Final Report

Detailed Watershed Plan for the Poplar Creek Watershed Study Area: Volume 1

Prepared for

Metropolitan Water Reclamation District of Greater Chicago

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Hey and Associates, Inc.

Executive Summary

Background

The Metropolitan Water Reclamation District of Greater Chicago (District) has authority for regional stormwater management within Cook County as granted by the Illinois General Assembly in Public Act 93-1049 (the Act). The Act requires the District to develop watershed plans for six Cook County watersheds, which include the North Branch of the Chicago River, Lower Des Plaines River, Poplar Creek, Little Calumet River, Calumet-Sag Channel, and Upper Salt Creek. The District published the *Cook County Stormwater Management Plan* (CCSMP) in February 2007 to identify stormwater management goals and to outline the District's approach to watershed planning. Chapter 6 of the CCSMP defines the District's approach to and standards for Detailed Watershed Plans (DWPs), which address regional stormwater problems in Cook County. The six major watersheds for which DWPs are being developed cover approximately 730 square miles in Cook County. The primary goals of the DWPs are as follows:

- Document stormwater problem areas.
- Evaluate existing watershed conditions using hydrologic and hydraulic (H&H) models.
- Produce flow, stage, frequency, and duration information about flood events along regional waterways.
- Estimate damages associated with regional stormwater problems.
- Evaluate potential solutions to regional stormwater problems.

The Poplar Creek DWP was developed to meet the goals for the Poplar Creek Watershed study area as described in the CCSMP. The Act required the formation of Watershed Planning Councils (WPCs) to advise the District during development of its countywide stormwater management program; therefore, the DWPs were developed in coordination with the WPCs. Membership of the WPCs consists of the chief elected official of each municipality and township in each watershed, or their designees. Many municipalities and townships are represented by engineers, elected officials, or public works directors. WPC meetings are also open to the public. Frequent coordination with WPCs was performed to ensure that local knowledge is integrated into the DWP and the DWP reflects the communities' understanding of watershed issues as well as the practicability of proposed solutions.

Detailed Watershed Plan Scope

The scope of the Poplar Creek DWP includes the development of stormwater improvement projects to address regional problem areas along open waterways. Regional problems are defined as problems associated with waterways whose watersheds encompass multiple jurisdictions and drain an area greater than 0.5 square miles. Problems arising from capacity issues on local systems, such as storm sewer systems and minor open channel ditches, even if they drain more than one municipality, were considered local and beyond the scope of this study. Erosion problems addressed in this plan were limited to active erosion along regional waterways that poses an imminent risk to structures or critical infrastructure. Interstate Highways, U.S. Highways, state routes, county roads with four or more lanes, and smaller roads providing critical access that are impacted by overbank flooding of regional waterways at depths exceeding 0.5 feet were also considered regional problems.

Watershed Overview

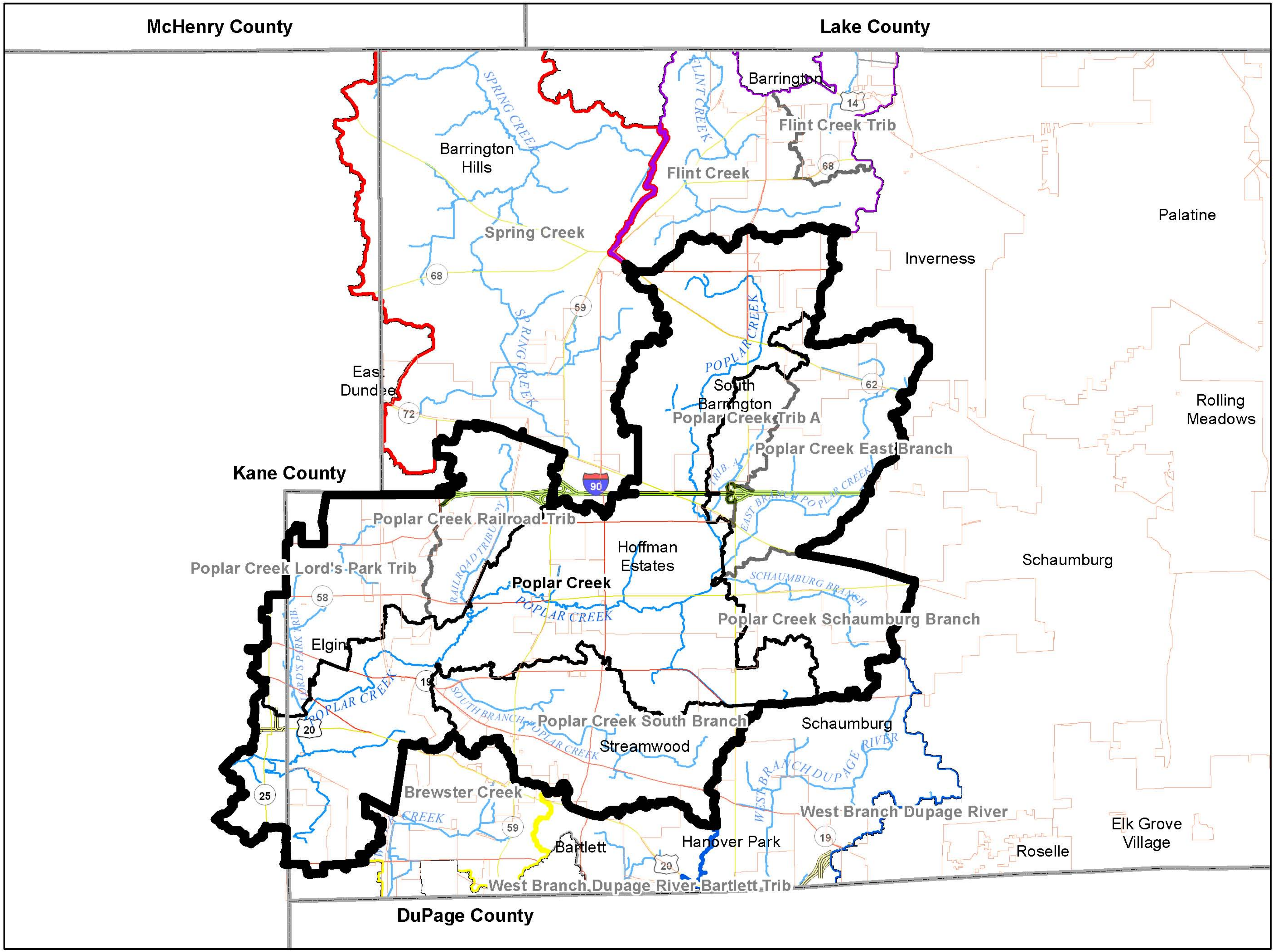
The Poplar Creek Watershed study area has an approximate size of 83.5 square miles in northwestern Cook County and includes the Cook County portions of the Poplar Creek, Flint Creek, Spring Creek, Brewster Creek, and West Branch DuPage River watersheds. The District has established boundaries of the Poplar Creek Watershed study area for purposes of its stormwater management program. The mainstem of Poplar Creek has six major tributaries: Tributary A, Poplar Creek East Branch, Poplar Creek Schaumburg Branch, Railroad Tributary, Poplar Creek South Branch, and Lord's Park Tributary. Flint Creek Tributary is tributary to Flint Creek that exits Cook County upstream of its confluence with Flint Creek. Figure ES.1 is an overview of the Poplar Creek DWP.

Existing Conditions Evaluation

Locations with historic flooding and stream bank erosion problems on regional waterways exist throughout the watershed. Information on existing problem areas was solicited from WPC members as well as federal and state agencies and other stakeholders during the data collection and evaluation phase of the DWP development, which also included the collection of data regarding the watershed and evaluation of the data's acceptability for use. Responses from stakeholders were used to help identify locations of concern, and where field assessment or surveys were needed to support H&H modeling.

Hydrologic models were developed to represent runoff generated by rainfall throughout the Poplar Creek study area. The runoff was then routed through hydraulic models, which were created for the major open channel waterways within the watersheds that comprise the study area. Design rainfall events were simulated for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval events based upon Bulletin 71 rainfall data (ISWS, 1992). The simulated water surface profiles were overlaid upon a ground elevation model of the study area to identify structures at risk of flooding.

Property damages due to flooding were estimated using a methodology consistent with the U.S. Army Corps of Engineers (USACE) Flood Damage Assessment program. Estimated flood damage resulting from a storm was considered in combination with the probability of the event occurring to estimate an expected annual damage. Erosion damages were assessed for structures or infrastructure at risk of loss due to actively eroding stream banks. Damages reported within this document refer to economic damages estimated over a 50-year period of analysis that result from regional overbank flooding or erosion of a regional waterway. Additional damages throughout the watershed exist, including damages due to flooding from local waterways and storm sewer systems, and also damages not easily quantified in financial terms such as water quality, wetland, riparian, and habitat impact, loss of emergency access, and loss of business or operations due to limited transportation access.



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Feet

LEGEND

- County Boundaries
- Municipal Boundaries
- Flint Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Spring Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Poplar Creek Watershed Boundary
- Freeway Non-Interstate
- Interstate
- Minor Arterial (Urban)
- Other Principal Arterial
- PoliticalTownship
- River/Stream
- Minor Watershed Boundaries

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Poplar Creek Watershed Study Area Detailed Watershed Plan

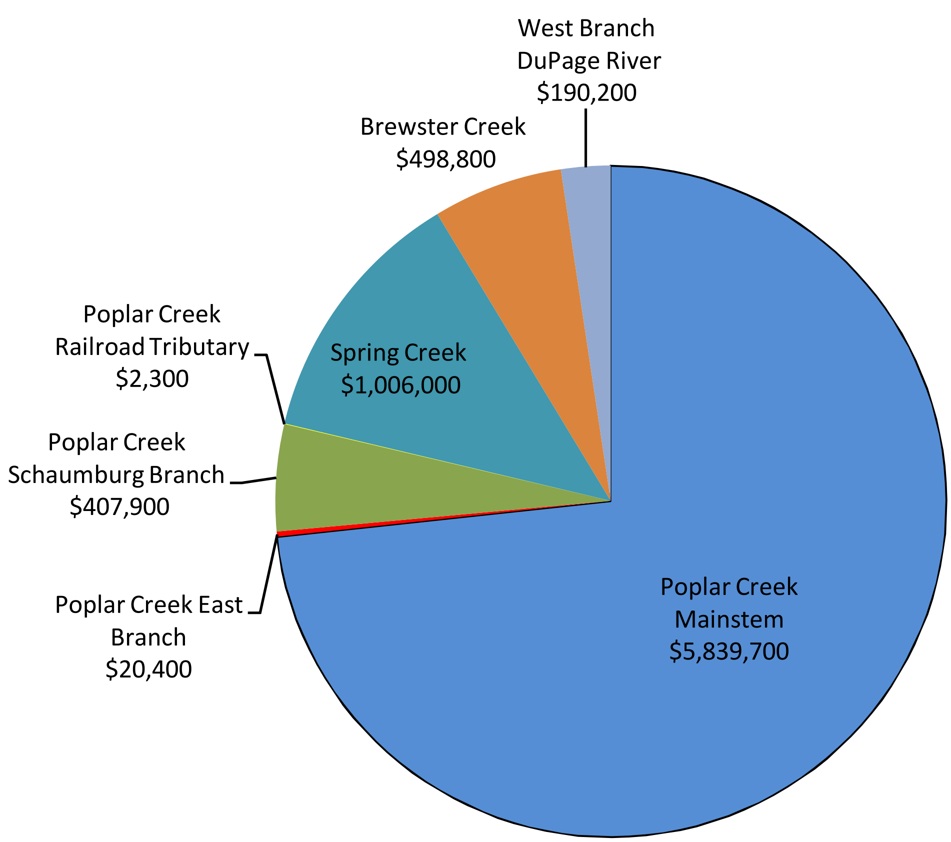
Poplar Creek Watershed Study Area Overview

Figure ES.1

Figure ES.2 summarizes the distribution of existing conditions damages within the Poplar Creek study area over a planning period of analysis of 50 years. The total damages in the study area are $7,965,300. Poplar Creek Mainstem and its tributaries account for 53% of the study area, but contain 79% of the computed damages. Of the total existing conditions damages, 66% are property damages, 16% are transportation damages and 18% are erosion damages.

The estimated damages summarized in Figure ES.2 include calculated regional damages related to overbank flooding, erosion problems on regional waterways that threaten structures, and transportation damages. Localized problems, such as storm-sewer capacity related problems, are not included in this estimate. Reported problems classified as local are presented in Table 2.2.1 in Section 2.2.1. Also provided in Table 2.2.1 is the reasoning behind classifying the problems as local or regional.

FIGURE ES.2
Summary of Existing Conditions Damages within the Poplar Creek Watershed study area over 50-Year Period of Analysis



Evaluation of Alternatives

Stormwater improvements, or alternatives, were developed to address regional stormwater problems along intercommunity waterways. WPC members participated in the alternative development process by providing input on possible solutions and candidate sites for new stormwater infrastructure. It should be noted that the alternatives presented in the DWP are developed at a conceptual level of feasibility.

H&H models were used to determine the benefit of alternative stormwater improvement projects. Models were run and damages were calculated for the existing conditions evaluation. Benefits were calculated for each project as the difference between existing and alternative conditions damages. Only regional financial benefits (e.g., relief of flooding due to a regional problem as defined above) were considered. Local benefits (e.g., improved sewer drainage due to reduced outlet elevation) and non-economic benefits (e.g. improved emergency access, improved wetland, riparian, and habitat, and improved access to businesses) are not included in the benefits. The alternative stormwater improvement projects may have significant local and non-economic benefits. Local benefits are not reported in the DWP, which focuses on regional benefits.

Conceptual level cost estimates were produced to represent the estimated costs for design, construction, and maintenance of each alternative over a 50-year period of analysis. The cost estimates were developed using standard unit cost items within a District database used for all six watershed plans. In addition, standard markups on the estimated capital costs, such as utility relocation, design and engineering costs, profit and contingency were included.

A benefit-to-cost (B/C) ratio was developed for each alternative, which represents the ratio of estimated benefits to costs. The B/C ratios calculated may be used to rank the alternatives in a relative manner as the District's Board of Commissioners prioritizes the implementation of recommended stormwater improvement projects. Only regional financial benefits were considered in determination of the B/C ratios. The B/C ratios do not include local and non-economic benefits and should not be interpreted to be the sole measure of justification of an alternative. In addition to the B/C ratio, noneconomic criteria such as water-quality impact, number of structures protected, and the impact on wetland and riparian area were noted for each alternative. These criteria may also be considered along with the calculated B/C ratios as the District's Board of Commissioners prioritizes the implementation of recommended stormwater improvement projects.

Recommendations

Alternatives were recommended based upon consideration of their ability to reduce stormwater damages and to address problems reported by communities. Table ES.1 lists the recommended alternatives, their costs and regional financial benefits.

Table ES.2 summarizes the extent to which recommended alternatives address existing regional financial damages within each tributary, ordered by decreasing existing conditions damages.

The Poplar Creek DWP integrated stormwater data from a large number of sources in order to identify and prioritize solutions to existing stormwater problems. An extensive data collection effort undertaken for the DWP development included surveying of streams, bridges, and culverts throughout the entire watershed. Field reconnaissance was performed throughout the watershed to understand conditions unique to the watershed. This compilation of current, accurate data was used by the District to document and identify existing stormwater problems throughout the study area.

A large number of alternatives were developed and evaluated for their effectiveness in reducing regional damages within the Poplar Creek Watershed study area. The alternatives listed in Table ES.1 were identified as the most effective improvements for reducing expected damages due to flooding within the watershed. In some tributaries, greater opportunities to reduce regional flooding were identified than in others. Factors such as the lack of availability of land and location of structures relative to stream channels limited the practicality of alternative projects to eliminate all flooding damages for all design storms evaluated.

The enabling legislation (70 ILCS 2605/7h (g)) for the District's stormwater management program states "the District shall not use Cook County Forest Preserve District land for stormwater or flood control projects without the consent of the Forest Preserve District (FPDCC)"; therefore proposed projects involving FPDCC property cannot be implemented without FPDCC's permission. The District will work collaboratively with FPDCC to develop multi-objective projects beneficial to both agencies along with our constituents and also consistent with our individual missions.

The data provided in the Poplar Creek DWP will be used by the District, along with consistently developed data in DWPs for the other five major Cook County Watersheds, to prioritize the implementation of stormwater improvement projects.

TABLE ES.1
Recommended Alternatives Summary for the Poplar Creek DWP

Project	Category	Description	B/C Ratio	Total Benefits ($)	Total Project Cost ($)	Probable Construction Cost ($)	Cumulative Structures Protected	Communities Involved
PCMS-2	Conveyance/ Levee	Levee, channel enlargement and bridge/culvert replacements in vicinity of Villa Street crossing of Poplar Creek in Elgin.	0.07	$2,989,900	$45,151,000	$25,182,400	217	Elgin (including portions of Elgin in Kane County)
PCMS-3	Erosion Stabilization	Bank stabilization adjacent to the Villa Street crossing of Poplar Creek in Elgin.	0.56	$398,800	$715,700	$381,200	1	Elgin
PCMS-4	Erosion Stabilization	Bank stabilization on south bank of Poplar Creek along north end of Thorndale Drive in Elgin.	0.47	$346,600	$745,200	$401,700	2	Elgin
PCMS-5	Erosion Stabilization	Bank stabilization on west bank of Poplar Creek and Campus Drive in Elgin.	0.79	$693,800	$874,000	$484,200	4	Elgin
PCSH-1	Conveyance	Enlarge existing Barrington Road crossing on Poplar Creek Schaumburg Branch.	0.08	$252,000	$3,282,500	$1,921,800	0	Hoffman Estates
PCRR-1	Conveyance	Enlarge existing railroad crossing of Poplar Creek Railroad Tributary near Golf Road.	0.002	$2,300	$1,486,400	$950,300	0	Hoffman Estates
SCTD-1	Conveyance	Enlarge Algonquin Road crossing and raise road elevation on Spring Creek Tributary D in Barrington Hills.	0.19	$321,200	$1,653,400	$1,049,400	0	Barrington Hills
BCMS-1	Conveyance/ Storage	Enlarge Bartlett Road and private drive cross-ings and construct detention storage near mobile home development in Bartlett.	0.08	$498,800	$6,044,000	$4,654,600	12	Bartlett
WBMS-3	Conveyance/ Storage	Improve 6,300 of channel, enlarge Syracuse Lane and Braintree Drive crossings and pro-vide compensatory storage in Atcher Park.	0.03	$141,500	$4,462,700	$3,040,100	0	Schaumburg, Hanover Park

TABLE ES.2
Poplar Creek DWP Alternatives Summary

Subwatershed	Existing Conditions Damages	Benefits from Recommended Alternatives	Percent of Damages Addressed	Benefit Cost Ratio
Poplar Creek Mainstem	$5,839,700	$4,429,100	76%	0.09
Spring Creek	$1,006,000	$321,200	32%	0.19
Brewster Creek	$498,800	$498,800	100%	0.08
Poplar Creek Schaumburg Branch	$407,900	$252,000	62%	0.08
West Branch DuPage River	$190,200	$141,500	74%	0.03
Poplar Creek Railroad Tributary	$2,300	$2,300	100%	0.002
Total	$7,944,900	$5,644,900	71%	0.09

Contents

Tables

Figures

Note: Figures not embedded in the chapters are contained in Volume 2.

Appendices

Acronyms and Abbreviations

ABM	Articulated Block Mat
AMC	Antecedent Moisture Conditions
AWQMN	Ambient Water Quality Monitoring Network
B/C	Benefit to Cost Ratio
CBBEL	Christopher B. Burke Engineering, Ltd.
CCHD	Cook County Highway Department
CCSMP	Cook County Stormwater Management Plan
CCTA	Cook County Tax Assessor
CFS	cubic feet per second
CIP	Capital Improvement Program
CMAP	Chicago Metropolitan Agency for Planning
CN	Curve Number
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
District	Metropolitan Water Reclamation District of Greater Chicago
DWP	Detailed Watershed Plan
FEMA	Federal Emergency Management Agency
FEQ	Full Equations
FFE	First Floor Elevation
FGCS	Federal Geodetic Control Subcommittee
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FPDCC	Forest Preserve District of Cook County
GIS	Geographic Information System
GPS	Geographic Positioning System
H&H	Hydrologic and Hydraulic
HEC-HMS	Hydrologic Engineering Center Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center River Analysis System
HSPF	Hydrologic Simulation Program - Fortran
IDNR	Illinois Department of Natural Resources
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
ISWS	Illinois State Water Survey
LiDAR	Light Detection and Ranging
LOMR	Letter of Map Revision
L-PIII	Log-Pearson Type III
NAVD 88	North American Vertical Datum, 1988
NFIP	National Flood Insurance Program
NGS	National Geodetic Survey
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory

ROW	Right-of-Way
SCS	Soil Conservation Service
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WMO	Watershed Management Ordinance
WPC	Watershed Planning Council
WSEL	Water Surface Elevation

1. Introduction

The Poplar Creek Watershed study area has an approximate size of 83.5 square miles in northwestern Cook County and includes the Cook County portions of the Poplar Creek, Flint Creek, Spring Creek, Brewster Creek, and West Branch DuPage River watersheds. Figure ES.1 is an overview of the Poplar Creek Watershed. Locations with historic flooding and stream bank erosion problems due to regional waterways exist throughout the study area.

The Poplar Creek Watershed is situated primarily in northwestern Cook County, but also includes a small portion of northeastern Kane County. A tributary to the Fox River, the Poplar Creek Watershed occupies 44 square miles (28,500 acres) of which 42.66 square miles are located within Cook County. Nine Cook County municipalities are located within the Poplar Creek Watershed. The mainstem of Poplar Creek has six major tributaries: Tributary A, Poplar Creek East Branch, Poplar Creek Schaumburg Branch, Railroad Tributary, Poplar Creek South Branch, and Lord's Park Tributary.

The Flint Creek Watershed is situated north of the Poplar Creek Watershed. The Flint Creek Watershed drains approximately 36.5 square miles (23,374 acres) of land to the Fox River. The Flint Creek Watershed is located in northwest Cook County and flows into southwest Lake County and ultimately to the Fox River. Approximately 9.05 square miles (5,794 acres) of the Flint Creek Watershed is in Cook County. Ten municipalities are located within the Flint Creek Watershed. Two primary tributaries drain the Cook County portion of the Flint Creek Watershed: Flint Creek and Flint Creek tributary

The Spring Creek Watershed is found north of the Poplar Creek Watershed and west of the Flint Creek Watershed. The Spring Creek Watershed is located in northwest Cook County and flows into southeast McHenry County and ultimately to the Fox River where it drains approximately 25.8 square miles of land. Approximately 17.9 square miles (11,446 acres) of the Spring Creek Watershed are located in Cook County. Four Cook County municipalities are located within the Spring Creek Watershed.

The Brewster Creek Watershed is located southwest of the Poplar Creek Watershed. The Brewster Creek Watershed is located in northwest Cook County and flows into DuPage County and ultimately to the Fox River. Approximately 4.5 square miles (2,890 acres) of the 15.5 square mile Brewster Creek Watershed are located in Cook County. Three Cook County municipalities are located within the Brewster Creek Watershed.

The West Branch DuPage River Watershed is situated southeast of the Poplar Creek Watershed. The West Branch DuPage River Watershed is located in northwest Cook County and flows into DuPage County and ultimately to the Des Plaines River. It encompasses approximately 127 square miles and approximately 9.3 square miles (5,981 acres) of the West Branch DuPage River Watershed is located in Cook County. Seven municipalities are located within the West Branch DuPage River Watershed in Cook County.

The Poplar Creek Detailed Watershed Plan (DWP) was developed by the Metropolitan Water Reclamation District of Greater Chicago (District) with the participation of the Poplar Creek Watershed Planning Council (WPC) which provided local input to the District throughout the development process. The DWP was developed to accomplish the following goals:

- Document stormwater problem areas.
- Evaluate existing watershed conditions using hydrologic and hydraulic (H&H) models.
- Produce flow, stage, frequency, and duration information along regional waterways.
- Estimate damages associated with regional stormwater problems.
- Evaluate solutions to regional stormwater problems.

Regional problems are defined as problems associated with waterways whose watersheds encompass multiple jurisdictions and drain an area greater than 0.5 square miles. Problems arising from capacity issues on local systems, such as storm sewer systems and minor open channel ditches, even if they drain more than one municipality, were considered local and beyond the scope of this regional stormwater management program. Erosion problems addressed in this plan were limited to active erosion along regional waterways that pose an imminent risk to structures or critical infrastructure and/or threaten public safety. Interstate Highways, U.S. Highways, state routes, county roads with four or more lanes, and smaller roads providing critical access that are impacted by overbank flooding of regional waterways at depths exceeding 0.5 feet were also considered regional problems.

1.1 Scope and Approach

The DWP scope included data collection and evaluation, H&H modeling, development and evaluation of alternatives, and recommendation of alternatives. The data collection and evaluation task included collection and evaluation of existing H&H models, geospatial data, previous studies, reported problem areas, and other data relevant to the watershed plan. H&H models were developed to produce inundation mapping for existing conditions for the 100-year storm event and to evaluate stormwater improvement project alternatives. Stormwater improvement project alternatives were developed and evaluated to determine their effectiveness in addressing regional stormwater problems. Estimates of damage reduction, or benefits, associated with proposed projects were considered along with conceptual cost estimates and noneconomic criteria to develop a list of recommended improvement projects for the Poplar Creek Watershed study area.

1.2 Data Collection and Evaluation

The data collection and evaluation phase (Phase A) of the DWP focused on obtaining data regarding the watershed and evaluation of the material's acceptability for use. The District contacted all WPC members as well as federal and state agencies and other stakeholders requesting relevant data. Coordination with WPC members to support the DWP took place throughout development of the DWP. Existing and newly developed data was evaluated according to criteria of use defined in Chapter 6 of the *Cook County Stormwater Management Plan* (CCSMP), included in Appendix B. Where data was unavailable or insufficient to complete the DWP, additional data was collected. This report includes information on all data collected and evaluated as a part of the Poplar Creek DWP development. Table 1.2.1 lists key dates of coordination activities including meetings with WPC members prior to and throughout DWP development.

TABLE 1.2.1
Poplar Creek DWP WPC Coordination Activities

Description of Activity		Date(s)
07-608-5C Poplar Creek DWP - Phase A - Contract start date		January 14, 2008
08-609-5C Poplar Creek DWP - Phase B - Contract start date		September 9, 2008
Information Gathering		
Data Request (Forms A and B) sent out as part of Phase A		Fall 2007
Watershed field visit		February 27, 2008
Open meetings with Watershed representatives during Phase A to discuss Forms A and B		February 27, 2008 March 6, 2008 November 7, 2008 November 10, 2008 November 14, 2008 December 4, 2008 December 12, 2008
District phone calls to communities after the September 13th and 14th, 2008 storm event		September 15, 2008
Poplar Creek Watershed Study Area Planning Council Meetings (12)		
January 16, 2008	April 16, 2008	July 16, 2008
October 15, 2008	January 22, 2009	April 15, 2009
July 15, 2009	October 21, 2009	January 20, 2010
April 21, 2010	July 21, 2010	October 20, 2010
Modeling Results and Alternatives Review Meetings		
Initial Model Review Workshops		December 15, 2009, and February 22, 2010
Preliminary Alternatives Review Workshop		April 15, 20010
Final Alternatives Presentation Workshop		August 18, 2010
MWRDGC Board of Commissioners' Study Sessions		
January 10, 2006	April 27, 2006	October 2,2008

1.3 Hydrologic and Hydraulic Modeling

This section of the report provides a description of H&H modeling completed to support the DWP development. H&H models were developed for all tributaries within the watershed containing open waterways. Most models were developed independent of any past H&H modeling efforts. At a minimum, the extent of the hydraulic models was defined based upon the extent of detailed study for effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs). Models were extended further, where appropriate, to aid in the evaluation of damages associated with regional stormwater problems. Appendix A includes a comparison of FEMA's revised Digital Flood Insurance Rate Map (DFIRM) panels with inundation areas developed for DWP modeling purposes. Tables comparing DWP inundation area to FEMA floodplain mapping by community and subwatershed are also included in Appendix A.

H&H models were developed to be consistent with the protocols defined in Chapter 6 of the CCSMP. In numerous instances, models included additional open channel or other drainage facilities not strictly required by Chapter 6, to aid the evaluation of community reported problem areas. Available monitoring data, including USGS stream gage data, District facility data and high water marks observed following storm events were used to perform model verification and calibration consistent with Chapter 6 guidelines. All H&H modeling data and documentation of the data development are included in the appendices as referenced in the report sections below.

