure). The banks are proposed to be a 3:1 slope until the existing ground banks are met. These conditions for both structures were modeled as described above.

Sediment Transport and Hydraulic Modeling

Sediment transport and hydraulic modeling on the Vermilion and North Fork Vermilion River for both existing and proposed conditions are presented in this section. The one-dimensional, quasi-unsteady sediment transport capabilities within the Hydrologic Engineering Center, River Analysis System model (HEC-RAS Version 4.1.0) were used to predict changes in the stream channel and sediment load for the 2-, 10-, and 100-year flood. The existing conditions sediment transport model was verified using sediment transport and streamflow data collected downstream of the Danville Dam at a USGS gaging station on the Vermilion River. The HEC-RAS model was also used to simulate the hydraulic impacts of the proposed conditions on the velocity, shear stress, flow depth, and top width at low flows and flood flows.

The original survey and hydraulic model was completed by the IDNR-OWR utilizing survey data from April 2004 and August 2009. IDNR-OWR surveyed additional cross sections downstream of the Danville Dam in July 2011, and these data were added to the model by the USGS.

The steady flow values for the original IDNR-OWR model were determined by a combination of streamflow data at USGS gage 03339000 Vermilion River at Danville, IL (Figure 2), StreamStats, and

Flood Insurance Study results. The hydrographs for the quasi-unsteady sediment transport modeling were obtained using the historic streamflow data at the existing USGS gage 03339000. The 2-yr, 10-yr, and 100-yr hydrographs were obtained using data from January 3-20, 2008; March 9-19, 1990; and April 8-23, 1994, respectively. The corresponding hydrographs needed for input at the upstream end of the reaches, were proportioned by comparing the steady flow values between downstream and upstream.

For the sediment transport modeling within HEC-RAS, the Laursen-Copeland transport function, Exner 5 sorting method, and the Ruby fall velocity methods were selected. Bed material samples taken by the USGS in 2011 (Appendix C) were assigned to representative cross sections within the model.

The existing conditions sediment transport model was verified using sediment transport and streamflow data at the Vermilion River at Danville gage (03339000) using a flood event on May 29, 2011. The peak streamflow for the event was 11,000 ft^3/s, which was nearly a 2-yr flood (12,400 ft^3/s). Using methods outlined in the Data Collection section, the sediment load for May 29, 2011 was computed to be 25,000 tons at gage 03339000. The HEC-RAS model, using the existing conditions geometry, simulated the sediment load (26,000 tons) within five percent of the measured sediment load.

To model possible changes between existing and proposed conditions on the Vermilion River, the 2-, 10-, and 100-year flood hydrographs were modeled with sediment transport. The longitudinal thalweg profile for each flow and condition are shown in Figure 6-8, and show minimal difference between the proposed and existing conditions. The maximum difference in bed elevation changes occurs between the Danville Dam and the confluence of the North Fork Vermilion River. For the 100-yr flood event the maximum modeled difference in this reach between existing and proposed is approximately 1 ft.

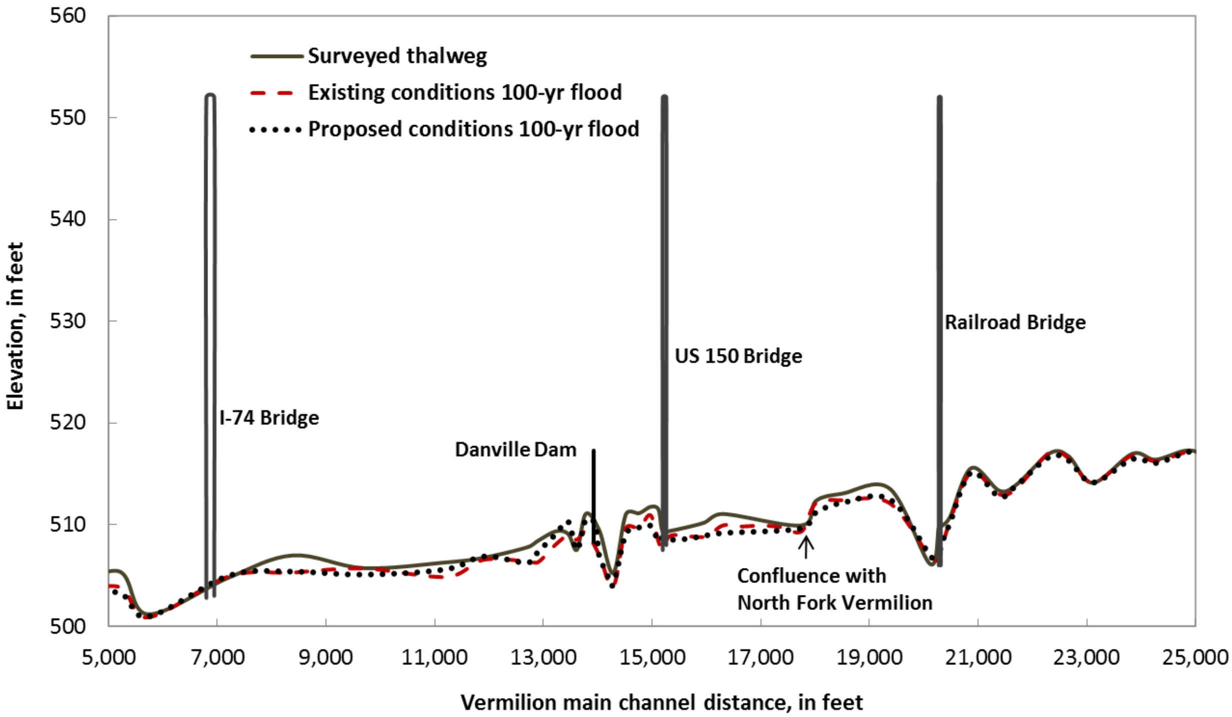


Figure 6. Longitudinal thalweg profile of surveyed conditions, and after simulating sediment transport of a 100-yr flood on existing and proposed conditions on the Vermilion River upstream and downstream of Danville Dam

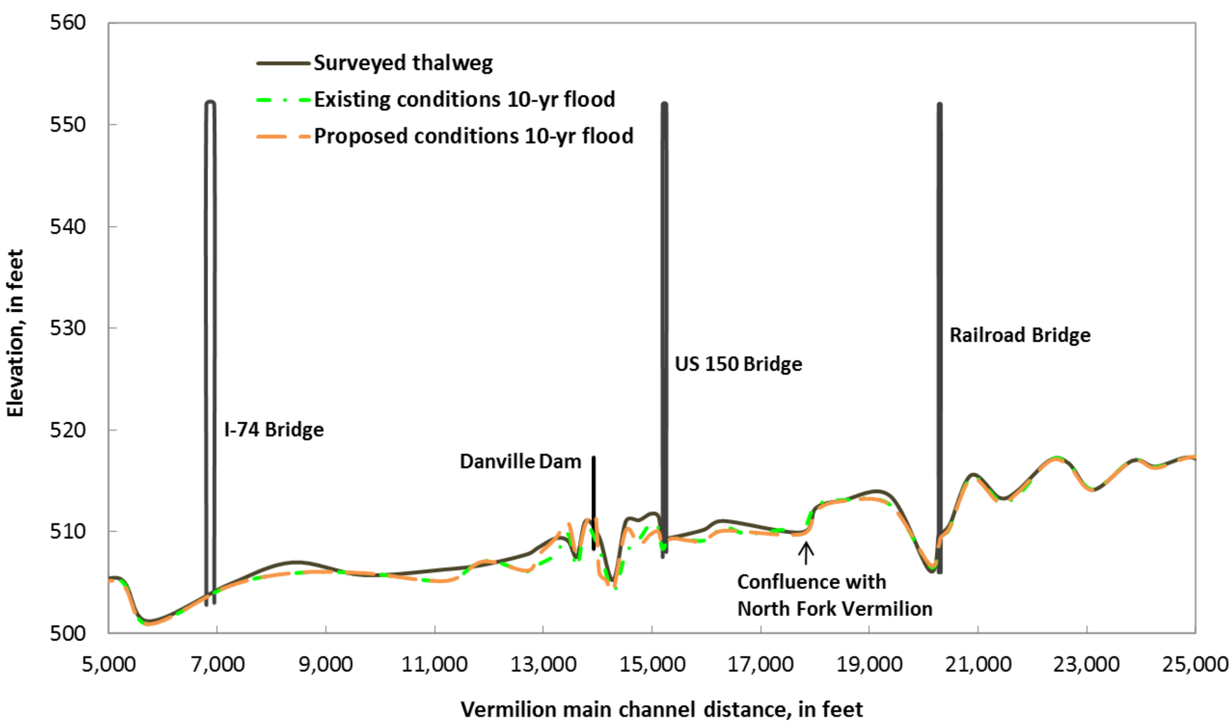


Figure 7. Longitudinal thalweg profile of surveyed conditions, and after simulating sediment transport of a 10-yr flood on existing and proposed conditions on the Vermilion River upstream and downstream of Danville Dam

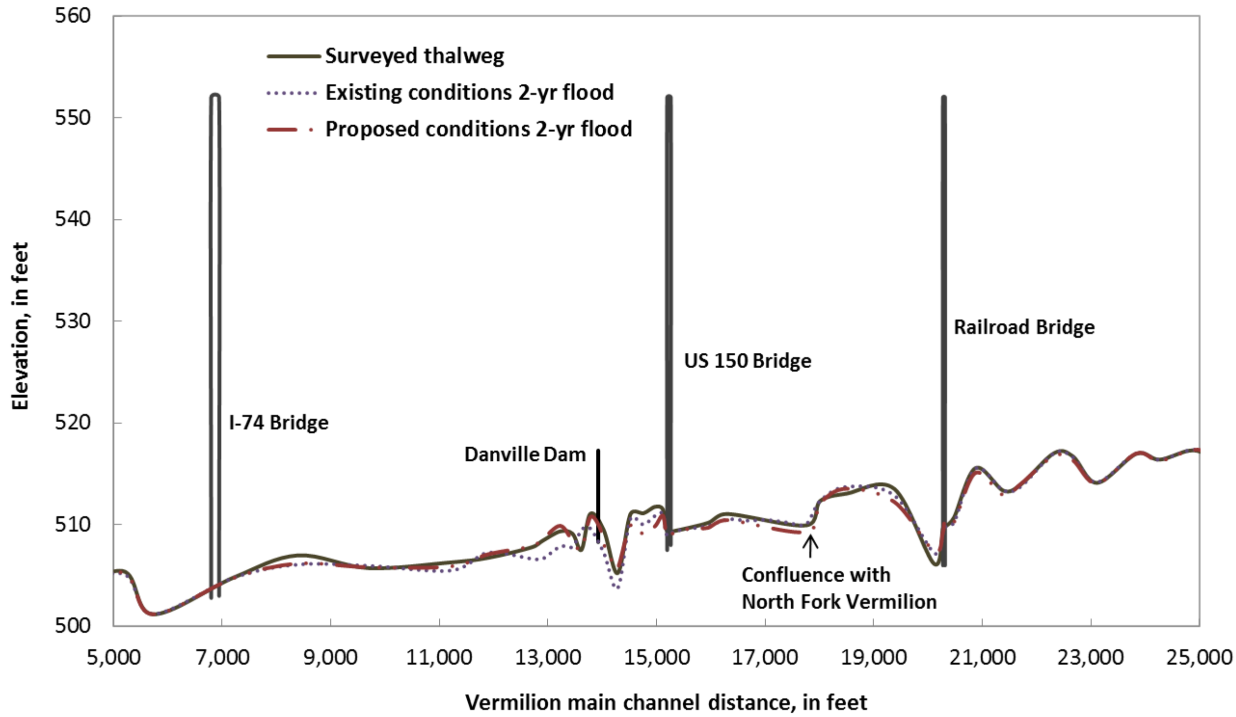


Figure 8. Longitudinal thalweg profile of surveyed conditions, and after simulating sediment transport of a 2-yr flood on existing and proposed conditions on the Vermilion River upstream and downstream of Danville Dam

To further quantify the differences between existing and proposed conditions, the sediment loads (Table 1) at cross section 0 (Figure 9) are presented for each flow. The largest change in sediment load is at the 100-yr flood, but the increase is only approximately one-third of what is transported in the 2-yr flood under existing conditions. The increases in the sediment load between the existing and proposed conditions can be attributed to the increases in velocity and shear stress in the stream channel. Increases in steady flow velocity and shear stress for selected cross sections (Figure 9) are presented in Tables 2-3 and Figure 10-11 for various flow conditions (7Q10, 50 percent of the mean daily flow, 2-yr flood, 10-yr flood, and 100-yr flood). At the 2-yr flood and greater, the modifications of the Danville and Ellsworth Park Dams have minimal influence on velocity and shear stress. However, in the sediment transport modeling, the full hydrograph for a storm event is input, and therefore lower flows are also included in the sediment modeling. The 50 percent mean daily flows show an increase in velocity between proposed and existing of approximately 1.5 ft/s near the Danville Dam (Cross Section 2056, Table 2). The shear stress for that same cross section increases from 0.01 to 0.16 lb/ft^2 (Table 3). These increases bring the velocity and shear stress within the range of permissible velocities and critical shear stresses of sands (Julien, 1998). Sands are prevelant in the system (Appendix C), and additional transport of sands will occur from the proposed Danville Dam plan as quantified in Table 1. Even with the increases at the lower flows, the velocities and shear stresses at the 2-yr flood are more than double the low flow values (Table 2-3).

The impacts of the dam removal or modification on the flow depth and top width are presented in Tables 4-5 and Figure 12-13. Similar to the velocity and shear stress results, the 2-yr flood and greater have minimal influence. A maximum channel depth of at least 1 ft for the 7Q10 flow is maintained for nearly all selected cross sections. The proposed conditions effect on top width is minimal for most selected cross sections at the 50 percent mean daily and greater flows.

Table 1. Modeled sediment load results on the Vermilion River at cross section 0 for the 100-yr, 10-yr, and 2-yr flood on existing and proposed conditions

	Total sediment load in tons for each storm		
Scenario	**2-yr flood**	**10-yr flood**	**100-yr flood**
Existing conditions	142,000	198,000	369,000
Proposed conditions	174,000	215,000	422,000

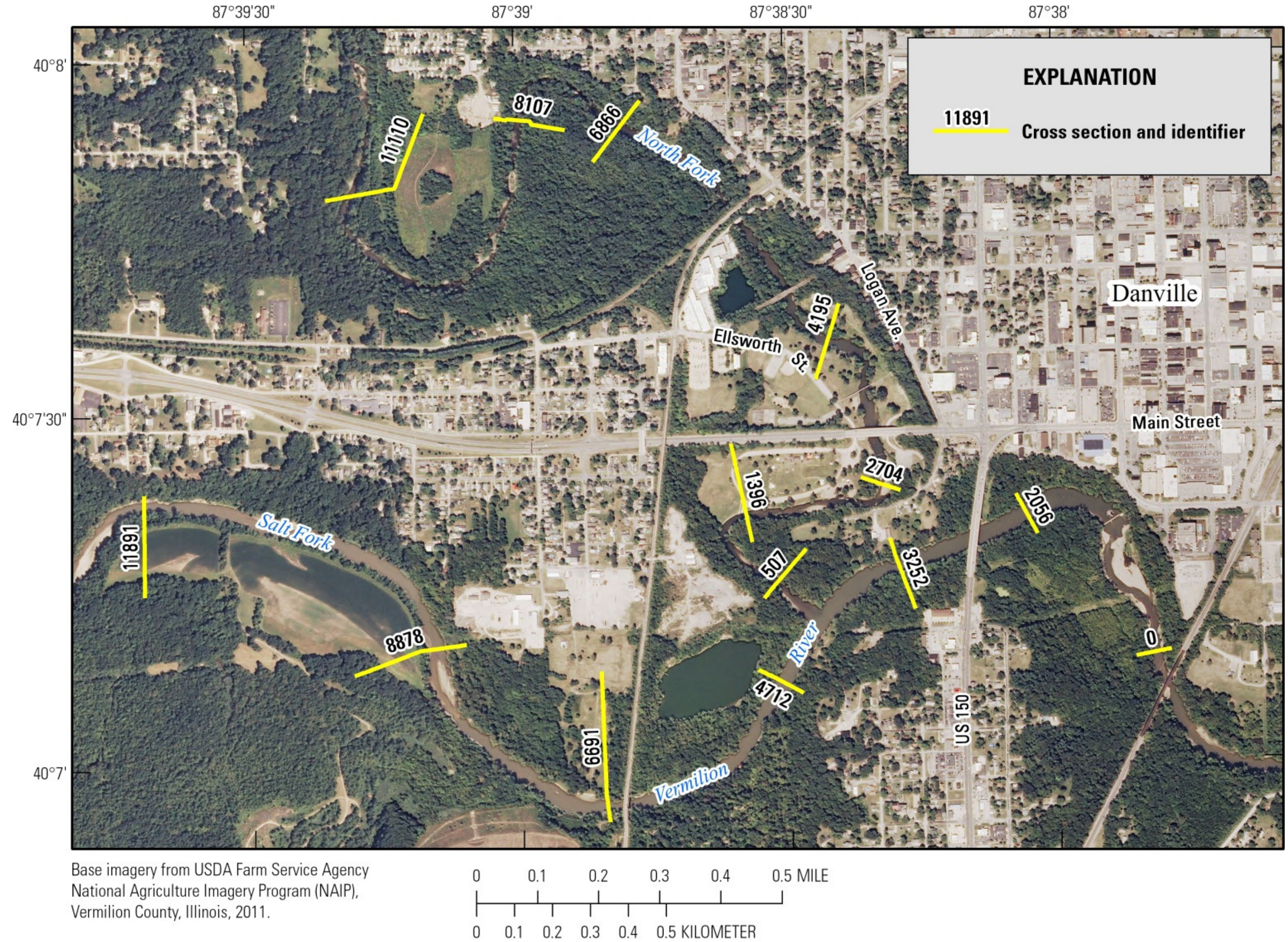
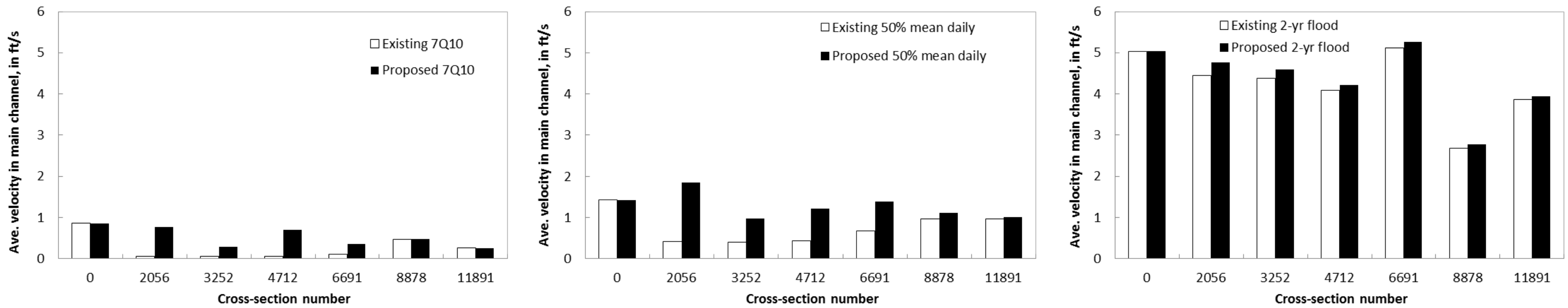


Figure 9. Selected cross sections used to summarize hydraulic modeling results on the Vermilion and North Fork Vermilion Rivers.

Table 2. Existing and proposed condition average velocity of flow in the main channel for the 7Q10 flow, 50 percent of the mean daily flow, 2-yr flood, 10-yr flood, and 100-yr flood on the Vermilion and North Fork Vermilion Rivers

Main-channel distance (feet)	Cross-section number	Average velocity of flow in main channel (ft/s) for each flow and condition									
		7Q10		50% mean daily		2-yr flood		10-yr flood		100-yr flood	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Vermilion River											
12699	0	0.86	0.86	1.42	1.42	5.03	5.04	6.38	6.39	7.41	7.40
13929	1230	Danville Dam									
14756	2056	0.05	0.77	0.41	1.84	4.44	4.76	5.70	5.80	6.49	6.53
15952	3252	0.05	0.28	0.39	0.97	4.38	4.59	5.48	5.55	6.11	6.13
18501	4712	0.06	0.70	0.43	1.22	4.09	4.22	4.61	4.66	5.70	5.72
20479	6691	0.11	0.36	0.67	1.39	5.12	5.27	4.57	4.64	4.34	4.36
22666	8878	0.47	0.48	0.97	1.11	2.68	2.78	2.44	2.47	2.73	2.73
25679	11891	0.26	0.26	0.97	1.01	3.87	3.95	3.13	3.16	3.25	3.26
North Fork Vermilion River											
507	507	0.00	0.01	0.41	0.68	2.01	2.14	2.10	2.13	2.36	2.37
1396	1396	0.00	0.02	0.57	1.03	2.48	2.71	1.58	1.61	1.52	1.53
2704	2704	0.00	0.00	0.35	0.35	2.36	2.45	2.60	2.64	2.80	2.82
2965	2965	Ellsworth Dam									
4195	4195	0.00	0.00	0.39	0.55	2.77	2.95	2.22	2.27	2.12	2.13
6866	6866	0.00	0.00	0.36	0.46	2.76	2.80	3.45	3.48	3.58	3.60
8107	8107	0.00	0.00	0.70	0.86	3.09	3.13	3.58	3.62	3.42	3.43
11110	11110	0.97	0.97	0.74	0.74	2.09	2.11	2.45	2.46	2.33	2.34

Vermilion River



North Fork Vermilion River

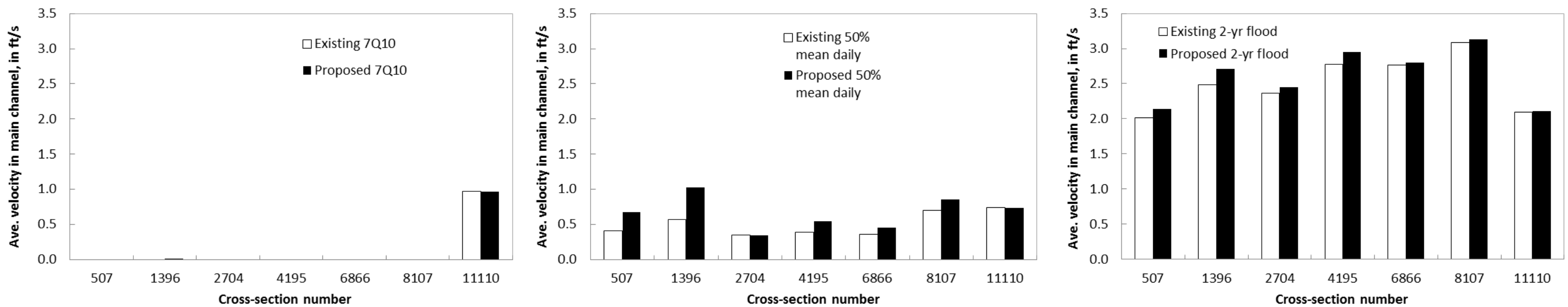


Figure 10. Existing and proposed condition average velocity of flow in the main channel for the 7Q10 flow, 50 percent of the mean daily flow, and 2-yr flood on the Vermilion and North Fork Vermilion Rivers

Table 3. Existing and proposed condition shear stress in the main channel for the 7Q10 flow, 50 percent of the mean daily flow, 2-yr flood, 10-yr flood, and 100-yr flood on the Vermilion and North Fork Vermilion Rivers

Main-channel distance (feet)	Cross-section number	Shear stress in main channel (lb/ft^2) for each flow and condition									
		7Q10		50% mean daily		2-yr flood		10-yr flood		100-yr flood	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Vermilion River											
12699	0	0.05	0.05	0.09	0.09	0.62	0.62	0.86	0.86	1.08	1.08
13929	1230	Danville Dam									
14756	2056	0.00	0.03	0.01	0.16	0.49	0.57	0.70	0.72	0.84	0.85
15952	3252	0.00	0.00	0.00	0.13	0.47	0.52	0.64	0.66	0.74	0.75
18501	4712	0.00	0.03	0.01	0.07	0.41	0.44	0.51	0.52	0.72	0.72
20479	6691	0.00	0.01	0.02	0.09	0.67	0.71	0.48	0.49	0.40	0.40
22666	8878	0.02	0.02	0.05	0.06	0.22	0.23	0.15	0.16	0.17	0.17
25679	11891	0.00	0.00	0.04	0.04	0.44	0.46	0.27	0.28	0.26	0.26
North Fork Vermilion River											
507	507	0.00	0.00	0.01	0.02	0.11	0.13	0.10	0.10	0.12	0.12
1396	1396	0.00	0.00	0.01	0.05	0.16	0.19	0.05	0.06	0.05	0.05
2704	2704	0.00	0.00	0.00	0.00	0.15	0.16	0.15	0.16	0.16	0.16
2965	2965	Ellsworth Dam									
4195	4195	0.00	0.00	0.01	0.01	0.25	0.29	0.15	0.15	0.11	0.11
6866	6866	0.00	0.00	0.00	0.01	0.20	0.21	0.28	0.28	0.27	0.28
8107	8107	0.00	0.00	0.02	0.04	0.27	0.28	0.31	0.32	0.26	0.26
11110	11110	0.19	0.19	0.03	0.03	0.15	0.15	0.17	0.17	0.14	0.14

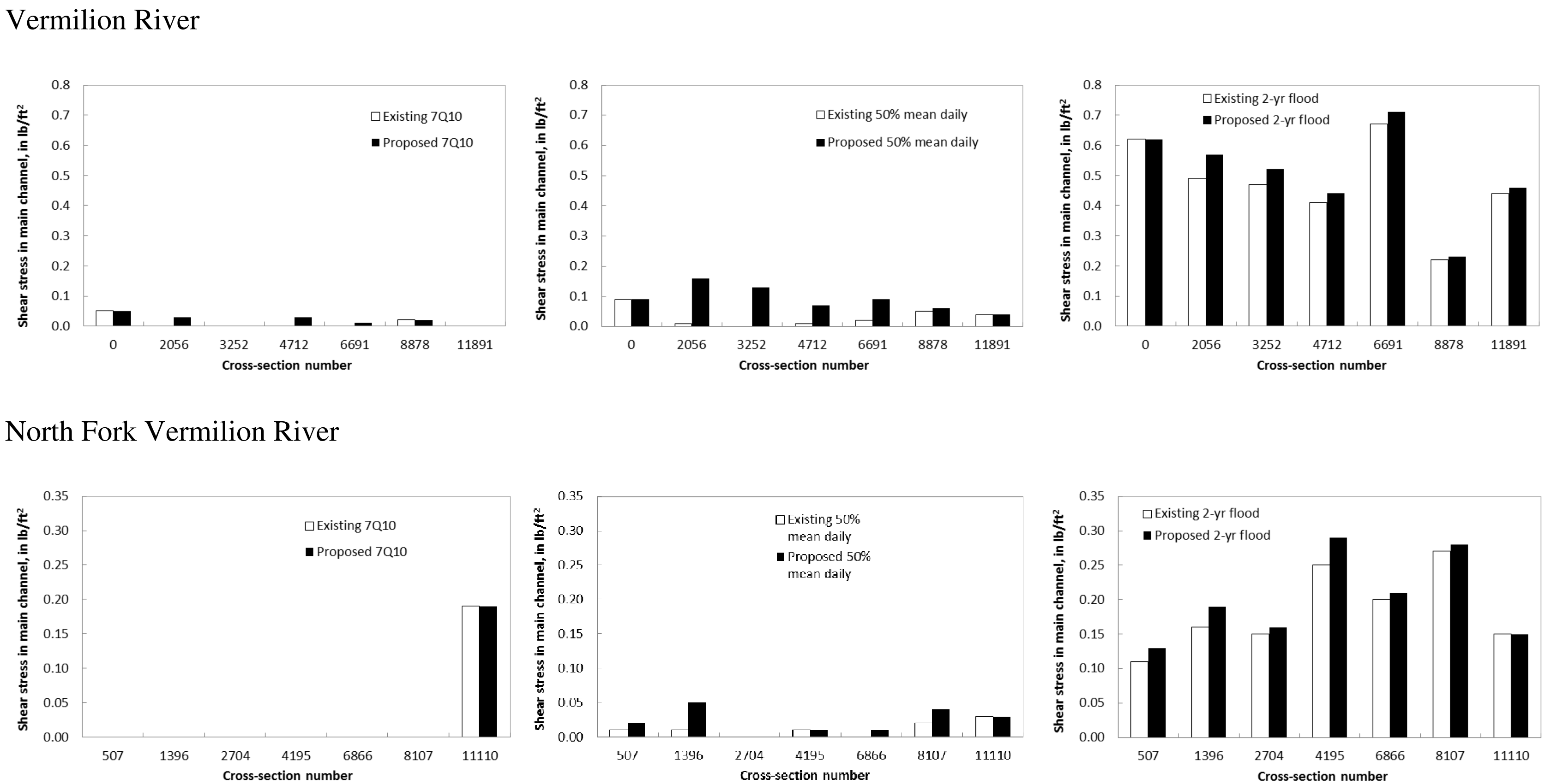
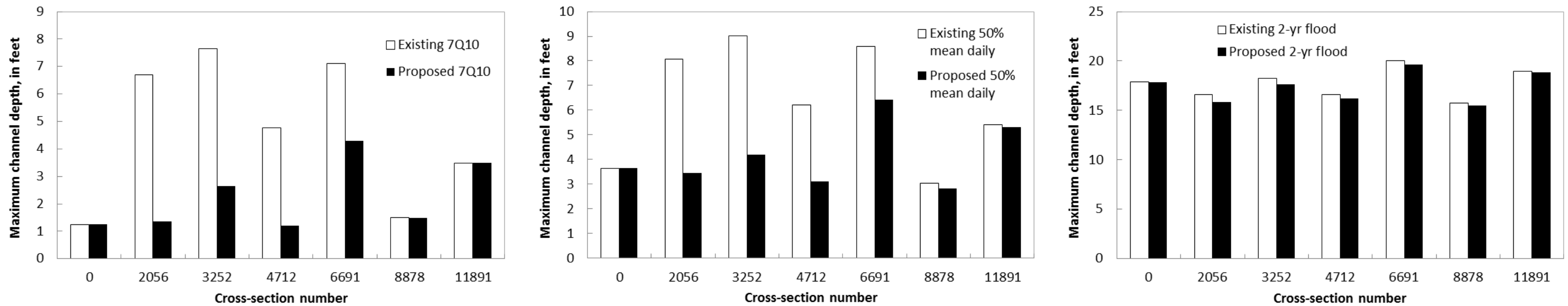


Figure 11. Existing and proposed condition shear stress in the main channel for the 7Q10 flow, 50 percent of the mean daily flow, and 2-yr flood on the Vermilion and North Fork Vermilion Rivers

Table 4. Existing and proposed condition maximum channel depth for the 7Q10 flow, 50 percent of the mean daily flow, 2-yr flood, 10-yr flood, and 100-yr flood on the Vermilion and North Fork Vermilion Rivers

Main-channel distance (feet)	Cross-section number	Maximum channel depth (feet) for each flow and condition									
		7Q10		50% mean daily		2-yr flood		10-yr flood		100-yr flood	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Vermilion River											
12699	0	1.25	1.25	3.64	3.64	17.90	17.87	25.48	25.47	30.49	30.50
13929	1230	Danville Dam									
14756	2056	6.71	1.35	8.07	3.46	16.63	15.85	23.79	23.53	28.78	28.68
15952	3252	7.64	2.64	9.02	4.19	18.26	17.64	25.49	25.29	30.59	30.52
18501	4712	4.77	1.20	6.20	3.12	16.63	16.20	23.76	23.59	28.72	28.66
20479	6691	7.11	4.28	8.58	6.42	20.02	19.67	27.46	27.33	33.10	33.06
22666	8878	1.50	1.49	3.03	2.82	15.75	15.50	22.32	22.21	27.73	27.69
25679	11891	3.49	3.49	5.41	5.32	18.97	18.82	24.86	24.78	30.10	30.06
North Fork Vermilion River											
507	507	2.54	0.69	3.98	2.82	14.36	13.91	21.55	21.38	26.60	26.53
1396	1396	2.42	0.57	3.88	2.77	14.41	13.98	21.54	21.38	26.59	26.52
2704	2704	3.68	3.68	5.42	5.42	14.76	14.41	21.68	21.53	26.65	26.59
2965	2965	Ellsworth Dam									
4195	4195	4.64	3.52	5.32	4.19	12.64	12.31	18.92	18.79	23.73	23.66
6866	6866	3.95	2.83	4.76	3.93	13.62	13.45	19.74	19.65	24.73	24.67
8107	8107	1.47	0.59	2.46	2.10	11.93	11.81	17.75	17.67	22.60	22.55
11110	11110	0.05	0.05	2.24	2.24	11.40	11.35	15.68	15.64	19.90	19.86