1.3.1 Model Selection

H&H models were developed within the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS) Version 3.3.0 modeling application and Hydrologic Engineering Center-River Analysis System (HEC-RAS) Version 4.0. These applications were identified as acceptable in Tables 6.10 and 6.11 of the CCSMP. The Soil Conservation Service (SCS) curve number (CN) loss module was used with the SCS unit hydrograph methodology within HEC-HMS to model basin hydrology. The dynamic unsteady flow routing methodology was used within HEC-RAS. Both applications have an extensive toolkit to interface with geographic information systems (GIS) software to produce input data and display model results.

1.3.2 Model Setup and Unit Numbering

1.3.2.1 Hydrologic Model Setup

Hydrologic model data was primarily developed within the ArcHydro and HEC-GeoHMS extensions to ArcGIS Version 9.2. These extensions provided an interface to various geoprocessing functions used to characterize general watershed hydrology and subbasin parameters within the hydrologic model. ArcHydro was used to preprocess Cook County topography data into base files to be utilized as the foundation for the HEC-GeoHMS calculations. HEC-GeoHMS was used to calculate the CN, Impervious Area and centroid for each basin; to define the longest flow path, and flow path slope to be used in unit hydrograph equation; and to establish a network of connecting hydrologic elements (e.g., subbasins, reservoirs, reaches, and inflow locations) to the outlet of the system. HEC-HMS was used to create and sometimes route stormwater runoff hydrographs to the appropriate flow loading locations in the HEC-RAS model. Hydrologic model data was transferred between HEC-HMS and HEC-RAS through HEC-DSS files.

Subbasin Delineation. Each major tributary model was subdivided into subbasins to form the basis of each hydrologic model. Elevation data provided by Cook County, described in Section 2.3.4, was the principal data source used for subbasin delineation. Elevation data was preprocessed using ArcHydro tools to create a digital elevation model (DEM) for the Poplar Creek Watershed study area. Additional ArcHydro tools were then used to provide an initial delineation of subbasins. These initial subbasin boundaries and flowpath accumulation lines were reviewed based on storm sewer atlases, contour data, hydrological significant points in the watershed, and a colorized visual representation of the DEM. Areas requiring modification were identified and the major subbasins were redelineated with ArcHydro tools based on the added storm sewers or other open channel flow paths. In some cases subbasins were further modified manually to prepare a final set of subbasin boundaries. Finally, boundaries were defined to most accurately represent the area tributary to specific modeled elements, such as constrictions caused by river and stream crossings, and reservoirs. GIS data was developed for all subbasins delineated and used for hydrologic model data development.

Runoff Volume Calculation. The SCS CN loss model uses the empirical CN parameter to calculate runoff volumes based on landscape characteristics such as soil type, land cover, imperviousness, and land use development. Areas characterized by saturated or poorly infiltrating soils, or impervious development, have higher CN values, converting a greater portion of rainfall volume into runoff. The SCS methodology uses Equation 1.1 to compute stormwater runoff volume for each time step:

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad (1.1)$$

Where:

Q = runoff volume (in.)

P = precipitation (in.)

S = storage coefficient (in.)

I_a = initial abstraction (in.)

Rainfall abstractions due to ponding and evapotranspiration can be simulated using an initial abstraction (I_a) parameter. In the Poplar Creek DWP, the commonly used default value of I_a was estimated as $0.2 \times S$, where S is the storage coefficient for soil in the subbasin. S is related to CN through Equation 1.2:

$$S = \frac{1000}{CN} - 10 \qquad (1.2)$$

where:

CN = curve number (dimensionless)

S = storage coefficient (in.)

Table 1.3.2 describes the input data used to develop the CN values throughout thef.

TABLE 1.3.1
Description of Curve Number Input Data

Variable Used to Determine CN	Approach for Definition of Variable for Poplar Creek Watershed Hydrologic Modeling
Ground cover	Chicago Metropolitan Agency for Planning (CMAP) 2001 land use inventory (v.1.2 2006) is used to define land use. A lookup table was developed to link CMAP categories to categories for which CN values have been estimated.
Soil type	The Natural Resources Conservation Service (NRCS) publishes county soil surveys that include a hydrologic classification of A, B, C, or D. If a soil group's infiltration capacity is affected by a high water table, it is classified as, for instance, "A/D," meaning the drained soil has "A" infiltration characteristics, undrained "D." Areas of "/D" soils that were not associated with wetlands or open water were assumed to be drained.
Antecedent moisture condition	Antecedent Moisture Conditions (AMC) reflect the initial soil storage capacity available for rainfall. AMC values used for the modeling were based on calibration procedures, described in Section 1.3.8.

Specific combinations of land use and soil type were linked to CN values using a lookup table based on values recommended in Table 1.3.2 excerpted from TR-55: Urban Hydrology for Small Watersheds (U.S. Department of Agriculture [USDA], 1986). The CN matrix includes assumptions about the imperviousness of land use classes, and therefore, percent impervious does not need to be explicitly considered in the SCS runoff volume calculation. Since the CMAP land-use data does not correspond to the categories in Table 1.3.2, a mapping between TR-55 land use categories and CMAP land use categories was necessary. This process is detailed in Appendix C, which includes a technical memorandum detailing the process used to develop CN values for the Poplar Creek Watershed study area. The memorandum was prepared by CH2MHill, a consultant to the District.

The HEC-GeoHMS extension for ArcGIS was used to develop an area-weighted average CN for each subbasin.

Runoff Hydrograph Production. The runoff volume produced for a subbasin is converted into a basin-specific hydrograph by using a standard unit hydrograph and an estimate of the subbasin's time of concentration. The time of concentration is the time it takes for a drop of water to travel from the hydraulically furthest point in a watershed to the outlet.

The current study used the Clark unit hydrograph method to generate the runoff hydrographs. The time of concentration (Tc) and storage coefficient (R) are used to develop a stormwater discharge hydrograph for each subbasin. Both parameters have units of hours. In 1982, Graf et al. (USGS, 1982) developed a technique to estimate the Tc and R coefficients for use in the Clark unit-hydrograph method. These techniques were further refined for applicability in Lake County Illinois (Melching, 1996). This study developed several new equations for Tc (Equation 1.3) and R (Equation 1.4) based on watershed area in square miles (A), percentage of impervious cover as an integer (I), depth of effective precipitation in inches (D) and slope of the main channel in the subbasin in feet/mile (S). The equations selected for use in this study are:

$$Tc = 39.1\ A^{0.577}\ (I+1)^{-1.146}\ D^{0.781} \qquad (1.3)$$

$$R = 123\ A^{0.390}\ (I+1)^{-0.722}\ S^{-0.303} \qquad (1.4)$$

Where:

A = Area based on the subbasin size as delineated (sq. mi.)

I = Imperviousness was based on the U.S. Geological Survey's (USGS) National Land Cover Database 2001 Imperviousness Layer (percentage as an integer)

D = Depth was based on the 100-year, 12-hour event. The depth of rainfall must be converted to effective precipitation for each subbasin based on the subbasin's CN (in.)

S = Slope of the main channel determined from elevations at points that represent 10 and 85 percent of the distance along the channel from the watershed outlet to the watershed divide or other location in the watershed representing the longest flow path (ft/mi)

Using the results of these equations and the Clark unit hydrograph method, stormwater runoff discharge hydrographs were developed for each subbasin within the Poplar Creek DWP. These parameters were later tested for sensitivity and evaluated as potential calibration parameters as described in Section 1.3.8.

Rainfall Data. Observed and design event rainfall data was used to support modeling evaluations for the DWP. Monitored rainfall data is described in Section 2.3.1. Design event rainfall data was obtained from Bulletin 71, Rainfall Frequency Atlas of the Midwest (Huff, 1992). Design event rainfall depths obtained from Bulletin 71 were used to support design event modeling performed for existing and proposed conditions assessment.

1.3.3 Storm Duration

A critical-duration analysis was performed for each modeled watershed to determine the storm duration that generally results in higher WSEL estimates for the Poplar Creek DWP. Among the various watersheds, the critical durations were found to be the 12-, 24-, or 48-hour storm events. The 24-hour duration storm was most commonly identified as the critical duration for streams within the Poplar Creek DWP. A third quartile storm is recommended for 24-hour storms (Huff, 1992). Table 1.3.3 summarizes rainfall depths for the 24-hour duration storm.

TABLE 1.3.2
Runoff Curve Numbers for Urban Areas

Cover Type and Hydrologic Condition	Avg. % Impervious Area	A	B	C	D
Fully developed urban areas (vegetation established)					
Open Space (lawns, parks, golf courses, cemeteries, etc.)					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50 to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious Areas					
Paved parking lots, roofs, driveways, etc. [(excluding right-of-way (ROW)]		98	98	98	98
Streets and roads					
Paved; curbs and storm sewers (excluding ROW)		98	98	98	98
Paved; open ditches (including ROW)		83	89	92	93
Gravel (including ROW)		76	85	89	91
Dirt (including ROW)		72	82	87	89
Western Desert Urban Areas					
Natural desert landscaping (pervious areas only)		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin barriers		96	96	96	96
Urban Districts					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential Districts by Average Lot Size					
1/8 acre or less	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing Urban Areas					
Newly Graded Areas (pervious areas only, no vegetation)		77	86	91	94

Note: Average runoff condition, and $I_a = 0.2S$.

Note: Table Source is *TR-55: Urban Hydrology for Small Watersheds* (USDA, 1986)

1.3.4 Areal Reduction Factor

The rainfall depths presented in Table 1.3.3 summarize expected point rainfall accumulation for modeled recurrence intervals. The probability of uniform rainfall across a subwatershed decreases with increasing watershed size. While some watersheds in the study area are large enough (greater than 10 square miles) to warrant the use of alternative distributions for areas between 10 and 50 square miles, the use of these distributions would inappropriately reduce the risk shown for subbasin areas smaller than 10-square miles which together form the larger watershed. Because the intent of this study is to identify flood risk for all subbasins that are greater than one square mile, the point rainfall (Bulletin 71, Part 2, Table 1) and point distributions (Bulletin 71, Part 1, Table 10) were used.

TABLE 1.3.3
Rainfall Depths

Recurrence Interval	24-hr Duration Rainfall Depth
2-year	3.04
5-year	3.80
10-year	4.47
25- year	5.51
50- year	6.46
100-year	7.58
500-year	10.90[a]

[a] 500-year rainfall depth based on a June 15, 1999 ISWS memorandum and verified by the logarithmic relationship between rainfall depth and recurrence interval.

1.3.5 Hydrologic Routing

Stormwater runoff hydrographs were sometimes routed within HEC-HMS in upstream areas where the resolution of defined subbasins was greater than the hydraulic model extent. The routings were used to represent features such as reservoirs or significant storm water flow paths. Reservoirs were represented using Modified-Puls and flow path were represented using Muskingum-Cunge or kinematic wave routing methods, respectively.

For Modified Puls reservoir routings, stage-storage curves were computed based on the Cook County topographic mapping. Stage-discharge curves were computed based on using information available from the detailed survey, historical plans, and/or field measurements.

Stormwater flow path routing was employed when a subbasin's most downstream point discharges to a flow path that is not represented in the HEC-RAS hydraulic model. In areas where a flow path cross section could be identified from topographic or storm sewer data, Muskingum-Cunge routing was performed using the approximate geometry from a representative cross section of the modeled hydrologic reach.

1.3.6 Hydraulic Model Setup

Hydraulic model data was developed through field surveys with some additional definition of channel overbank areas and roadway crests defined using Cook County topographic data. Cross section locations were developed in HEC-GeoRAS, and surveyed channel geometry were inserted into topographically generated cross-sectional data. Cross sections were generally surveyed and/or extracted from Cook County topography at intervals of 500 to 1,000 feet. Interpolated cross sections were added at many locations to the models to increase stability and reduce errors. Bridges, culverts, and other major hydraulic structures were surveyed within the hydraulic model extent. The locations of all surveyed and modeled cross sections, bridges, culverts, and other structures are shown in Appendix D.

1.3.6.1 Bridges, Culverts, and Hydraulic Structures

Bridges, culverts, and hydraulic structures were surveyed consistent with FEMA mapping protocol as identified in Guidelines and Specifications for Flood Hazard Mapping Partners, "Guidance for Aerial Mapping and Surveying" (FEMA 2003). A State of Illinois licensed professional land surveyor certified each location as FEMA compliant. Documentation of certifications is provided in Appendix D. Bridges, culverts, and hydraulic structures were surveyed consistent with the North American Vertical Datum, 1988 (NAVD 1988) datum using 5-centimeter or better geographic positioning system (GPS) procedures (as specified in National Geodetic Survey (NGS-58) for local network accuracy) or third-order (or better) differential leveling, or trigonometric leveling for short distances. A total of 237 structures were surveyed in the study area. Ineffective flow areas were placed at cross sections upstream and downstream of crossings, generally assuming a contraction ratio of 1:1 and an expansion ratio of 4:1. Contraction and expansion coefficients generally were increased to 0.3 and 0.5, respectively, at cross sections adjacent to crossings.

1.3.6.2 Cross-Sectional Data

Cross-sectional data was surveyed consistent with FEMA mapping protocol as identified in *Guidelines and Specifications for Flood Hazard Mapping Partners*, "Guidance for Aerial Mapping and Surveying" (FEMA 2003). A total of 314 cross sections were surveyed in the study area.

All survey work, including survey of cross sections, was certified as compliant to FEMA mapping protocol by a State of Illinois licensed professional land surveyor. Documentation of certifications is provided in Appendix D. Cross sections were surveyed consistent with the NAVD 1988 using 5-centimeter or better GPS procedures (as specified in NGS-58 for local network accuracy) or third-order (or better) differential leveling, or trigonometric leveling for short distances. Cross sections were interpolated at many locations within the hydraulic models, to aid model stability and reduce errors.

1.3.6.3 Boundary Conditions

A variety of approaches were used to set boundary conditions based on the following factors. Normal depth was used for all waterways that leave the study area. It was also used for the initial runs and debugging of the Poplar Creek tributary models. The boundary conditions at the downstream end of Poplar Creek, Brewster Creek, West Branch DuPage River, Flint Creek Tributary, Flint Creek and Spring Creek were set using normal depth. Normal depth requires a slope based on the general flowline of the stream channel. The slope was typically computed using the inverts of the last two surveyed cross sections or using the general flowline slope of the last modeled stream reach.

For tributaries to Poplar Creek, initial model runs were performed using normal depth. Based on FEMA's *Study Contractor's Guide*, normal depth is allowable since all of mainstem to tributary watershed area ratios are greater than 1.4. Once the models were run, the computed water surface elevations (WSELs) along the mainstem of Poplar Creek were compared to normal depth of tributaries at the confluence. In some cases, normal depth at the most downstream cross section exceeded the elevation of the receiving system (making normal depth the controlling water surface). In cases where the downstream water surface was higher, the boundary condition for a tributary to Poplar Creek was changed to a stage hydrograph based on the Poplar Creek mainstem water surface stages.

1.3.7 Model Run Settings

All hydraulic model simulations were carried out using the fully dynamic, unsteady flow simulation settings within HEC-RAS. The Saint-Venant equations, or the continuity and momentum balance equations for open channel flow, were solved using implicit finite difference scheme. HEC-RAS has the ability to model storage areas and hydraulic connections between storage areas and between stream reaches. The computational time step for model runs varied between 1 and 6 seconds and was adjusted as necessary for model stability.

1.3.8 Model Calibration and Verification

Model calibration and verification was performed for waterways where monitoring data was available to ensure that the H&H models accurately predict stormwater runoff. Available monitoring data used for calibration is described in Section 2.3.1. The only USGS gage in the study area is located on Poplar Creek in the City of Elgin. There are 35.2 square miles tributary to this gage, which represents 42 percent of the total study area. Initial model runs were performed for the Poplar Creek Watershed using H&H parameters estimated from available GIS data (land-use, soils, topography) and field reconnaissance. Stages (or peak WSEL) and runoff volumes were compared to modeled values for storms that occurred in August 2007 and September 2008. Calibration methodology for the Poplar Creek Watershed was applied to the hydrologic parameters for Brewster Creek, Flint Creek and Spring Creek watersheds which are ungaged. Additional calibration data was available for the West Branch DuPage River, where the District operates two stream gages (elevation only) near the Hanover Park Reclamation plant and at the Upper DuPage reservoir as well as one elevation gage within the reservoir. For the West Branch DuPage River, a separate calibration was conducted that involved modification of CN, time of concentration and the storage coefficient.

Throughout Poplar Creek Watershed study area, there were a number of measured WSELs measurements taken during the September 2008 calibration event. This data recorded time and stage (not limited to strictly high water marks) was used for additional model verification.

Initial calibration model results generally over-predicted stage, volume and peak flow rates for both Poplar Creek and the West Branch DuPage River. Modification to time of concentration, CN estimates and storage coefficient in the hydrologic model, and the roughness coefficient in the hydraulic model, were considered to address observed differences. For Poplar Creek, modification of the CN was found to be the best calibration parameter, bringing all stage, flow and runoff volumes to within established targets. For the West Branch DuPage River, three hydrologic parameters (CN, time of concentration and storage coefficient) were modified within a reasonable range. Detailed calibration and verification methodology and results are presented in subwatershed subsections, including hydrographs, comparisons of measured stage, and for Poplar Creek, runoff volume.

1.3.9 Flood Inundation Mapping

Flood inundation maps were produced to display the inundation areas associated with the 100-year event. The flood inundation maps were produced by overlaying the WSEL results of the hydraulic modeling on the ground surface DEM of the watershed, which was derived from Cook County LiDAR data.

1.3.10 Discrepancies between Inundation Mapping and Regulatory Flood Maps

Discrepancies may exist between inundation mapping produced under this DWP and existing regulatory flood maps. Discrepancies may be the result of updated rainfall data, more detailed topographic information, updated land use data, and differences in modeling methodology. A discussion of discrepancies is included in Appendix A.

1.3.11 Model Review

The H&H models developed under this DWP were independently reviewed by Christopher B. Burke Engineering, Ltd (CBBEL). CBBEL's review of the hydrologic models included a general verification of drainage areas, subbasin divides, and hydrologic model parameters such as CNs and time of concentration. CBBEL's review of the hydraulic models included a general verification of Manning n roughness values, bank stations, ineffective flow areas, hydraulic structures, boundary conditions and connectivity with the hydrologic model output files. Recommendations from the independent review have been addressed in the H&H models developed to support the DWP.

1.4 Development and Evaluation of Alternatives

1.4.1 Problem Area Identification

Problem area data for the Poplar Creek DWP was generated from three sources. The first was community response data that identified flooding, erosion, water quality, and maintenance problems. In addition, problem areas were identified by reviewing inundation extents created by overlaying the results of H&H modeling on the ground surface DEM of the watershed to identify structures at risk of flooding along regional waterways. Modeled flood problems generally corroborated the communities' reported problems. A final source of potential problem areas was the existing FEMA FIRM panel maps. Areas shown within FEMA floodplain were carefully considered in H&H modeling and communication with communities in order to identify problem areas.

1.4.2 Economic Analysis

1.4.2.1 Flood Damages

Property damages due to flooding were assessed based upon the intersection of inundation areas for modeled storm recurrence intervals (2-, 5-, 10-, 25-, 50-, and 100-year) with the Cook County parcel data, considering ground elevation data, to calculate estimated flood depths. Damages were estimated using a methodology consistent with one developed by the USACE that estimates structure and contents damage as a fraction of structure value based upon the estimated depth of flooding (USACE 2003). The general procedure estimating property damage due to flooding is outlined in Appendix F of the CCSMP. This method of damage calculation requires estimating a number of parameters for properties at risk of flooding.

The foundation for property damage values due to flooding is derived from the 2006 Cook County Tax Assessor (CCTA) data multiplied by a standard factor derived from a statistical analysis comparing recent sales data to the CCTA property values. The CCTA data includes tax assessed value of land, improvements, total tax assessed value, structure class (residential single family, multi-family, industrial etc.), number of stories, basement information, land area (square footage), and other data fields not relevant to this study.

1.4.2.2 Identification of Parcels at Risk of Flooding

All structures within the limits of the 100-year inundation were identified and depicted on the draft 100-year inundation maps. For all parcels within the 100-year inundation boundary, a point was manually placed on the low side of the structure as identified from the topographic mapping. Intersection of inundation mapping with the location of these points was then performed for each modeled recurrence interval storm and used to identify parcels within the subwatershed that may, based upon their zero-damage elevations, be subject to property damage due to flooding for a particular recurrence interval.

1.4.2.3 Parcel Zero Damage Elevation

Structures do not incur damage due to flooding until the water surface exceeds the zero-damage elevation, at which water is assumed to begin flowing into the structure and cause damages. For most structures, the zero-damage elevation is the ground surface. Floodwaters exceeding the ground surface may enter the structure through doorways, window wells, and other openings within the structure. The zero-damage elevation was assumed to be the ground elevation for all parcels with living space below the ground elevation. For parcels constructed on slab, the zero-damage elevation was set at 6 inches above the lowest adjacent ground elevation. The ground elevation estimate was obtained at the point representing the parcel, generally located on the lower, stream-side of the actual structure.

1.4.2.4 Parcel First Floor Elevation

USACE depth-damage curves relate flooding depths to the first floor elevation (FFE) of the structure, a value not provided within the CCTA data. FFEs generally were not surveyed, however field inspections, observation and measurements were taken at a number of locations. The FFEs were generally set as 18 inches above ground for structures with basements, 6 inches above ground for structures without basements, and 24 to 30 inches for mobile homes (depending on typical field measurements). Modifications to these estimates were made when detailed survey data or other parcel specific data was available.

1.4.2.5 Structure Estimated Value

The estimated value of flooded structures is an input to damage calculations. The CCTA database included data that identified values for the land value as well as the improvement value (i.e., building, garage, etc.). The values in the CCTA data are assessed valuations of the estimated property value, which require a factor to bring the value, depending on the structure's use, to the CCTA estimation of property value. For example, residential structures receive an assessed valuation factor of 16 percent, thus the value identified by CCTA is the CCTA estimated value divided by a standardized 0.16. The adjusted CCTA data (reported values divided by the assessed valuation factor) was then compared with recent sales data throughout the county to statistically derive a multiplier that brings the 2006 CCTA estimated value of the properties to 2008 market value of properties. This multiplier was calculated to be 1.66. Since this plan analyzes damage to the structure, the land component of the property value was removed from the analysis. The value of the structure was computed by applying the assessed valuation multiplier and the District calculated market value multiplier to the improvement value identified in the CCTA data. This method was used on all property types to generate information to be used in the damage calculations. In one case, the value of the structure was based on a comparable property because the structure is owned by the Forest Preserve District Cook County (FPDCC) and is not in the CCTA database.

1.4.2.6 Depth-Damage Curves

Six residential depth-damage curves were obtained from the USACE technical guidance memorandum EGM 04-01 (USACE, 2003) to relate estimated structure and contents damage to structure replacement value as a function of flooding depth. These damage curves are one story, two-story, and split-level resident structures, either with or without basements. For non-residential structures, a depth-damage curve representing the average of structure and contents depth damage curves for a variety of structure types, generated by the Galveston District of the USACE was selected for use. Appendix F contains the depth-damage curves used to calculate property damage due to flooding. CCTA data was analyzed to identify the number of stories on residential structures and the presence or absence of a basement.

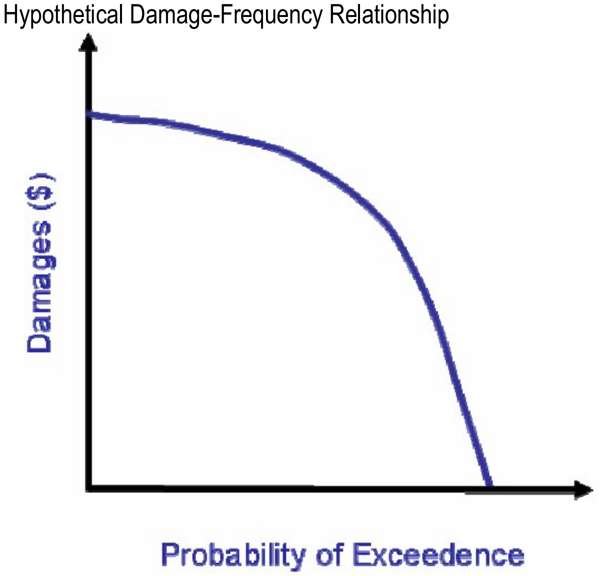
1.4.2.7 Property Damage Calculation

The estimated structure value, flooding depth, and depth-damage curve information were used to estimate the property damage from flooding for a specific structure due to a storm of given recurrence interval. Higher magnitude events, such as the 100-year event, cause higher damages for flooded properties but also have a lower likelihood of occurring in a given year. Figure 1.4.1 shows the hypothetical relationship between expected damage and modeled recurrence interval. Estimated annual damages were calculated according to Appendix F of Chapter 6 of the CCSMP, essentially weighting the expected annual damages by their annual probability of occurrence. Damages were then capitalized over a 50-year period of analysis, consistent with the period of analysis over which maintenance and replacement costs were calculated, using the federal discount rate for 2008 of 4.875 percent.

1.4.2.8 Erosion Damages

Locations of potential erosion risk were identified through community response data, field observations and a comparison of the proximity of the streambank to adjacent structures as shown on the aerial photograph and topographic mapping. The CCSMP contains direction that erosion damages be estimated as the full value of structures at "imminent risk" of damage due to active stream bank erosion, and that erosion damages not be assessed for loss of land. Field visits to areas identified as erosion problems were performed. Properties and infrastructure were judged to be at imminent risk if they were located within 30 feet of a site of active erosion, characterized by exposed

FIGURE 1.4.1
Hypothetical Damage-Frequency Relationship



earth, lack of vegetation, or collapsing banks. The estimated market value of the structure and contents derived from CCTA data was used to estimate erosion damages for structures deemed at imminent risk.

1.4.2.9 Transportation Damages

In areas with widespread property damages including road inundation, transportation damage was estimated as 15 percent of property damage due to flooding. In some specific instances, significant transportation damages occurred in absence of attendant property damage due to flooding. For the Poplar Creek Watershed , specific transportation damages were calculated when flooding exceeded six inches on the pavement during the 100-year event and these damages were not captured as a fraction of property damages. In such instances, transportation damages were calculated according to FEMA guidance in the document "What Is a Benefit?" (FEMA, 2001). The duration of road closure was estimated for the modeled storms, and transportation damage was calculated according to a value of $39.82 (based on a FEMA recommended rate of $32.23 in 2000 and brought forward to 2008 dollars using a 3.068% discount rate) per hour of delay per vehicle based on average traffic counts and the estimated time to detour around each flooded location.

1.4.3 Alternative Development and Evaluation

Potential stormwater improvements, referred to within the DWP as alternatives, were developed using a systematic procedure to screen, develop, and evaluate technologies consistently throughout the Poplar Creek Watershed. Tributary-specific technologies were screened and evaluated in consideration of the stormwater problems identified through community response data and modeling. An alternative is a combination of the technologies developed to address the identified stormwater problems. In some instances, communities had input and feedback on the development of alternatives which was considered during final alternative development.

Alternatives were evaluated with respect to their ability to reduce flooding, erosion, and other damages under existing conditions. The reduction in expected damages for an alternative is called a benefit. Conceptual level costs were developed for each alternative using countywide unit cost data that considered expected expenses such as excavation, land-acquisition, pipe costs, channel lining, etc. Standard countywide markups were used to account for the cost of utility relocation, profit, design engineering and construction management costs, and contingency. Expected maintenance and replacement costs were considered over a 50-year design period. Detailed design studies are required to confirm the details associated with the feasibility of construction and precise configuration of proposed facilities.

Additional non-economic factors, such as the number of structures protected, the expected water-quality benefit, and the impact on wetland or riparian areas were considered in alternative development and evaluation.

1.4.3.1 Flood Control

Flood control technologies were considered during the development of alternatives for addressing flooding problems, as summarized in Table 1.4.1. Conceptual alternatives were developed after selection of an appropriate technology or technologies for a problem area, and review of information provided by communities and/or obtained from other sources (such as aerial photography and parcel data) regarding potentially available land, conceptual alternatives were developed.

Hydrologic or hydraulic models for alternative conditions were created to analyze the effect of the conceptual alternatives. Initial model runs were performed to determine whether an alternative significantly affected WSEL near the target problem area, or had negative impacts in other parts of the tributary area. For alternatives that successfully achieved the expected results, damages due to flooding were recomputed under the alternative conditions. Benefits were calculated based on damages reduced from existing to proposed conditions.