Vermilion River



North Fork Vermilion River

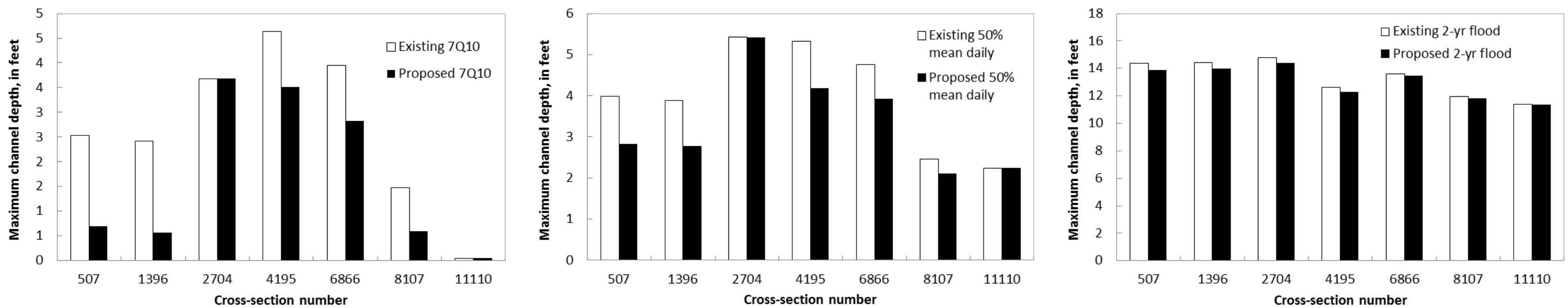
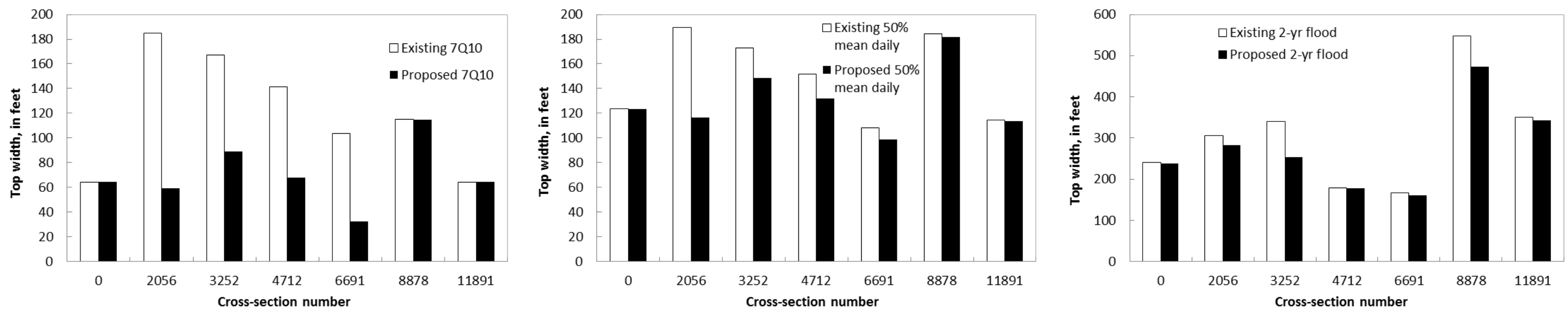


Figure 12. Existing and proposed condition maximum channel depth for the 7Q10 flow, 50 percent of the mean daily flow, and 2-yr flood on the Vermilion and North Fork Vermilion Rivers

Table 5. Existing and proposed condition top width for the 7Q10 flow, 50 percent of the mean daily flow, 2-yr flood, 10-yr flood, and 100-yr flood on the Vermilion and North Fork Vermilion Rivers

Main-channel distance (feet)	Cross-section number	Top width (feet) for each flow and condition									
		7Q10		50% mean daily		2-yr flood		10-yr flood		100-yr flood	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Vermilion River											
12699	0	64.46	64.46	123.53	123.53	240.26	238.71	385.45	385.33	443.01	443.17
13929	1230	Danville Dam									
14756	2056	185.00	59.40	189.55	116.79	306.43	283.28	471.68	467.47	731.08	725.74
15952	3252	167.03	89.06	173.12	148.65	339.76	253.61	548.65	540.37	639.76	638.49
18501	4712	141.62	67.65	151.64	131.84	178.35	177.77	302.88	301.56	341.99	341.49
20479	6691	103.53	32.55	108.43	98.93	166.03	161.33	903.70	899.95	987.84	987.37
22666	8878	115.23	114.97	184.54	181.73	548.16	473.54	723.37	721.80	793.49	792.89
25679	11891	64.38	64.31	114.56	113.86	350.48	342.98	728.08	727.66	763.70	763.37
North Fork Vermilion River											
507	507	103.77	35.24	116.18	106.80	424.87	409.31	528.59	528.30	537.32	537.21
1396	1396	78.24	18.59	96.54	84.47	979.51	912.29	1298.70	1298.37	1308.62	1308.50
2704	2704	77.52	77.52	121.10	121.10	271.34	259.95	657.80	656.96	685.02	684.69
2965	2965	Ellsworth Dam									
4195	4195	85.77	82.33	87.22	84.41	256.78	250.80	592.64	589.25	799.68	796.95
6866	6866	97.21	89.66	101.82	97.13	144.06	143.51	462.91	459.27	585.05	584.10
8107	8107	86.33	61.49	99.04	97.31	175.66	170.86	611.69	610.61	679.34	678.60
11110	11110	4.52	4.52	115.98	115.98	386.63	383.53	658.05	645.79	1169.63	1168.79

Vermilion River



North Fork Vermilion River

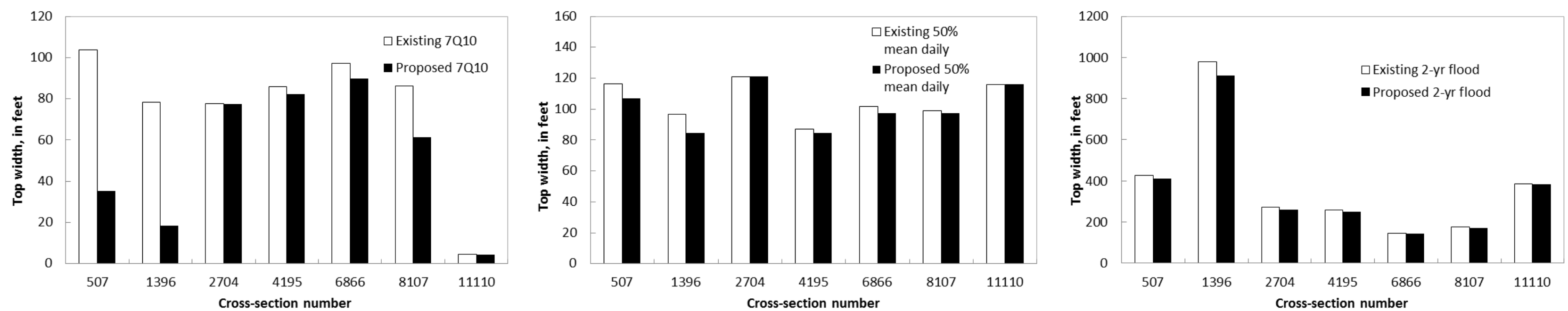


Figure 13. Existing and proposed condition top width for the 7Q10 flow, 50 percent of the mean daily flow, and 2-yr flood on the Vermilion and North Fork Vermilion Rivers

Summary and Conclusions

Two dams exist in close proximity to each other at Danville, Illinois in the Vermilion River watershed. To remedy the public safety hazards caused by the dams, the City of Danville and State of Illinois are planning modification of each structure. In 2011 the U.S. Geological Survey, Illinois Water Science Center (USGS-ILWSC) in cooperation with the Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR) began a study to characterize sediment transport, hydraulics, and sediment properties of the Vermilion and North Fork Vermilion Rivers upstream and downstream of both dams. This report documents the sediment transport and hydraulic modeling on the Vermilion and North Fork Vermilion River for both existing and proposed conditions. Additionally, this report summarizes over 60 analytes that were tested on 32 sediment cores and 11 supernatant samples.

A comparison of the existing cross sections and longitudinal thalweg survey show minimal sediment deposited upstream and downstream of the Danville Dam on the Vermilion River. Further comparisons of existing and proposed sediment transport and hydraulic properties verify this observation. The results show that the overall channel stability is similar between existing and proposed conditions. This can be quantified by summarizing the results of four parameters: 1) sediment load, 2) channel bed elevation, 3) flow velocity, and 4) shear stress.

The largest change in sediment load is at the 100-yr flood hydrograph, but the increase is only approximately one-third of what is transported in the 2-yr flood hydrograph under existing conditions. At the 2-yr flood and greater, the modifications of the Danville and Ellsworth Park Dams have minimal influence on velocity and shear stress. For the proposed plans at the Danville Dam, the 50 percent mean daily flows show increases that bring the velocity and shear stress within the range of permissible velocities and critical shear stresses of sands upstream of the dam to the confluence with the North Fork. However, the proposed condition velocities for these flows are similar to natural conditions in the river outside the influence of the dam. Sands are prevelant in the system, and additional transport of sands will occur from the proposed plans at the lower flow conditions. Even with the increases at the lower flows, the velocities and shear stresses at the 2-yr flood are more than double the low flow values. The maximum difference in bed elevation changes occurs between the Danville Dam and the confluence of the North Fork Vermilion. For the 100-yr flood event the maximum modeled difference in this reach between existing and proposed is approximately 1 ft.

Bed and bank material in the proposed conditions should not need to be protected given the results from the four parameters. However, because the Danville Dam is on a meander bend, the proposed bank protection in the vicinity and just upstream of the Danville Dam will help minimize the impact of potential erosion. Erosion can naturally occur on meander bends from secondary flow currents that are not modeled in the one-dimensional hydraulic model used in this study. This type of bank erosion was observed on meander bends in the Vermilion watershed stream system outside of the project reach.

At Ellsworth Park Dam a comparison of the upstream and downstream cross sections shows that approximately 6,000 yd^3 of sediment has been trapped behind the dam. A rock ramp is proposed at this structure that will extend to an approximate elevation of 522.3 ft (only approximately 1 ft lower than the existing structure). The modeling results show similar existing and proposed conditions.

In conclusion, the proposed conditions for each structure are being planned by IDNR-OWR to minimize sediment quantity and quality impacts on each stream system. The survey data show minimal sediment deposited upstream of the Danville Dam. The modeling results show that the sediment transport will increase slightly in the proposed conditions for Danville Dam when modeling a full range of flows in a flood hydrograph. However, the increases are below what is transported during a frequent flood like the 2-yr event in the existing conditions.

References

Edwards, T.K., Glysson, G.D., 1999, Field Methods for Measurement of Fluvial Sediment: Techniques of Water-Resources Investigations Report of the U.S. Geological Survey, Applications of Hydraulics, book 3, chapter C2, 89 p.

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Porterfield, G., 1972, Computation of fluvial-sediment discharge: U.S. Geological Survey Techniques of Water-Resources Investigations Report, book 3, chapter C3, 66 p., which can be accessed at http://water.usgs.gov/pubs/twri/.

Sholar, C.J., and Shreve, E.A., 1998, Quality-assurance plan for the analysis of fluvial sediment by the Northeastern Region, Kentucky District Sediment Laboratory: U.S. Geological Survey Open-File Report 98-384, 20 p. This report also is available at http://ky.water.usgs.gov/projects/sed_lab/OFR_98_384.pdf.

Appendix A – 1997 USEPA Sediment Report for Vermilion Watershed

United States Environmental Protection Agency | Science and Technology (4305) | EPA 823-R-97-006 September 1997

EPA

The Incidence And Severity Of Sediment Contamination In Surface Waters Of The United States

Vermilion 05120109

Watershed Summary Information

Accounting Unit Name:	Wabash
State(s):	IL (IN)
Political Boundaries:	Vermilion, Ford, Champaign, Iroquois, Benton, Warren, Vermillion
Major Waterways:	Vermilion R Vermilion R, Salt Fk Vermilion R, M Fk Vermilion R, N Fk Upper Salt Fk Drainage Di
Number of Stations in Watershed:	Tier1 - 12 Tier2 - 16 Tier3 - .

Sediment Chemistry Data: Chemical Summary

Sediment Parameter	Total Observations			Detected Observations		
	Num.	Mean (ppb)	Median (ppb)	Num.	Max (ppb)	Min (ppb)
Aldrin	20	0.00	0.00	0	.	.
Arsenic	26	6011.54	6000.00	26	9000.00	4000.00
BHC	58	0.00	0.00	0	.	.
Cadmium	26	0.00	0.00	0	.	.
Chlordane	103	1.00	0.00	20	16.00	2.00
Chromium	26	27288.46	24000.00	26	50000.00	11900.00
Copper	26	24092.31	22000.00	26	43000.00	15000.00
Dieldrin	26	2.57	2.80	21	9.50	1.30
DDT	147	0.33	0.00	20	12.00	0.80
Endrin	20	0.00	0.00	0	.	.
Heptachlor	20	0.00	0.00	0	.	.
Heptachlor epoxide	26	0.21	0.00	3	2.60	1.00
Hexachlorobenzene	20	0.00	0.00	0	.	.
Lead	26	25576.92	22000.00	26	97000.00	4800.00
Mercury	26	500.31	50.00	24	3800.00	20.00
Methoxychlor	20	0.00	0.00	0	.	.
Nickel	2	17850.00	17850.00	2	22400.00	13300.00
Polychlorinated biphenyls	26	1.38	0.00	1	36.00	36.00
Silver	2	0.00	0.00	0	.	.
Zinc	26	101492.3	99000.00	26	170000.0	57900.00