1.4.3.2 Floodproofing and Acquisition

Alternatives consisting of structural flood control measures may not feasibly provide a 100-year level of protection for all structures. The DWP identifies areas that will experience flooding at the 100-year event, even if recommended alternatives are implemented. Floodproofing and/or acquisition of such structures are nonstructural flood control measures that may reduce or eliminate damages during flood events, which is why these measures are listed in Table 1.4.1. However, due to the localized nature of implementing such solutions, the District may look to address structures that are candidates for nonstructural flood control measures under separate initiatives, outside of the Capital Improvement Program (CIP).

1.4.3.3 Erosion Control

Erosion control alternatives were developed to address problem areas where erosion problems on regional waterways were determined to threaten structures. Damages were calculated based on the value of the threatened structures. A full range of alternative technologies is summarized in Table 1.4.2.

1.4.3.4 Water Quality

The potential effect of alternatives on water quality was considered qualitatively. Most detention basins built for flood control purposes have an ancillary water quality benefit because pollutants in sediment will settle out while water is detained. Sediments can be removed as a part of maintenance of the detention basin, preventing the pollutants from entering the waterway. Detention basins typically have a sediment forebay specifically designed for this purpose. Some detention basins could be designed as created wetland basins with wetland plants included which could naturally remove pollutants and excess nutrients from the basin. Streambank stabilization alternatives can help address water quality problems through reduction of sedimentation.

TABLE 1.4.1
Flood Control Technologies

Flood Control Option	Description	Technology Requirements
Detention/Retention		
Detention facilities (Dry basins)	Impoundments to temporarily store stormwater in normally dry basins.	Open space, available land. Only an upstream option.
Retention facilities (Wet basins)	Impoundments that include a permanent pool which stores stormwater and removes it through infiltration and evaporation. Retention facilities generally have an outfall to the receiving water-way that is located at an elevation above the permanent pool.	Open space, available land. Only an upstream option.
Pumped detention	Similar to detention or retention facilities, but includes a portion of the impoundment which cannot be drained by gravity and must be pumped out.	Open space, available land. Only an upstream option. Best applied when significant area is available to allow for filling only during large storms.
Underground de-tention	A specialized form of storage where stormwater is detained in underground facilities such as vaults or tunnels. Underground detention may also be pumped.	Space without structures, available land. Only an upstream option. Signifi-cantly more expensive than above ground facilities. Surface disruption must be acceptable during construction.
Bioretention	Decentralized microbasins distributed through-out a site or watershed to control runoff close to where it is generated. Runoff is detained in the bioretention facilities and infiltrated into the soil and removed through evapotranspiration.	Open space, multiple available oppor-tunities for various sizes of open space.
Conveyance Improvement		
Culvert/bridge re-placement	Enhancement of the hydraulic capacity of cul-verts or bridges through size increase, rough-ness reduction, and removal of obstacles (for example, piers).	Applicable only if restricted flow and no negative impact upstream or down-stream. May require compensatory sto-rage to prevent negative downstream impact. Permitting requirements and available adjacent land.
Channel improve-ment	Enhancement of the hydraulic capacity of the channels by enlarging cross sections (for exam-ple, floodplain enhancement), reducing rough-ness (for example, lining), or channel realignment.	No negative upstream or downstream impact of increased conveyance ca-pacity. Permitting requirements and available adjacent land. Permanent and/or construction easements.
Flood Barriers		
Levees	Earth embankments built along rivers and streams to keep flood waters within a channel.	Permitting requirements and available adjacent land. Wide floodplains will be analyzed. Requires 3 feet of free-board to remove structures behind le-vees from regulatory floodplain. Often requires compensatory storage.
Floodwalls	Vertical walls typically made of concrete or other hard materials built along rivers and streams to keep flood waters within a channel.	Permitting requirements and available adjacent land. Permanent and/or construction easements.

TABLE 1.4.1
Flood Control Technologies

Flood Control Option	Description	Technology Requirements
Acquisition	Acquisition and demolition of properties in the floodplain to permanently eliminate flood damages. In some cases, acquired property can be used for installation of flood control facilities.	Severe flooding, repetitive losses, other alternatives are not feasible.
Floodproofing		
Elevation	Modification of a structure's foundation to elevate the building above a given flood level. Typically applied to houses.	Severe flooding, repetitive losses, other alternatives are not feasible
Dry Floodproofing	Installation of impermeable barriers and flood gates along the perimeter of a building to keep flood waters out. Typically deployed around commercial and industrial buildings that cannot be elevated or relocated.	Better suited for basement or shallow flooding. Need the ability to provide closure of openings in walls or levees. Plan for emergency access to permit evacuation.
Wet Floodproofing	Implementation of measures that do not prevent water from entering a building but minimize damages; for example, utility relocation and installation of resistant materials.	Most applicable for larger buildings where content damage due to flooding can be minimized. Waterproofing sealant applied to walls and floors, a floor drain and sump pump.

TABLE 1.4.2
Erosion Control Technologies

Erosion Control Option	Description	Technology Requirements
Natural (vegetated or bioengineered) stabilization	The stabilization and protection of eroding overland flow areas or stream banks with selected vegetation using bioengineering techniques. The practice applies to natural or excavated channels where the stream banks are susceptible to erosion from the action of water, ice, or debris and the problem can be solved using vegetation. Vegetative stabilization is generally applicable where bankfull flow velocity does not exceed 5 ft/sec and soils are more erosion resistant, such as clayey soils. Combinations of the stabilization methods listed below and others may be used.	Requires stream bank slopes flat enough to prevent slope failure based upon underlying soils. Channels with steep banks with no room for expansion or high bank full velocities (> 5 ft/sec) should avoid these technologies.
Vegetating by sodding, seeding, or planting	Establishing permanent vegetative cover to stabilize disturbed or exposed areas. Required in open areas to prevent erosion and provide runoff control. This stabilization method often includes the use of geotextile materials to provide stability until the vegetation is established and able to resist scour and shear forces.	

TABLE 1.4.2
Erosion Control Technologies

Erosion Control Option	Description	Technology Requirements
Vegetated armoring (joint planting)	The insertion of live stakes, trees, shrubs, and other vegetation in the openings or joints between rocks in riprap or articulated block mat (ABM). The object is to reinforce riprap or ABM by establishing roots into the soil. Drainage may also be improved through extracting soil moisture.	
Vegetated cellular grid (erosion blanket)	Lattice-like network of structural material installed with planted vegetation to facilitate the establishment of the vegetation, but not strong enough to armor the slope. Typically involves the use of coconut or plastic mesh fiber (erosion blanket) that may disintegrate over time after the vegetation is established.	
Reinforced grass systems	Similar to the vegetated cellular grid, but the structural coverage is designed to be permanent. The technology can include the use of mats, meshes, interlocking concrete blocks, or the use of geocells containing fill material.	
Live cribwall	Installation of a regular framework of logs, timbers, rock, and woody cuttings to protect an eroding channel bank with structural components consisting of live wood.	
Structural stabilization	Stabilization of eroding stream banks or other areas by use of designed structural measures, such as those described below. Structural stabilization is generally applicable where flow velocities exceed 5 ft/sec or where vegetative stream bank protection is inappropriate.	Applicable to areas with steep stream bank slopes (> 3:1) and no room for channel expansion, or areas with high velocities (> 5 ft/sec) can benefit from this technology.
Interlocking concrete	Interlocking concrete may include A-Jacks®, ABM, or similar structural controls that form a grid or matrix to protect the channel from erosion. A-Jacks armor units may be assembled into a continuous, flexible matrix that provides channel toe protection against high velocity flow. The matrix of A-Jacks can be backfilled with topsoil and vegetated to increase system stability and to provide in-stream habitat. ABM can be used with or without joint planting with vegetation. ABM is available in several sizes and configurations from several manufacturers. The size and configuration of the ABM is determined by the shear forces and site conditions of the channel.	
Riprap	A section of rock placed in the channel or on the channel banks to prevent erosion. Riprap typically is underlain by a sand and geotextile base to provide a foundation for the rock, and to prevent scour behind the rock.	
Gabions	Gabions are wire mesh baskets filled with river stone of specific size to meet the shear forces in a channel. Gabions are used more often in urban areas where space is not available for other stabilization techniques. Gabions can provide stability when designed and installed correctly, but failure more often is sudden rather than gradual.	
Grade Control	A constructed concrete channel designed to convey flow at a high velocity (greater than 5 ft/sec) where other stabilization methods cannot be used. May be suitable in situations where downstream areas can handle the increase in peak flows and there is limited space available for conveyance.	
Concrete channels	Prevent stream bank erosion from excessive discharge velocities where stormwater flows out of a pipe. Outlet stabilization may include any method discussed above.	

2. Watershed Characteristics

2.1 General Watershed Description

The Poplar Creek DWP is located in northwestern Cook County and includes five major watersheds: the Poplar Creek Watershed, Flint Creek Watershed, Spring Creek Watershed, Brewster Creek Watershed, and West Branch DuPage River Watershed. The District has established boundaries of the Poplar Creek Watershed study area for purposes of its stormwater management program. Figure ES.1 shows the location and the District's established boundaries of the Poplar Creek DWP.

2.1.1 Poplar Creek Watershed

The Poplar Creek Watershed is situated primarily in northwestern Cook County, but also includes a small portion of northeastern Kane County. A tributary to the Fox River, the Poplar Creek Watershed occupies 44 square miles (28,500 acres) of which 42.66 square miles are located within Cook County. Nine Cook County municipalities are located within the Poplar Creek Watershed. The City of Elgin and Villages of Hoffman Estates, Schaumburg, South Barrington, and Streamwood are the largest municipalities in the Cook County portion of the watershed. Figure ES.1 shows the municipal boundaries and the major streams within the Poplar Creek Watershed. Figure ES.1 also shows the subwatershed divides for the major tributaries within the Poplar Creek Watershed. Table 2.1.1 lists the municipalities within the Poplar Creek Watershed. Table 2.1.2 lists the major streams and tributaries to the Poplar Creek Watershed and stream lengths. Each stream is briefly described with a narrative in the following subsection.

TABLE 2.1.1
Municipalities in the Poplar Creek Watershed

Municipality	% of Municipality Area within Poplar Creek Watershed	% of Poplar Creek Watershed by Municipality
Barrington Hills	1.46	0.94
Bartlett	1.16	0.37
Elgin [a]	31.94	16.03
Hanover Park	3.27	0.45
Hoffman Estates	65.75	29.67
Inverness	13.24	1.91
Schaumburg	14.27	6.17
South Barrington	74.25	11.41
Streamwood	87.79	14.47
Barrington Township [b]	1.42	1.16
Hanover Township [b]	13.07	9.97
Schaumburg Township [b]	0.37	0.26
FPDCC [c]	3.10	7.19

a Municipality area for the City of Elgin includes approximately 1,040 acres within Kane County
b Includes only unincorporated portions of townships (excludes FPDCC)
c Includes only portions of FPDCC in unincorporated Cook County

The mainstem of Poplar Creek has six major tributaries: Tributary A, Poplar Creek East Branch, Poplar Creek Schaumburg Branch, Railroad Tributary, Poplar Creek South Branch, and Lord's Park Tributary. The Poplar Creek mainstem is approximately 18.3 miles long

TABLE 2.1.2
Poplar Creek Watershed Open Channel Stream Lengths

Open Channel Name	Length (miles)
Poplar Creek Mainstem	18.03
Poplar Creek Mainstem Unnamed Tributary A	0.16
Poplar Creek Mainstem Unnamed Tributary B	0.51
Poplar Creek Mainstem Unnamed Tributary C	0.37
Poplar Creek Mainstem Unnamed Tributary D	0.78
Poplar Creek Mainstem Unnamed Tributary E	0.09
Poplar Creek Mainstem Unnamed Tributary F	0.03
Poplar Creek Mainstem Unnamed Tributary G	0.79
Poplar Creek Tributary A	1.22
Poplar Creek East Branch	4.92
Poplar Creek East Branch Unnamed Tributary A	0.66
Poplar Creek Schaumburg Branch	3.23
Poplar Creek Railroad Tributary	2.11
Poplar Creek South Branch	3.91
Poplar Creek South Branch Unnamed Tributary A	0.20
Poplar Creek Lord's Park Tributary	1.57
Poplar Creek Lord's Park Unnamed Tributary 1	0.30
Poplar Creek Lord's Park Overflow Tributary	0.51
TOTAL	**39.39**

with 17.4 miles located within Cook County. The headwaters of the mainstem can be found in several wetlands at the Crabtree Forest Preserve located in South Barrington. From its headwaters, the mainstem flows south to just south of Illinois Route 72 (Higgins Road) to the confluence with Tributary A. Tributary A is 1.2 miles in length and is located entirely in Cook County. From the confluence with Tributary A, the mainstem then continues to flow south to Illinois Route 58 (Golf Road) where it joins the Poplar Creek East Branch and the Poplar Creek Schaumburg Branch. The Poplar Creek East Branch is approximately 4.9 miles in length and is located completely in Cook County. The Poplar Creek East Branch begins in wetlands north of Interstate 90 and west of Ela Road. The Poplar Creek Schaumburg Branch is 3.2 miles in length, with its headwaters in drainage ditches and ponds near Bode Road in Schaumburg and Hoffman Estates. From its confluence with the Poplar Creek East Branch and the Poplar Creek Schaumburg Branch, the mainstem of Poplar Creek flows west and southwest until it meets the Poplar Creek Railroad Tributary near the intersection of Poplar Creek, Illinois Route 58, and the EJ&E railroad tracks. The Railroad Tributary is approximately 2.1 miles in length. The mainstem of Poplar Creek then continues to flow westward where it meets the Poplar Creek South Branch just west of the EJ&E Railroad tracks. The Poplar Creek South Branch is 3.9 miles in length and its headwaters are the Dolphin Park Reservoir in Streamwood. From its confluence with the South Branch, the mainstem flows westward where it joins the Lord's Park Tributary just north of the termination of Jay Street at Poplar Creek. The headwaters of the Lord's Park Tributary can be found in Lord's Park located within the City of Elgin. Lord's Park Tributary is approximately 1.6 miles in length. The mainstem of Poplar Creek then continues to flow west where it discharges into the Fox River.

There are many significant on-line and off-line lakes located within the Poplar Creek Watershed. Table 2.1.3 lists the most significant lakes, their size and the municipality they are in.

TABLE 2.1.3
Lakes in the Poplar Creek Watershed

Lake	Municipality	Size (acres)
Quarry Lakes	Elgin	91
Lake of the Coves	South Barrington	85
Cobblers Crossing	Elgin	25
Gray Farm Lake	Schaumburg	24
Arlingdale Lake	Streamwood	23
Lake Adalyn	South Barrington	22
Bode Lake North & South	Hoffman Estates	20
Harrow Gate Lake	Inverness	17
Rose Lake	South Barrington	15
Left Foot Lake	South Barrington	2
Kollar Pond	Streamwood	2

Table 2.1.4 lists the Poplar Creek subwatersheds each municipality drains, with subwatersheds listed in decreasing order based upon the area within the municipality. Although municipalities contribute stormwater to the listed subwatersheds, the actual stream may not be included within the municipality's boundaries.

TABLE 2.1.4
Municipality and Poplar Creek Subwatersheds within the Municipality Boundary

Municipality	Poplar Creek Subwatersheds within Municipality Boundary (square miles)[a]
Barrington Hills	Poplar Creek Mainstem (0.42)
Bartlett	South Branch Poplar Creek (0.11), Poplar Creek Mainstem (0.05)
Elgin	Poplar Creek Mainstem (4.23), Lord's Park Poplar Creek (2.84)
Hanover Park	South Branch Poplar Creek (0.20)
Hoffman Estates	Poplar Creek Mainstem (4.54), East Branch Poplar Creek (4.13), Railroad Branch Poplar Creek (1.95), Schaumburg Branch Poplar Creek (1.66), Lord's Park Poplar Creek (0.52), Poplar Creek Tributary A (0.28)
Inverness	Poplar Creek Mainstem (0.77), East Branch Poplar Creek (0.07)
Schaumburg	Schaumburg Branch Poplar Creek (1.47), Poplar Creek Mainstem (1.03), South Branch Poplar Creek (0.22)
South Barrington	Poplar Creek Mainstem (3.33), Poplar Creek Tributary A (0.95), East Branch Poplar Creek (0.76)
Streamwood	South Branch Poplar Creek (4.47), Poplar Creek Mainstem (1.78), Schaumburg Branch Poplar Creek (0.13)
Barrington Township [c]	Poplar Creek Mainstem (0.38), Railroad Branch Poplar Creek (0.07), Poplar Creek Tributary A (0.05), East Branch Poplar Creek (0.01)
Hanover Township [c]	Poplar Creek Mainstem (1.99), Lord's Park Poplar Creek (1.09), South Branch Poplar Creek (0.66), Railroad Branch Poplar Creek (0.64), East Branch Poplar Creek (0.01)
Schaumburg Township[c]	East Branch Poplar Creek (0.11)
FPDCC [d]	Poplar Creek Mainstem (2.89), East Branch Poplar Creek (0.03), Railroad Branch Poplar Creek (0.11), South Branch Poplar Creek (0.12), Poplar Creek Tributary A (0.02)

a Subwatersheds are ordered in decreasing order of area within municipality
b Less than 0.1 square miles within municipality contributes to subwatershed
c Includes only unincorporated portions of townships (excludes FPDCC)
d Includes only portions of FPDCC in unincorporated Cook County

2.1.2 Flint Creek Watershed

The Flint Creek Watershed is situated north of the Poplar Creek Watershed. The Flint Creek Watershed drains approximately 36.5 square miles (23,374 acres) of land to the Fox River. The Flint Creek Watershed is located in northwest Cook County and flows into southwest Lake County and ultimately to the Fox River. Approximately 7.38 square miles (4,723 acres) drain to Flint Creek or Flint Creek Tributary in Cook County. Ten municipalities are located within the Flint Creek Watershed. Barrington, Barrington Hills, and Inverness are the three municipalities in the Cook County portion of the watershed. Figure ES.1 shows the municipal boundaries and the major streams within the Flint Creek Watershed. Figure ES.1 also shows the subwatershed divides for the major streams within the Flint Creek Watershed. Table 2.1.5 lists the municipalities within the Flint Creek Watershed. Table 2.1.6 lists the major streams and tributaries to the Flint Creek Watershed and stream lengths.

Two primary tributaries drain the Cook County portion of the Flint Creek Watershed. The larger of the tributaries is the mainstem of Flint Creek. The mainstem flows northwest for 18.6 miles and drains 17.3 square miles of area. Approximately 5.6 miles of the mainstem of Flint Creek is located in Cook County. The second tributary, the Flint Creek tributary, flows for 10.8 miles and drains 8.5 square miles of area before its confluence with the mainstem of Flint Creek near Barrington. Approximately 0.8 miles of Flint Creek Tributary are located in Cook County. In addition to the major branches of Flint Creek, over 1,300 acres of open water and 4,400 acres of wetlands are situated in the Flint Creek Watershed.

There are numerous lakes occurring within the Cook County portion of the Flint Creek Watershed. The most notable is the 112-acre Baker's Lake, located in Baker's Lake Nature Preserve, which is owned by the Forest Preserve District of Cook County, Barrington Park District, and Village of Barrington. This site was given Nature Preserve status to protect a significant breeding area for rare and endangered birds (the Baker's Lake Heron Rookery). Also found within the Cook County portion of the Flint Creek Watershed are LaBuy's Lake (16 acres), Hawley Lake (67 acres), Hawthorne Lake, and Keene Lake (51 acres). All of the lakes discussed above are on-line impoundments.

TABLE 2.1.5
Municipalities in the Flint Creek Watershed

Municipality	% of Municipality Area within Flint Creek Watershed	% of Flint Creek Watershed by Municipality
Barrington	39.97	24.93
Barrington Hills	9.27	35.68
Inverness	21.34	18.38
Barrington Township [a]	0.74	3.63
Palatine Township [a]	0.65	3.19
FPDCC [b]	1.02	14.20

a Includes only unincorporated portions of townships (excludes FPDCC)
b Includes only portions of FPDCC in unincorporated Cook County

TABLE 2.1.6
Flint Creek Watershed Open Channel Stream Lengths

Open Channel Name	Length (miles)
Flint Creek Mainstem	5.62
Flint Creek Mainstem Unnamed Tributary A	0.33
Flint Creek Tributary	0.84
TOTAL	**5.48**

Table 2.1.7 lists the Flint Creek subwatersheds each municipality drains to, with subwatersheds listed in decreasing order based upon the area within the municipality. Although municipalities contribute stormwater to the listed subwatersheds, the actual stream may not be included within the municipality's boundaries.

TABLE 2.1.7
Municipality and Flint Creek Subwatersheds within the Municipality Boundary

Municipality	Flint Creek Subwatersheds within Municipality Boundary (square miles)[a]
Barrington	Flint Creek Tributary (1.06), Flint Creek Mainstem (0.78)
Barrington Hills	Flint Creek Mainstem (2.63)
Inverness	Flint Creek Mainstem (1.18), Flint Creek Tributary (0.18)
Barrington Township [b]	Flint Creek Mainstem (0.20), Flint Creek Tributary (0.07)
Palatine Township [b]	Flint Creek Tributary (0.24)
FPDCC [c]	Flint Creek Mainstem (0.78), Flint Creek Tributary (0.27)

a Subwatersheds are ordered in decreasing order of area within municipality
b Includes only unincorporated portions of townships (excludes FPDCC)
c Includes only portions of FPDCC in unincorporated Cook County

2.1.3 Spring Creek

The Spring Creek Watershed is north of the Poplar Creek Watershed and west of the Flint Creek Watershed. The Spring Creek Watershed is located in northwest Cook County and flows into southeast McHenry County and ultimately to the Fox River. Spring Creek drains approximately 25.8 square miles of land into the Fox River. Approximately 19.55 square miles (12,512 acres) drain into Spring Creek and its unnamed tributaries, with 17.9 square miles (11,446 acres) of that area located in Cook County. Four Cook County municipalities are located within the Spring Creek Watershed. Barrington Hills and South Barrington are the major municipalities in the Spring Creek Watershed. Figure ES.1 shows the municipal boundaries and the major streams within the Spring Creek Watershed. Figure ES.1 also shows the subwatershed divides for the major streams within the Spring Creek Watershed. Table 2.1.8 lists the municipalities within the Spring Creek Watershed. Table 2.1.9 lists the major streams and tributaries to the Spring Creek Watershed and stream lengths.

The headwaters of Spring Creek are found near the intersection of Route 72 (Higgins Road) and Illinois Route 59 (New Sutton Road). From its headwaters, Spring Creek generally flows northward to the Cook / Lake County border. The Cook County portion of Spring Creek is approximately 8.2 miles in length.

TABLE 2.1.8
Municipalities in the Spring Creek Watershed

Municipality	% of Municipality Area within Spring Creek Watershed	% of Spring Creek Watershed by Municipality
Barrington Hills [a]	48.06	69.91
East Dundee [b]	5.74	0.80
Hoffman Estates	4.93	5.02
South Barrington	25.75	8.93
Barrington Township [c]	3.70	6.84
Hanover Township [c]	0.05	0.09
FPDCC [d]	1.11	5.81
Miscellaneous Kane County [e]	N/A	2.61

a Municipality area for the Village of Barrington Hills includes approximately 323 acres within Kane County
b Municipality area for the Village of East Dundee includes approximately 95 acres within Kane County
c Includes only unincorporated portions of townships (excludes FPDCC)
d Includes only portions of FPDCC in unincorporated Cook County
e Miscellaneous Kane County includes Unincorporated areas, Forest Preserve District property, and the Village of Carpentersville

TABLE 2.1.9
Spring Creek Watershed Open Channel Stream Lengths

Open Channel Name	Length (miles)
Spring Creek Mainstem	8.20
Spring Creek Mainstem Unnamed Tributary A	1.63
Spring Creek Mainstem Unnamed Tributary B	0.54
Spring Creek Mainstem Unnamed Tributary C	0.57
Spring Creek Mainstem Unnamed Tributary D	2.74
Spring Creek Mainstem Unnamed Tributary E	0.79
Spring Creek Mainstem Unnamed Tributary F	1.39
Spring Creek Mainstem Overflow	0.78
TOTAL	**16.64**

Table 2.1.10 lists the Spring Creek subwatersheds each municipality drains to, with subwatersheds listed in decreasing order based upon the area within the municipality. Although municipalities contribute stormwater to the listed subwatersheds, the actual stream may not be included within the municipality's boundaries.

TABLE 2.1.10
Municipality and Spring Creek Watershed within the Municipality Boundary

Municipality	Spring Creek Watershed within Municipality Boundary (square miles)
Barrington Hills	Spring Creek Mainstem (13.65)
East Dundee	Spring Creek Mainstem (0.16)
Hoffman Estates	Spring Creek Mainstem (0.98)
South Barrington	Spring Creek Mainstem (1.74)
Barrington Township [a]	Spring Creek Mainstem (1.34)
Hanover Township [a]	Spring Creek Mainstem (0.02)
FPDCC [b]	Spring Creek Mainstem (1.13)
Miscellaneous Kane County	Spring Creek Mainstem (0.51)

a Includes only unincorporated portions of townships (excludes FPDCC)
b Includes only unincorporated areas of FPDCC

2.1.4 Brewster Creek

The Brewster Creek Watershed is located southwest of the Poplar Creek Watershed. The Brewster Creek Watershed is located in northwestern Cook County and flows into DuPage County. Approximately 3.70 square miles (2,368 acres) of the 15.5 square mile Brewster Creek drain to the portion of Brewster Creek located within Cook County. Three Cook County municipalities are located within the Brewster Creek Watershed. Bartlett is the major municipality located in the Cook County portion of the watershed. Figure ES.1 shows the municipal boundaries and the major streams within the Brewster Creek Watershed. Figure ES.1 also shows the subwatershed divides for the major streams within the Brewster Creek Watershed. Table 2.1.11 lists the municipalities within the Brewster Creek Watershed. Table 2.1.12 lists the major streams and tributaries to the Brewster Creek Watershed and stream lengths. Each stream is briefly described with a narrative in the following subsection.

The headwaters of Brewster Creek are found near the intersection of Naperville Road and the Canadian Pacific Railway railroad tracks in Village of Bartlett. From its headwaters, Brewster Creek flows west and then to the south to the Cook / Kane County line. The Cook County portion of Brewster Creek is 2.4 miles in length.

One notable open water body is found within the Cook County portion of the Brewster Creek Watershed near the intersection of West Bartlett Road and Naperville Road. This lake/wetland complex is in close proximity to James "Pate" Phillips (formerly Tri-County) State Park and Pratt's Wayne Woods Forest Preserve in DuPage County.

TABLE 2.1.11
Municipalities in the Brewster Creek Watershed

Municipality	% of Municipality Area within Brewster Creek Watershed	% of Brewster Creek Watershed by Municipality
Bartlett	15.39	58.24
Elgin	1.87	11.16
Streamwood	1.92	3.78
Hanover Township [a]	2.95	26.82

a Includes only unincorporated portions of townships

TABLE 2.1.12
Brewster Creek Watershed Open Channel Stream Lengths

Open Channel Name	Length (miles)
Brewster Creek	2.37
TOTAL	**2.37**

Table 2.1.13 lists the Brewster Creek subwatersheds each municipality drains to, with subwatersheds listed in decreasing order based upon the area within the municipality. Although municipalities contribute stormwater to the listed subwatersheds, the actual stream may not be included within the municipality's boundaries.

TABLE 2.1.13
Municipality and Brewster Creek Watershed within the Municipality Boundary

Municipality	Brewster Creek Watershed within Municipality Boundary (square miles)
Bartlett	Brewster Creek (2.15)
Elgin	Brewster Creek (0.41)
Streamwood	Brewster Creek (0.14)
Hanover Township [a]	Brewster Creek (0.99)

a Includes only unincorporated portions of township

2.1.5 West Branch DuPage River

The West Branch DuPage River Watershed is situated southeast of the Poplar Creek Watershed. The West Branch Watershed encompasses approximately 127 square miles of Cook County, Illinois, DuPage County, and Will County. Approximately 8.74 square miles (5,594 acres) of the West Branch DuPage River Watershed are located in Cook County. Of this, 6.6 square miles are tributary to the portion of the West Branch DuPage River located in Cook County and an additional 2.2 square miles of the watershed is tributary to an unnamed sewer that exits Cook County before eventually discharging to the river downstream in DuPage County. Seven municipalities are located within the West Branch DuPage River Watershed in Cook County. The Villages of Schaumburg, Bartlett and Hanover Park are the larger municipalities in the Cook County portion of the watershed. Figure ES.1 shows the municipal boundaries and the major streams within the West Branch DuPage River Watershed. Figure ES.1 also shows the subwatershed divides for the major streams within the West Branch DuPage River Watershed. Table 2.1.14 lists the municipalities within the West Branch DuPage River Watershed. Table 2.1.15 lists the major streams and tributaries to the

West Branch DuPage River Watershed and stream lengths. Each stream is briefly described with a narrative in the following subsection.

The West Branch DuPage River flows south through DuPage County to its confluence with the East Branch DuPage River in northern Will County. The DuPage River then flows south into the Des Plaines River. The main channel of the West Branch DuPage River has a total length of 32.0 miles. Approximately 3.9 miles of the West Branch DuPage River is located within Cook County.

Several ponds and small lakes occur within the Cook County portion of the West Branch DuPage River Watershed. Many of these are publicly owned by the Village of Schaumburg and Schaumburg Park District.

TABLE 2.1.14
Municipalities in the West Branch DuPage River Creek Watershed

Municipality	% of Municipality Area within West Branch DuPage River Watershed	% of West Branch DuPage River Watershed by Municipality
Bartlett	7.04	11.28
Hanover Park	40.79	28.00
Hoffman Estates	0.20	0.45
Schaumburg	20.38	44.42
Streamwood	10.29	8.55
Hanover Township [a]	0.20	0.76
Schaumburg Township [a]	1.85	6.53

a Includes only unincorporated portions of townships

TABLE 2.1.15
West Branch DuPage River Watershed Open Channel Stream Lengths

Open Channel Name	Length (miles)
West Branch DuPage River	3.88
West Branch DuPage River Unnamed Tributary A	0.39
TOTAL	**4.46**

Table 2.1.16 lists the West Branch DuPage River subwatersheds each municipality drains to, with subwatersheds listed in decreasing order based upon the area within the municipality. Although municipalities contribute stormwater to the listed subwatersheds, the actual stream may not be included within the municipality's boundaries.

TABLE 2.1.16
Municipality and West Branch DuPage River Creek Subwatersheds within the Municipality Boundary

Municipality	West Branch DuPage River Subwatersheds within Municipality Boundary (square miles)
Bartlett	West Branch DuPage River Bartlett Tributary (0.99)
Hanover Park	West Branch DuPage River (1.94), West Branch DuPage River Bartlett Tributary (0.51)
Hoffman Estates	West Branch DuPage River (0.04)
Schaumburg	West Branch DuPage River (3.88)
Streamwood	West Branch DuPage River Bartlett Tributary (0.64), West Branch DuPage River (0.11)
Hanover Township [a]	West Branch DuPage River Bartlett Tributary (0.07)
Schaumburg Township [a]	West Branch DuPage River (0.57)

a Includes only unincorporated portions of townships

2.2 Stormwater Problem Data

To support DWP development, the District solicited input from stakeholders within thef. Municipalities, townships, and countywide, statewide, and national agencies such as Cook County Highway Department (CCHD), Illinois Department of Natural Resources (IDNR), Illinois Department of Transportation (IDOT), and the USACE, were asked to fill out two forms with information to support DWP development. Organizations such as ecosystem partnerships were also contacted by the District as part of this information-gathering effort. Form A included questions on stormwater data and regulations, Form B included questions on known flooding, erosion, and stream maintenance problem areas. In addition to problem areas reported by municipalities, townships, public agencies and other stakeholders, results of H&H modeling performed as a part of DWP development identified stormwater problem areas. The H&H modeling process is described in general in Section 1.3 and specifically for each modeled tributary in Section 3.

Figure 2.2.1 and Table 2.2.1 summarize the responses to Form B questions as well as other problem area information collected by the District about flooding, erosion, and stream maintenance problem areas. As noted, the scope of the DWP addresses regional problems along open channel waterways. The definition of regional problems was provided in Section 1.

TABLE 2.2.1
Summary of Responses to Form B Questionnaire

Problem ID	Municipality	Problem as Reported by Local Agency	Location	Problem Description	Local/ Regional	Reason for Classification
Poplar Creek						
PCEL-1	Elgin	Poor instream habitat	Rolling Knolls Golf Course	The CMAP Poplar Creek Watershed Action Plan identified poor instream habitat in this reach compared to adjacent reaches.	Regional	1, 7
PCEL-2	Elgin	Structure flooding	The general vicinity of the Villa Avenue crossing in Elgin.	Lord's Park Tributary and Poplar Creek flooding areas north of Villa, east of Willard and South of Route 19. Also includes many structures flooding between Villa Ave and the county line.	Regional	1
PCEL-3	Elgin, FPDCC	Water quality	Bluff Springs Fen Nature Preserve	FPDCC reported that high volumes of off-site surface runoff with high levels of chlorides and other pollutants are threatening to contaminate the groundwater supply of the fen.	Regional	1, 7
PCEL-4	Elgin	Pavement flooding	Hammond Ave. and Cookane Ave.	The City of Elgin reported overbank and pavement flooding at this location.	Regional	1
PCEL-5	Elgin	Bank erosion	Campus Drive South of Route 19.	Bank erosion on high stream bank is putting private property at risk.	Regional	1
PCEL-6	Elgin	Bank erosion	North of the end of Thorndale Dr.	Bank erosion on high stream bank is putting private property at risk.	Regional	1
PCEL-7	Elgin	Bank erosion	Upstream of Villa Ave. on south bank	Bank erosion on high stream bank is putting private property at risk.	Regional	1
PCHE-1	Hoffman Estates	Pavement flooding	Poplar Creek crossing of Route 58 (Golf Road), west of Barrington Road	IDOT reported pavement flooding.	Regional	1, 2, 7
PCHE-2	Hoffman Estates	Bank erosion	Southwest of Higgins and Barrington Roads	The CMAP Poplar Creek Watershed Action Plan identified severe bank erosion and debris in this reach.	Regional	1, 6
PCSW-1	Streamwood, FPDCC	Water quality	Streamwood outfall in Glenbrook Park	Reported water quality problems from potential pump station SSO events.	Local	5, 7

TABLE 2.2.1
Summary of Responses to Form B Questionnaire

Problem ID	Municipality	Problem as Reported by Local Agency	Location	Problem Description	Local/ Regional	Reason for Classification
PCFP-1	Barrington Township, FPDCC	Potential Pavement flooding	Crabtree Nature Center along Palatine Road	FPDCC reported that off-site stormwater events are causing rapid increases in the water levels of the Palatine Marsh and the rising water threatens to result in pavement flooding on Palatine Road.	Regional	1, 7
Poplar Creek East Branch						
EBHE-1	Hoffman Es-tates	Pavement flooding	The Poplar Creek East Branch crossing of Barrington Road, south of Higgins Road	IDOT reported pavement flooding. Flood profiles show no overtopping in the 500-year event.	Regional	1, 3, 7
EBHE-2	Hoffman Es-tates	Pavement flooding	The Poplar Creek East Branch crossing of Route 62 (Algonquin Road), west of Lexington	IDOT reported pavement flooding. Poplar Creek East Branch is unnumbered Zone A at this crossing.	Regional	1, 3, 7
EBHE-3	Hoffman Es-tates	Bank Erosion	The Poplar Creek East Branch confluence southwest of Barring-ton Road and Higgins Road.	The CMAP Poplar Creek Watershed Action Plan reported that the Poplar Creek East Branch subwatershed likely contributes the highest sediment load per unit area.	Regional	1, 6, 7
Poplar Creek Schaumburg Branch						
SHHE-1	Hoffman Estates, Schaumburg Township	Water quality	Barrington Road and Higgins Road	The Village of Hoffman Estates has re-ported severe bank erosion on Brookside Pond that is contributing TSS to Poplar Creek.	Local	5, 6, 7
SHSC-1	Schaumburg	Poor habitat	Victoria Park on Bode Road	The CMAP Poplar Creek Watershed Action Plan reported that the stream through Victo-ria Park is unmanaged and the adjacent wetland is overrun with invasive plant spe-cies.	Regional	5, 7
Railroad Tributary						
-	n/a	n/a	n/a	No Form Bs were received for this subwa-tershed.	n/a	n/a

TABLE 2.2.1
Summary of Responses to Form B Questionnaire

Problem ID	Municipality	Problem as Reported by Local Agency	Location	Problem Description	Local/ Regional	Reason for Classification
Poplar Creek South Branch						
SBSW-1	Streamwood	Bank erosion	Route 19 and Whispering Drive	The Village of Streamwood and the CMAP Poplar Creek Watershed Action Plan reported large amount of streambank erosion from the golf course to 3,000 feet upstream	Regional	1, 7
SBSW-2	Streamwood	Water quality	Kollar Pond on Route 19	The CMAP Poplar Creek Watershed Action Plan reported that Kollar Pond is the most eutrophic lake/pond in the watershed.	Local	5, 7
SBSW-3	Streamwood	Bank erosion	Dolphin Park	The CMAP Poplar Creek Watershed Action Plan reported streambank erosion in 2,500 feet of channel though the park. The Action Plan also identified that untreated urban runoff is allowed to enter the park through several ditches.	Regional	1, 6, 7
Flint Creek						
FCBA-1	Barrington	Pavement flooding	East Lincoln Avenue, South Summit Street, East Russell Street, and Miller Park	Reported flooding on East Lincoln Avenue, South Summit Street, East Russell Street, and within Miller Park	Local	4, 5
FCBH-1	Barrington Hills	Storm sewer flow restriction	Hart Hills Road and Oakdene Road	Reported that a blocked drain tile at the intersection causes flooding on multiple private properties.	Local	4, 5
FCBH-2	Barrington Hills, Barrington Township	Storm sewer flow restriction	Hawthorne Road and Old Dundee Road	Reported that a blocked drain tile causes flooding and restricts the access to a property on Hawthorne Road. IDOT/FPD cooperation would be required to repair drain tile.	Local	4, 5
FCBH-3	Barrington Hills	Pavement flooding	Three Lake Road and County Line Road	Reported that normal storm events cause flooding of driveways and roads due to restricted ditches and culverts.	Local	4, 5

TABLE 2.2.1
Summary of Responses to Form B Questionnaire

Problem ID	Municipality	Problem as Reported by Local Agency	Location	Problem Description	Local/ Regional	Reason for Classification
FCBH-4	Barrington Hills, Barrington Township	Potential pavement flooding	Lakeview Lane and IL Route 68	Reported that insufficient vertical relief along the northern roadside ditch of IL Route 68, as evidenced by cattails in the ditch line.	Local	4, 5
FCBH-5	Barrington Hills	Pavement flooding	The Flint Creek crossing of Route 59, north of Dundee Road	IDOT has reported pavement flooding. Flint Creek is unnumbered Zone A at this crossing.	Local	1, 2, 7
FCBT-1	Barrington Hills	Water quality	Area collectively known as College Streets (Wisconsin Street, Harvard Street, Princeton Streets, etc) west of Baker's Lake	Reported that the environmentally sensitive and perennial wetlands in the area are threatened by development.	Local	5, 7
FCFP-1	FPDCC	Poor habitat, bank erosion	Route 59 to LaBuy's Lake Dam	Reported this is the poorest quality reach of Flint Creek in Cook County. Identified problems include high channelization, high debris load, high sediment accumulation, moderate erosion, and poor habitat quality.	Local	1, 6, 7
Spring Creek						
SCFP-1	Barrington Hills, Barrington Township, FPDCC	Pavement flooding	North Spring Forest Preserve	Reported that overflow results in flooding of local roads and basements west of Old Sutton Road. The excess flows also cause bank erosion on the FPDCC property.	Regional	2, 6, 7
SCSB-1	South Barrington	Pavement flooding	Higgins Road and Bartlett Road	The CCHD reported that the retention ponds on Allstate property flood during heavy rain events. The overflows flood Bartlett Road.	Local	2, 5
Brewster Creek						
-	n/a	n/a	n/a	No Form Bs were received for this subwatershed.	n/a	n/a

TABLE 2.2.1
Summary of Responses to Form B Questionnaire

Problem ID	Municipality	Problem as Reported by Local Agency	Location	Problem Description	Local/ Regional	Reason for Classification
West Branch DuPage River						
WBSC-1	Schaumburg	Pavement flooding	Terada Park, Salem Drive	Reported that park area and a small section of Salem Drive floods during heavy rain events.	Local	5
WBSC-2	Schaumburg	Storm sewer flow restriction	Campanelli Park	The Village of Schaumburg reported that an incorrectly installed outflow pipe causes flooding of the park.	Local	5, 7
WBSC-3	Schaumburg, Hanover Park	Overbank flooding	Basin A – Atcher Park	The Village of Schaumburg reported that ponding and overbank flooding occurs at Basin A in Atcher Park.	Regional	1, 7
WBST-1	Schaumburg Township	Storm sewer flow restriction, pavement flooding	East of Wise Road and Parkview Drive	Schaumburg Township reported that the sewer system under Wise Road becomes overwhelmed during heavy rains and water ponds in the adjacent grassy area.	Local	5

Reasons for Regional / Local Classifications:
1. Located on a regional waterway with greater than 0.5 square mile drainage area
2. Roadway culvert (two-lane road)
3. Roadway culvert (greater than two-lane road)
4. Located in headwater area (less than 0.5 square mile drainage area)
5. Located within storm sewer system (regardless of drainage area)
6. Erosion does not impact structure(s)
7. No structural/transportation damages associated with problem area

2.3 Watershed Analysis Data

2.3.1 Monitoring Data

2.3.1.1 USGS Gage Data

The USGS owns and maintains a nationwide network of stream gages used to record real-time measurements of the monitored stream's WSELs. Rating curves developed through periodic paired stage and flow measurements are used to develop rating curves for the stream, relating estimated flow to measured stage. There is one current USGS surface water data monitoring site within the Poplar Creek Watershed: "05550550" located on Poplar Creek in Elgin. Table 2.3.1 summarizes the data available from this site.

2.3.1.2 Stage Data

Stage data is taken at the USGS gauge as discussed in Section 2.3.1.1. In addition, stage data is continuously measured by the District at two locations on the West Branch DuPage River between the Hanover Park Water Reclamation Plant and the Upper DuPage Reservoir and also in the wet well of the Upper DuPage Reservoir. Figure 2.3.1 shows locations where monitoring data was available to support the Poplar Creek DWP.

2.3.1.3 Rainfall Data

The District owns and maintains two rain gages in the Poplar Creek Watershed study area that record rainfall at 10-minute intervals. One gage is located in Barrington, and the other is located in Hanover Park. District rainfall data was obtained for specific gages and dates to support calibration of the Poplar Creek DWP models. In addition, daily precipitation is collected by several municipal public works departments in the study area. The daily precipitation values are not consistently available at all locations for all storms. Some of these recording devices require manual readings that are not consistently taken. Figure 2.3.1 shows locations where rainfall gage data was used to support the Poplar Creek DWP. Reliable data from the gages were not available for all calibration events. Details on how rainfall data was used for model calibration are provided in Section 3.1.2.3.

2.3.2 Subwatershed Delineation

Each watershed in the Poplar Creek DWP was divided into subwatersheds representing areas tributary to the waterways in the study area. Drainage divides were established based upon consideration of the direction of steepest descent from local elevation maxima. The storm sewer network was also considered in the delineation of some areas, particularly when sewers crossed localized high elevation areas. Reference of previous studies and consultation with community representatives helped resolve subwatershed boundaries in areas of question.

Following the definition of subwatersheds, tributaries studied in detail were divided into smaller subbasins. The size of subbasins varied based upon the drainage network density and proximity to the hydraulically modeled waterway. Subbasin boundaries were modified to generally encompass areas with similar development patterns. Finally, boundaries were defined to most accurately represent the area tributary to specific modeled elements, such as constrictions caused by crossings, and reservoirs.

TABLE 2.3.1
USGS Gage Data Used in the Poplar Creek DWP

Description	USGS 05550500	
Location	Poplar Creek at Elgin	
Latitude	42°01'34"	
Longitude	-88°15'20" NAD83 Cook County, Illinois, Hydrologic Unit 07120006 NAD83 Cook County, Illinois, Hydrologic Unit 07120006	
Contributing drainage area:	35.2 square miles	
Datum of gauge:	716.00 feet above sea level NGVD29	
Data Type	**Begin Date**	**End Date**
Real-time	This site is real-time.	
Peak stream flow	1952	Present
Daily Data		
Discharge, cubic ft per second (ft^3/sec)	08/14/1959	Present
Gage height, ft	10/01/1993	Present
Daily Statistics		
Discharge, ft^3/sec	08/14/1959	Present
Gage height, ft	10/01/1993	Present
Monthly Statistics		
Discharge, ft^3/sec	August 1951	September 2004
Gage height, ft	October 1993	September 2004
Annual Statistics		
Discharge, ft^3/sec	1951	2004
Gage height, ft	1994	2004
Field/lab water quality samples	10/09/1974	07/15/2000
Field Measurements	04/25/1954	11/06/2007

Figure 2.3.2 shows the subwatersheds and subbasins developed for the DWP. Subbasins were not defined for areas that were not modeled in detail.

2.3.3 Drainage Network

The principal waterways of the Poplar Creek DWP were defined during Phase A of the study. Initial identification of the stream centerline was made using planimetry data obtained from Cook County. Stream centerlines were reviewed against aerial photography and Cook County contour data at a 1:500 scale, and modified to best represent existing conditions. These streamlines were included in the topographic model of the Poplar Creek DWP (see Section 2.3.4), and collect runoff from upland drainage areas. Secondary drainageways that were not modeled were identified based upon review of contour data. Secondary drainageways were used to help define flow paths in the hydrologic models for individual tributaries. Figure 2.3.3 shows the major drainageways within the Poplar Creek DWP superimposed upon an elevation map of the watershed.

2.3.4 Topography and Benchmarks

Topographic data for the Poplar Creek DWP was developed from Cook County light detection and ranging (LiDAR) data generated from a 2003 LiDAR mission (Cook County, 2003). The LiDAR data was obtained along with break lines from Cook County. A DEM was developed for the Poplar Creek DWP models based upon a subset of filtered elevation points. Figure 2.3.3 shows elevations within the watershed.

Stream channel cross section and stream crossing structure (such as bridge and culvert) topographic data was collected during field survey work conducted primarily between January 2009 and August 2009 to support the DWP.

Where available in the study area, the survey was referenced to National Geodetic Survey (NGS) monuments with first or second order vertical control. These benchmarks were used to set a network of temporary local control points that were used throughout the study area. In places where NGS vertical control was unavailable, GPS technology was used that meets the specifications of the Federal Geodetic Control Subcommittee (FGCS) Second Order Class One and accuracy standards specified in FEMA's *Guidelines and Specifications for Flood Hazard Mapping,* "Guidance for Aerial Mapping" (FEMA 2003). The horizontal ground control was established by GPS technology, and horizontal positioning accuracy meets the specifications of the FGCS Second Order Class One. All survey points conform to NAD 83 (Latest Adjustment) and NAVD 88, Illinois State Plane Coordinate System, East Zone, 1201.

In South Barrington, a significant residential and commercial development was constructed after the 2003 LiDAR data was collected. This development was located in the upper portion of Spring Creek and included channel and floodplain grading that did not match the 2003 LiDAR topography. The District provided additional LiDAR data collected in 2008 to facilitate the development of H&H models in this reach of Spring Creek. The 2008 elevation data was spliced into the 2003 data to be used for model development and inundation mapping. A comparison of the 2008 and 2003 data outside the development site showed negligible elevation differences indicating that the 2008 data was consistent with the 2003 data outside the development site.

2.3.5 Soil Classifications

NRCS soil data representative of 2002 conditions was obtained for Cook County except for unmapped areas (which include the City of Chicago and some portions of nearby communities). Surface soils in the watershed range widely in texture including silty loam, silty clay loam, loams, and muck. However, categorization of various types with similar characteristics and locations allows for the delineation of three basic soil type areas. The western half of the watershed consists of Warsaw-Fox-Will soils. The soils of the central portion of the watershed are classified as the Morley-Ashkum complex. Along the eastern side of the watershed, Markham-Ashkum soils dominate. The soils in an approximately 500 foot swath adjacent to Poplar Creek itself are classified as Ashkum or Sawmill silty clay loam - deep, poorly drained, moderately permeable soils formed in silty alluvial materials.

The NRCS soil data includes hydrologic soil group, representing the minimum infiltration rate of the soil after wetting. Table 2.3.2 summarizes the hydrologic soil groups.

TABLE 2.3.2
Hydrologic Soil Groups

Hydrologic Soil Group	Description	Texture	Infiltration Rates (in./hr)
A	Low runoff potential and high infiltration rates even when wetted	Sand, loamy sand, or sandy loam	> 0.30
B	Moderate infiltration rates when wetted	Silt loam or loam	0.15–0.30
C	Low infiltration rates when wetted	Sandy clay loam	0.05–0.15
D	High runoff potential and very low infiltration when wetted	Clay loam, silty clay loam, sandy clay, silty clay, or clay	0–0.05

All data from *Technical Release 55, Urban Hydrology for Small Watersheds*, NRCS, June 1986

Soil groups with drainage characteristics affected by a high water table are indicated with a "/D" designation, where the letter preceding the slash indicates the hydrologic group of the soil under drained conditions. Thus, an "A/D" indicates that the soil has characteristics of the A soil group if drained but the D group if not. In the development of CN, all areas of wetlands and open water were treated as open water surfaces (98 CN). This method resulted in assigning a high CN to many of the "/D" soils that are in fact undrained. The remaining "/D" soils (not associated with wetlands or open water) were assumed to be drained and converted to their respective drained condition soil type. Table 2.3.3 summarizes the distribution of hydrologic soil type throughout the Poplar Creek DWP. Figure 2.3.4 shows the distribution of soil types throughout the study area.

TABLE 2.3.3
Hydrologic Soil Group Distribution

Hydrologic Soil Group	% of Poplar Creek Study Area
Unmapped	16.99
A	1.11
A/D	4.33
B	18.24
B/D	18.71
C	40.06
C/D	0.05
D	0.52

2.3.6 Land Use

Land use has a significant effect on basin hydrology, affecting the volume of runoff produced by a given area and the speed of runoff delivered to the receiving system. Impervious areas restrict infiltration and produce more runoff, which is often delivered to receiving systems more rapidly through storm sewer networks. Land use was one of two principal inputs into the calculation of CN for the Poplar Creek DWP, detailed more extensively in Section 1.3.2.

TABLE 2.3.4
Land Use Distribution within the Poplar Creek Watershed Study Area

Land Use Type	Area (mi^2)	Area (%)
Residential	34.68	41.55
Forest/Open Land	28.58	34.24
Commercial/Industrial	5.78	6.92
Water/Wetland	4.66	5.58
Agricultural	6.69	8.01
Transportation/Utility	1.24	1.48
Institutional	1.85	2.21

A 2001 land use inventory for the Chicago metropolitan area was received from CMAP in GIS format. The data was used to characterize existing conditions land use within the Poplar Creek DWP. The data includes 49 land use classifications, grouped into seven general categories for summarizing land use within the DWP. When applicable, specific areas of the study area were updated to current land use categories to represent existing conditions. Table 2.3.4 summarizes the land use distribution within the Poplar Creek study area. Figure 2.3.5 shows the distribution of general land use categories throughout the study area.

2.3.7 Anticipated Development and Future Conditions

Anticipated development within the Poplar Creek DWP was analyzed using population projection data. Projected future conditions land use data for the study area are unavailable from CMAP or other regional agencies. Projected 2030 population data for Cook County was obtained from CMAP. Population data was overlaid upon subwatershed boundaries to identify the potential for increases in subwatershed populations. Table 2.3.5 shows subwatersheds with a projected population increase from the year 2000 population. Projected increases in population along with current subwatershed land use conditions make it likely that there will also be a corresponding increase in impervious surface area. This potential change in impervious surface area could contribute to higher flow rates and volumes of stormwater runoff drained by those tributaries.

TABLE 2.3.5
Projected Population Increase by Watershed

Name	2000 Population	2030 Population	% Change	Population Change
Poplar Creek	108,137	120,726	11.64	12,589
Flint Creek	5,714	5,976	4.59	262
Spring Creek	5,618	9,449	68.19	3,831
Brewster Creek	4,535	8,874	95.68	4,339
West Branch Du-Page River	46,080	47,854	3.85	1,774

Management of future development may be regulated through both local ordinances and the Cook County Watershed Management Ordinance (WMO) as described below in Section 2.3.9. This regulation would be an effort to prevent an increase in peak flows, via the construction of site-specific stormwater controls. The impact of the modified H&H characteristics of the subwatersheds due to changing land use over time may require the recommended projects to be re-evaluated under the conditions at the time of implementation to refine the details of the final design. To accomplish this, it is recommended that at the time projects are implemented, if updated land use and topographic information is available, the H&H models be rerun incorporating this new data.

2.3.8 Wetland and Riparian Areas

Wetland areas within the Poplar Creek DWP were identified using National Wetlands Inventory (NWI) mapping. NWI data includes approximately 1,350 acres of wetland areas in the Poplar Creek study area. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provide flood management, habitat, and water quality enhancement. Identified riparian areas defined as part of the DWP offer potential opportunities for restoration. Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek DWP.

2.3.9 Management of Future Conditions through the Regulations of Site Stormwater Management

The District regulates the discharge of stormwater runoff from development projects located within separate sewer areas within the District's corporate boundaries through its Sewer Permit Ordinance. Currently, development projects meeting certain thresholds must provide stormwater detention in an effort to restrict the post-development flow rate to the pre-development flow rate. A number of communities enforce standards beyond the District's currently required standards and thresholds. This DWP supports the continued regulation of future development through countywide stormwater management.

The WMO is under development and is proposed to provide uniform minimum countywide standards for site stormwater runoff for events up to and including the 100-year event that are appropriate for Cook County. This effort seeks to prevent post-development flows from exceeding pre-development conditions. The WMO is proposed to be a comprehensive ordinance addressing site runoff, floodplains, floodways, wetlands, soil erosion and sedimentation, water quality, and riparian environments.

3. Tributary Characteristics and Analysis

3.1 Poplar Creek Mainstem

The Poplar Creek Watershed is primarily situated in northwestern Cook County, but also includes a small portion of northeastern Kane County. The Poplar Creek Watershed is tributary to the Fox River and occupies approximately 44.1 square miles of which 42.7 square miles are located within Cook County. Table 3.1.1 lists the communities draining to Poplar Creek (including the major tributaries described in Sections 3.2 to 3.7).

Table 3.1.2 summarizes the land use distribution within the Poplar Creek Watershed. Figure 3.1.1 is an overview of the tributary area of the watershed. Reported stormwater problem areas, flood inundation areas, and proposed alternative projects are also shown on the figure, and are discussed in the following subsections.

TABLE 3.1.1
Communities Draining to Poplar Creek

Community	Tributary Area (mi^2)
Barrington Hills	0.42
Bartlett	0.16
Elgin	7.06
Hanover Park	0.20
Hoffman Estates	13.10
Inverness	0.84
Schaumburg	2.72
South Barrington	5.03
Streamwood	6.38
Unincorporated/Forest Preserve	8.19

Note: Includes areas tributary to Tributary A, East Branch, South Branch, Railroad Tributary, Schaumburg Branch and Lords' Park Tributary.

TABLE 3.1.2
Land Use Distribution for Poplar Creek

Land Use Category	Area (acres)	%
Residential	11,244.8	39.84
Forest/Open Land	10,028.8	35.53
Commercial/Industrial	2,368.0	8.39
Institutional	755.2	2.68
Transportation/Utility	467.2	1.66
Agricultural	1,888.0	6.69
Water/Wetland	1,472.0	5.21

Note: Includes areas tributary to Tributary A, East Branch, South Branch, Railroad Tributary, Schaumburg Branch and Lords' Park Tributary.

3.1.1 Sources of Data

3.1.1.1 Previous Studies

Poplar Creek is mapped in detail in the most recent FEMA Flood Insurance Study (FIS) (August 19, 2008) for approximately 90,100 feet from the Cook County boundary (about 4,800 feet above the confluence with the Fox River) to about 2,500 feet above Stover Road in unincorporated Cook County.

The Illinois State Water Survey (ISWS) prepared an Hydrologic Simulation Program – Fortran (HSPF) model for the Poplar Creek Watershed (ISWS, 2007). This model is being used as part of a water quality study for the Fox River. The model has been calibrated for long term flows, but its focus is on daily and mean discharges, not peak storm events. Also, the average size of the subwatershed used in this study is 1.2 square miles, appropriate for watershed computations, but inadequate for detailed hydrologic results on the Poplar Creek tributaries. The river channel hydraulics network is represented in the HSPF model using a simplified hydraulic function table.