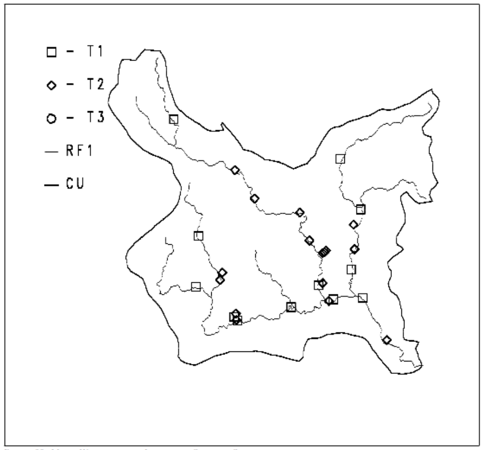


Figure 92. Major Waterways and Location of Sampling Stations

Appendix B – Sediment Sampling and Coring Locations

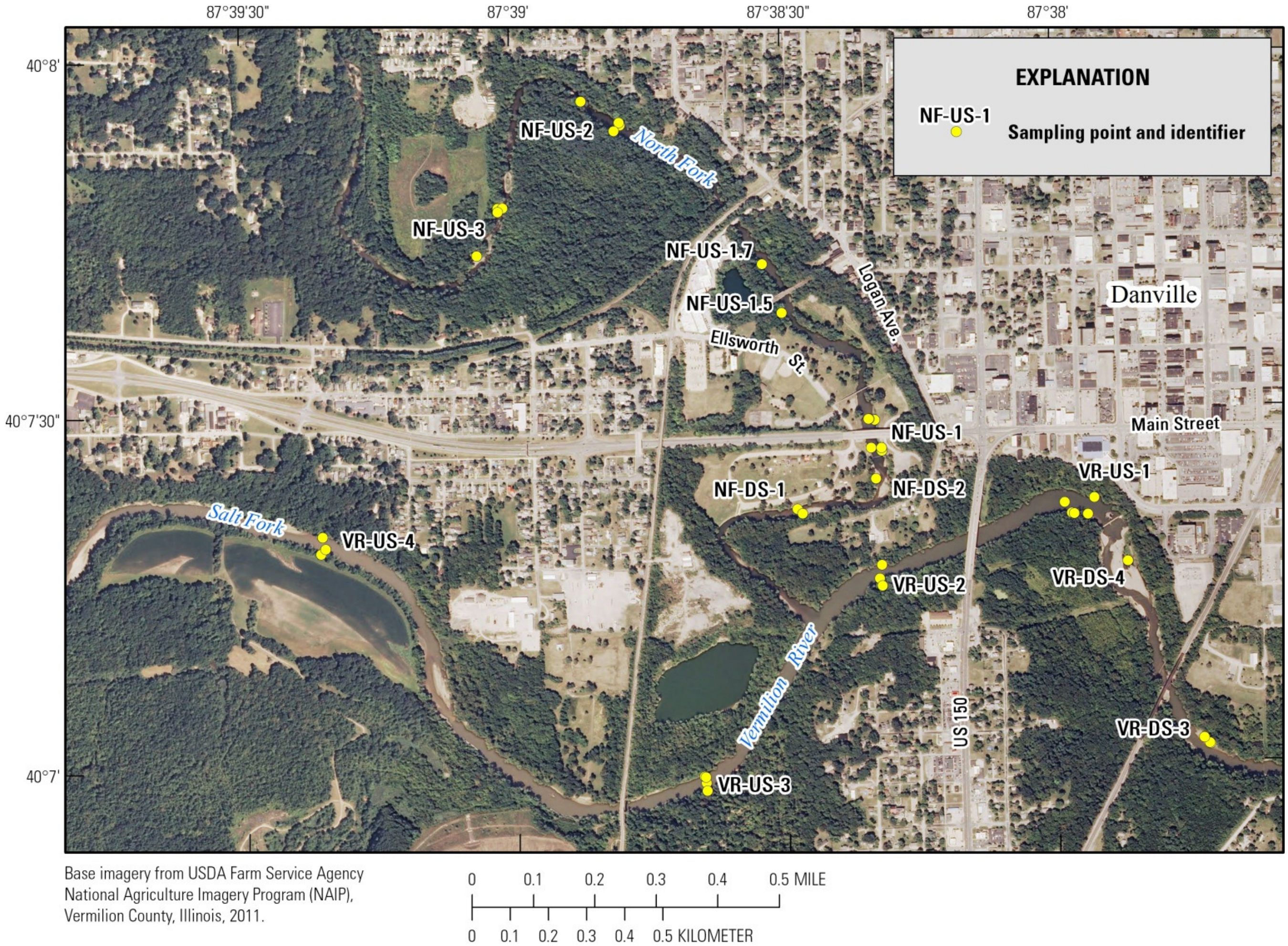


Figure B1. Sediment bed material sampling and (or) coring locations on the Vermilion and North Fork Vermilion Rivers near Danville, Illinois

Table B1. Sediment bed material sampling and (or) coring locations on the Vermilion and North Fork Vermilion Rivers near Danville, Illinois

Location	Sample Number	Latitude	Longitude
NF-DS-1	Sample 119	40.12261	-87.64116
NF-DS-1	Sample 120	40.12272	-87.64132
NF-DS-1	Sample 35	40.12261	-87.64116
NF-DS-2	Sample 45	40.12340	-87.63888
NF-US-1	Sample 129 0-0.45'	40.12413	-87.63870
NF-US-1	Sample 130 0.45-1.8'	40.12413	-87.63870
NF-US-1	Sample 131	40.12406	-87.63869
NF-US-1	Sample 132	40.12478	-87.63890
NF-US-1	Sample 133	40.12481	-87.63906
NF-US-1	Sample 2 0.45-1.8'	40.12413	-87.63870
NF-US-1	Sample 3	40.12413	-87.63902
NF-US-1	Sample 7	40.12481	-87.63908
NF-US-1.5	Sample 134	40.12732	-87.64172
NF-US-1.7	Sample 127	40.12848	-87.64230
NF-US-2	Sample 11	40.13235	-87.64783
NF-US-2	Sample 124	40.13164	-87.64683
NF-US-2	Sample 125	40.13177	-87.64663
NF-US-2	Sample 126	40.13183	-87.64666
NF-US-3	Sample 12	40.12875	-87.65111
NF-US-3	Sample 121	40.12986	-87.65044
NF-US-3	Sample 122	40.12978	-87.65044
NF-US-3	Sample 123	40.12875	-87.65111
NF-US-3	Sample 15	40.12987	-87.65029
VR-DS-3	Sample 115	40.11724	-87.62886
VR-DS-3	Sample 116	40.11711	-87.62870
VR-DS-3	Sample 39	40.11709	-87.62866
VR-DS-4	Sample 117	40.12141	-87.63113
VR-DS-4	Sample 118	40.12140	-87.63114
VR-US-1	Sample 104 0-0.8'	40.12253	-87.63277
VR-US-1	Sample 105 0.8-1.8'	40.12253	-87.63277
VR-US-1	Sample 106	40.12255	-87.63285
VR-US-1	Sample 107	40.12251	-87.63235
VR-US-1	Sample 108	40.12290	-87.63215
VR-US-1	Sample 22 0.8-1.8'	40.12253	-87.63277
VR-US-1	Sample 26	40.12279	-87.63307
VR-US-2	Sample 101	40.12138	-87.63873
VR-US-2	Sample 102 0-2.8'	40.12090	-87.63873
VR-US-2	Sample 103 2.8-4.0'	40.12090	-87.63873
VR-US-2	Sample 29 2.8-4.0'	40.12090	-87.63873
VR-US-2	Sample 30	40.12107	-87.63880
VR-US-3	Sample 112	40.11614	-87.64422
VR-US-3	Sample 113	40.11648	-87.64430
VR-US-3	Sample 114	40.11646	-87.64426
VR-US-3	Sample 31	40.11633	-87.64424
VR-US-4	Sample 109 0-1.4'	40.12221	-87.65598
VR-US-4	Sample 110 1.4-1.8'	40.12221	-87.65598
VR-US-4	Sample 111	40.12193	-87.65589
VR-US-4	Sample 18 1.4-1.8	40.12221	-87.65598
VR-US-4	Sample 19	40.12193	-87.65589
VR-US-4	Sample 20	40.12181	-87.65603

Appendix C – Bed Material Particle-size Distribution

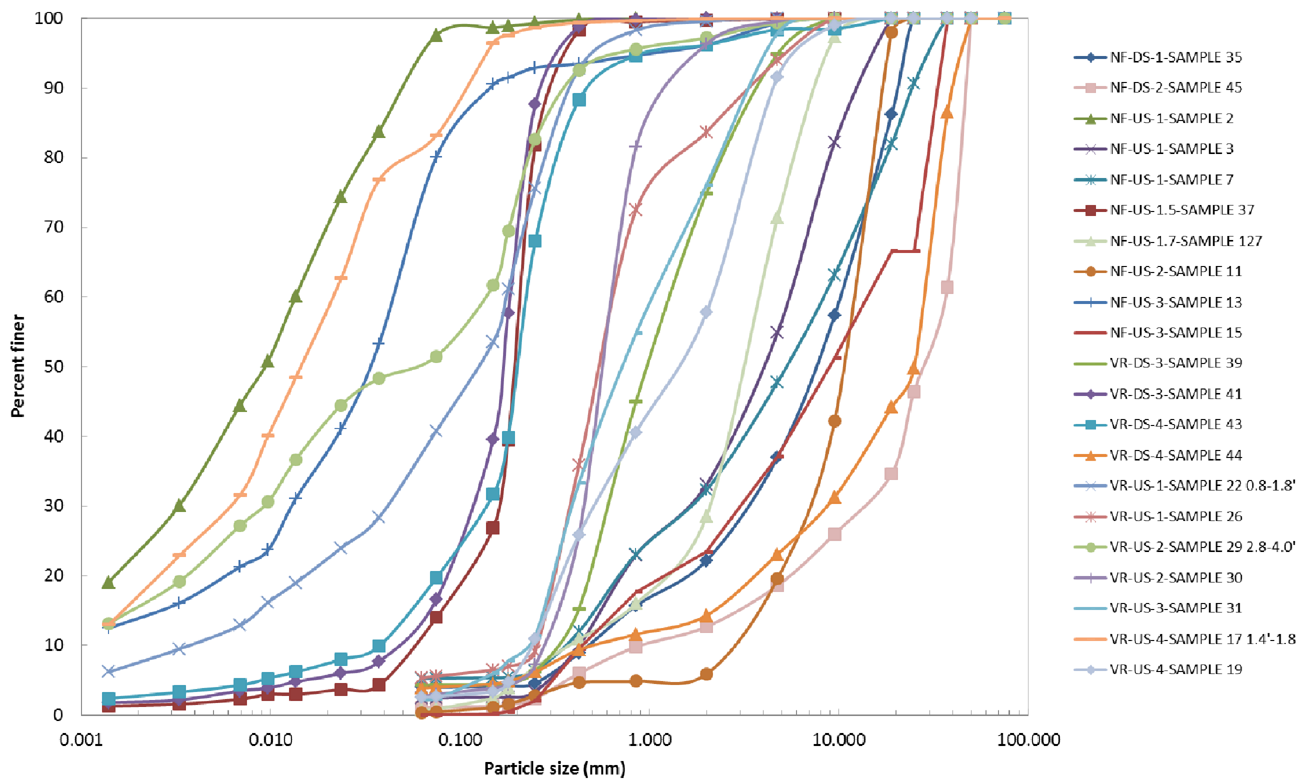


Figure C1. Sediment bed material or core particle-size analysis data on the Vermilion and North Fork Vermilion Rivers near Danville, Illinois

Appendix D – Sediment Core Analytes

Table D1. Sediment core analyte results for solids at location VR-US-1 on the Vermilion River near Danville, Illinois.

Parameter	CAS Number	Total Observations (Solid) Num.	Mean (mg/Kg)	Median (mg/Kg)	Detected Observations (Solid) Num.	Max (mg/Kg)	Min (mg/Kg)	Location of Max
4,4'-DDD	72-54-8	5	0	0	0	---	---	---
4,4'-DDE	72-55-9	5	0	0	0	---	---	---
4,4'-DDT	50-29-3	5	0.00042	0	1	0.0021	0.0021	VR-US-1-SAMPLE 108
Aldrin	309-00-2	5	0	0	0	---	---	---
alpha-BHC	319-84-6	5	0	0	0	---	---	---
alpha-Chlordane	5103-71-9	5	0	0	0	---	---	---
Aluminum	7429-90-5	5	3960	2000	5	9300	1300	VR-US-1-SAMPLE 105
Antimony	7440-36-0	5	0	0	0	---	---	---
Aroclor 1016	12674-11-2	5	0	0	0	---	---	---
Aroclor 1221	11104-28-2	5	0	0	0	---	---	---
Aroclor 1232	11141-16-5	5	0	0	0	---	---	---
Aroclor 1242	53469-21-9	5	0	0	0	---	---	---
Aroclor 1248	12672-29-6	5	0	0	0	---	---	---
Aroclor 1254	11097-69-1	5	0	0	0	---	---	---
Aroclor 1260	11096-82-5	5	0	0	0	---	---	---
Arsenic	7440-38-2	5	3.42	3.5	5	5	2.3	VR-US-1-SAMPLE 105
Barium	7440-39-3	5	29.30	16	5	60	9.5	VR-US-1-SAMPLE 105
Benzene	71-43-2	5	0	0	0	---	---	---
Beryllium	7440-41-7	5	0.238	0.15	5	0.48	0.1	VR-US-1-SAMPLE 105
beta-BHC	319-85-7	5	0	0	0	---	---	---
Cadmium	7440-43-9	5	0.1326	0.081	5	0.24	0.065	VR-US-1-SAMPLE 105
Calcium	7440-70-2	5	16600	18000	5	19000	11000	VR-US-1-SAMPLE 108
Chlordane (n.o.s.)	57-74-9	5	0.000078	0	1	0.00039	0.00039	VR-US-1-SAMPLE 108
Chromium	7440-47-3	5	7.76	4.6	5	14	3.9	VR-US-1-SAMPLE 105
Cobalt	7440-48-4	5	3.74	2.7	5	6.7	2	VR-US-1-SAMPLE 105
Copper	7440-50-8	5	8.3	4.9	5	17	2.5	VR-US-1-SAMPLE 105
delta-BHC	319-86-8	5	0	0	0	---	---	---
Dieldrin	60-57-1	5	0	0	0	---	---	---
Endosulfan I	959-98-8	5	0	0	0	---	---	---
Endosulfan II	33213-65-9	5	0	0	0	---	---	---
Endosulfan sulfate	1031-07-8	5	0	0	0	---	---	---
Endrin	72-20-8	5	0	0	0	---	---	---
Endrin aldehyde	7421-93-4	5	0	0	0	---	---	---
Endrin ketone	53494-70-5	5	0	0	0	---	---	---

Parameter	CAS Number	Total Observations (Solid)			Detected Observations (Solid)			Location of Max
		Num.	Mean (mg/Kg)	Median (mg/Kg)	Num.	Max (mg/Kg)	Min (mg/Kg)	
Ethylbenzene	100-41-4	5	0	0	0	---	---	---
gamma-BHC (Lindane)	58-89-9	5	0	0	0	---	---	---
gamma-Chlordane	5103-74-2	5	0	0	0	---	---	---
Gasoline (C6-C10)	8006-61-9	5	0	0	0	---	---	---
Heptachlor	76-44-8	5	0.000078	0	1	0.00039	0.00039	VR-US-1-SAMPLE 108
Heptachlor epoxide	1024-57-3	5	0	0	0	---	---	---
Hexachlorobenzene	118-74-1	5	0	0	0	---	---	---
Iron	7439-89-6	5	9140	6800	5	15000	5300	VR-US-1-SAMPLE 105
Lead	7439-92-1	5	10.580	4.2	5	27	3.8	VR-US-1-SAMPLE 108
Magnesium	7439-95-4	5	7420	7600	5	8600	5500	VR-US-1-SAMPLE 107
Manganese	7439-96-5	5	258	190	5	480	170	VR-US-1-SAMPLE 105
Mercury	7439-97-6	5	0.0094	0	2	0.027	0.02	VR-US-1-SAMPLE 105
Methoxychlor	72-43-5	5	0	0	0	---	---	---
Methyl tert-butyl ether	1634-04-4	5	0	0	0	---	---	---
Molybdenum	7439-98-7	5	0.09	0	1	0.45	0.45	VR-US-1-SAMPLE 108
m-Xylene & p-Xylene	179601-23-1	5	0	0	0	---	---	---
Nickel	7440-02-0	5	8.36	5.7	5	16	3.6	VR-US-1-SAMPLE 105
o-Xylene	95-47-6	5	0	0	0	---	---	---
Phosphorus	7723-14-0	5	90.40	110	4	190	12	VR-US-1-SAMPLE 105
Potassium	7440-09-7	5	716	390	5	1600	270	VR-US-1-SAMPLE 105
Selenium	7782-49-2	5	0	0	0	---	---	---
Silver	7440-22-4	5	0	0	0	---	---	---
Sodium	7440-23-5	5	138	120	5	180	110	VR-US-1-SAMPLE 108
Thallium	7440-28-0	5	0	0	0	---	---	---
Toluene	108-88-3	5	0	0	0	---	---	---
Total Cyanide	57-12-5	5	0	0	0	---	---	---
Toxaphene	8001-35-2	5	0	0	0	---	---	---
Vanadium	7440-62-2	5	10.520	7.2	5	18	5.7	VR-US-1-SAMPLE 105
Xylenes, Total	1330-20-7	5	0	0	0	---	---	---
Zinc	7440-66-6	5	33.20	19	5	62	14	VR-US-1-SAMPLE 105

Table D2. Sediment core analyte results for solids at location NF-US-1 on the North Fork Vermilion River near Danville, Illinois.

Parameter	CAS Number	Total Observations (Solid) Num.	Mean (mg/Kg)	Median (mg/Kg)	Detected Observations (Solid) Num.	Max (mg/Kg)	Min (mg/Kg)	Location of Max
4,4'-DDD	72-54-8	5	0	0	0	---	---	---
4,4'-DDE	72-55-9	5	0	0	0	---	---	---
4,4'-DDT	50-29-3	5	0	0	0	---	---	---
Aldrin	309-00-2	5	0	0	0	---	---	---
alpha-BHC	319-84-6	5	0	0	0	---	---	---
alpha-Chlordane	5103-71-9	5	0	0	0	---	---	---
Aluminum	7429-90-5	5	3260	2600	5	7000	1800	NF-US-1-SAMPLE 131
Antimony	7440-36-0	5	0	0	0	---	---	---
Aroclor 1016	12674-11-2	5	0	0	0	---	---	---
Aroclor 1221	11104-28-2	5	0	0	0	---	---	---
Aroclor 1232	11141-16-5	5	0	0	0	---	---	---
Aroclor 1242	53469-21-9	5	0	0	0	---	---	---
Aroclor 1248	12672-29-6	5	0	0	0	---	---	---
Aroclor 1254	11097-69-1	5	0.014	0	1	0.07	0.07	NF-US-1-SAMPLE 129
Aroclor 1260	11096-82-5	5	0.0038	0	1	0.019	0.019	NF-US-1-SAMPLE 129
Arsenic	7440-38-2	5	7.24	6.1	5	13	4.5	NF-US-1-SAMPLE 130
Barium	7440-39-3	5	32.60	30	5	59	20	NF-US-1-SAMPLE 131
Benzene	71-43-2	5	0	0	0	---	---	---
Beryllium	7440-41-7	5	0.25	0.23	5	0.43	0.11	NF-US-1-SAMPLE 131
beta-BHC	319-85-7	5	0	0	0	---	---	---
Cadmium	7440-43-9	5	0.276	0.18	5	0.51	0.13	NF-US-1-SAMPLE 131
Calcium	7440-70-2	5	42400	36000	5	66000	21000	NF-US-1-SAMPLE 132
Chlordane (n.o.s.)	57-74-9	5	0	0	0	---	---	---
Chromium	7440-47-3	5	7.8	5.9	5	12	4.8	NF-US-1-SAMPLE 130
Cobalt	7440-48-4	5	3.46	3.2	5	5.6	2.1	NF-US-1-SAMPLE 131
Copper	7440-50-8	5	10.240	9.6	5	19	3.7	NF-US-1-SAMPLE 131
delta-BHC	319-86-8	5	0	0	0	---	---	---
Dieldrin	60-57-1	5	0	0	0	---	---	---
Endosulfan I	959-98-8	5	0	0	0	---	---	---
Endosulfan II	33213-65-9	5	0	0	0	---	---	---
Endosulfan sulfate	1031-07-8	5	0	0	0	---	---	---
Endrin	72-20-8	5	0	0	0	---	---	---
Endrin aldehyde	7421-93-4	5	0	0	0	---	---	---
Endrin ketone	53494-70-5	5	0	0	0	---	---	---
Ethylbenzene	100-41-4	5	0.0024	0	1	0.012	0.012	NF-US-1-SAMPLE 130
gamma-BHC (Lindane)	58-89-9	5	0	0	0	---	---	---
gamma-Chlordane	5103-74-2	5	0	0	0	---	---	---
Gasoline (C6-C10)	8006-61-9	5	0.182	0	2	0.52	0.39	NF-US-1-SAMPLE 129

Parameter	CAS Number	Total Observations (Solid)			Detected Observations (Solid)			Location of Max
		Num.	Mean (mg/Kg)	Median (mg/Kg)	Num.	Max (mg/Kg)	Min (mg/Kg)	
Heptachlor	76-44-8	5	0	0	0	---	---	---
Heptachlor epoxide	1024-57-3	5	0	0	0	---	---	---
Hexachlorobenzene	118-74-1	5	0	0	0	---	---	---
Iron	7439-89-6	5	14860	12000	5	26000	6600	NF-US-1-SAMPLE 133
Lead	7439-92-1	5	21.960	13	5	56	3	NF-US-1-SAMPLE 129
Magnesium	7439-95-4	5	14580	17000	5	22000	6000	NF-US-1-SAMPLE 132
Manganese	7439-96-5	5	416	440	5	530	220	NF-US-1-SAMPLE 130 NF-US-1-SAMPLE 133
Mercury	7439-97-6	5	0.0224	0	2	0.094	0.018	NF-US-1-SAMPLE 130
Methoxychlor	72-43-5	5	0	0	0	---	---	---
Methyl tert-butyl ether	1634-04-4	5	0	0	0	---	---	---
Molybdenum	7439-98-7	5	1.042	0.77	5	2.2	0.36	NF-US-1-SAMPLE 133
m-Xylene & p-Xylene	179601-23-1	5	0.0074	0	2	0.026	0.011	NF-US-1-SAMPLE 130
Nickel	7440-02-0	5	8.78	8.8	5	14	5	NF-US-1-SAMPLE 131
o-Xylene	95-47-6	5	0.0024	0	1	0.012	0.012	NF-US-1-SAMPLE 130
Phosphorus	7723-14-0	5	134	110	5	320	47	NF-US-1-SAMPLE 130
Potassium	7440-09-7	5	548	450	5	1100	290	NF-US-1-SAMPLE 131
Selenium	7782-49-2	5	0.26	0	1	1.3	1.3	NF-US-1-SAMPLE 130
Silver	7440-22-4	5	0.076	0	1	0.38	0.38	NF-US-1-SAMPLE 131
Sodium	7440-23-5	5	128	130	5	140	110	NF-US-1-SAMPLE 130 NF-US-1-SAMPLE 133
Thallium	7440-28-0	5	0	0	0	---	---	---
Toluene	108-88-3	5	0.0054	0	1	0.027	0.027	NF-US-1-SAMPLE 129
Total Cyanide	57-12-5	5	0.348	0.33	5	0.42	0.31	NF-US-1-SAMPLE 131
Toxaphene	8001-35-2	5	0	0	0	---	---	---
Vanadium	7440-62-2	5	10.480	11	5	16	5.6	NF-US-1-SAMPLE 131
Xylenes, Total	1330-20-7	5	0.0076	0	1	0.038	0.038	NF-US-1-SAMPLE 130
Zinc	7440-66-6	5	42	47	5	61	18	NF-US-1-SAMPLE 131

Table D3. Sediment core analyte results for solids at location NF-DS-1, NF-US-1.5, NF-US-2, NF-US-3, VR-DS-3, VR-DS-4, VR-US-2, VR-US-3, VR-US-4 on the Vermilion and North Fork Vermilion Rivers near Danville, Illinois.

Parameter	CAS Number	Total Observations (Solid) Num.	Mean (mg/Kg)	Median (mg/Kg)	Detected Observations (Solid) Num.	Max (mg/Kg)	Min (mg/Kg)	Location of Max
4,4'-DDD	72-54-8	22	0	0	0	---	---	---
4,4'-DDE	72-55-9	22	0	0	0	---	---	---
4,4'-DDT	50-29-3	22	0	0	0	---	---	---
Aldrin	309-00-2	22	0	0	0	---	---	---
alpha-BHC	319-84-6	22	0	0	0	---	---	---
alpha-Chlordane	5103-71-9	22	0	0	0	---	---	---
Aluminum	7429-90-5	22	4238	3100	22	11000	240	VR-US-4-SAMPLE 110
Antimony	7440-36-0	22	0	0	0	---	---	---
Aroclor 1016	12674-11-2	22	0	0	0	---	---	---
Aroclor 1221	11104-28-2	22	0	0	0	---	---	---
Aroclor 1232	11141-16-5	22	0	0	0	---	---	---
Aroclor 1242	53469-21-9	22	0	0	0	---	---	---
Aroclor 1248	12672-29-6	22	0	0	0	---	---	---
Aroclor 1254	11097-69-1	22	0	0	0	---	---	---
Aroclor 1260	11096-82-5	22	0	0	0	---	---	---
Arsenic	7440-38-2	22	5.5	4.35	22	24	1.6	NF-US-2 SAMPLE 126
Barium	7440-39-3	22	37.1	33	22	90	7.8	VR-US-2-SAMPLE 103
Benzene	71-43-2	22	0	0	0	---	---	---
Beryllium	7440-41-7	22	0.299	0.235	22	0.7	0.058	VR-US-2-SAMPLE 103
beta-BHC	319-85-7	22	0	0	0	---	---	---
Cadmium	7440-43-9	22	0.190	0.165	22	0.36	0.055	NF-DS-1 SAMPLE 120 VR-US-2-SAMPLE 103
Calcium	7440-70-2	22	22682	18500	22	75000	11000	VR-DS-4-SAMPLE 118
Chlordane (n.o.s.)	57-74-9	22	0.0000	0	2	0.00067	0.0003	VR-US-4-SAMPLE 110
Chromium	7440-47-3	22	8.6	7.15	22	19	3.1	VR-US-2-SAMPLE 103
Cobalt	7440-48-4	22	4.8	4.1	22	9	1.7	VR-US-4-SAMPLE 110
Copper	7440-50-8	22	9.2	8.2	22	21	1.7	VR-US-2-SAMPLE 103
delta-BHC	319-86-8	22	0.00004	0	1	0.00086	0.00086	VR-US-4-SAMPLE 110
Dieldrin	60-57-1	22	0	0	0	---	---	---
Endosulfan I	959-98-8	22	0	0	0	---	---	---
Endosulfan II	33213-65-9	22	0	0	0	---	---	---
Endosulfan sulfate	1031-07-8	22	0	0	0	---	---	---
Endrin	72-20-8	22	0	0	0	---	---	---
Endrin aldehyde	7421-93-4	22	0	0	0	---	---	---
Endrin ketone	53494-70-5	22	0	0	0	---	---	---
Ethylbenzene	100-41-4	22	0.002	0	4	0.015	0.012	VR-US-4-SAMPLE 109
gamma-BHC (Lindane)	58-89-9	22	0	0	0	---	---	---

Parameter	CAS Number	Total Observations (Solid) Num.	Mean (mg/Kg)	Median (mg/Kg)	Detected Observations (Solid) Num.	Max (mg/Kg)	Min (mg/Kg)	Location of Max
gamma-Chlordane	5103-74-2	22	0	0	0	---	---	---
Gasoline (C6-C10)	8006-61-9	22	0.1	0	3	1.3	0.5	NF-US-1.5-SAMPLE 134
Heptachlor	76-44-8	22	0.0000	0	2	0.00067	0.0003	VR-US-4-SAMPLE 110
Heptachlor epoxide	1024-57-3	22	0	0	0	---	---	---
Hexachlorobenzene	118-74-1	22	0	0	0	---	---	---
Iron	7439-89-6	22	11973	10700	22	23000	3500	VR-US-4-SAMPLE 110
Lead	7439-92-1	22	9.7	7.75	22	38	2.9	NF-US-2 SAMPLE 126
Magnesium	7439-95-4	22	8682	7650	22	24000	4600	NF-DS-1 SAMPLE 119
Manganese	7439-96-5	22	312	305	22	530	89	VR-US-2-SAMPLE 101
Mercury	7439-97-6	22	0.0147	0.01115	12	0.07	0.0093	VR-US-2-SAMPLE 103
Methoxychlor	72-43-5	22	0	0	0	---	---	---
Methyl tert-butyl ether	1634-04-4	22	0.002	0	1	0.041	0.041	NF-US-3 SAMPLE 123
Molybdenum	7439-98-7	22	0.43	0.5	16	1.3	0.39	NF-DS-1 SAMPLE 119
m-Xylene & p-Xylene	179601-23-1	22	0.0075	0	8	0.03	0.0087	VR-US-3-SAMPLE 112
Nickel	7440-02-0	22	11.0	8.7	22	22	3.1	VR-US-3-SAMPLE 112
o-Xylene	95-47-6	22	0.0026	0	5	0.014	0.0053	VR-US-3-SAMPLE 112 VR-US-4-SAMPLE 110
Phosphorus	7723-14-0	22	66.4	58.50	16	250	1.9	VR-US-3-SAMPLE 114
Potassium	7440-09-7	22	803	640	22	1900	170	VR-US-2-SAMPLE 103
Selenium	7782-49-2	22	0.05	0	1	0.99	0.99	VR-DS-4-SAMPLE 118
Silver	7440-22-4	22	0	0	0	---	---	---
Sodium	7440-23-5	22	122	120	22	180	79	VR-US-4-SAMPLE 110
Thallium	7440-28-0	22	0	0	0	---	---	---
Toluene	108-88-3	22	0.045	0	2	0.95	0.045	NF-US-1.5-SAMPLE 134
Total Cyanide	57-12-5	22	0.09	0	9	0.38	0.14	NF-DS-1 SAMPLE 119
Toxaphene	8001-35-2	22	0.01	0	1	0.25	0.25	NF-US-2 SAMPLE 125
Vanadium	7440-62-2	22	12.3	10.50	22	27	3.5	VR-US-2-SAMPLE 103
Xylenes, Total	1330-20-7	22	0.010	0	7	0.044	0.016	VR-US-3-SAMPLE 112
Zinc	7440-66-6	22	36.9	35.50	22	77	9.1	VR-US-2-SAMPLE 103

Table D4. Sediment core analyte results for supernatants at location VR-US-1 on the Vermilion River near Danville, Illinois.

Parameter	CAS Number	Total Observations (Supernatant) Num.	Mean (µg/L)	Median (µg/L)	Detected Observations (Supernatant) Num.	Max (µg/L)	Min (µg/L)	Location of Max
4,4'-DDD	72-54-8	1	0	---	0	---	---	---
4,4'-DDE	72-55-9	1	0	---	0	---	---	---
4,4'-DDT	50-29-3	1	0	---	0	---	---	---
Aldrin	309-00-2	1	0	---	0	---	---	---
alpha-BHC	319-84-6	1	0	---	0	---	---	---
alpha-Chlordane	5103-71-9	1	0	---	0	---	---	---
Aluminum	7429-90-5	1	91000	91000	1	91000	91000	VR-US-1-SAMPLE 108
Antimony	7440-36-0	1	0	---	0	---	---	---
Aroclor 1016	12674-11-2	1	0	---	0	---	---	---
Aroclor 1221	11104-28-2	1	0	---	0	---	---	---
Aroclor 1232	11141-16-5	1	0	---	0	---	---	---
Aroclor 1242	53469-21-9	1	0	---	0	---	---	---
Aroclor 1248	12672-29-6	1	0	---	0	---	---	---
Aroclor 1254	11097-69-1	1	0	---	0	---	---	---
Aroclor 1260	11096-82-5	1	0	---	0	---	---	---
Arsenic	7440-38-2	1	100	100	1	100	100	VR-US-1-SAMPLE 108
Barium	7440-39-3	1	890	890	1	890	890	VR-US-1-SAMPLE 108
Benzene	71-43-2	1	0	---	0	---	---	---
Beryllium	7440-41-7	1	6.4	6.4	1	6.4	6.4	VR-US-1-SAMPLE 108
beta-BHC	319-85-7	1	0	---	0	---	---	---
Cadmium	7440-43-9	1	6.1	6.1	1	6.1	6.1	VR-US-1-SAMPLE 108
Calcium	7440-70-2	1	160000	160000	1	160000	160000	VR-US-1-SAMPLE 108
Chlordane (n.o.s.)	57-74-9	1	0	---	0	---	---	---
Chromium	7440-47-3	1	140	140	1	140	140	VR-US-1-SAMPLE 108
Cobalt	7440-48-4	1	78	78	1	78	78	VR-US-1-SAMPLE 108
Copper	7440-50-8	1	270	270	1	270	270	VR-US-1-SAMPLE 108
delta-BHC	319-86-8	1	0	---	0	---	---	---
Dieldrin	60-57-1	1	0	---	0	---	---	---
Endosulfan I	959-98-8	1	0	---	0	---	---	---
Endosulfan II	33213-65-9	1	0	---	0	---	---	---
Endosulfan sulfate	1031-07-8	1	0	---	0	---	---	---
Endrin	72-20-8	1	0	---	0	---	---	---
Endrin aldehyde	7421-93-4	1	0	---	0	---	---	---
Endrin ketone	53494-70-5	1	0	---	0	---	---	---
Ethylbenzene	100-41-4	1	0	---	0	---	---	---
gamma-BHC (Lindane)	58-89-9	1	0	---	0	---	---	---
gamma-Chlordane	5103-74-2	1	0	---	0	---	---	---
Gasoline (C6-C10)	8006-61-9	1	0	---	0	---	---	---

Parameter	CAS Number	Total Observations (Supernatant)			Detected Observations (Supernatant)			Location of Max
		Num.	Mean (µg/L)	Median (µg/L)	Num.	Max (µg/L)	Min (µg/L)	
Heptachlor	76-44-8	1	0	---	0	---	---	---
Heptachlor epoxide	1024-57-3	1	0	---	0	---	---	---
Hexachlorobenzene	118-74-1	1	0	---	0	---	---	---
Iron	7439-89-6	1	210000	210000	1	210000	210000	VR-US-1-SAMPLE 108
Lead	7439-92-1	1	670	670	1	670	670	VR-US-1-SAMPLE 108
Magnesium	7439-95-4	1	76000	76000	1	76000	76000	VR-US-1-SAMPLE 108
Manganese	7439-96-5	1	4300	4300	1	4300	4300	VR-US-1-SAMPLE 108
Mercury	7439-97-6	1	0.0013	0.0013	1	0.0013	0.0013	VR-US-1-SAMPLE 108
Methoxychlor	72-43-5	1	0	---	0	---	---	---
Methyl tert-butyl ether	1634-04-4	1	0	---	0	---	---	---
Molybdenum	7439-98-7	1	6.7	6.7	1	6.7	6.7	VR-US-1-SAMPLE 108
m-Xylene & p-Xylene	179601-23-1	1	0	---	0	---	---	---
Nickel	7440-02-0	1	170	170	1	170	170	VR-US-1-SAMPLE 108
o-Xylene	95-47-6	1	0	---	0	---	---	---
Phosphorus	7723-14-0	1	0.0084	0.0084	1	0.0084	0.0084	VR-US-1-SAMPLE 108
Potassium	7440-09-7	1	15000	15000	1	15000	15000	VR-US-1-SAMPLE 108
Selenium	7782-49-2	1	0	---	0	---	---	---
Silver	7440-22-4	1	1.3	1.3	1	1.3	1.3	VR-US-1-SAMPLE 108
Sodium	7440-23-5	1	15000	15000	1	15000	15000	VR-US-1-SAMPLE 108
Thallium	7440-28-0	1	0	---	0	---	---	---
Toluene	108-88-3	1	0	---	0	---	---	---
Total Cyanide	57-12-5	1	0.025	0.025	1	0.025	0.025	VR-US-1-SAMPLE 108
Toxaphene	8001-35-2	1	0	---	0	---	---	---
Vanadium	7440-62-2	1	160	160	1	160	160	VR-US-1-SAMPLE 108
Xylenes, Total	1330-20-7	1	0	---	0	---	---	---
Zinc	7440-66-6	1	1200	1200	1	1200	1200	VR-US-1-SAMPLE 108

Table D5. Sediment core analyte results for supernatants at location NF-US-1 on the North Fork Vermilion River near Danville, Illinois.