The *Floodwater Management Plan and Environmental Assessment Poplar Creek Watershed* includes the earliest known floodplain mapping and profiles for Poplar Creek and selected tributaries (Poplar Creek Steering Committee, 1976). Rudimentary flood control alternatives were outlined. IDOT-DWR prepared the *Report on the Regulation of Construction within the Flood Plain of Poplar Creek and Tributaries, Cook and Kane Counties* (IDOT-DWR, 1977). This report provided detailed flow and elevation information as companion document to the 1976 Poplar Creek Steering Committee Report. Profiles and flows were superseded by the FEMA studies completed in the late 1970's.

The Resource Coordination and Policy Committee prepared Our Community and Flooding (Resource Coordination and Policy Committee, 1998) which provided background information on previous projects, studies and agency involvement in floodwater management.

The Forest Preserve District of Cook County prepared *An Evaluation of Flood Storage* (FPDCC, 1988) which provided a broad estimation of flood storage available in Poplar Creek and Spring Creek. The information in this report was too general and current GIS datasets are far more sophisticated for making flood storage estimates.

The *Poplar Creek Watershed Action Plan* was prepared in 2007 by the CMAP, 2007. This plan provided an assessment of problems in the watershed primarily related to water quality and streambank erosion issues. The plan recommended various projects and programs to improve the condition of the watershed. Flooding issues were not addressed by the plan.

3.1.1.2 Water Quality Data

The water quality of Poplar Creek is identified as impaired by the Illinois Environmental Protection Agency (IEPA). Specifically, Segment IL_DTG-02 is reported in IEPA's 2010 Integrated Water Quality Report as a 303(d) listed water body, with impairments to its designated uses of aquatic life and primary contact recreation due to chloride, pH, Total Suspended Solids (TSS) and fecal coliform. The causes identified by the 2010 Report are generally indicative of impairments associated with an urban stream environment. Additionally, the Poplar Creek Watershed Action Plan identifies oil and grease and hydromodification as additional potential causes of impairment. At this time, it does not appear that Poplar Creek is to be scheduled for Total Maximum Daily Load (TMDL) development.

Water quality for the Poplar Creek Watershed is currently monitored by two agencies, the IEPA and the District. IEPA monitors water quality at one location in the Poplar Creek Watershed as part of the Ambient Water Quality Monitoring Network (AWQMN). This water quality monitoring station (DTG-02) is at the Villa Street crossing in Elgin, Illinois. At the station, water samples are collected nine times per year and analyzed for a minimum of 55 water quality parameters including pH, temperature, specific conductance, dissolved oxygen, suspended solids, nutrients, fecal coliform bacteria, and total and dissolved metals. The District has one water quality monitoring station (WW_90) located on Poplar Creek at Illinois Route 19. Detailed annual water quality summaries of all the water quality data collected have been published by the District for the years 1979 through the present.

According to a water permit discharge query by the United States Environmental Protection Agency (USEPA), there are no active National Pollution Discharge Elimination System

(NPDES) permits issued by IEPA for discharges to Poplar Creek. Municipalities discharging to Poplar Creek are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.1.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 1,714 acres of wetland areas in the Poplar Creek Watershed. Restoration and enhancement of wetlands were included when applicable as part of alternatives described below. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.1.1.4 Floodplain Mapping

Flood inundation areas supporting the National Flood Insurance Program (NFIP) were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised based upon updated Cook County topographic information; but the effective models, which are used to estimate flood levels, generally were not updated. Letters of Map Revision (LOMRs) were incorporated into revised floodplain areas. Approximately 90,100 feet of the Poplar Creek Mainstem in Cook County is mapped in detail in the DFIRM mapping update. According to the FIS, Poplar Creek hydrology was computed with log-Pearson Type III distribution (l-PIII) in Cook County and Hoffman Estates, and with Regional Equation (RE73) and l-PIII in South Barrington. Poplar Creek was modeled with the HEC-2 hydraulic model. Poplar Creek between Algonquin Road and Barrington Road in Inverness and South Barrington was also modeled with HEC-1 and HEC-RAS for LOMR 05-05-0378P. The LOMR was noted in the 2008 FIS. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.1.1.5 Stormwater Problem Data

Table 3.1.3 summarizes reported problem areas reviewed as a part of the DWP development. The problem area data was obtained primarily from Form B questionnaire response data provided by watershed communities, agencies, and stakeholders to the District. Problems are classified in Table 3.1.3 as regional or local. This classification is described in Section 2.2 of this report.

3.1.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others that would impact the computed 100-year floodplain elevations or the identified damages have been identified for the Poplar Creek subwatershed.

TABLE 3.1.3
Community Response Data for Poplar Creek Mainstem

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
PCEL-1	Elgin	Poor instream habitat	Rolling Knolls Golf Course	The CMAP Poplar Creek Watershed Action Plan identified poor instream habitat in this reach compared to adjacent reaches.	Regional	Problem was reported as a water quality concern, no structures are at risk. There are no proposed projects to address this.
PCEL-2	Elgin	Structure flooding	Upstream of Villa Street	Lord's Park Tributary and Poplar Creek flooding areas north of Villa, east of Willard and South of Route 19.	Regional	Alternatives PCMS-1 and PCMS-2 were developed to address this problem.
PCEL-3	Elgin, FPDCC	Water quality	Bluff Springs Fen Nature Preserve	FPDCC reported that high volumes of off-site runoff with high levels of chlorides and other pollutants are threatening to contaminate the groundwater supply of the fen.	Regional	Problem was reported as a water quality concern, no structures are at risk. There are no proposed projects to address this.
PCEL-4	Elgin	Pavement flooding	Hammond Ave. and Cookane Rd.	The City of Elgin reported pavement flooding at this location.	Regional	Alternatives PCMS-1 and PCMS-2 were developed to address this problem.
PCEL-5	Elgin	Bank erosion	West bank near Campus Drive South of Route 19.	Bank erosion on high stream bank is putting private property at risk.	Regional	Alternative PCMS-5 was developed to address this problem.
PCEL-6	Elgin	Bank erosion	South bank north of Thorndale Dr.	Bank erosion on high stream bank is putting private property at risk.	Regional	Alternative PCMS-4 was developed to address this problem.
PCEL-7	Elgin	Bank erosion	Upstream of Villa St. on south bank	Bank erosion on high stream bank is putting private property at risk.	Regional	Alternative PCMS-3 was developed to address this problem.
PCHE-1	Hoffman Estates	Pavement flooding	Poplar Creek crossing of Route 58 (Golf Road), west of Barrington Road	IDOT reported pavement flooding.	Regional	Previous overtopping may have been the results of significant debris at this location. No structural alternatives were developed for this location.

TABLE 3.1.3
Community Response Data for Poplar Creek Mainstem

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
PCHE-2	Hoffman Estates	Bank erosion	Southwest of Higgins and Barrington Roads	The CMAP Poplar Creek Watershed Action Plan identified severe bank erosion and debris in this reach.	Regional	Problem was reported primarily as a water quality concern, no structures are at risk. There are no proposed projects
PCSW-1	Streamwood, FPDCC	Water quality	Streamwood outfall in Glenbrook Park	Reported SSO from a pump station located in the park.	Local	A local water quality problem associated with sanitary sewer system; will not be addressed by DWP.
PCFP-1	Barrington Township, FPDCC	Potential Pavement flooding	Crabtree Nature Center along Palatine Road	FPDCC reported that storm events are causing rapid increases in the water levels of the Palatine Marsh and threatens to flood Palatine Road.	Regional	Detailed modeling showed that Palatine road will not flood during the 100-year event as a result of overbank flooding.

3.1.2 Watershed Analysis

3.1.2.1 Hydrologic Model Development

Subbasin Delineation. The Poplar Creek drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. One hundred and ninety-five subbasins were delineated for the Poplar Creek Watershed, with an average size of 129.5 acres and total drainage area of 44.1 square miles. The subbasins are summarized in Table 3.1.4.

TABLE 3.1.4
Poplar Creek Watershed Subbasin Summary

Subbasin	Drainage Area (mi^2)	Number of Modeled Subbasins	Average Modeled Subbasin Size (acres)
Poplar Creek Mainstem	21.40	78	175.2
Major Tributaries to Poplar Creek			
Tributary A	1.30	13	64.1
East Branch	5.11	29	112.8
Schaumburg Branch	3.25	19	109.6
Railroad	2.80	12	148.1
South Branch	5.79	24	154.1
Lord's Park	4.45	20	142.5
Total	44.1	195	129.5

Reservoirs. The Poplar Creek Mainstem model includes one flood control reservoir that was constructed by the District. The Hillside Park Reservoir in Streamwood limits peak flows and detains stormwater runoff before releasing it to a sewer that eventually discharges to Poplar Creek unnamed Tributary D. The reservoir, which provides 32.0 acre-feet of storage in the 100-year event, was represented in the HEC-HMS model.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Adjustments made to hydrologic parameters during model calibration are discussed in Section 3.1.2.3. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.1.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. One hydraulic model that met District criteria was available for use in DWP development. This HEC-RAS model was prepared for LOMR 05-05-0378P, completed in 2000, and includes several small unnamed tributaries that drain into Poplar Creek between Algonquin Road and Barrington Road. For all other areas, surveys of the mainstem of Poplar Creek, culvert or bridge crossings and instream weirs or dams were performed. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's n roughness coefficients along the modeled stream length.

Boundary Conditions. Because of potential backwater effects from bridge crossings downstream of the Cook County border on Poplar Creek, the model was extended all the way to the mouth of Poplar Creek at the Fox River. Normal depth, assuming a friction slope of 0.001, was used as a downstream boundary condition at the mouth Poplar Creek. The mouth of Poplar Creek is approximately one mile downstream of the Cook County border with Kane County.

3.1.2.3 Calibration and Verification

Observed Data. USGS Stream Gage 05550500 is located on Poplar Creek just upstream of Villa Street in Elgin. It is located approximately 1.3 miles upstream of the Cook County border on Poplar Creek (15.8 miles downstream of the headwaters of Poplar Creek). Approximately 35.2 square miles of the total 44.0 square mile watershed is tributary to this gage location. Gage records at this location are available from August 14, 1959 to the present. Analysis of the gage record showed two large and recent storm events that could be used for calibration. These two events represent the largest two storm events recorded by the USGS gage on Poplar Creek.

In August 2007 there was a significant rainfall event spanning multiple days. The first day of rainfall occurred on August 19 to August 20 when approximately 3.4 to 5.2 inches of rain fell across the watershed. Reliable hourly data was available only at the Hanover Park rain gage, which is outside the Poplar Creek Watershed. Daily rainfall totals were available at the Tyler Creek, Streamwood and Salt Creek rain gage stations. The recorded totals at the Tyler Creek (6.88 inches), Streamwood (3.42 inches) and Salt Creek (5.02 inches) gages were used to develop three zones of rainfall. The rainfall records were assigned to the watershed using Thiessen polygons. Daily data from these stations was used distributed using the hourly record from the Hanover Park gage, the closest station to the watershed with hourly data recorded for this storm.

The second event used in the calibration was the September 12 to September 14, 2008 event. For this event, hourly rainfall event was available at both the Hanover Park rain gage and the Barrington rain gage. These two gages nicely bound the northwest and southeast sides of the watershed. Rainfall totals for this event ranged from 4.4 inches of precipitation in Barrington to 8.6 inches in Hanover Park. Due to this significant difference in rainfall at the two gages, Thiessen polygons were developed and then modified to create "blended" zone between the two gages where the rainfall total was computed to be 6.5 inches over the storm event. This resulted in a more gradual change in rainfall across the modeled watershed.

Calibration Adjustments. Model calibration was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. Flow and stage comparisons were made between the hydraulic model (cross section 11889) and the USGS stream gage for Poplar Creek (05550500) located approximately 35 feet upstream of Villa Street. An elevation of 715.92 feet was used to convert recorded stages at the gage to WSELs on the NAVD88 datum.

The initial calibration runs resulted in high peak flows and stages. Several model parameters were evaluated for potential adjustment including CN, Clark unit hydrograph time of concentration and Clark unit hydrograph storage coefficient. Adjustments to the CN proved to be the most effective at matching the recorded data. The CNs were first adjusted to an AMC I condition, however, this adjustment resulted in flows and stages that were too low. The CN value were then raised to represent AMC I plus 25% of the difference between CNs in the AMC I and AMC II condition. This adjustment yielded acceptable calibration results.

Calibration Results. For the 2007 event, the observed peak flow was 878 cfs and the modeled peak flow was 830 cfs (-5.5%). The observed peak stage was 720.89 feet versus modeled 721.79 feet (+0.90 feet). For the 2008 event the observed peak flow was 1,556 cfs and the modeled peak flow was 1,605 cfs (3.2%). The observed peak stage was 723.43 feet versus modeled 724.31 feet (+0.88 feet). Flow and stage calibration results are summarized on Table 3.1.5. Graphs of the model and calibration data are included in Figures 3.1.2 and 3.1.3.

Another factor that was evaluated was the overflow from the mainstem of Poplar Creek to Lord's Park Tributary. During the 2008 event, a large amount of water was diverted to Lord's Park Tributary (773 cfs representing about 32% of the total flow prior to split flow occurring). This makes the overflow reach a critical factor in calibrating. During the smaller 2007 event, there is negligible flow in the overflow. Since both events closely match the flow observed at the gage, one with and one without overflow, the hydrologic model (total flow produced) and the modeled hydraulics of the overflow (when and how much flow diverts to Lord's Park Tributary) appear to be appropriately represented by the model.

TABLE 3.1.5
Poplar Creek Calibration Summary

Condition	Peak Stage (ft)	Peak Flow (cfs)	Runoff Volume (ac-ft)
August 19, 2007 Gage	720.89	878	3,871
August 19, 2007 Model	721.79	830	2,872
Difference	+0.90	-5.5%	-25.8%
September 12, 2008 Gage	723.43	1556	6,250
September 12, 2008 Model	724.31	1605	6,075
Difference	+0.88	3.2%	-2.8%

In addition to the gage data, a number of WSEL measurements were taken on September 14, 2008. At many locations, these measurements were taken over one day after the primary peak of the storm, during a smaller secondary peak. Also, most measurements were taken at the upstream face of the bridge structures, where turbulent hydraulics and drawdown were frequently observed. Although some of the measurements don't conform to the target calibration stage difference of 0.5 foot, they are indicative of reasonable model results with no consistent pattern suggesting the model is producing too little or too much flow. These measurements are summarized on Table 3.1.6.

FIGURE 3.1.2
Poplar Creek Calibration for August 19, 2007 Event

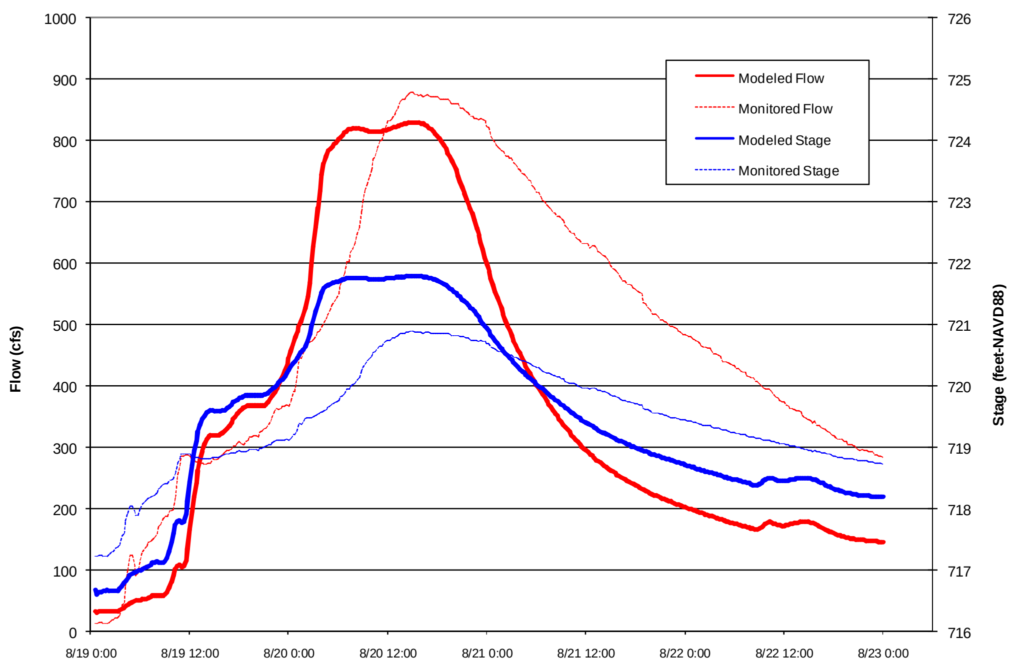


FIGURE 3.1.3
Poplar Creek Calibration for September 12, 2008 Event

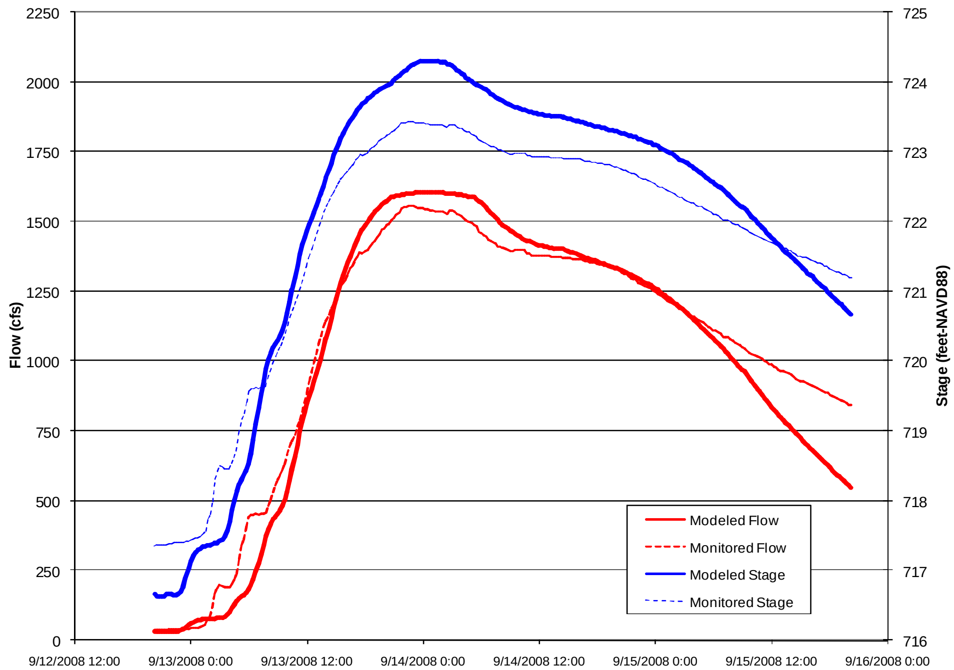


TABLE 3.1.6
Observed Water Surface Elevations on Poplar Creek Mainstem during September 2008 Storm Event

Location	Observation Time	Observed Elevation	Model Elevation	Difference
IL Route 62	9/14/2008 16:10	839.8	841.3	1.5
Mundhank Road	9/14/2008 16:30	827.2	829.4	2.2
Shoe Factory Road	9/14/2008 17:30	793.5	792.6	-0.9
Golf Road (first crossed west of Bar-rington Road)	9/14/2008 17:12	781.3	780.3	-1.0
Route 59 (Old bridge upstream of new crossing)	9/14/2008 17:02	773.2	773.8	0.6
IL Route 19	9/14/2008 15:44	744.1	745.2	1.1
Woodview Circle	Time unknown, reported as HWM	726.2	726.0	-0.2
Bluff City Boulevard	Time unknown, reported as HWM	715.4	715.2	-0.2
Cookane and Hammond	9/14/2008 16:27	711.2	711.6	0.4

3.1.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.1.1 shows inundation areas along Poplar Creek produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along the Poplar Creek mainstem. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.1.3 Development and Evaluation of Alternatives

3.1.3.1 Problem Definition

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. Table 3.1.7 summarizes problem areas identified through hydraulic modeling of Poplar Creek. The first problem area, MPA-1, is generally located around the Villa Street crossing in Elgin, but includes all the flooding along Poplar Creek as well as Lord's Park Creek Tributary in Elgin. This is the major problem area identified on Poplar Creek and includes 234 structures that are damaged in the 100-year event. In addition, there are another 181 structures that are within the 100-year floodplain but not damaged. These structures are mobile homes that are elevated such that they are not damaged, however they do present a safety problem due to emergency access issues. MPA-2 includes five structures that are located further upstream from MPA-1. MPA-3 includes two structures that are adjacent to the pond in Glenbrook Park in Streamwood on unnamed Tributary D to Poplar Creek.

TABLE 3.1.7
Modeled Problem Definition for Poplar Creek Mainstem Subwatershed

Problem ID	Location	Recurrence Interval of Flooding (yr)	Related Form B (If Any)	Resolution in DWP
MPA-1	The general vicinity of the Villa Street crossing in Elgin.	2, 5, 10, 25, 50, 100	PCEL-2	Alternatives PCMS-1 and PCMS-2 created to reduce flooding in this area. PCMS-2 was recommended because it had a higher B/C ratio. Neither alternative was capable of solving all flooding problems, so additional measures such as floodproofing or acquisitions would be needed to eliminate all 100-year flood damages. MPA-1 includes $3,772,900 of property damages, $1,440,100 of erosion damages, and $565,900 of transportation damages.
MPA-2	Upstream of Shales Pkwy and also Rohrssen Road.	100	none	Risk of flooding cannot be feasibly mitigated by structural measures. Properties are candidates for protection using nonstructural flood control measures, such as flood-proofing or acquisition. MPA-2 includes $58,200 of property damages.
MPA-3	Adjacent to the pond in Glenbrook park in Streamwood.	100	none	Alternative PCTD-1 was created to reduce flooding in this area. This project was not recommended because the benefit-cost ratio was very low. The subject properties are candidates for protection using non-structural measures such as floodproofing or acquisition. MPA-3 includes $2,400 of property damages.

3.1.3.2 Damage Assessment

Damages were assessed for Poplar Creek over a 50-year period using the methodology outlined in Section 1.4.2 of this report and Section 6.6 of the CCSMP. Estimated damages are listed in Table 3.1.8.

TABLE 3.1.8
Estimated Damages for Poplar Creek Mainstem Subwatershed

Damage Category	Estimated Damage	Note
Property	$3,833,600	Includes 241 structures.
Erosion-structures	$1,440,100	Based on seven structures at risk due to erosion.
Transportation	$565,900	Assumed as 15% of property damage at MPA-1 due to flooding. MPA-2 and MPA-3 do not have transportation damages associated with them.

3.1.3.3 Technology Screening

Flood control technologies were screened to identify those most appropriate for addressing the flooding problems along Poplar Creek Mainstem and its associated minor unnamed tributaries. Increased conveyance, storage, and levees were identified as potential technologies for addressing flooding problems along the Poplar Creek Mainstem.

3.1.3.4 Alternative Development

Flood Control Alternatives. Alternative solutions to regional flooding were developed and evaluated consistent with the methodology described in Section 1.4 of this report. Three flood control alternatives were developed to address overbank flooding problems from the Poplar Creek Mainstem. The alternatives are summarized in Table 3.1.9.

PCMS-1 proposes a 2,000-acre-foot detention basin north of Villa Street, north of the existing Poplar Creek channel. There are approximately 35 square miles tributary to this location, therefore, this storage option results in an extremely large reservoir. Construction of the reservoir requires the buyout of 301 properties. With implementation of this alternative, there are 24 properties that will still be damaged by the 100-year event. These would be candidates for buyout or floodproofing.

PCMS-2 proposes to construct 1,700 feet of new levee along Ramona Avenue and to the east. This levee will prevent the diversion and overflow of floodwaters from Poplar Creek Mainstem to the Lord's Park Tributary. In order to accommodate this flow in the main channel, the Villa Street crossing must be improved and the flood conveyance channel must be enlarged for 1,700 feet between Villa Street and the confluence with Lord's Park Tributary. Additional crossings that must be improved are at Bent Street on Lord's Park Tributary; and Bluff City Boulevard, Illinois Route 25 and the railroad crossing on Poplar Creek. The Illinois Route 25 and railroad crossings are in Kane County. Construction of this alternative requires the buyout of 37 properties. With implementation of this alternative, there are 17 properties that will still be damaged by the 100-year event. These would be candidates for buyout or floodproofing.

TABLE 3.1.9
Flood Control and Erosion Control Alternatives for Poplar Creek Mainstem

Alternative	Problem Addressed	Location	Description
PCMS-1	Flooding	North of Villa Street in Elgin.	Construct a 2,000-acre-foot reservoir north of Villa Street in Elgin.
PCMS-2	Flooding	Primarily north of Villa Street in Elgin, but includes additional components in that vicinity.	Construct levee north of Villa Street, replace Villa Street crossing and enlarge Poplar Creek flood conveyance channel between Villa Street and the confluence with Lord's Park Tributary. Replace structures downstream of Villa Street to prevent increased WSELs downstream of the levee and channelization work.
PCTD-1	Flooding	Bode Road crossing of unnamed tributary leading from Glenbrook Park in Streamwood.	Increase size of Bode Road culvert to reduce upstream WSEL.
PCMS-3	Erosion	North of Villa Street on south bank of Poplar Creek in Elgin.	Stabilize using hard-armoring or other acceptable technology to prevent erosion problems that threaten one structure on Villa Street.
PCSM-4	Erosion	South bank of Poplar Creek along Thorndale Drive cul-de-sac in Elgin.	Stabilize using hard-armoring or other acceptable technology to prevent erosion problems that threaten one structure on Thorndale Drive.
PCMS-5	Erosion	West bank of Poplar Creek along Campus Drive in Elgin.	Stabilize using hard-armoring or other acceptable technology to prevent erosion problems that threaten three structures on Campus Drive.

For MPA-2, the problem area in the vicinity of Shales Parkway and Rohrssen Road, both storage and conveyance measures were considered. The storage option would involve a reservoir similar in size as that developed for PCMS-1. This type of reservoir (estimated to cost over $200 million) would cost many times the value of the 5 structures it would protect at MPA-2 and was not considered further. No conveyance alternatives (bridge or channel improvements) were able to sufficiently lower WSELs to eliminate damages at this location.

For MPA-3, both storage and conveyance solutions were explored. A storage solution would involve the creation of an additional 30 acre-feet of storage in the Glenbrook Park area. There was no physical location where this storage could be created without necessitating the acquisition of properties. The need for property acquisition ruled out the alternative since the problem area only involved two structures with very minimal damages. A conveyance solution was developed that results in the elimination of flood damages. PCTD-1 proposes to increase the size of the Bode Road culvert on Poplar Creek unnamed Tributary D. Enlargement of this culvert reduces the 100-year WSEL by 1.1 feet upstream of the crossing. The 100-year WSELs downstream of this improvement are raised by up to 0.2 feet for 1,500 feet downstream on FPDCC property. The shallow depth of flooding, minimal cost of damages and the low B/C ratio of 0.004 for this alternative suggest that these properties would best be addressed through nonstructural flood control measures, such as floodproofing or acquisition.

Erosion Control Alternatives. Three erosion control alternatives were developed for the Poplar Creek Mainstem. The alternatives are also summarized in Table 3.1.9.

PCMS-3 proposes to use hard-armoring or other acceptable technology along 400 feet of streambank to prevent erosion problems that threaten one structure on Villa Street. Due to the need to buyout the structure, this problem will not exist if PCMS-2 is implemented to control flooding in this reach.

PCMS-4 proposes to use hard-armoring or other acceptable technology along 400 feet of streambank to prevent erosion problems that threaten one structure on Thorndale Drive.

PCMS-5 proposes to use hard-armoring or other acceptable technology along 450 feet of streambank to prevent erosion problems that threaten two structures on Campus Drive.

3.1.3.5 Alternative Evaluation and Selection

The alternatives listed in Table 3.1.9 were evaluated to determine their effectiveness and produce data required for the countywide prioritization of watershed projects. Flood control alternatives were modeled to evaluate their impact on water elevations and flood damages. Developed alternatives result in reduced stage and/or flow along the modeled waterways. Table 3.1.10 provides a comparison of the modeled maximum WSEL, and modeled flow at the time of peak at representative locations along the waterway for PCMS-1 and PCMS-2. PCTD-1, which addresses MPA-3 in Streamwood, only reduces water surfaces upstream of Bode Road. PCTD-1 results in the lowering of the 100-year water surfaces upstream of Bode Road by 1.1 feet. This eliminates the flood damages associated with MPA-3.

A number of properties are at risk of shallow flooding during the 100-year flood event under existing conditions or recommended alternative conditions. In addition, due to their locations, other properties' risk of flooding cannot be feasibly mitigated by structural measures. Such properties are candidates for protection using nonstructural flood control measures, such as flood-proofing or acquisition. These measures may be considered to address damages that are not fully addressed by capital projects recommended in the Poplar Creek DWP.