Parameter	CAS Number	Total Observations (Supernatant) Num.	Mean (µg/L)	Median (µg/L)	Detected Observations (Supernatant) Num.	Max (µg/L)	Min (µg/L)	Location of Max
4,4'-DDD	72-54-8	1	0.043	0.043	1	0.043	0.043	NF-US-1-SAMPLE 130
4,4'-DDE	72-55-9	1	0.018	0.018	1	0.018	0.018	NF-US-1-SAMPLE 130
4,4'-DDT	50-29-3	1	0	---	0	---	---	---
Aldrin	309-00-2	1	0	---	0	---	---	---
alpha-BHC	319-84-6	1	0.0087	0.0087	1	0.0087	0.0087	NF-US-1-SAMPLE 130
alpha-Chlordane	5103-71-9	1	0	---	0	---	---	---
Aluminum	7429-90-5	1	62000	62000	1	62000	62000	NF-US-1-SAMPLE 130
Antimony	7440-36-0	1	0	---	0	---	---	---
Aroclor 1016	12674-11-2	1	0	---	0	---	---	---
Aroclor 1221	11104-28-2	1	0	---	0	---	---	---
Aroclor 1232	11141-16-5	1	0	---	0	---	---	---
Aroclor 1242	53469-21-9	1	0	---	0	---	---	---
Aroclor 1248	12672-29-6	1	0	---	0	---	---	---
Aroclor 1254	11097-69-1	1	0	---	0	---	---	---
Aroclor 1260	11096-82-5	1	0	---	0	---	---	---
Arsenic	7440-38-2	1	58	58	1	58	58	NF-US-1-SAMPLE 130
Barium	7440-39-3	1	700	700	1	700	700	NF-US-1-SAMPLE 130
Benzene	71-43-2	1	0	---	0	---	---	---
Beryllium	7440-41-7	1	4.1	4.1	1	4.1	4.1	NF-US-1-SAMPLE 130
beta-BHC	319-85-7	1	0	---	0	---	---	---
Cadmium	7440-43-9	1	4.7	4.7	1	4.7	4.7	NF-US-1-SAMPLE 130
Calcium	7440-70-2	1	260000	260000	1	260000	260000	NF-US-1-SAMPLE 130
Chlordane (n.o.s.)	57-74-9	1	0.011	0.011	1	0.011	0.011	NF-US-1-SAMPLE 130
Chromium	7440-47-3	1	97	97	1	97	97	NF-US-1-SAMPLE 130
Cobalt	7440-48-4	1	52	52	1	52	52	NF-US-1-SAMPLE 130
Copper	7440-50-8	1	190	190	1	190	190	NF-US-1-SAMPLE 130
delta-BHC	319-86-8	1	0	---	0	---	---	---
Dieldrin	60-57-1	1	0	---	0	---	---	---
Endosulfan I	959-98-8	1	0	---	0	---	---	---
Endosulfan II	33213-65-9	1	0	---	0	---	---	---
Endosulfan sulfate	1031-07-8	1	0	---	0	---	---	---
Endrin	72-20-8	1	0	---	0	---	---	---
Endrin aldehyde	7421-93-4	1	0	---	0	---	---	---
Endrin ketone	53494-70-5	1	0	---	0	---	---	---
Ethylbenzene	100-41-4	1	0	---	0	---	---	---
gamma-BHC (Lindane)	58-89-9	1	0	---	0	---	---	---
gamma-Chlordane	5103-74-2	1	0.011	0.011	1	0.011	0.011	NF-US-1-SAMPLE 130

Parameter	CAS Number	Total Observations (Supernatant)			Detected Observations (Supernatant)			Location of Max
		Num.	Mean (µg/L)	Median (µg/L)	Num.	Max (µg/L)	Min (µg/L)	
Gasoline (C6-C10)	8006-61-9	1	0	---	0	---	---	---
Heptachlor	76-44-8	1	0	---	0	---	---	---
Heptachlor epoxide	1024-57-3	1	0	---	0	---	---	---
Hexachlorobenzene	118-74-1	1	0	---	0	---	---	---
Iron	7439-89-6	1	130000	130000	1	130000	130000	NF-US-1-SAMPLE 130
Lead	7439-92-1	1	630	630	1	630	630	NF-US-1-SAMPLE 130
Magnesium	7439-95-4	1	88000	88000	1	88000	88000	NF-US-1-SAMPLE 130
Manganese	7439-96-5	1	4000	4000	1	4000	4000	NF-US-1-SAMPLE 130
Mercury	7439-97-6	1	1.4	1.4	1	1.4	1.4	NF-US-1-SAMPLE 130
Methoxychlor	72-43-5	1	0	---	0	---	---	---
Methyl tert-butyl ether	1634-04-4	1	0	---	0	---	---	---
Molybdenum	7439-98-7	1	10	10	1	10	10	NF-US-1-SAMPLE 130
m-Xylene & p-Xylene	179601-23-1	1	0	---	0	---	---	---
Nickel	7440-02-0	1	130	130	1	130	130	NF-US-1-SAMPLE 130
o-Xylene	95-47-6	1	0	---	0	---	---	---
Phosphorus	7723-14-0	1	3.3	3.3	1	3.3	3.3	NF-US-1-SAMPLE 130
Potassium	7440-09-7	1	8500	8500	1	8500	8500	NF-US-1-SAMPLE 130
Selenium	7782-49-2	1	0	---	0	---	---	---
Silver	7440-22-4	1	11	11	1	11	11	NF-US-1-SAMPLE 130
Sodium	7440-23-5	1	7000	7000	1	7000	7000	NF-US-1-SAMPLE 130
Thallium	7440-28-0	1	0	---	0	---	---	---
Toluene	108-88-3	1	0	---	0	---	---	---
Total Cyanide	57-12-5	1	0	---	0	---	---	---
Toxaphene	8001-35-2	1	0	---	0	---	---	---
Vanadium	7440-62-2	1	130	130	1	130	130	NF-US-1-SAMPLE 130
Xylenes, Total	1330-20-7	1	0	---	0	---	---	---
Zinc	7440-66-6	1	870	870	1	870	870	NF-US-1-SAMPLE 130

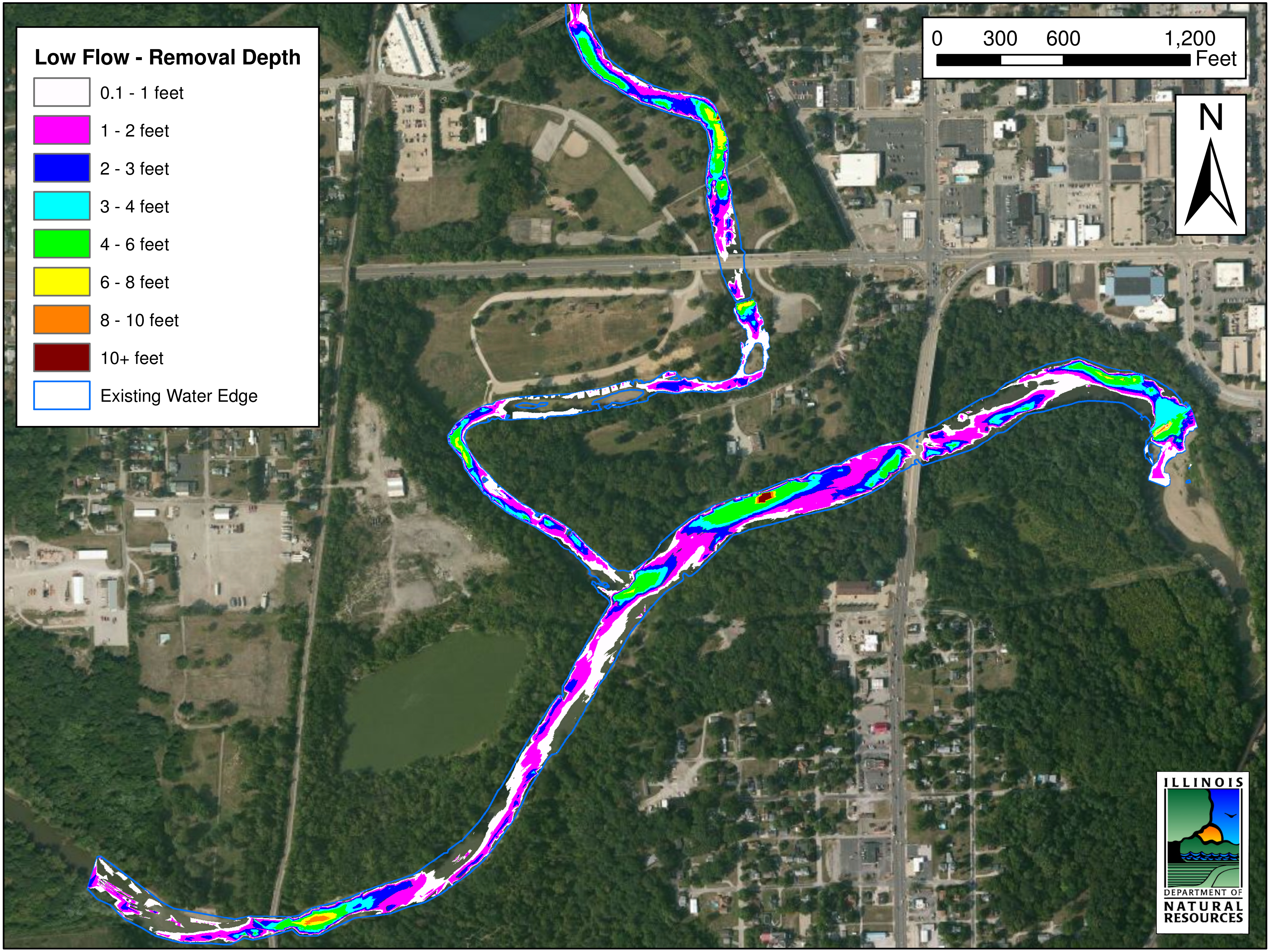
Table D6. Sediment core analyte results for supernatant at location NF-DS-1, NF-US-1.5, NF-US-2, NF-US-3, VR-DS-3, VR-DS-4, VR-US-2, VR-US-3, VR-US-4 on the Vermilion and North Fork Vermilion Rivers near Danville, Illinois.

Parameter	CAS Number	Total Observations (Supernatant) Num.	Mean (µg/L)	Median (µg/L)	Detected Observations (Supernatant) Num.	Max (µg/L)	Min (µg/L)	Location of Max
4,4'-DDD	72-54-8	9	0	---	0	---	---	---
4,4'-DDE	72-55-9	9	0	---	0	---	---	---
4,4'-DDT	50-29-3	9	0	---	0	---	---	---
Aldrin	309-00-2	9	0	---	0	---	---	---
alpha-BHC	319-84-6	9	0	---	0	---	---	---
alpha-Chlordane	5103-71-9	9	0.0027	0.01225	2	0.018	0.0065	NF-US-1.5-SAMPLE 134
Aluminum	7429-90-5	9	87444	50000	9	350000	11000	VR-US-4-SAMPLE 110
Antimony	7440-36-0	9	0	---	0	---	---	---
Aroclor 1016	12674-11-2	9	0	---	0	---	---	---
Aroclor 1221	11104-28-2	9	0	---	0	---	---	---
Aroclor 1232	11141-16-5	9	0	---	0	---	---	---
Aroclor 1242	53469-21-9	9	0	---	0	---	---	---
Aroclor 1248	12672-29-6	9	0	---	0	---	---	---
Aroclor 1254	11097-69-1	9	0	---	0	---	---	---
Aroclor 1260	11096-82-5	9	0	---	0	---	---	---
Arsenic	7440-38-2	9	55.5	44	9	190	9.7	VR-US-4-SAMPLE 110
Barium	7440-39-3	9	971	520	9	3800	180	VR-US-4-SAMPLE 110
Benzene	71-43-2	9	0.047	0.094	5	0.11	0.078	VR-DS-3-SAMPLE 115
Beryllium	7440-41-7	9	6.53	3.1	9	28	0.75	VR-US-4-SAMPLE 110
beta-BHC	319-85-7	9	0.002	0.016	1	0.016	0.016	NF-US-3 SAMPLE 121
Cadmium	7440-43-9	9	3.65	2.6	9	10	0.64	VR-US-4-SAMPLE 110
Calcium	7440-70-2	9	288333	200000	9	830000	85000	VR-US-4-SAMPLE 110
Chlordane (n.o.s.)	57-74-9	9	0.008	0.036	2	0.05	0.022	NF-US-1.5-SAMPLE 134
Chromium	7440-47-3	9	133	81	9	530	18	VR-US-4-SAMPLE 110
Cobalt	7440-48-4	9	96	48	9	370	11	VR-US-4-SAMPLE 110
Copper	7440-50-8	9	191	130	9	670	29	VR-US-4-SAMPLE 110
delta-BHC	319-86-8	9	0	---	0	---	---	---
Dieldrin	60-57-1	9	0.0008	0.0075	1	0.0075	0.0075	NF-US-1.5-SAMPLE 134
Endosulfan I	959-98-8	9	0	---	0	---	---	---
Endosulfan II	33213-65-9	9	0	---	0	---	---	---
Endosulfan sulfate	1031-07-8	9	0	---	0	---	---	---
Endrin	72-20-8	9	0	---	0	---	---	---
Endrin aldehyde	7421-93-4	9	0	---	0	---	---	---
Endrin ketone	53494-70-5	9	0	---	0	---	---	---
Ethylbenzene	100-41-4	9	0.01	0.12	1	0.12	0.12	NF-US-3 SAMPLE 121
gamma-BHC (Lindane)	58-89-9	9	0	---	0	---	---	---
gamma-Chlordane	5103-74-2	9	0.002	0.022	1	0.022	0.022	NF-US-1.5-SAMPLE 134