3.1.3.6 Data Required for Countywide Prioritization of Watershed Project

Appendix I presents conceptual level cost estimates for the recommended alternatives. Table 3.1.11 lists the total estimated cost, benefits, and B/C ratio for each alternative. Figures 3.1.4 to 3.1.7 show the recommended alternatives for the Poplar Creek and a comparison of the existing conditions inundation mapping and inundation mapping for recommended flood control alternative PCMS-2.

TABLE 3.1.10
Poplar Creek Mainstem Existing and Alternative Condition Flow and WSEL Comparison

		Existing Conditions		PCMS-1		PCMS-2	
Location	Station (ft)	Max WSEL (ft)	Max Flow (cfs)	Max WSEL (ft)	Max Flow (cfs)	Max WSEL (ft)	Max Flow (cfs)
Poplar Creek Mainstem							
Confluence with the Fox River[1]	744.28	706.14	3,167	705.32	2,367	706.23	3,268
Upstream of Railroad Bridge[1]	1,420.02	708.40	3,167	707.20	2,363	707.63	3,268
Upstream of the Illinois Prairie Path[1]	1,672.17	708.83	3,167	707.53	2,362	707.96	3,268
Upstream of Raymond Street[1]	1,883.55	708.94	3,167	707.77	2,363	708.26	3,268
Upstream of CPRS Railroad Bridge[1]	2,330.07	709.40	3,157	708.25	2,310	708.99	3,249
Upstream of St. Charles Street (IL 25)[1]	3,377.08	712.41	3,158	710.99	2,266	711.72	3,249
Cook County Boundary with Kane County	5,013.84	712.93	3,153	711.60	2,260	712.20	3,240
Confluence with Tributary G	7,274.58	713.05	3,090	711.74	2,113	712.40	3,154
Upstream of Bluff City Boulevard	9,047.02	720.65	3,049	717.23	2,079	716.67	3,113
Upstream of U.S. Route 20	9,477.24	721.17	3,049	717.87	2,072	718.17	3,113
Confluence with Lord's Park Tributary	10,640.09	721.41	3,049	718.49	2,064	719.18	3,114
Upstream of Villa Street	11,960.86	725.50	1,607	726.17	1,639	723.56	2,852
Upstream of Woodview Circle	13,516.38	726.67	2,958	726.89	2,958	726.62	2,959
Upstream of Varsity Drive	15,026.38	735.33	2,958	735.33	2,958	735.33	2,958
Upstream of Chicago Street (IL 19)	18,034.26	747.59	2,957	747.59	2,957	747.59	2,957
Upstream of Shales Parkway	20,701.72	752.19	2,957	752.19	2,957	752.19	2,957
Upstream of Rohrssen Road	23,128.10	757.93	2,953	757.93	2,953	757.93	2,953
Upstream of EJ&E Railroad Bridge	24,462.03	762.19	2,951	762.19	2,951	762.19	2,951
Confluence with Poplar Creek South Branch	25,020.22	762.61	2,951	762.61	2,951	762.61	2,951
Lord's Park Tributary							
Ramona Avenue (Upstream of confluence with Poplar Creek)	198.01	721.43	1,446	718.50	436	719.18	186
Upstream of Bent Street	1,536.85	723.51	1,450	721.85	463	719.77	529
Upstream of Lake Street	2,394.49	724.82	1,462	722.48	451	721.46	512
Upstream of Laurel Street	4,591.96	725.04	324	725.04	324	725.05	324
Downstream of Chicago Street (IL 19)	5,302.98	728.41	392	728.41	392	728.41	392

1. Location in Kane County.

TABLE 3.1.11
Poplar Creek Mainstem Project Alternative Matrix to Support District Capital Improvement Program Prioritization

Project	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures Protected	Water Quality Benefit	Recommended	Communities Involved
PCMS-1	2000 ac-ft reservoir	0.01	$2,747,800	$205,148,700	210[1]	Slightly positive	No	Elgin
PCMS-2	Levee, channel en-largement and bridge/culvert re-placements.	0.07	$2,989,900	$45,151,000	217[1]	Slightly positive	Yes	Elgin (including portions of Elgin in Kane County)
PCTD-1	Culvert replacement	0.004	$2,400	$681,500	2	Slightly negative	No	Streamwood
PCMS-3	Bank stabilization	0.56	$398,800	$715,700	1	Slightly positive	Yes	Elgin
PCMS-4	Bank stabilization	0.47	$346,600	$745,200	1	Slightly positive	Yes	Elgin
PCMS-5	Bank stabilization	0.79	$693,800	$874,000	2	Slightly positive	Yes	Elgin

(1) Includes structures that are no longer flooded because they need to be acquired in order to construct proposed improvements.
Note: Net Benefits values do not include local benefits or non-economic benefits.

3.2 Poplar Creek Tributary A

Poplar Creek Tributary A is a 1.2 mile long waterway located in northwestern Cook County. The headwaters of Poplar Creek Tributary A are a series of detention basins at the intersection of Lakewood Boulevard and Barrington Road in Hoffman Estates. From this location, Poplar Creek Tributary A flows in a south-southwesterly direction to its mouth just upstream of Shoe Factory Road at river mile 11.65 on Poplar Creek. Table 3.2.1 summarizes the communities that are tributary to Poplar Creek Tributary A. Land use within the drainage area of Poplar Creek Tributary A is shown in Table 3.2.2.

TABLE 3.2.1
Communities Draining to Poplar Creek Tributary A

Community/Tributary	Tributary Area (mi^2)
Hoffman Estates	0.28
South Barrington	0.95
Unincorporated/Forest Preserve	0.07

There were no reported problem areas on Poplar Creek Tributary A. Figure 3.2.1 provides an overview of the tributary area of the subwatershed.

TABLE 3.2.2
Land Use Distribution for Poplar Creek Tributary A

Land Use Category	Area (acres)	%
Residential	151.67	18.20
Forest/Open Land	202.77	24.33
Commercial/Industrial	187.75	22.53
Transportation/Utility	14.37	1.72
Institutional	46.13	5.54
Water/Wetland	82.62	9.91
Agriculture	148.11	17.77

3.2.1 Sources of Data

3.2.1.1 Previous Studies

No previous reports specific for Poplar Creek Tributary A have been prepared. However, as a tributary to Poplar Creek, it was inherently included in the reports prepared for the Poplar Creek Mainstem identified in Section 3.1.1.1.

3.2.1.2 Water Quality Data

The water quality of Poplar Creek Tributary A is not identified as impaired by the IEPA. According to a water permit discharge query by the USEPA, there are no NPDES permits issued by IEPA for discharges to Poplar Creek Tributary A. Municipalities discharging to Poplar Creek Tributary A are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.2.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 79 acres of wetland areas in the Poplar Creek Tributary A subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.2.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised per updated Cook County topographic information. However, the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into the revised floodplains. Poplar Creek Tributary A is mapped in detail in the 2008 FIS for about 5,310 feet from the confluence with Poplar Creek to about 240 feet above Midlands Drive. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.2.1.5 Stormwater Problem Data

As part of the DWP development, communities, agencies (e.g., IDOT, CCHD), and stakeholders submitted Form B questionnaire response data to the District summarizing known stormwater problems within their jurisdictions. No Form B Responses related to Poplar Creek Tributary A were received.

3.2.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others have been identified for the Poplar Creek Tributary A subwatershed.

3.2.2 Watershed Analysis

3.2.2.1 Hydrologic Model Development

Subbasin Delineation. The Poplar Creek Tributary A drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Thirteen subbasins were delineated for the Poplar Creek Tributary A subwatershed, with an average size of 64.1 acres and total drainage area of 1.30 square miles.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Adjustments made to hydrologic parameters during model calibration are discussed in Section 3.1.2.3. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.2.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Poplar Creek Tributary A and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficients along the modeled stream length.

Boundary Conditions. In order to avoid double counting floodplain storage, the first cross section of the Poplar Creek Tributary A model was placed at the approximate boundary of Poplar Creek Mainstem floodplain. Initial model trials were run using first a normal depth boundary condition and secondly a Poplar Creek Mainstem stage hydrograph boundary condition to determine which condition resulted in a higher downstream boundary condition. For Poplar Creek Tributary A, normal depth with a friction slope of 0.0087 was the selected boundary condition.

3.2.2.3 Calibration and Verification

No measured or observed flows or stage data was available for the Poplar Creek Tributary A subwatershed. CNs were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

3.2.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.2.1 shows inundation areas along Poplar Creek Tributary A produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Poplar Creek Tributary A. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.2.3 Development and Evaluation of Alternatives

There were no problem areas identified through hydraulic modeling of Poplar Creek Tributary A, so no alternatives were developed.

3.3 Poplar Creek East Branch

The Poplar Creek East Branch is approximately 4.9 miles in length and is located completely in Cook County. The headwaters of Poplar Creek East Branch are the ponds in Charlemagne Park north of Algonquin Road in Hoffman Estates. From this location, Poplar Creek East Branch flows in a south-southwesterly direction to its mouth just downstream of Barrington Road at river mile 10.95 on Poplar Creek. Table 3.3.1 summarizes the communities that are tributary to Poplar Creek East Branch. Land use within the drainage area of Poplar Creek East Branch is shown in Table 3.3.2.

TABLE 3.3.1
Communities Draining to Poplar Creek East Branch

Community/Tributary	Tributary Area (mi^2)
Hoffman Estates	4.13
Inverness	0.07
South Barrington	0.75
Unincorporated/Forest Preserve	0.16

TABLE 3.3.2
Land Use Distribution for Poplar Creek East Branch

Land Use	Area (acres)	%
Residential	944.62	28.87
Forest/Open Land	1355.32	41.42
Commercial/Industrial	522.75	15.98
Institutional	66.92	2.05
Transportation/Utility	100.46	3.07
Agriculture	144.27	4.41
Water/Wetland	137.52	4.20

Figure 3.3.1 provides an overview of the tributary area of the subwatershed. Reported stormwater problem areas and flood inundation areas are also shown on the figure, and are discussed in the following subsections.

3.3.1 Sources of Data

3.3.1.1 Previous Studies

No previous reports specific for Poplar Creek East Branch have been prepared. However, as a tributary to Poplar Creek, it was inherently included in the reports prepared for the Poplar Creek Mainstem identified in Section 3.1.1.1.

3.3.1.2 Water Quality Data

The water quality of Poplar Creek East Branch is not identified as impaired by the IEPA. According to a water permit discharge query by the USEPA, there are no NPDES permits issued by IEPA for discharges to Poplar Creek East Branch. Municipalities discharging to Poplar Creek East Branch are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.3.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 240 acres of wetland areas in the Poplar Creek East Branch subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.3.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised based upon updated Cook County topographic information; but the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into revised floodplain areas. Poplar Creek East Branch is mapped in detail in the 2008 FIS for approximately 14,050 feet, extending from the confluence with Poplar Creek to about 3,500 feet upstream of Huntington Boulevard. For the FEMA floodplain, Poplar Creek East Branch was modeled with RE73 and RE75 hydrologic computations and the HEC-2 hydraulic model. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.3.1.5 Stormwater Problem Data

Table 3.3.3 summarizes reported problem areas reviewed as a part of the DWP development. The problem area data was obtained primarily from Form B questionnaire response data provided by watershed communities, agencies, and stakeholders to the District. Problems are classified in Table 3.3.3 as regional or local. This classification is based on a process described in Section 2.2 of this report.

3.3.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. Hoffman Estates is planning to replace three separate Poplar Creek East Branch crossings on Hassell Road. According to Hoffman Estates, the crossings will be designed to have hydraulic properties that are nearly equivalent to the existing structures. No other near-term planned projects by others that would impact the computed 100-year floodplain elevations or the identified damages have been identified for the Poplar Creek East Branch subwatershed.

3.3.2 Watershed Analysis

3.3.2.1 Hydrologic Model Development

Subbasin Delineation. The Poplar Creek East Branch drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Twenty-nine subbasins were delineated for the Poplar Creek East Branch subwatershed, with an average size of 112.8 acres and total drainage area of 5.11 square miles.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Adjustments made to hydrologic parameters during model calibration are discussed in Section 3.1.2.3. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

TABLE 3.3.3
Community Response Data for Poplar Creek East Branch

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
EBHE-1	Hoffman Estates	Pavement flooding	Poplar Creek East Branch crossing of Barrington Road, south of Higgins Road	IDOT reported pavement flooding. Flood profiles show no overtopping in the 500-year event.	Regional	Detailed modeling showed that Barrington Road will not flood during the 100-year event as a result of overbank flooding.
EBHE-2	Hoffman Estates	Pavement flooding	Poplar Creek East Branch crossing of Route 62 (Algonquin Road), west of Lexington	IDOT reported pavement flooding. Poplar Creek East Branch is unnumbered Zone A at this crossing.	Regional	Detailed modeling showed that Algonquin Road will not flood during the 100-year event as a result of overbank flooding.
EBHE-3	Hoffman Estates	Bank Erosion	Poplar Creek East Branch confluence southwest of Barrington Road and Higgins Road.	The CMAP Poplar Creek Watershed Action Plan reported that the Poplar Creek East Branch subwatershed likely contributes the highest sediment load per unit area.	Regional	There are no structures in the vicinity of this erosion problem.

3.3.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. Surveys of Poplar Creek East Branch, culvert or bridge crossings and instream weirs or dams were performed. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficients along the modeled stream length.

Boundary Conditions. In order to avoid double counting floodplain storage, the first cross section of the Poplar Creek East Branch model was placed at the approximate boundary of Poplar Creek Mainstem floodplain. Initial model trials were run using first a normal depth boundary condition and secondly a Poplar Creek Mainstem stage hydrograph boundary condition to determine which condition resulted in a higher downstream boundary condition. For Poplar Creek East Branch, a stage hydrograph on the Poplar Creek Mainstem was used as the boundary condition.

3.3.2.3 Calibration and Verification

Model calibration on the Poplar Creek Mainstem was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. Poplar Creek East Branch calibration was part of the overall Poplar Creek analysis and calibration. CNs were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

For Poplar Creek East Branch, several WSEL measurements were taken on September 14, 2008. These measurements occurred at least one day after the primary peak of the storm, during a smaller secondary peak and do not represent true high water marks. A frequent observation in H&H modeling is that model results tend to underreport flow and stages during the falling limb of storm hydrographs. Although all the measurements don't conform to the target calibration stage difference of 0.5 foot, they are indicative of reasonable model results. These measurements are summarized on Table 3.3.4.

TABLE 3.3.4
Observed Water Surface Elevations on Poplar Creek East Branch during September 2008 Storm Event

Location	Observation Time	Observed Elevation	Model Elevation	Difference
Hassell Road east of Parkview Circle East.	9/14/2008 17:46	792.2	791.8	0.6
Hassell Road east of Stonington	9/14/2008 17:36	784.8	785.1	0.5
Old Higgins Road (closed)	9/14/2008 17:23	783.6	783.0	0.5

3.3.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Poplar Creek East Branch has a very large wetlands and open space area north of I-90 that provides significant flood storage. This storage area impacts the critical duration of Poplar Creek East Branch. Because of its significant flood flow attenuation, inundation mapping cannot be performed using a single event. Inundation mapping is based on the 100-year 24-hour storm event upstream of this wetland, and the 100-year 48-hour storm event downstream of the wetland. Figure 3.3.1 shows inundation areas along Poplar Creek East Branch produced by the hydraulic model for these storms.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along the Poplar Creek Mainstem. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms. These profiles depict the 100-year 48-hour event. Model results should be consulted for peak 100-year elevations above station 21,284.4.

3.3.3 Development and Evaluation of Alternatives

3.3.3.1 Problem Definition

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. Table 3.3.5 summarizes one problem area identified through hydraulic modeling of Poplar Creek East Branch. Modeled problem area MPA-4 is located south of Hassell Road and east of Huntington Boulevard and involves one condominium building and 7 townhomes.

TABLE 3.3.5
Modeled Problem Definition for Poplar Creek East Branch Subwatershed

Problem ID	Location	Recurrence Interval of Flooding (yr)	Related Form B (If any)	Resolution in DWP
MPA--4	South of Hassell Road and east of Huntington Boulevard.	100, 50	none	One multi-family and seven townhome structures are inundated by the 100-year event resulting in $20,400 of flood damages. Storage and conveyance alternatives were investigated. There was no locally acceptable location to implement storage and the conveyance solution was incapable of providing adequate flooding relief due to the low-gradient water surface profiles in the area. The subject properties are candidates for protection using non-structural measures such as floodproofing or acquisition.

3.3.3.2 Damage Assessment

Damages were assessed for Poplar Creek East Branch over a 50-year period using the methodology outlined in Section 1.4.2 of this report and Section 6.6 of the CCSMP. Estimated damages are listed in Table 3.3.6.

TABLE 3.3.6
Estimated Damages for Poplar Creek East Branch Subwatershed

Damage Category	Estimated Damage	Note
Property	$20,400	One condominium and seven townhomes.
Transportation	$0	Flooding is backyard flooding with no associated road flooding.

3.3.3.3 Technology Screening

Flood control technologies were screened to identify those most appropriate for addressing the flooding problems along Poplar Creek East Branch. Increased conveyance or storage alternatives were identified as potential technologies for addressing flooding problems along the Poplar Creek East Branch.

3.3.3.4 Alternative Development

Flood Control Alternatives. Alternative solutions to regional flooding were developed and evaluated consistent with the methodology described in Section 1.4 of this report. Both storage and conveyance based flood control alternatives were evaluated to address overbank flooding problems on Poplar Creek East Branch.

A storage based solution that involves the construction of an overbank peak shaving flood reservoir. This reservoir would have to provide a minimum of 50 acre-feet and had an estimated cost of $4.1 million. Not only was the cost extremely high relative to the computed damages of $22,400 (which would have resulted in a B/C ratio of 0.005), but there was no locally acceptable location to implement this storage.

A conveyance based solution was also evaluated. There are no restrictive bridge crossings in the area that contribute significantly to the computed 100-year WSELs at the problem area, so bridge improvements were not an option. Also, the floodplain profile has a low gradient in the area. Potential channel improvements would involve a minimum of 3,000 feet of channelization at a cost of at least $2 million (which would have resulted in a B/C ratio of 0.01). The project would also have resulted in an unnatural stream profile that could lead to unintended environmental and stream stability problems that could harm downstream properties. Therefore, the conveyance solution was disregarded as a potential alternative.

3.3.3.5 Alternative Evaluation and Selection

No locally acceptable or feasible alternatives were able to be developed to address the damages associates with MPA-4. The properties identified in MPA-4 are inundated by 0.2 to 1.0 feet in the 100-year event, which make them candidates for protection using nonstructural flood control measures, such as flood-proofing or acquisition.

3.4 Poplar Creek Schaumburg Branch

The Poplar Creek Schaumburg Branch is 3.2 miles in length, with its headwaters in drainage ditches and ponds near Bode Road in Schaumburg and Hoffman Estates. From this location, Poplar Creek Schaumburg Branch flows in a westerly direction to its mouth just downstream of Barrington Road at river mile 10.64 on Poplar Creek. Table 3.4.1 summarizes the communities that are tributary to Poplar Creek Schaumburg Branch. Land use within the drainage area of Poplar Creek Schaumburg Branch is shown in Table 3.4.2.

TABLE 3.4.1
Communities Draining to Poplar Creek Schaumburg Branch

Community/Tributary	Tributary Area (mi^2)
Hoffman Estates	1.66
Schaumburg	1.46
Streamwood	0.13

Figure 3.4.1 provides an overview of the tributary area of the subwatershed. Reported stormwater problem areas, flood inundation areas, and proposed alternative projects are also shown on the figure, and are discussed in the following subsections.

TABLE 3.4.2
Land Use Distribution for Poplar Creek Schaumburg Branch

Land Use Category	Area (acres)	%
Forest/Open Land	458.2	22.01
Residential	1312.9	63.06
Commercial/Industrial	205.9	9.89
Institutional	74.4	3.57
Water/Wetland	30.7	1.47

3.4.1 Sources of Data

3.4.1.1 Previous Studies

No previous reports specific for Poplar Creek Schaumburg Branch have been prepared. However, as a tributary to Poplar Creek, it was inherently included in the reports prepared for the Poplar Creek Mainstem identified in Section 3.1.1.1.

3.4.1.2 Water Quality Data

The water quality of Poplar Creek Schaumburg Branch is not identified as impaired by the IEPA. According to a water permit discharge query by the USEPA, there are no NPDES permits issued by IEPA for discharges to Poplar Creek Schaumburg Branch. Municipalities discharging to Poplar Creek Schaumburg Branch are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.4.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 126 acres of wetland areas in the Poplar Creek Schaumburg Branch subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.4.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised based upon updated Cook County topographic information; but the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into revised floodplain areas. Poplar Creek Schaumburg Branch is mapped in detail in the 2008 FIS for approximately 14,700 feet from the confluence with Poplar Creek to about 4,500 feet upstream of Harmon Boulevard. Poplar Creek Schaumburg Branch was modeled with RE73 and RE75 hydrologic computations and the HEC-2 hydraulic model. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.4.1.5 Stormwater Problem Data

Table 3.4.3 summarizes reported problem areas reviewed as a part of the DWP development. The problem area data was obtained primarily from Form B questionnaire response data provided by watershed communities, agencies, and stakeholders to the District. Problems are classified in Table 3.4.3 as regional or local. This classification is based on a process described in Section 2.2 of this report.

TABLE 3.4.3
Community Response Data for Poplar Creek Schaumburg Branch

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
SHHE-1	Hoffman Estates, Schaumburg Township	Water quality	Barrington Road and Higgins Road	The Village of Hoffman Estates has reported severe bank erosion on Brookside Pond that is contributing TSS to Poplar Creek.	Local	The problem is located on the local drainage system and is not addressed by the DWP.
SHSC-1	Schaumburg	Poor habitat	Victoria Park on Bode Road	The CMAP Poplar Creek Watershed Action Plan reported that the stream through Victoria Park is unmanaged and the adjacent wetland is overrun with invasive plant species.	Regional	There are no other recommended alternatives in this area that could incorporate habitat restoration features.

3.4.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. The golf course upstream of Barrington Road in Hoffman Estates has proposed to reconfigure and regrade the floodplain through its property. Based on the intended design, no floodplain storage will be lost and floodplain elevations will not be impacted upstream or downstream of the project. No other near-term planned projects by others that would impact the computed 100-year floodplain elevations or the identified damages have been identified for the Poplar Creek Schaumburg Branch subwatershed.

3.4.2 Watershed Analysis

3.4.2.1 Hydrologic Model Development

Subbasin Delineation. The Poplar Creek Schaumburg Branch drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Nineteen subbasins were delineated for the Poplar Creek Schaumburg Branch subwatershed, with an average size of 109.6 acres and total drainage area of 3.25 square miles.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Adjustments made to hydrologic parameters during model calibration are discussed in Section 3.1.2.3. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.4.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. Surveys of Poplar Creek Schaumburg Branch, culvert or bridge crossings and instream weirs or dams were performed. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's n roughness coefficients along the modeled stream length.

Boundary Conditions. In order to avoid double counting floodplain storage, the first cross section of the Poplar Creek Schaumburg Branch model was placed at the approximate boundary of Poplar Creek Mainstem floodplain. Initial model trials were run using first a normal depth boundary condition and secondly a Poplar Creek Mainstem stage hydrograph boundary condition to determine which condition resulted in a higher downstream boundary condition. For Poplar Creek Schaumburg Branch, a stage hydrograph on the Poplar Creek Mainstem was used as the boundary condition.

3.4.2.3 Calibration and Verification

Model calibration on the Poplar Creek Mainstem was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. Poplar Creek Schaumburg Branch calibration was part of the overall Poplar Creek analysis and calibration. CNs were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

For Poplar Creek Schaumburg Branch, one WSEL measurement was taken on September 14, 2008. This measurement occurred at least one day after the primary peak of the storm, during a smaller secondary peak and does not represent a true high water mark. A frequent observation in H&H modeling is that model results tend to underreport flow and stages during the falling limb of storm hydrographs. The observed water surface and model results are summarized on Table 3.4.4.

TABLE 3.4.4
Observed Water Surface Elevations on Poplar Creek Schaumburg Branch during September 2008 Storm Event

Location	Observation Time	Observed Elevation	Model Elevation	Difference
Barrington Road	9/14/2008 17:18	784.7	784.3	-0.4

3.4.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.4.1 shows inundation areas along Poplar Creek Schaumburg Branch produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Poplar Creek Schaumburg Branch. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.4.3 Development and Evaluation of Alternatives

3.4.3.1 Problem Definition

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. Table 3.4.5 summarizes two problem areas identified through hydraulic modeling of Poplar Creek Schaumburg Branch. Modeled problem area MPA-5 is located south of Crowfoot Circle South in Hoffman Estates and involves one structure. Modeled problem area MPA-6 is the Barrington Road crossing of Poplar Creek Schaumburg Branch.

TABLE 3.4.5
Modeled Problem Definition for Poplar Creek Schaumburg Branch Subwatershed

Problem ID	Location	Recurrence Interval of Flooding (yr)	Related Form B (If any)	Resolution in DWP
MPA-5	South of Crowfoot Circle South in Hoffman Estates.	100, 50, 25	none	One structure is inundated by the 25-, 50- and 100-year events resulting in $155,400 of flood damages. Storage and conveyance alternatives were investigated. There was no locally acceptable location to implement storage and the conveyance solution was incapable of providing adequate flooding relief. The subject property is a candidate for protection using non-structural measures such as floodproofing or acquisition.
MPA-6	Barrington Road crossing of Poplar Creek Schaumburg Branch	100	none	Barrington Road pavement is inundated by 0.7 feet in the 100-year event. Alternative PCSH-1 was developed to address this identified problem.

3.4.3.2 Damage Assessment

Damages were assessed for Poplar Creek Schaumburg Branch over a 50-year period using the methodology outlined in Section 1.4.2 of this report and Section 6.6 of the CCSMP. Estimated damages are listed in Table 3.4.6.

TABLE 3.4.6
Estimated Damages for Poplar Creek Schaumburg Branch Subwatershed

Damage Category	Estimated Damage	Note
Property	$155,400	Compute damage at one structure.
Transportation	$252,500	Computed damages for the Barrington Road crossing.

3.4.3.3 Technology Screening

Flood control technologies were screened to identify those most appropriate for addressing the flooding problems along Poplar Creek Schaumburg Branch. Increased conveyance or storage alternatives were identified as potential technologies for addressing flooding problems along the Poplar Creek Schaumburg Branch.

3.4.3.4 Alternative Development

Flood Control Alternatives Alternative solutions to regional flooding were developed and evaluated consistent with the methodology described in Section 1.4 of this report. Both storage and conveyance based flood control alternatives were evaluated to address overbank flooding problems on Poplar Creek Schaumburg Branch.

A storage based solution that involves the construction of an overbank peak shaving flood reservoir. This reservoir would have to provide a minimum of 25 acre-feet and had an estimated cost of at least $2.1 million. The inundated property is already located next to a very large wetland complex. The only available location to construct a storage facility (that wouldn't require property acquisitions in excess of the value of the single damage structure) was a neighborhood park, which was not a locally acceptable solution.

A conveyance based solution was also evaluated. Any downstream conveyance solution that lowered the 100-year WSEL at the damaged property would also result in the loss of floodplain storage throughout the large open wetlands area that surrounds the problem area. This would then necessitate compensatory storage that is approximately equivalent to the storage-only solution. As with the storage-only solution, there is no available location to construct the necessary storage without property acquisition. Therefore, the conveyance solution was disregarded as a potential alternative.

Alternative PCSH-1 involves the replacement of the existing Barrington Road culvert. Replacement of the restrictive culvert lowers the upstream water surface by 0.8 feet, allowing water to pass under instead of over the bridge and results in less than 0.1 foot raise in water surfaces downstream. Alternative PCSH-1 is summarized in Table 3.4.7.

TABLE 3.4.7
Flood Control Alternative for Poplar Creek Schaumburg Branch

Alternative	Problem Addressed	Location	Description
PCSH-1	Flooding	Barrington Road crossing of Poplar Creek Schaumburg Branch	Replace the existing Barrington Road culvert with a larger culvert.

3.4.3.5 Alternative Evaluation and Selection

No locally acceptable or feasible alternatives were able to be developed to address the damages associates with MPA-5. The property identified in MPA-5 is inundated 1.4 feet in the 100-year event, which makes it a candidate for protection using nonstructural flood control measures, such as flood-proofing or acquisition.

The alternative listed Table 3.4.7 was evaluated to determine its effectiveness and produce data required for the countywide prioritization of watershed projects. The flood control alternative was modeled to evaluate its impact on water elevations and flood damages. PCSH-1, which addresses MPA-6 in Hoffman Estates, reduces water surfaces upstream of Barrington Road by 0.8 feet in the 100-year event. This eliminates the pavement flooding associated with MPA-6.

3.4.3.6 Data Required for Countywide Prioritization of Watershed Project

Appendix I presents conceptual level cost estimates for the recommended alternatives. Table 3.4.8 lists the total estimated cost, benefits, and B/C ratio for each alternative. Figure 3.4.2 shows the recommended alternative for Poplar Creek Schaumburg Branch and a comparison of the existing conditions inundation mapping and inundation mapping for recommended flood control alternative PCSH-1.

TABLE 3.4.8
Poplar Creek Schaumburg Branch Project Alternative Matrix to Support District Capital Improvement Program Prioritization

Project	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures Protected	Water Quality Benefit	Recommended	Communities Involved
PCSH-1	Replace Barrington Road crossing over Poplar Creek Schaumburg Branch.	0.08	$252,000	$3,282,500	0	Slightly positive	Yes	Hoffman Estates

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.5 Poplar Creek Railroad Tributary

Poplar Creek Railroad Tributary is a 2.1 mile long waterway located in northwestern Cook County. The headwaters of Poplar Creek Railroad Tributary are the large wetlands complex located north of Interstate 90. From this location, Poplar Creek Railroad Tributary flows in a southern direction to its mouth just downstream of Golf Road at river mile 6.11 on Poplar Creek. Table 3.5.1 summarizes the communities that are tributary to Poplar Creek Railroad Tributary. Land use within the drainage area of Poplar Creek Railroad Tributary is shown in Table 3.5.2.

TABLE 3.5.1
Communities Draining to Poplar Creek Railroad Tributary

Community	Tributary Area (mi^2)
Hoffman Estates	1.95
Unincorporated/ Forest Preserve	0.83

TABLE 3.5.2
Land Use Distribution for Poplar Creek Railroad Tributary

Land Use	Area (acres)	%
Forest/Open Land	795.89	44.79
Residential	433.88	24.42
Agricultural	140.55	7.91
Water/Wetland	68.01	3.83
Institutional	22.17	1.25
Commercial/Industrial	219.21	12.33
Transportation/Utility	97.22	5.47

There were no reported problem areas on Poplar Creek Railroad Tributary. Figure 3.5.1 provides an overview of the tributary area of the subwatershed. Flood inundation areas and proposed alternative projects are also shown on the figure, and are discussed in the following subsections.

3.5.1 Sources of Data

3.5.1.1 Previous Studies

No previous reports specific for Poplar Creek Railroad Tributary have been prepared. However, as a tributary to Poplar Creek, it was inherently included in the reports for the Poplar Creek Mainstem identified in Section 3.1.1.1.

3.5.1.2 Water Quality Data

The water quality of Poplar Creek Railroad Tributary is not identified as impaired by the IEPA. According to a water permit discharge query by the USEPA, there are no NPDES permits issued by IEPA for discharges to Poplar Creek Railroad Tributary. Municipalities discharging to Poplar Creek Railroad Tributary are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.5.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 39 acres of wetland areas in the Poplar Creek Railroad Tributary subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.5.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised per updated Cook County topographic information. However, the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into the revised floodplains. Railroad Tributary is currently mapped as an unnumbered Zone A in the 2008 FIS. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.5.1.5 Stormwater Problem Data

Communities, agencies (e.g., IDOT, CCHD), and stakeholders submitted Form B questionnaire response data to the District summarizing known stormwater problems within their jurisdictions. No Form B Responses related to Poplar Creek Railroad Tributary were submitted.

3.5.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others have been identified for the Poplar Creek Railroad Tributary subwatershed.

3.5.2 Watershed Analysis

3.5.2.1 Hydrologic Model Development

Subbasin Delineation. The Poplar Creek Railroad Tributary drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Twelve subbasins were delineated for the Poplar Creek Railroad Tributary subwatershed, with an average size of 148.1 acres and total drainage area of 2.78 square miles.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Adjustments made to hydrologic parameters during model calibration are discussed in Section 3.1.2.3. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.5.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Poplar Creek Railroad Tributary and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficients along the modeled stream length.

Boundary Conditions. In order to avoid double counting floodplain storage, the first cross section of the Poplar Creek Railroad Tributary model was placed at the approximate boundary of Poplar Creek Mainstem floodplain. Initial model trials were run using first a normal depth boundary condition and secondly a Poplar Creek Mainstem stage hydrograph boundary condition to determine which condition resulted in a higher downstream boundary condition. For Poplar Creek Railroad Tributary, normal depth with a friction slope of 0.006 was the selected boundary condition.

3.5.2.3 Calibration and Verification

No measured or observed flows or stage data was available for the Poplar Creek Railroad Tributary subwatershed. CNs were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

3.5.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.5.1 shows inundation areas along Poplar Creek Railroad Tributary produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Poplar Creek Railroad Tributary. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.5.3 Development and Evaluation of Alternatives

3.5.3.1 Problem Definition

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. Table 3.5.3 summarizes one problem areas identified through hydraulic modeling of Poplar Creek Railroad Tributary. Modeled problem area MPA-7 is located on the Golf Road crossing of the Poplar Creek Railroad Tributary.

TABLE 3.5.3
Modeled Problem Definition for Poplar Creek Railroad Tributary Subwatershed

Problem ID	Location	Recurrence Interval of Flooding (yr)	Related Form B (If any)	Resolution in DWP
MPA-7	Golf Road crossing of Poplar Creek Railroad Tributary in Hoffman Estates.	100	none	Barrington Road pavement is inundated by 0.7 feet in the 100-year event. Alternative PCRR-1 was developed to address this identified problem.

3.5.3.2 Damage Assessment

Damages were assessed for Poplar Creek Railroad Tributary over a 50-year period using the methodology outlined in Section 1.4.2 of this report and Section 6.6 of the CCSMP. Estimated damages are listed in Table 3.5.4.

TABLE 3.5.4
Estimated Damages for Poplar Creek Railroad Tributary Subwatershed

Damage Category	Estimated Damage	Note
Transportation	$2,300	Computed damages for the Golf Road crossing.

3.5.3.3 Technology Screening

Flood control technologies were screened to identify those most appropriate for addressing the flooding problems along the Poplar Creek Railroad Tributary. Increased conveyance or storage alternatives were identified as potential technologies for addressing flooding problems along the Poplar Creek Railroad Tributary.

3.5.3.4 Alternative Development

Flood Control Alternatives. Alternative solutions to regional flooding were developed and evaluated consistent with the methodology described in Section 1.4 of this report. Both storage and conveyance based flood control alternatives were evaluated to address overbank flooding problems on the Poplar Creek Railroad Tributary. It was quickly evident that a conveyance based solution was the preferable alternative as it could be implemented without the need for any compensatory storage because downstream stages were unaffected by the alternative.

Alternative PCRR-1 involves the replacement of the existing culvert under the EJ&E Railroad. Replacement of the restrictive culvert lowers the water upstream of the railroad by 2.7 feet and upstream of Golf Road by 2.3 feet, allowing water to pass under instead of over the road. This results in less than 0.1 foot increase in water surfaces downstream. Alternative PCRR-1 is summarized in Table 3.5.5.

TABLE 3.5.5
Flood Control Alternative for Poplar Creek Railroad Tributary

Alternative	Problem Addressed	Location	Description
PCRR-1	Flooding	EJ&E Railroad crossing of Poplar Creek Railroad Tributary	Replace the existing EJ&E culvert with a larger culvert.

3.5.3.5 Alternative Evaluation and Selection

The alternative listed Table 3.5.5 was evaluated to determine its effectiveness and produce data required for the countywide prioritization of watershed projects. The flood control alternative was modeled to evaluate its impact on water elevations and flood damages. PCRR-1, which addresses MPA-7 in Hoffman Estates, reduces water surfaces upstream of Golf Road by 2.3 feet in the 100-year event. This eliminates the pavement flooding associated with MPA-7.

3.5.3.6 Data Required for Countywide Prioritization of Watershed Project

Appendix I presents conceptual level cost estimates for the recommended alternatives. Table 3.5.6 lists the total estimated cost, benefits, and B/C ratio for each alternative. Figure 3.5.2 shows the recommended alternative for Poplar Creek Railroad Tributary and a comparison of the existing conditions inundation mapping and inundation mapping for recommended flood control alternative PCRR-1.

TABLE 3.5.6
Poplar Creek Railroad Tributary Project Alternative Matrix to Support District Capital Improvement Program Prioritization

Project	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures Protected	Water Quality Benefit	Recommended	Communities Involved
PCRR-1	Replace EJ&E crossing over Poplar Creek Railroad Tributary.	0.002	$2,300	$1,486,400	0	Slightly positive	Yes	Hoffman Estates (and EJ&E Railroad)

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.6 Poplar Creek South Branch

Poplar Creek South Branch is a 3.9 mile waterway located in northwestern Cook County. The headwaters of Poplar Creek South Branch are located in Dolphin Park, a flood control reservoir, located in Streamwood. From this location, Poplar Creek South Branch flows in a western direction to its mouth just downstream of Schaumburg Road at river mile 4.74 on Poplar Creek. Table 3.6.1 summarizes the communities that are tributary to Poplar Creek South Branch. Land use within the drainage area of Poplar Creek South Branch is shown in Table 3.6.2.

TABLE 3.6.1
Communities Draining to Poplar Creek South Branch

Community	Tributary Area (mi^2)
Bartlett	0.11
Hanover Park	0.20
Schaumburg	0.22
Streamwood	4.47
Unincorporated/Forest Preserve	0.78

Figure 3.6.1 provides an overview of the tributary area of the subwatershed. Reported stormwater problem areas and flood inundation areas are also shown on the figure, and are discussed in the following subsections.

TABLE 3.6.2
Land Use Distribution for Poplar Creek South Branch

Land Use Category	Area (acres)	%
Residential	2238.77	60.54
Institutional	162.21	4.39
Transportation/ Utility	9.21	0.25
Commercial/ Industrial	282.90	7.65
Forest/Open Land	723.99	19.58
Water/Wetland	158.14	4.27
Agriculture	122.79	3.32

3.6.1 Sources of Data

3.6.1.1 Previous Studies

No previous reports specific for Poplar Creek South Branch have been prepared. However, as a tributary to Poplar Creek, it was inherently included in the reports for the Poplar Creek Mainstem identified in Section 3.1.1.1.

3.6.1.2 Water Quality Data

The water quality of Poplar Creek South Branch is not identified as impaired by the IEPA. According to a water permit discharge query by the USEPA, there are no NPDES permits issued by IEPA for discharges to Poplar Creek South Branch. Municipalities discharging to Poplar Creek South Branch are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.6.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 86 acres of wetland areas in the Poplar Creek South Branch subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.6.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised per updated Cook County topographic information. However, the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into the revised floodplains. Poplar Creek South Branch is mapped in detail in the 2008 FIS for approximately 16,850 feet, from the confluence with Poplar Creek to about 820 feet above Bartlett Road. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.6.1.5 Stormwater Problem Data

Table 3.6.3 summarizes reported problem areas reviewed as a part of the DWP development. The problem area data was obtained primarily from Form B questionnaire response data provided by watershed communities, agencies, and stakeholders to the District. Problems are classified in Table 3.6.3 as regional or local. This classification is based on a process described in Section 2.2 of this report.

TABLE 3.6.3
Community Response Data for Poplar Creek South Branch

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
SBSW-1	Streamwood	Bank erosion	Route 19 and Whispering Drive	The Village of Streamwood and the CMAP Poplar Creek Watershed Action Plan reported large amount of streambank erosion from the golf course to 3,000 feet upstream.	Regional	Streamwood constructed an erosion control project in 2009 for the most critical segment in this reach. No structures are at risk as a result of the reported erosion.
SBSW-2	Streamwood	Water quality	Kollar Pond on Route 19	The CMAP Poplar Creek Watershed Action Plan reported that Kollar Pond is the most eutrophic lake/pond in the watershed.	Local	A shoreline erosion and water quality problem on the local drainage system.
SBSW-3	Streamwood	Bank erosion	Dolphin Park	The CMAP Poplar Creek Watershed Action Plan reported streambank erosion in 2,500 feet of channel though the park. The Action Plan also identified that untreated urban runoff enters the park through several ditches.	Regional	There are no structures at risk as a result of the reported erosion.

3.6.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others have been identified for the Poplar Creek South Branch subwatershed.

3.6.2 Watershed Analysis

3.6.2.1 Hydrologic Model Development

Subbasin Delineation. The Poplar Creek South Branch drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Twenty-four subbasins were delineated for the Poplar Creek South Branch subwatershed, with an average size of 154.1 acres and total drainage area of 5.78 square miles.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Adjustments made to hydrologic parameters during model calibration are discussed in Section 3.1.2.3. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.6.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Poplar Creek South Branch and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficients along the modeled stream length.

Reservoir. The South Branch Poplar Creek includes two reservoirs that were constructed by the District. These were modeled as part of the HEC-RAS model. The Dolphin Park Reservoir is an online reservoir at the upstream end of the Poplar Creek South Branch. It was represented as a storage area in HEC-RAS with an inline structure as its outlet. The Oak Hill Reservoir has a control structure that limits peak flows and diverts water into the offline reservoir located adjacent to the Streamwood public works building. It was represented as a storage area with a lateral weir structure in HEC-RAS.

Boundary Conditions. In order to avoid double counting floodplain storage, the first cross section of the Poplar Creek South Branch model was placed at the approximate boundary of Poplar Creek Mainstem floodplain. Initial model trials were run using first a normal depth boundary condition and secondly a Poplar Creek Mainstem stage hydrograph boundary condition to determine which condition resulted in a higher downstream boundary condition. For Poplar Creek South Branch A, a stage hydrograph on the Poplar Creek Mainstem was used as the boundary condition.

3.6.2.3 Calibration and Verification

Model calibration on the Poplar Creek Mainstem was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. Poplar Creek South Branch calibration was part of the overall Poplar Creek analysis and calibration. CNs were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

For Poplar Creek South Branch, two WSEL measurements were taken on September 14, 2008. These measurements occurred at least one day after the primary peak of the storm, during a smaller secondary peak and do not represent true high water marks. A frequent observation in H&H modeling is that model results tend to underreport flow and stages during the falling limb of storm hydrographs. Although one measurement doesn't conform to the target calibration stage difference of 0.5 foot, the comparison is indicative of reasonable model results. The observed water surface and model results are summarized on Table 3.6.4.

TABLE 3.6.4
Observed Water Surface Elevations on Poplar Creek South Branch during September 2008 Storm Event

Location	Observation Time	Observed Elevation	Model Elevation	Difference
Bartlett Rd.	9/14/2008 15:24	782.1	781.5	-0.6
Schaumburg Rd.	9/14/2008 15:34	771.4	771.0	-0.4

3.6.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.6.1 shows inundation areas along Poplar Creek South Branch produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Poplar Creek South Branch. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.6.3 Development and Evaluation of Alternatives

There were no problem areas identified through hydraulic modeling of Poplar Creek South Branch, so no alternatives were developed.

3.7 Lord's Park Tributary

Lord's Park Tributary is a 1.3 mile waterway located in the City of Elgin in northwestern Cook County. The headwaters of the Lord's Park Tributary can be found in Lord's Park in the City of Elgin. From this location, Lord's Park Tributary flows in a southerly direction to its mouth just downstream of Villa Street at river mile 2.02 on Poplar Creek. Table 3.2.1 summarizes the communities that are tributary to Lord's Park Tributary. Land use within the drainage area of Lord's Park Tributary is shown in Table 3.7.2.

TABLE 3.7.1
Communities Draining to Lord's Park Tributary

Community	Tributary Area (mi^2)
Elgin	2.84
Hoffman Estates	0.52
Unincorporated/Forest Preserve	1.09

Figure 3.7.1 provides an overview of the tributary area of the subwatershed. Reported stormwater problem areas and flood inundation areas are also shown on the figure, and are discussed in the following subsections.

TABLE 3.7.2
Land Use Distribution for Lord's Park Tributary

Land Use	Area (acres)	%
Residential	1509.81	52.98
Commercial/Industrial	184.63	6.48
Forest/Open Land	441.87	15.51
Institutional	71.45	2.51
Agricultural	447.02	15.69
Transportation/Utility	85.05	2.98
Water/Wetland	109.76	3.85

3.7.1 Sources of Data

3.7.1.1 Previous Studies

No previous reports specific for Lord's Park Tributary have been prepared. However, as a tributary to Poplar Creek, it was inherently included in the reports for the Poplar Creek Mainstem identified in Section 3.1.1.1.

3.7.1.2 Water Quality Data

The water quality of Lord's Park Tributary is not identified as impaired by the IEPA. According to a water permit discharge query by the USEPA, there are no NPDES permits issued by IEPA for discharges to Lord's Park Tributary. Municipalities discharging to Lord's Park Tributary are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.7.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 114 acres of wetland areas in the Lord's Park Tributary subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.7.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised per updated Cook County topographic information. However, the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into the revised floodplains. Lord's Park Tributary is mapped in detail in the 2008 FIS for approximately 4,950 feet from the mouth at Poplar Creek to about 750 feet upstream of Laurel Street. Lord's Park Tributary was modeled with RE73 and RE75 hydrologic computations and the HEC-2 hydraulic model. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.7.1.5 Stormwater Problem Data

The only stormwater problem area reported for Lord's Park Tributary was PCEL-2 which was reported in Table 3.1.3 in the Poplar Creek Mainstem section of this report.

3.7.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others have been identified for the Lord's Park Tributary subwatershed.

3.7.2 Watershed Analysis

3.7.2.1 Hydrologic Model Development

Subbasin Delineation. The Lord's Park Tributary drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Twenty subbasins were delineated for the Lord's Park Tributary subwatershed, with an average size of 142.5 acres and total drainage area of 4.45 square miles.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Adjustments made to hydrologic parameters during model calibration are discussed in Section 3.1.2.3. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.7.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Lord's Park Tributary and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's n roughness coefficients along the modeled stream length.

Boundary Conditions. Due to the significant overflow between Poplar Creek and Lord's Park Tributary, the Lord's Park Tributary model was run as part of the Poplar Creek Mainstem model. As such, there was no boundary condition to set other than placement of the junction that connects Lord's Park Tributary to Poplar Creek.

3.7.2.3 Calibration and Verification

Model calibration on the Poplar Creek Mainstem was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. Lord's Park Tributary calibration was part of the overall Poplar Creek analysis and calibration. CNs were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

For Lord's Park Tributary, two WSEL measurements were taken on September 14, 2008. These measurements occurred at least one day after the primary peak of the storm, during a smaller secondary peak and do not represent true high water marks. A frequent observation in H&H modeling is that model results tend to underreport flow and stages during the falling limb of storm hydrographs. Although one measurement doesn't conform to the target calibration stage difference of 0.5 foot, the comparison is indicative of reasonable model results. The observed water surface and model results are summarized on Table 3.7.3.

TABLE 3.7.3
Observed Water Surface Elevations on Lord's Park Tributary during September 2008 Storm Event

Location	Observation Time	Observed Elevation	Model Elevation	Difference
Willard Avenue	9/14/2008 15:55	723.4	723.3	0.1
Villa Street	9/14/2008 16:01	722.5	723.0	0.5

3.7.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.7.1 shows inundation areas along Lord's Park Tributary produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Poplar Creek South Branch. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.7.3 Development and Evaluation of Alternatives

The problems on Lord's Park Tributary are associated with PCEL-2 and MPA-1 on the Poplar Creek Mainstem. The development, evaluation and recommendation of Alternatives for this area were addressed in Section 3.1.3.

3.8 Flint Creek

Two primary tributaries drain the Cook County portion of the Flint Creek Watershed. The larger of the tributaries is the mainstem of Flint Creek. Approximately 5.6 miles of the mainstem of Flint Creek is located in Cook County. The headwaters of Flint Creek is a large wetlands area located east of Barrington Road in Inverness. From this location, Flint Creek flows in a westerly direction for approximately two miles before it turns north and flows toward the county line. Table 3.8.1 summarizes the communities that are tributary to Flint Creek. Land use within the drainage area of Flint Creek is shown in Table 3.8.2.

TABLE 3.8.1
Communities Draining to Flint Creek

Community	Tributary Area (mi^2)
Barrington	0.78
Barrington Hills	2.63
Inverness	1.18
Unincorporated/Forest Preserve	0.97

TABLE 3.8.2
Land Use Distribution for Flint Creek

Land Use	Area (acres)	%
Residential	1882.66	52.90
Forest/Open Land	946.96	26.61
Institutional	61.44	1.73
Commercial/Industrial	107.87	3.03
Water/Wetland	512.88	14.41
Agricultural	39.58	1.11
Transportation/Utility	7.30	0.21

Figure 3.8.1 provides an overview of the tributary area of the Flint Creek Watershed. Reported stormwater problem areas and flood inundation areas are also shown on the figure, and are discussed in the following subsections.

3.8.1 Sources of Data

3.8.1.1 Previous Studies

The ISWS prepared an HSPF model for the Flint Creek Watershed (ISWS, 2007). This model is being used as part of a water quality study for the Fox River. The report provides background information on Flint Creek and describes development of HSPF models. Models were not calibrated, but used to test transferability of calibration parameters developed previously for Poplar Creek.

The Flint Creek Watershed Protection and Restoration Strategy was prepared in 2007 by the Flint Creek Watershed Partnership (AES, 2007). This Watershed Based Plan identified goals and recommended strategies to: protect water resources and enhance water quality, protect natural areas and open space, reduce flooding, improve habitat, increase coordination among stakeholders, and enhance stewardship and education.

3.8.1.2 Water Quality Data

The water quality of Flint Creek is identified as impaired by the IEPA. Flint Creek's designated use of aquatic life is considered impaired and Segment IL_DTZS-01 is identified on the 303(d) list of IEPA's 2010 Report. According to the report, the segment is considered impaired due to phosphorous and other unknown causes. Although identified as impaired, Flint Creek does not appear to be scheduled for TMDL development at this time.

According to a water permit discharge query by the USEPA, there are no active NPDES permits issued by IEPA for discharges to Poplar Creek. Municipalities discharging to Poplar Creek are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.8.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 527 acres of wetland areas in the Flint Creek subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.8.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised per updated Cook County topographic information. However, the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into the revised floodplains. Flint Creek is mapped in detail in the 2008 FIS for approximately 3,425 feet from just below Abbotsford Drive to approximately 3,195 feet upstream of Abbotsford Drive. This reach of Flint Creek was modeled with RE74 hydrologic equations and the WSP2 hydraulic model. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.8.1.5 Stormwater Problem Data

Table 3.8.3 summarizes reported problem areas reviewed as a part of the DWP development. The problem area data was obtained primarily from Form B questionnaire response data provided by watershed communities, agencies, and stakeholders to the District. Problems are classified in Table 3.8.3 as regional or local. This classification is based on a process described in Section 2.2 of this report.

3.8.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others have been identified for the Flint Creek subwatershed.

TABLE 3.8.3
Community Response Data for Flint Creek

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
FCBA-1	Barrington	Pavement flooding	East Lincoln Ave. by Miller Park	Reported flooding on East Lincoln Avenue, South Summit Street, East Russell Street, and within Miller Park	Local	Problem not located on a regional waterway. This is a local drainage problem.
FCBH-1	Barrington Hills	Storm sewer flow restriction	Hart Hills Road and Oakdene Road	Reported that a blocked drain tile at the intersection causes flooding on multiple private properties.	Local	Problem not located on a regional waterway. This is a local drainage problem.
FCBH-2	Barrington Hills, Barrington Township	Storm sewer flow restriction	Hawthorne Road and Old Dundee Road	Reported that a blocked drain tile causes flooding and restricts the access to a property on Hawthorne Road.	Local	Problem not located on a regional waterway. This is a local drainage problem.
FCBH-3	Barrington Hills	Pavement flooding	Three Lake Road and County Line Road	Reported that normal storm events cause flooding of driveways and roads due to restricted ditches and culverts.	Local	Problem not located on a regional waterway. This is a local drainage problem.
FCBH-4	Barrington Hills, Barrington Township	Potential pavement flooding	Lakeview Lane and IL Route 68	Reported that insufficient vertical relief along the northern roadside ditch of IL Route 68, as evidenced by cattails in the ditch line.	Local	Problem not located on a regional waterway. This is a local drainage problem.
FCBH-5	Barrington Hills	Pavement flooding	Route 59, north of Dundee Road	IDOT has reported pavement flooding. Flint Creek is unnumbered Zone A at this crossing.	Local	Problem is not a result of overbank flooding.
FCBT-1	Barrington Hills	Water quality	Area known as College Streets west of Baker's Lake	Reported that the environmentally sensitive and perennial wetlands in the area are threatened by development.	Local	Problem not located on a regional waterway. There no proposed projects that could address this issue.
FCFP-1	FPDCC	Poor habitat, bank erosion	Route 59 to LaBuy's Lake Dam	Reported this is the poorest quality reach of Flint Creek in Cook County. Identified problems include high channelization, high debris load, high sediment accumulation, moderate erosion, and poor habitat quality.	Regional	There are no structures at risk as a result of the reported erosion.

3.8.2 Watershed Analysis

3.8.2.1 Hydrologic Model Development

Subbasin Delineation. The Flint Creek drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Thirty subbasins were delineated for the Flint Creek Watershed; with an average size of 119.5 acres and total drainage area of 5.79 square miles (hydrologic model coverage includes some areas outside Cook County that are tributary to Flint Creek).

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.8.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Flint Creek and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficients along the modeled stream length.

Boundary Conditions. The Flint Creek hydraulic model was extended to 1,000 feet beyond the Cook County border. From this location a normal depth with a friction slope of 0.003 was used as the boundary condition.

3.8.2.3 Calibration and Verification

No stream gage data exists for Flint Creek in Cook County. Model calibration on the Poplar Creek Mainstem (an adjacent watershed) was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. CNs for Flint Creek were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

For Flint Creek, three WSEL measurements were taken on September 14, 2008. These measurements occurred at least one day after the primary peak of the storm, during a smaller secondary peak and do not represent true high water marks. A frequent observation in H&H modeling is that model results tend to underreport flow and stages during the falling limb of storm hydrographs. Although one measurement doesn't conform to the target calibration stage difference of 0.5 foot, the results are indicative of reasonable model results. The observed water surfaces and model results are summarized on Table 3.8.4.

TABLE 3.8.4
Observed Water Surface Elevations on Flint Creek during September 2008 Storm Event

Location	Observation Time	Observed Elevation	Model Elevation	Difference
Upstream of Braymore Dr.	9/14/2008 15:45	852.59	852.39	-0.2
Keene Lake	9/14/2008 15:15	828.25	827.89	-0.4
Main Street (Lake-Cook Rd.)	9/14/2008 14:15	798.43	797.64	-0.8

3.8.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.8.1 shows inundation areas along Flint Creek produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Flint Creek. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.8.3 Development and Evaluation of Alternatives

There were no problem areas identified through hydraulic modeling of Flint Creek, so no alternatives were developed.

3.9 Flint Creek Tributary

Flint Creek Tributary is a 1.0 mile long waterway located in northwestern Cook County. The headwaters of Flint Creek Tributary are located in Baker's Lake in Barrington. From this location, Flint Creek Tributary flows in a northerly direction toward the Cook County border with Lake County. Table 3.9.1 summarizes the communities that are tributary to Flint Creek Tributary. Land use within the drainage area of Flint Creek Tributary is shown in Table 3.9.2.

TABLE 3.9.1
Communities Draining to Flint Creek Tributary

Community	Tributary Area (mi^2)
Barrington	1.06
Inverness	0.18
Unincorporated/ Forest Preserve	0.58

There were no reported problem areas on Flint Creek Tributary. Figure 3.9.1 provides an overview of the tributary area of the subwatershed.

TABLE 3.9.2
Land Use Distribution for Flint Creek Tributary

Land Use	Area (acres)	%
Residential	543.76	46.67
Forest/Open Land	426.33	36.59
Commercial/ Industrial	21.59	1.85
Institutional	29.43	2.53
Water/Wetland	144.03	12.36

3.9.1 Sources of Data

3.9.1.1 Previous Studies

No previous reports specific for Flint Creek Tributary have been prepared. However, as a tributary to Flint Creek, it was inherently included in the reports prepared for the Flint Creek Mainstem identified in Section 3.8.1.1.

3.9.1.2 Water Quality Data

The water quality of Flint Creek Tributary is not identified as impaired by the IEPA. According to a water permit discharge query by the USEPA, there are no NPDES permits issued by IEPA for discharges to Flint Creek Tributary. Municipalities discharging to Flint Creek Tributary are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.9.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping as described in Section 2.3.8. Based on this mapping, there are approximately 187 acres of wetland areas in the Flint Creek Tributary subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.9.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised per updated Cook County topographic information. However, the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into the revised floodplains.