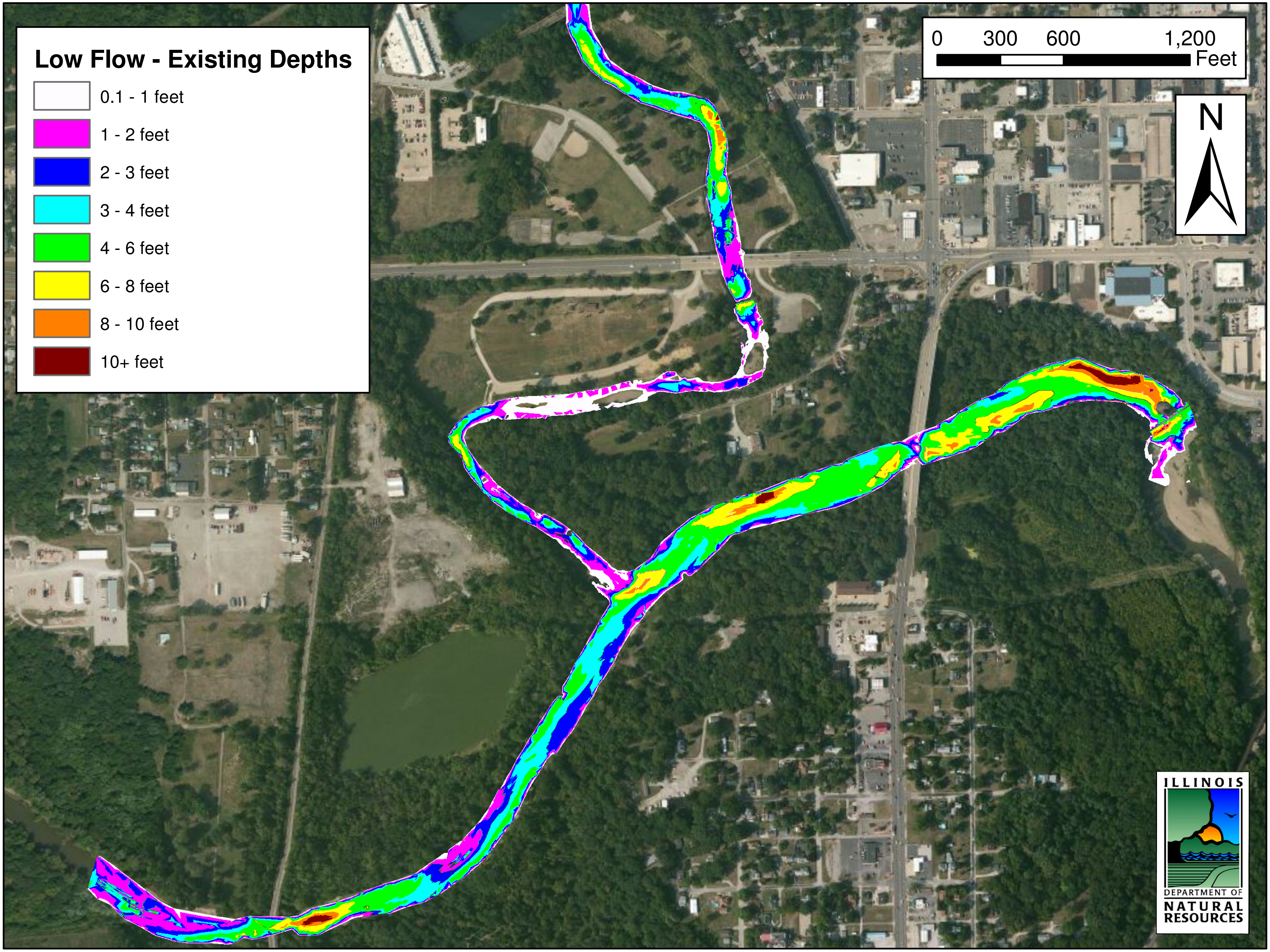
Parameter	CAS Number	Total Observations (Supernatant) Num.	Mean (µg/L)	Median (µg/L)	Detected Observations (Supernatant) Num.	Max (µg/L)	Min (µg/L)	Location of Max
Gasoline (C6-C10)	8006-61-9	9	0	4	1	4	4	VR-US-4-SAMPLE 110
Heptachlor	76-44-8	9	0.00	0.013	2	0.016	0.01	NF-US-3 SAMPLE 121
Heptachlor epoxide	1024-57-3	9	0	---	0	---	---	---
Hexachlorobenzene	118-74-1	9	0	---	0	---	---	---
Iron	7439-89-6	9	223000	110000	9	1000000	24000	VR-US-4-SAMPLE 110
Lead	7439-92-1	9	180	130	9	590	36	VR-US-4-SAMPLE 110
Magnesium	7439-95-4	9	124222	72000	9	390000	34000	VR-US-4-SAMPLE 110
Manganese	7439-96-5	9	7961	4000	9	35000	550	VR-US-4-SAMPLE 110
Mercury	7439-97-6	9	0.327	0.21	9	0.9	0.058	VR-DS-4-SAMPLE 117
Methoxychlor	72-43-5	9	0	---	0	---	---	---
Methyl tert-butyl ether	1634-04-4	9	0	---	0	---	---	---
Molybdenum	7439-98-7	9	3.4	6.4	5	9.2	3.2	NF-US-3 SAMPLE 121
m-Xylene & p-Xylene	179601-23-1	9	0.06	0.285	2	0.29	0.28	NF-US-2 SAMPLE 124
Nickel	7440-02-0	9	212	120	9	780	27	VR-US-4-SAMPLE 110
o-Xylene	95-47-6	9	0	---	0	---	---	---
Phosphorus	7723-14-0	9	0.931	1.025	8	2.4	0.012	VR-DS-3-SAMPLE 115
Potassium	7440-09-7	9	10422	9000	9	29000	3900	VR-US-4-SAMPLE 110
Selenium	7782-49-2	9	2.4	6.9	3	9.9	4.9	VR-DS-4-SAMPLE 117
Silver	7440-22-4	9	0	---	0	---	---	---
Sodium	7440-23-5	9	9056	9800	9	15000	6000	VR-US-4-SAMPLE 110
Thallium	7440-28-0	9	0.7	5.9	1	5.9	5.9	VR-DS-4-SAMPLE 117
Toluene	108-88-3	9	0.12	0.36	3	0.38	0.31	NF-US-3 SAMPLE 121
Total Cyanide	57-12-5	9	0.0010	0.0087	1	0.0087	0.0087	VR-US-2-SAMPLE 101
Toxaphene	8001-35-2	9	0	---	0	---	---	---
Vanadium	7440-62-2	9	167	110	9	640	27	VR-US-4-SAMPLE 110
Xylenes, Total	1330-20-7	9	0.12	0.4	3	0.42	0.24	NF-US-2 SAMPLE 124
Zinc	7440-66-6	9	801	500	9	2900	110	VR-US-4-SAMPLE 110

Appendix B: CD Containing the Hydraulic Modeling

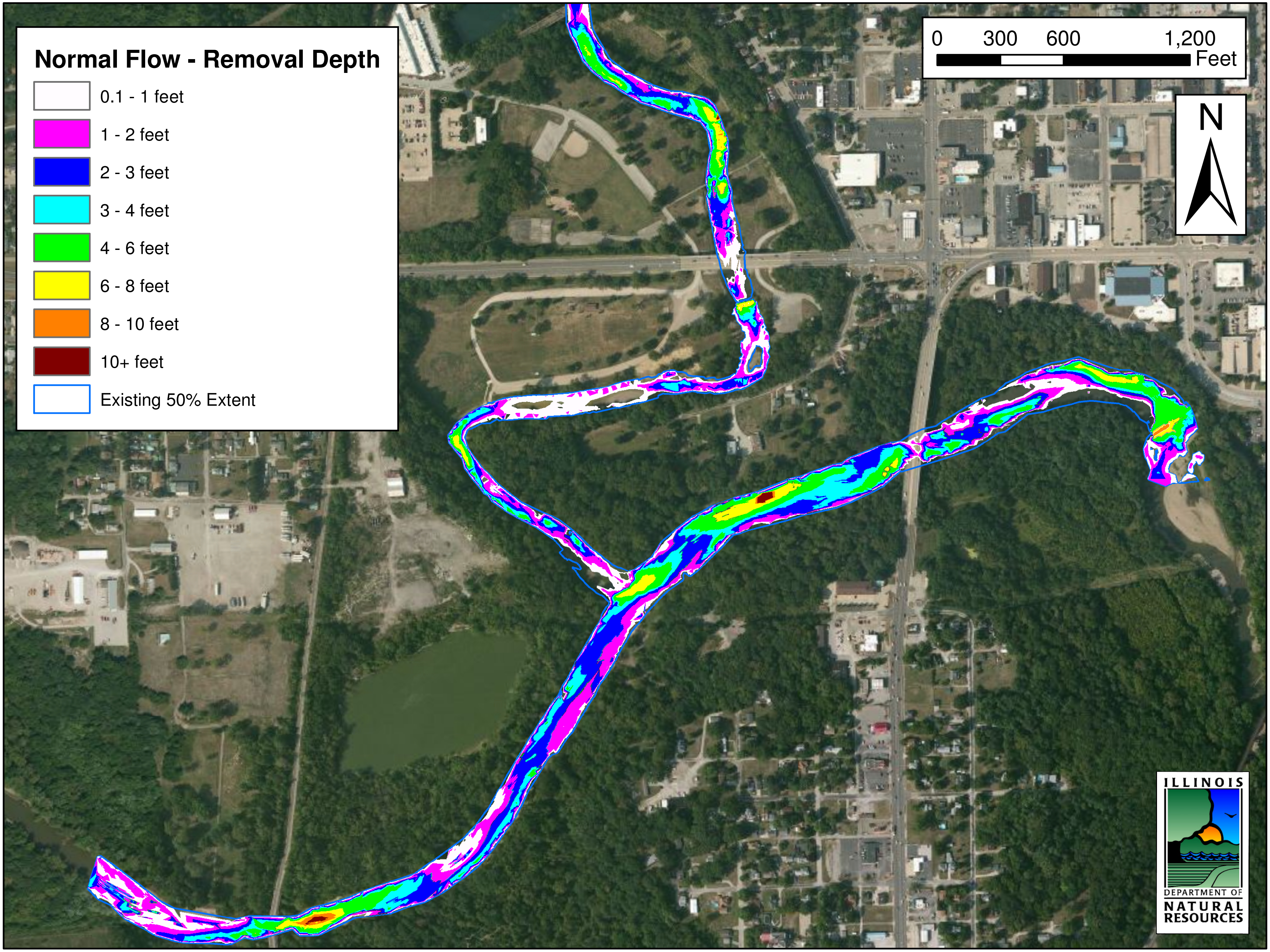
Appendix C: Alternative Inundation Maps

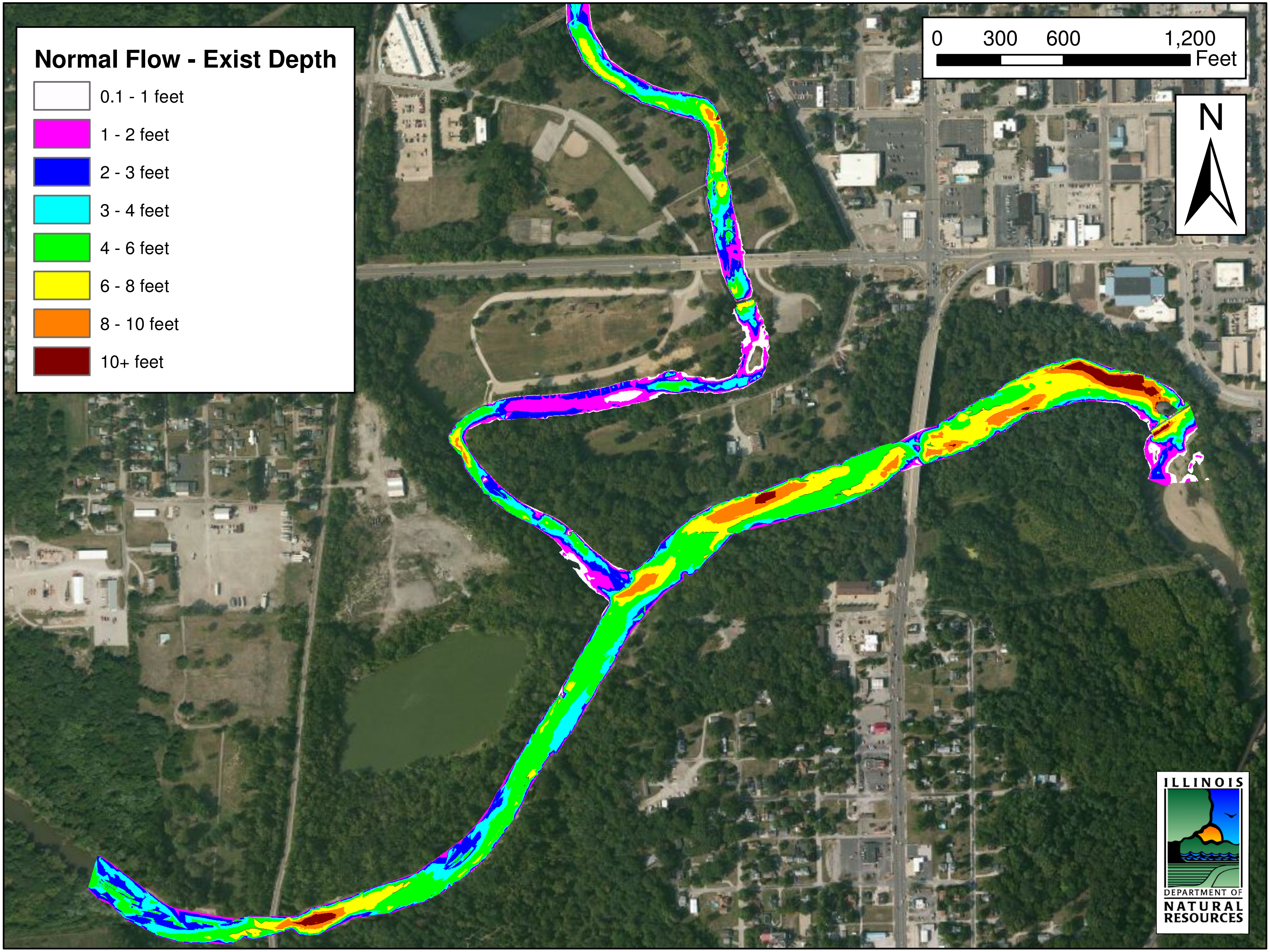


Low Flow - Removal Depth
0.1 - 1 feet
1 - 2 feet
2 - 3 feet
3 - 4 feet
4 - 6 feet
6 - 8 feet
8 - 10 feet
10+ feet
Existing Water Edge
0 300 600 1,200
Feet
N
ILLINOIS
DEPARTMENT OF
NATURAL
RESOURCES



Low Flow - Existing Depths
0.1 - 1 feet
1 - 2 feet
2 - 3 feet
3 - 4 feet
4 - 6 feet
6 - 8 feet
8 - 10 feet
10+ feet
0 300 600 1,200
Feet
N
ILLINOIS
DEPARTMENT OF
NATURAL
RESOURCES


Normal Flow - Removal Depth
0.1 - 1 feet
1 - 2 feet
2 - 3 feet
3 - 4 feet
4 - 6 feet
6 - 8 feet
8 - 10 feet
10+ feet
Existing 50% Extent
0 300 600 1,200
Feet
N
ILLINOIS
DEPARTMENT OF
NATURAL
RESOURCES


Normal Flow - Exist Depth
0.1 - 1 feet
1 - 2 feet
2 - 3 feet
3 - 4 feet
4 - 6 feet
6 - 8 feet
8 - 10 feet
10+ feet
0
300
600
1,200
Feet
N
ILLINOIS
DEPARTMENT OF
NATURAL
RESOURCES

Appendix D: Detailed Cost Estimate of Alternatives

Danville Alternative 1 - Full Dam Removal					
Cost Estimate					
Vermilion County					*revised:2/21/2013*
PAY ITEM #	**ITEM DESCRIPTION**	**UNITS**	**UNIT PRICE**	**QUANTITY**	**COST**
CONSTRUCTION MATERIALS					
28000400	Perimeter Erosion Barrier	foot	$ 3.58	1,500	$5,400
20201550	Subbase Granular Material, Type B, C	cu yd	$ 41.00	667	$27,300
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 6.15	2,000	$12,300
50102400	Concrete Removal	cu yd	$ 692.00	1,210	$837,600
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 12,000.00	0.29	$3,500
	East Abutment Rehabilitation	lump	$ 10,000.00	1	$10,000
EARTHWORK & GRADING					
20100500	Tree Removal, Acres	acre	$ 15,227.00	0.52	$7,900
21101505	Topsoil Excavation and Placement	cu yd	$ 15.60	333	$5,200
20200100	Earth Excavation	cu yd	$ 18.37	1,700	$31,200
				SUBTOTAL	**$940,400**
OTHER					
	Contingencies (15%)	lump	lump	1	$141,100
67000400	Engineer Field Office/Lab	month	$ 1,764.50	6	$10,600
Approx.	Mobilization (6% subtotal)	lump	lump	1	$56,400
				SUBTOTAL	**$208,100**
	CONSTRUCTION COSTS				**$1,148,500**
DESIGN COSTS					
	Engineering (20%)	lump	lump	1	$229,700
	Construction Supervision (7.5%)	lump	lump	1	$86,100
				SUBTOTAL	**$315,800**
LAND RIGHTS & UTILITY RELOCATIONS					
					$0
					$0
					$0
				SUBTOTAL	**$0**
	TOTAL PROJECT COSTS				**$1,464,300**

Ellsworth Alternative 1 - Full Dam Removal

Cost Estimate

Vermilion County *revised:2/21/2013*

PAY ITEM #	ITEM DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	COST
	CONSTRUCTION MATERIALS				
28000400	Perimeter Erosion Barrier	foot	$ 3.58	650	$2,300
20201550	Subbase Granular Material, Type B, C	cu yd	$ 41.00	44	$1,800
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 6.15	133	$800
50102400	Concrete Removal	cu yd	$ 692.00	132	$91,500
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 12,000.00	0.21	$2,500
28100207	Stone Riprap, CL A4	tons	$ 57.34	1,148	$65,800
28200200	Filter Fabric	sq yd	$ 4.00	750	$3,000
	EARTHWORK & GRADING				
21101505	Topsoil Excavation and Placement	cu yd	$ 15.60	22	$300
20200100	Earth Excavation	cu yd	$ 18.37	256	$4,700
					$0
				SUBTOTAL	**$172,700**
	OTHER				
	Contingencies (15%)	lump	lump	1	$25,900
67000400	Engineer Field Office/Lab	month	$ 2,380.00	3	$7,100
Approx.	Mobilization (6% subtotal)	lump	lump	1	$10,400
				SUBTOTAL	**$43,400**
	CONSTRUCTION COSTS				**$216,100**
	DESIGN COSTS				
	Engineering (20%)	lump	lump	1	$43,200
	Construction Supervision (7.5%)	lump	lump	1	$16,200
				SUBTOTAL	**$59,400**
	LAND RIGHTS & UTILITY RELOCATIONS				
					$0
					$0
					$0
				SUBTOTAL	**$0**
	TOTAL PROJECT COSTS				**$275,500**

Danville Alternative 2 - Partial Dam Removal

Cost Estimate

Vermilion County *revised:2/21/2013*

PAY ITEM #	ITEM DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	COST
	CONSTRUCTION MATERIALS				
28000400	Perimeter Erosion Barrier	foot	$ 3.58	1,500	$5,400
20201550	Subbase Granular Material, Type B, C	cu yd	$ 41.00	667	$27,300
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 6.15	2,000	$12,300
50102400	Concrete Removal	cu yd	$ 692.00	678	$469,400
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 12,000.00	0.29	$3,500
28100207	Stone Riprap, CL A4	tons	$ 57.34	10,832	$621,100
28200200	Filter Fabric	sq yd	$ 4.00	1,351	$5,400
	EARTHWORK & GRADING				
20100500	Tree Removal, Acres	acre	$ 15,227.00	0.52	$7,900
21101505	Topsoil Excavation and Placement	cu yd	$ 15.60	333	$5,200
20200100	Earth Excavation	cu yd	$ 18.37	1,235	$22,700
				SUBTOTAL	**$1,180,200**
	OTHER				
	Contingencies (15%)	lump	lump	1	$177,000
67000400	Engineer Field Office/Lab	month	$ 1,764.50	5	$8,800
Approx.	Mobilization (6% subtotal)	lump	lump	1	$70,800
				SUBTOTAL	**$256,600**
	CONSTRUCTION COSTS				**$1,436,800**
	DESIGN COSTS				
	Engineering (20%)	lump	lump	1	$287,400
	Construction Supervision (7.5%)	lump	lump	1	$107,800
				SUBTOTAL	**$395,200**
	LAND RIGHTS & UTILITY RELOCATIONS				
				SUBTOTAL	**$0**
	TOTAL PROJECT COSTS				**$1,832,000**

Ellsworth Alternative 2 - Partial Removal					
Cost Estimate					
Vermilion County					*revised:2/21/2013*
PAY ITEM #	**ITEM DESCRIPTION**	**UNITS**	**UNIT PRICE**	**QUANTITY**	**COST**
CONSTRUCTION MATERIALS					
28000400	Perimeter Erosion Barrier	foot	$ 3.58	650	$2,300
20201550	Subbase Granular Material, Type B, C	cu yd	$ 41.00	44	$1,800
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 6.15	133	$800
50102400	Concrete Removal	cu yd	$ 692.00	9	$6,200
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 12,000.00	0.21	$2,500
28100207	Stone Riprap, CL A4	tons	$ 57.34	1,697	$97,300
28200200	Filter Fabric	sq yd	$ 4.00	750	$3,000
EARTHWORK & GRADING					
21101505	Topsoil Excavation and Placement	cu yd	$ 15.60	22	$300
20200100	Earth Excavation	cu yd	$ 18.37	642	$11,800
				SUBTOTAL	**$126,000**
OTHER					
	Contingencies (15%)	lump	lump	1	$18,900
67000400	Engineer Field Office/Lab	month	$ 1,764.50	2	$3,500
Approx.	Mobilization (6% subtotal)	lump	lump	1	$7,600
				SUBTOTAL	**$30,000**
	CONSTRUCTION COSTS				**$156,000**
DESIGN COSTS					
	Engineering (20%)	lump	lump	1	$31,200
	Construction Supervision (7.5%)	lump	lump	1	$11,700
				SUBTOTAL	**$42,900**
LAND RIGHTS & UTILITY RELOCATIONS					
				SUBTOTAL	**$0**
	TOTAL PROJECT COSTS				**$198,900**

Danville Alternative 3 - Stepped Spillway					
Cost Estimate					
Vermilion County					*revised:2/21/2013*
PAY ITEM #	**ITEM DESCRIPTION**	**UNITS**	**UNIT PRICE**	**QUANTITY**	**COST**
CONSTRUCTION MATERIALS					
28000400	Perimeter Erosion Barrier	foot	$ 3.58	1,500	$5,400
20201550	Subbase Granular Material, Type B, C	cu yd	$ 41.00	667	$27,300
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 6.15	2,000	$12,300
OWR Spec.	Temporary Coffer Dam System	l sum	$ 300,000.00	1.00	$300,000
50102400	Concrete Removal	cu yd	$ 692.00	399	$276,400
	Concrete Structures	cu yd	$ 683.25	1,198	$818,400
	Reinforcement Bars, Epoxy Coated	Pound	$ 1.20	134,147	$161,000
	Denil Fish Ladder	l sum	$ 260,000.00	1	$260,000
42400100	PC Conc Sidewalk 4	Sq ft	$ 6.32	1,020	$6,400
	Dam Rehabilitation	l sum	$ 25,000.00	1	$25,000
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 12,000.00	0.29	$3,500
28100207	Stone Riprap, CL A4	tons	$ 57.34	7,772	$445,700
28200200	Filter Fabric	sq yd	$ 4.00	2727	$10,900
EARTHWORK & GRADING					
20100500	Tree Removal, Acres	acre	$ 12,000.00	2.52	$30,200
21101505	Topsoil Excavation and Placement	cu yd	$ 15.60	333	$5,200
20200100	Earth Excavation	cu yd	$ 18.37	833	$15,300
				SUBTOTAL	**$2,403,000**
OTHER					
	Contingencies (15%)	lump	lump	1	$360,500
67000400	Engineer Field Office/Lab	month	$ 2,380.00	6	$14,300
Approx.	Mobilization (6% subtotal)	lump	lump	1	$144,200
				SUBTOTAL	**$519,000**
	CONSTRUCTION COSTS				**$2,922,000**
DESIGN COSTS					
	Engineering (20%)	lump	lump	1	$584,400
	Construction Supervision (7.5%)	lump	lump	1	$219,200
				SUBTOTAL	**$803,600**
LAND RIGHTS & UTILITY RELOCATIONS					
					$0
					$0
					$0
				SUBTOTAL	**$0**
	TOTAL PROJECT COSTS				**$3,725,600**

Ellsworth Alternative 3 - Stepped Spillway					
Cost Estimate					
Vermilion County					***revised:2/21/2013***
PAY ITEM #	**ITEM DESCRIPTION**	**UNITS**	**UNIT PRICE**	**QUANTITY**	**COST**
CONSTRUCTION MATERIALS					
28000400	Perimeter Erosion Barrier	foot	$ 3.58	650	$2,300
20201550	Subbase Granular Material, Type B, C	cu yd	$ 41.00	44	$1,800
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 6.15	133	$800
OWR Spec.	Temporary Coffer Dam System	l sum	$ 150,000.00	1.00	$150,000
	Concrete Structures	cu yd	$ 613.69	134	$82,100
	Reinforcement Bars, Epoxy Coated	Pound	$ 1.93	14,976	$28,900
	Denil Fish Ladder	l sum	$ 150,000.00	1	$150,000
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 12,000.00	0.21	$2,500
28100207	Stone Riprap, CL A4	tons	$ 62.72	1,485	$93,200
28200200	Filter Fabric	sq yd	$ 4.00	498	
EARTHWORK & GRADING					
21101505	Topsoil Excavation and Placement	cu yd	$ 10.05	22	$200
				SUBTOTAL	**$511,800**
OTHER					
	Contingencies (15%)	lump	lump	1	$76,800
67000400	Engineer Field Office/Lab	month	$ 1,764.50	6	$10,600
Approx.	Mobilization (6% subtotal)	lump	lump	1	$30,700
				SUBTOTAL	**$118,100**
	CONSTRUCTION COSTS				**$629,900**
DESIGN COSTS					
	Engineering (20%)	lump	lump	1	$126,000
	Construction Supervision (7.5%)	lump	lump	1	$47,200
				SUBTOTAL	**$173,200**
LAND RIGHTS & UTILITY RELOCATIONS					
	Flood Easements	acre	$ 4,000.00	60.0	$240,000
					$0
					$0
				SUBTOTAL	**$240,000**
	TOTAL PROJECT COSTS				**$1,043,100**

Danville Alternative 4 - Rock Ramp Spillway

Cost Estimate

Vermilion County *revised:2/21/2013*

PAY ITEM #	ITEM DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	COST
	CONSTRUCTION MATERIALS				
28000400	Perimeter Erosion Barrier	foot	$ 3.58	1,500	$5,400
20201550	Subbase Granular Material, Type B, C	cu yd	$ 41.00	667	$27,300
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 6.15	2,000	$12,300
OWR Spec.	Temporary Coffer Dam System	l sum	$ 300,000.00	1.00	$300,000
50102400	Concrete Removal	cu yd	$ 692.00	402	$278,400
	Portland Cement Concrete Sidewalk 5	sq ft	$ 6.71	1,380	$9,300
	Dam Rehabilitation	l sum	$ 20,000.00	1	$20,000
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 12,000.00	0.33	$3,900
28100207	Stone Riprap, CL A4	tons	$ 57.34	17,866	$1,024,400
28200200	Filter Fabric	sq yd	$ 4.00	4236	$16,900
	EARTHWORK & GRADING				
20100500	Tree Removal, Acres	acre	$ 12,000.00	2.52	$30,200
21101505	Topsoil Excavation and Placement	cu yd	$ 15.60	333	$5,200
20200100	Earth Excavation	cu yd	$ 18.37	833	$15,300
				SUBTOTAL	**$1,748,600**
	OTHER				
	Contingencies (15%)	lump	lump	1	$262,300
67000400	Engineer Field Office/Lab	month	$ 1,764.50	4	$7,100
Approx.	Mobilization (6% subtotal)	lump	lump	1	$104,900
				SUBTOTAL	**$374,300**
	CONSTRUCTION COSTS				**$2,122,900**
	DESIGN COSTS				
	Engineering (20%)	lump	lump	1	$424,600
	Construction Supervision (7.5%)	lump	lump	1	$159,200
				SUBTOTAL	**$583,800**
	LAND RIGHTS & UTILITY RELOCATIONS				
				SUBTOTAL	**$0**
	TOTAL PROJECT COSTS				**$2,706,700**

Ellsworth Alternative 4 - Rock Ramp Spillway					
Cost Estimate					
Vermilion County					*revised:2/21/2013*
PAY ITEM #	**ITEM DESCRIPTION**	**UNITS**	**UNIT PRICE**	**QUANTITY**	**COST**
CONSTRUCTION MATERIALS					
28000400	Perimeter Erosion Barrier	foot	$ 3.26	650	$2,100
20201550	Subbase Granular Material, Type B, C	cu yd	$ 34.44	44	$1,500
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 1.60	133	$200
OWR Spec.	Temporary Coffer Dam System	l sum	$ 150,000.00	1.00	$150,000
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 3,500.00	0.36	$1,300
28100207	Stone Riprap, CL A4	tons	$ 62.72	7,088	$444,600
28200200	Filter Fabric	sq yd	$ 4.00	1605	$6,400
EARTHWORK & GRADING					
21101505	Topsoil Excavation and Placement	cu yd	$ 10.05	22	$200
				SUBTOTAL	**$606,300**
OTHER					
	Contingencies (15%)	lump	lump	1	$90,900
67000400	Engineer Field Office/Lab	month	$ 2,380.00	3	$7,100
Approx.	Mobilization (6% subtotal)	lump	lump	1	$36,400
				SUBTOTAL	**$134,400**
	CONSTRUCTION COSTS				**$740,700**
DESIGN COSTS					
	Engineering (20%)	lump	lump	1	$148,100
	Construction Supervision (7.5%)	lump	lump	1	$55,600
				SUBTOTAL	**$203,700**
LAND RIGHTS & UTILITY RELOCATIONS					
	Flood Easements	acre	$ 4,000.00	34.0	$136,000
					$0
					$0
				SUBTOTAL	**$136,000**
	TOTAL PROJECT COSTS				**$1,080,400**

Danville Alternative 5 - Dam Repair					
Cost Estimate					
Vermilion County					*revised:7/12/2013*
PAY ITEM #	**ITEM DESCRIPTION**	**UNITS**	**UNIT PRICE**	**QUANTITY**	**COST**
CONSTRUCTION MATERIALS					
28000400	Perimeter Erosion Barrier	foot	$ 3.58	1,500	$5,400
20201550	Subbase Granular Material, Type B, C	cu yd	$ 41.00	667	$27,300
21001000	Geotechnical Fabric for Ground Stabili	sq yd	$ 6.15	2,000	$12,300
OWR Spec.	Temporary Coffer Dam System	l sum	$ 300,000.00	1.00	$300,000
50102400	Concrete Removal	cu yd	$ 692.00	89	$61,500
	Concrete Structures	cu yd	$ 683.25	107	$72,800
	Reinforcement Bars, Epoxy Coated	Pound	$ 1.20	11,937	$14,300
OWR Spec.	Seeding. Mulching, and Fertilizing	acre	$ 12,000.00	0.29	$3,500
28100207	Stone Riprap, CL A4	tons	$ 57.34	3,435	$197,000
28200200	Filter Fabric	sq yd	$ 4.00	4590	$18,400
EARTHWORK & GRADING					
20100500	Tree Removal, Acres	acre	$ 12,000.00	0.52	$6,200
21101505	Topsoil Excavation and Placement	cu yd	$ 15.60	333	$5,200
20200100	Earth Excavation	cu yd	$ 18.37	833	$15,300
				SUBTOTAL	**$739,200**
OTHER					
	Contingencies (15%)	lump	lump	1	$110,900
67000400	Engineer Field Office/Lab	month	$ 2,380.00	8	$19,000
Approx.	Mobilization (6% subtotal)	lump	lump	1	$44,400
				SUBTOTAL	**$174,300**
	CONSTRUCTION COSTS				**$913,500**
DESIGN COSTS					
	Engineering (20%)	lump	lump	1	$182,700
	Construction Supervision (7.5%)	lump	lump	1	$68,500
				SUBTOTAL	**$251,200**
LAND RIGHTS & UTILITY RELOCATIONS					
					$0
					$0
					$0
				SUBTOTAL	**$0**
	TOTAL PROJECT COSTS				**$1,164,700**