Flint Creek Tributary is mapped in detail in the 2008 FIS from Lake-Cook Road to 1,890 feet above Lake-Cook Road. This reach of Flint Creek was modeled with the HEC-2 hydraulic model. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.9.1.5 Stormwater Problem Data

Communities, agencies (e.g., IDOT, CCHD), and stakeholders submitted Form B questionnaire response data to the District summarizing known stormwater problems within their jurisdictions. No Form B Responses related to Flint Creek Tributary were submitted.

3.9.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others have been identified for the Flint Creek Tributary subwatershed.

3.9.2 Watershed Analysis

3.9.2.1 Hydrologic Model Development

Subbasin Delineation. The Flint Creek Tributary drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Ten subbasins were delineated for the Flint Creek Tributary subwatershed; with an average size of 119.4 acres and total drainage area of 1.87 square miles (hydrologic model coverage includes some areas outside Cook County that are tributary to Flint Creek).

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.9.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Flint Creek Tributary and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's n roughness coefficients along the modeled stream length.

Boundary Conditions. The Flint Creek hydraulic model ended at Lake-Cook Road. There is a hydraulic control structure for a lake immediately upstream of Lake-Cook Road which acts as the major boundary condition for the upstream portion of the Tributary. The Lake-Cook Road Bridge was included in the model and at this location a normal depth with a friction slope of 0.005 was used as the boundary condition on the downstream side of the bridge.

3.9.2.3 Calibration and Verification

No stream gage data exists for Flint Creek Tributary in Cook County. Model calibration on the Poplar Creek Mainstem (an adjacent watershed) was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. CNs for Flint Creek tributary were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

3.9.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.9.1 shows inundation areas along Flint Creek Tributary produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Flint Creek Tributary. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.9.3 Development and Evaluation of Alternatives

There were no problem areas identified through hydraulic modeling of Flint Creek Tributary, so no alternatives were developed.

3.10 Spring Creek

Spring Creek is an 8.2 mile waterway located in northwestern Cook County. The Spring Creek Watershed is found north of the Poplar Creek Watershed and west of the Flint Creek Watershed. There are six unnamed tributaries to Spring Creek that include another 7.6 miles of waterways. The headwaters of Spring Creek are in the detention basins near Barrington Road and Higgins Road in South Barrington. From this location, Spring Creek flows in a northerly direction toward the Cook County border at Lake-Cook Road. Table 3.10.1 summarizes the Cook County communities that are tributary to Spring Creek. Land use within the drainage area of Spring Creek is shown in Table 3.10.2.

TABLE 3.10.1
Communities Draining to Spring Creek

Community	Tributary Area (mi^2)
Barrington Hills	13.64
East Dundee	0.16
Hoffman Estates	0.98
South Barrington	1.74
Unincorporated/Forest Preserve	3.00

TABLE 3.10.2
Land Use Distribution for Spring Creek

Land Use	Acres	%
Forest/Open Land	5556.51	44.41
Residential	4268.39	34.11
Water/Wetland	563.05	4.50
Commercial/Industrial	248.59	1.99
Institutional	37.16	0.30
Transportation/Utility	102.96	0.82
Agriculture	1735.22	13.87

Figure 3.10.1 provides an overview of the tributary area of the watershed. Flood inundation areas and proposed alternative projects are also shown on the figure, and are discussed in the following subsections.

3.10.1 Sources of Data

3.10.1.1 Previous Studies

The FPDCC prepared *An Evaluation of Flood Storage* (FPDCC, 1988) which provided a broad estimation of flood storage available in Poplar Creek and Spring Creek. The information in this report was general in nature and current GIS datasets are far more sophisticated for making storage estimates.

3.10.1.2 Water Quality Data

The water quality of Spring Creek is not identified as impaired by IEPA. According to a water permit discharge query by the USEPA, there are no active NPDES permits issued by IEPA for discharges to Spring Creek. Municipalities discharging to Spring Creek are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.10.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 1,111 acres of wetland areas in the Spring Creek Watershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.10.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised per updated Cook County topographic information. Spring Creek in Cook County is not modeled or mapped in detail for the Cook County 2008 FIS. All floodplain areas depicted on Spring Creek are unnumbered Zone A. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

3.10.1.5 Stormwater Problem Data

Table 3.10.3 summarizes reported problem areas reviewed as a part of the DWP development. The problem area data was obtained primarily from Form B questionnaire response data provided by watershed communities, agencies, and stakeholders to the District. Problems are classified in Table 3.10.3 as regional or local. This classification is based on a process described in Section 2.2 of this report.

TABLE 3.10.3
Community Response Data for Spring Creek

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
SCFP-1	Barrington Hills, Barrington Township, FPDCC	Pavement flooding	North Spring Forest Preserve	Reported that overflow results in flooding of local roads and basements west of Old Sutton Road. The excess flows also cause bank erosion on the FPDCC property.	Regional	Pavement flooding is less than 6 inches deep. No structures are damaged by overbank flooding based on detailed modeling results.
SCSB-1	South Barrington	Pavement flooding	Higgins Road and Bartlett Road	The CCHD reported that the retention ponds on Allstate property flood during heavy rain events. The overflows flood Bartlett Road.	Local	This area was classified as a local drainage system problem.

3.10.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others have been identified for the Spring Creek Watershed.

3.10.2 Watershed Analysis

3.10.2.1 Hydrologic Model Development

Subbasin Delineation. The Spring Creek drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Sixty-five subbasins were delineated for the Spring Creek Watershed, with an average size of 206.5 acres and total drainage area of 20.65 square miles. The modeling extents included areas outside of Cook County that drain to Spring Creek.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin. CNs were used for calibration as described in Section 3.10.2.3.

For most of the Poplar Creek study area, the time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1. However, the methods used (Melching, 1996) are primarily applicable to urban watersheds and Spring Creek is only 37 percent developed with 63 percent of the land use as open space, water or agriculture. Because of this, 45 of the 65 subbasins had less than 7.32% of impervious surface coverage, below which the urban watershed equations for Tc and R were not considered applicable. The report *Equations for Estimating Clark Unit-Hydrograph Parameters for Small Rural Watersheds in Illinois* (USGS, 2000) extended the analysis methodology for urban watersheds developed in the 1996 study to rural watersheds. This rural watershed analysis resulted in several new equations for Tc and R based on watershed main-channel length and slope. Thus, for Spring Creek Tc and R were computed using equations developed in the 2000 report.

Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.10.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Spring Creek, its tributaries and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficients along the modeled stream length.

Boundary Conditions. The Spring Creek hydraulic model was extended to 1,000 feet beyond the Cook County border. From this location a normal depth with a friction slope of 0.0005 was used as the boundary condition.

3.10.2.3 Calibration and Verification

No stream gage data exists for Spring Creek in Cook County. Model calibration on the Poplar Creek mainstem (an adjacent watershed) was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. An initial calibration attempt was made by adjusting CNs following the methodology used for the Poplar Creek Mainstem as described in Section 3.1.2.3. This methodology is based on adjusting the CNs along a spectrum represented by CNs computed for the AMC I and AMC II condition. The CNs were first adjusted to AMC I plus 25% of the difference between CNs in the AMC I and AMC II condition. For Spring Creek, this did not result in satisfactory results, as computed WSELs were much lower than observed. The CNs were then adjusted to AMC I plus 50% of the difference between CNs in the AMC I and AMC II condition. This was the final condition used for the Spring Creek model.

For Spring Creek, five WSEL measurements were taken on September 14, 2008. These measurements occurred at least one day after the primary peak of the storm, during a smaller secondary peak and do not represent true high water marks. A frequent observation in H&H modeling is that model results tend to underreport flow and stages during the falling limb of storm hydrographs. Although several measurements do not conform to the target calibration stage difference of 0.5 foot, they are indicative of reasonable model results. The observed water surfaces and model results are summarized on Table 3.10.4.

TABLE 3.10.4
Observed Water Surface Elevations on Spring Creek during September 2008 Storm Event

Location	Observation Time	Observed Elevation	Model Elevation	Difference
Upstream of IL 59, near IL 72.	9/14/2008 1:15 PM	832.2	831.6	-0.6
Penny Road, west of IL 59	9/14/2008 1:30 PM	811.3	811.5	0.2
IL 68/Dundee Rd.	9/14/2008 1:45 PM	796.9	796.6	-0.3
IL 62/Algonquin Rd.	9/14/2008 2:00 PM	783.4	784.0	0.6
Lake-Cook Rd.	9/14/2008 2:30 PM	770.9	771.1	0.2

3.10.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.10.1 shows inundation areas along Spring Creek produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Spring Creek. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.10.3 Development and Evaluation of Alternatives

3.10.3.1 Problem Definition

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. Table 3.10.5 summarizes three problem areas identified through hydraulic modeling of Spring Creek. Modeled problem area MPA-8 is located at the Penny Road crossing of Spring Creek. This problem area includes pavement flooding on Penny Road as well as damages at one structure. Modeled problem area MPA-9 is located downstream of Penny Road and upstream of Dundee Road and includes damages at one structure. MPA-10 includes pavement flooding at the Algonquin Road crossing of Spring Creek unnamed Tributary D.

TABLE 3.10.5
Modeled Problem Definition for Spring Creek Watershed

Problem ID	Location	Recurrence Interval of Flooding (yr)	Related Form B (if any)	Resolution in DWP
MPA-8	Penny Road Crossing of Spring Creek	100, 50	none	Alternatives SCMS-1 and SCMS-2 were developed to address this problem area, but are not recommended.
MPA-9	Between Penny Road and Dundee Road	100, 50, 25, 10, 5	none	Alternatives were evaluated in conjunction with addressing MPA-8, but no feasible structural solution existing for protection of a single structure. Due to shallow flooding depths, structure is good candidate for flood-proofing or possible acquisition.
MPA-10	Algonquin Road on Spring Creek unnamed Tributary D	100, 50, 25, 10	none-	Alternative SCTD-1 was developed to address the pavement flooding at this location.

3.10.3.2 Damage Assessment

Damages were assessed for Spring Creek over a 50-year period using the methodology outlined in Section 1.4.2 of this report and Section 6.6 of the CCSMP. Estimated damages are listed in Table 3.10.6.

TABLE 3.10.6
Estimated Damages for Spring Creek Watershed

Damage Category	Estimated Damage	Note
Property	$674,300	Computed damages at two structures.
Transportation	$331,800	Computed damages for the Penny Road and Algonquin Road crossings.

3.10.3.3 Technology Screening

Flood control technologies were screened to identify those most appropriate for addressing the flooding problems along Spring Creek. Increased conveyance, storage or a combination of these approaches were identified as potential technologies for addressing flooding problems along Spring Creek and its tributaries.

3.10.3.4 Alternative Development

Flood Control Alternatives. Alternative solutions to regional flooding were developed and evaluated consistent with the methodology described in Section 1.4 of this report. Both storage and conveyance based flood control alternatives were evaluated to address overbank flooding problems on Spring Creek. Alternatives are summarized in Table 3.10.7.

The first effort to develop alternatives was to size a storage solution that would solve the property and transportation damages associated with MPA-8 and MPA-9. The flooding that occurs in this area is very shallow, however the floodplain is very broad and due to upstream storage areas, the shape of the hydrograph during flood events is also broad and flat. This results in a very large amount of storage being needed to solve the identified problems. A storage basin upstream of Penny Road that provides at least 180 acre-feet of storage was needed to solve the flooding problems. The primary location to provide this storage basin would be on FPDCC property. At a potential cost of $14.6 million, this solution was not evaluated further as it was evident that a combination of conveyance improvements and storage would be more reasonable.

Alternative SCMS-1 involves the replacement of the existing culvert under Penny Road and the provision of compensatory storage to offset increased downstream stages that would increase flood damages. The existing crossing under Penny Road consists of double 5-foot by 4-foot concrete box culverts. Woody debris jams have been observed at the upstream face of these culverts that may limit their capacity by up to 50 percent. This crossing is responsible for the transportation damages computed on Penny Road and for potential damages to the structure (a FPDCC owned house) upstream of the crossing. Increasing the crossing size at Penny Road to double 8-foot by 6-foot box culverts eliminates the transportation and property damages associated with MPA-8, but exacerbates flooding at the single structure associated with MPA-9 downstream (downstream 100-year inundation elevations are raised by 0.2 feet). A 78-acre-foot detention basin is needed to prevent the increase in downstream flood elevations. While the cost for improving the crossing at Penny Road was computed to be $408,400, the total cost for the alternative is $7.6 million due to the compensatory storage facility construction. This alternative is not recommended because over $7 million of the cost is to prevent increased damage to a single residential structure. However, the Penny Road crossing cannot simply be improved due to the potential increase in damages downstream. It is recommended to monitor the Penny Road crossing for debris to ensure that the existing culverts are maintained at full capacity. Due to the shallow depth of flooding, both of the residential structures are potential candidates for floodproofing and/or acquisition.

Alternative SCTD-1 involves replacement of the Algonquin Road crossing over unnamed Tributary D to Spring Creek. The existing crossing consists of double 5-foot by 3-foot box culverts. The proposed improvement is to replace them with larger double culverts and to raise the road surface elevation by two feet. The cost for these improvements is $1,736,200 and the proposed project would prevent the predicted damages at this location. The downstream 100-year WSEL would increase by less than 0.1 foot and there are no identified downstream problems or damages.

TABLE 3.10.7
Flood Control Alternatives for Spring Creek

Alternative	Problem Addressed	Location	Description
SCMS-1	Flooding	Penny Road crossing over Spring Creek	Replace the existing crossing with larger culverts and construct compensatory storage to prevent increase in downstream damages.
SCTD-1	Flooding	Algonquin Road crossing of unnamed Tributary D to Spring Creek	Replace the existing crossing with larger culverts.

3.10.3.5 Alternative Evaluation and Selection

The alternatives listed Table 3.10.7 were evaluated to determine their effectiveness and produce data required for the countywide prioritization of watershed projects. The flood control alternatives were modeled to evaluate their impact on water elevations and flood damages. SCMS-1, which addresses MPA-8 in Barrington Hills, reduces water surfaces upstream of Penny Road by 1.8 feet in the 100-year event. This eliminates the pavement and structure flooding associated with MPA-8, a benefit of $12,800. The flood damages at MPA-9 are unchanged by SCMS-1 with the compensatory storage facility being sized to prevent increased flood stages. With B/C ratio of 0.002, alternative SCMS-1 cannot be recommended. Instead, the crossing should be added to the maintenance program for regular inspection for debris jams. Also, both houses are potential candidates for floodproofing and/or acquisition.

Alternative SCTD-1 involves replacing an existing road crossing to prevent transportation damages. The culverts are enlarged from twin 5′ by 3′ concrete box culverts to twin 12′ by 6′ concrete box culverts and the top of road is raised to prevent overtopping. The damages are valued at $321,200, while the estimated cost of the alternative $1,653,400. The computed B/C ratio is 0.19.

3.10.3.6 Data Required for Countywide Prioritization of Watershed Project

Appendix I presents conceptual level cost estimates for the recommended alternatives. Table 3.10.8 lists the total estimated cost, benefits, and B/C ratio for each alternative. Figure 3.10.2 shows the recommended alternative for Spring Creek and a comparison of the existing conditions inundation mapping and inundation mapping for recommended flood control alternative SCTD-1.

TABLE 3.10.8
Spring Creek Project Alternative Matrix to Support District Capital Improvement Program Prioritization

Project	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures Protected	Water Quality Benefit	Recommended	Communities Involved
SCMS-1	Replace the existing crossing with larger culverts and construct compensatory storage to prevent increase in downstream damages.	0.002	$12,800	$7,712,500	1	Slightly negative	No	Barrington Hills, FPDCC
SCTD-1	Replace the existing crossing with larger culverts and raise road elevation.	0.19	$321,200	$1,653,400	0	Slightly positive	Yes	Barrington Hills

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.11 Brewster Creek

Brewster Creek is a 2.4 mile long waterway located in northwestern Cook County. The headwaters of Brewster Creek are found near the intersection of Naperville Road and the Canadian Pacific Railway tracks in Village of Bartlett. From its headwaters, Brewster Creek flows west and then to the south to the Cook/DuPage County line. The Cook County portion of Brewster Creek is 2.4 miles in length. Table 3.11.1 summarizes the communities that are tributary to Brewster Creek. Land use within the drainage area of Brewster Creek is shown in Table 3.11.2.

TABLE 3.11.1
Communities Draining to Brewster Creek

Community	Tributary Area (mi^2)
Bartlett	2.15
Elgin	0.41
Streamwood	0.14
Unincorporated/Forest Preserve	1.00

TABLE 3.11.2
Land Use Distribution for Brewster Creek

Land Use	Acres	%
Commercial/Industrial	430.07	18.17
Forest/Open Land	658.72	27.84
Institutional	86.92	3.67
Residential	687.10	29.04
Transportation/Utility	99.10	4.19
Water/Wetland	145.01	6.13
Agriculture	259.38	10.96

There were no reported problem areas on Brewster Creek. Figure 3.11.1 provides an overview of the tributary area of the subwatershed.

3.11.1 Sources of Data

3.11.1.1 Previous Studies

The ISWS prepared an HSPF model for the Brewster Creek Watershed (ISWS, 2007). This model is being used as part of a water quality study for the Fox River. The report provides background information on Brewster Creek and describes development of HSPF models. Models were not calibrated, but used to test transferability of calibration parameters developed previously for Poplar Creek.

3.11.1.2 Water Quality Data

The water quality of Brewster Creek in Cook County is not identified as impaired by the IEPA. According to a water permit discharge query by the USEPA, there are no NPDES permits issued by IEPA for discharges to Brewster Creek. Municipalities discharging to Brewster Creek are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.11.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Poplar Creek Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 147 acres of wetland areas in the Brewster Creek subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian ronments offer potential opportunities for restoration.

3.11.1.4 Floodplain Mapping

Brewster Creek in Cook County is not modeled or mapped in detail for the Cook County 2008 FIS. All floodplain areas depicted on Brewster Creek are unnumbered Zone A. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP

3.11.1.5 Stormwater Problem Data

As part of the DWP development, communities, agencies (e.g., IDOT, CCHD), and stakeholders submitted Form B questionnaire response data to the District summarizing known stormwater problems within their jurisdictions. No Form B Responses related to Brewster Creek were received.

3.11.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. Bartlett Road near the Brewster Creek crossing is being reconstructed and improved although this project does not impact the actual culverts conveying flow under Bartlett Road. No additional near-term planned projects by others have been identified for the Brewster Creek subwatershed.

3.11.2 Watershed Analysis

3.11.2.1 Hydrologic Model Development

Subbasin Delineation. The Brewster Creek drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Twenty five subbasins were delineated for the Brewster Creek subwatershed, with an average size of 103.4 acres and total modeled drainage area of 4.04 square miles.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The time of concentration and storage coefficients were determined as discussed in Section 1.3.2.1.

Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.11.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that meet District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Brewster Creek and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficients along the modeled stream length.

Boundary Conditions. The Brewster Creek hydraulic model ended downstream of the EJ&E Railroad culvert which is just below the Cook/DuPage County border. From this location a normal depth with a friction slope of 0.0033 was used as the boundary condition.

3.11.2.3 Calibration and Verification

No stream gage data exists for Brewster Creek in Cook County. Model calibration on the Poplar Creek mainstem (an adjacent watershed) was performed using the August 2007 and September 2008 storm events using stream gage records and observed high water marks. CNs for Brewster Creek were adjusted based on the calibration performed for the Poplar Creek Mainstem as described in Section 3.1.2.3.

For Brewster Creek, one WSEL measurement was taken on September 14, 2008. This measurement occurred at least one day after the primary peak of the storm, during a smaller secondary peak and does not represent true high water marks. A frequent observation in H&H modeling is that model results tend to underreport flow and stages during the falling limb of storm hydrographs. The one measurement conforms to the target calibration stage difference of 0.5 foot and is indicative of reasonable model results. The observed water surface and model results are summarized on Table 3.11.3.

TABLE 3.11.3
Observed Water Surface Elevations on Brewster Creek during September 2008 Storm Event

Location	Observation Time	Observed Elevation	Model Elevation	Difference
Upstream of Bartlett Road	9/14/2008 14:45	762.6	762.6	0.0

3.11.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.11.1 shows inundation areas along Brewster Creek produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along Brewster Creek. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.11.3 Development and Evaluation of Alternatives

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. Table 3.11.4 summarizes one problem area identified through hydraulic modeling of Brewster Creek. Modeled problem area MPA-11 is located upstream of the Bartlett Road crossing of Brewster Creek. This problem area includes overtopping of a long driveway culvert impacting one industrial structure as well as overbank flooding throughout a mobile home development immediately upstream of the driveway culvert.

TABLE 3.11.4
Modeled Problem Definition for Brewster Creek

Problem ID	Location	Recurrence Interval of Flooding (yr)	Related Form B (if any)	Resolution in DWP
MPA-11	Upstream of Bartlett Road	100, 50, 25, 10, 5, 2	none	Alternative BCMS-1 was developed to address this problem area.

3.11.3.1 Damage Assessment

Damages were assessed for Brewster Creek over a 50-year period using the methodology outlined in Section 1.4.2 of this report and Section 6.6 of the CCSMP. Estimated damages are listed in Table 3.11.5. Of the $433,800 of property damages, only $32,700 are associated with a permanent structure. The remaining damages are associated with 11 mobile homes and equate to $36,500 per structure, approximately the value of the structures themselves. Also, as mobile homes, these structures could be relocated to mobile home lots that are not susceptible to flood damages. Although only 11 mobile homes are estimated to be damaged, there are 177 mobile home lots that are within the predicted 100-year flood inundation area. There would be safety concerns regarding access to these properties during a flood event.

TABLE 3.11.5
Estimated Damages for Brewster Creek

Damage Category	Estimated Damage	Note
Property	$433,800	Includes 11 mobile homes and one industrial property.
Transportation	$65,100	Assumed as 15% of property damage due to flooding. Although only 12 structures are damaged, there are emergency access issues related to the mobile home development.

3.11.3.2 Technology Screening

Flood control technologies were screened to identify those most appropriate for addressing the flooding problems along Brewster Creek. Increased conveyance or storage alternatives were identified as potential technologies for addressing flooding problems along Brewster Creek.

3.11.3.3 Alternative Development

Flood Control Alternatives. Alternative solutions to regional flooding were developed and evaluated consistent with the methodology described in Section 1.4 of this report. Both storage and conveyance based flood control alternatives were evaluated to address overbank flooding problems on Brewster Creek. Alternatives are summarized in Table 3.11.6.

A storage based solution involves the construction of a flood storage reservoir. This reservoir would have to provide a minimum of 200 acre-feet and had an estimated cost of at least $20 million. There were potential locations to construct a storage facility upstream of the mobile home development. However, it was evident that 200-acre of storage was unnecessary through the development of an alternative that used both conveyance improvements and storage.

A conveyance based solution was also evaluated. Any downstream conveyance solution that lowered the 100-year WSEL at the damaged property would also result in the increased flows and stages downstream of the problem area. To offset these increases, compensatory storage of approximately 55 acre-feet could be provided upstream of the mobile home development.

Alternative BCMS-1 combines the conveyance and storage based alternative and involves the replacement of the Bartlett Road culvert and the existing private driveway culvert upstream of Bartlett Road. Replacement of these culverts lowers the water immediately upstream of Bartlett Road and the private driveway by 1.4 feet and by 0.8 feet at the upstream end of the mobile home development. This decrease in water surface mitigates the overbank flooding on the industrial property and throughout the mobile home development. In addition to the culvert improvements, a 55 acre-foot storage facility would be constructed upstream of the mobile home development. This results in less than 0.1 foot raise in water surfaces downstream.

TABLE 3.11.6
Flood Control Alternatives for Brewster Creek

Alternative	Location	Description
BCMS-1	Upstream of Bartlett Road	Replace Bartlett Road and Private Driveway Culverts to improve conveyance. Construct 55 acre-foot detention basin upstream of the mobile home development.

3.11.3.4 Alternative Evaluation and Selection

The alternative listed in Table 3.11.6 was evaluated to determine its effectiveness and produce data required for the countywide prioritization of watershed projects. The flood control alternative was modeled to evaluate its impact on water elevations and flood damages. BCMS-1, which addresses MPA-11 in Bartlett, reduces water surfaces upstream of Bartlett Road by 0.8 to 2.3 feet in the 100-year event. This eliminates the overbank flooding associated with MPA-11. Water surfaces downstream of the project are raised by less than 0.1 foot. Alternative also prevents flooding of the interior roads in the mobile home development to allow for emergency access during flood events. Alternative BCMS-1 is recommended, but if it is not implemented, then alternative measures that could be taken include moving the mobile homes that are susceptible to flood damages to lots on higher ground.

3.11.3.5 Data Required for Countywide Prioritization of Watershed Project

Appendix I presents conceptual level cost estimates for the recommended alternatives. Table 3.11.7 lists the total estimated cost, benefits, and B/C ratio for the BCMS-1 alternative. Figure 3.11.2 shows the recommended alternative for Brewster Creek and a comparison of the existing conditions inundation mapping and inundation mapping for recommended flood control alternative BCMS-1.

TABLE 3.11.7
Brewster Creek Project Alternative Matrix to Support District Capital Improvement Program Prioritization

Project	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures Protected	Water Quality Benefit	Recommended	Communities Involved
BCMS-1	Replace Bartlett Road and Driveway Culverts. Construct 55 acre-foot storage facility	0.08	$498,800	$6,044,000	12	Slightly positive	Yes	Bartlett

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.12 West Branch DuPage River

The West Branch DuPage River Watershed is situated primarily in northwestern Cook County, southeast of the Poplar Creek Watershed. The West Branch DuPage River flows west and south through Cook County before flowing into DuPage County. The main channel of the West Branch DuPage River has a total length of 32.0 miles. Approximately 3.8 miles of the West Branch DuPage River is located within Cook County. The Cook County portion of the watershed occupies approximately 8.74 square miles. Table 3.12.1 lists the communities draining to West Branch DuPage River.

TABLE 3.12.1
Communities Draining to West Branch DuPage River

Community	Tributary Area (mi^2)
Bartlett	0.99
Hanover Park	2.45
Hoffman Estates	0.04
Schaumburg	3.87
Streamwood	0.75
Unincorporated/Forest Preserve	0.64

Table 3.12.2 summarizes the land use distribution within the West Branch DuPage River Watershed. Figure 3.12.1 is an overview of the tributary area of the watershed. Reported stormwater problem areas, flood inundation areas, and proposed alternative projects are also shown on the figure, and are discussed in the following subsections.

TABLE 3.12.2
Land Use Distribution for West Branch DuPage River

Land Use	Acres	%
Residential	3565.48	63.75
Forest/Open land	672.66	12.03
Commercial/Industrial	529.24	9.46
Institutional	210.52	3.76
Agricultural	353.19	6.32
Transportation/Utility	115.62	2.07
Water/Wetland	146.14	2.61

3.12.1 Sources of Data

3.12.1.1 Previous Studies

The West Branch DuPage River has been studied by DuPage County using HSPF and FEQ. Several documents include a summary of this work. *Hydraulic Evaluation of HSPF Model for West Branch DuPage River Watershed* (Price et al., 2003) summarizes the calibration of the HSPF and Full Equations (FEQ) modeling. *FEQ Hydraulic Modeling of West Branch DuPage River* (URS, 2003) also summarizes the hydraulic modeling with the FEQ hydraulic model utilizing the HSPF land cover determined in prior reports; describes the modeling efforts and calibration results for the West Branch DuPage River; and discusses the hydraulic calibration of the FEQ model to observed peak stages, peak flows, and flow volumes to three USGS stream gauges for several storm events from 1985 to 1996. The FEQ detailed hydraulic model for the West Branch DuPage River extends into Cook County to the West Branch DuPage River's headwaters in the Terada and Campanelli reservoirs in Schaumburg, Illinois.

HEC-1 and HEC-2 modeling was prepared in 1998 for a Schaumburg and Hanover Park Flood Study. These models were obtained and reviewed.

Several water quality reports exist as part of the TMDL efforts to by the IEPA. These include: West Branch and Mainstem DuPage River Stage 2 TMDL – Sediment Oxygen Demand Monitoring (IEPA, 2009) and the DuPage River/Salt Creek Watershed TMDL Stage 1 Report (IEPA, 2009).

3.12.1.2 Water Quality Data

Water quality for the West Branch DuPage River in Cook County is currently monitored by the District. The District has four water quality monitoring station (WW_63, WW_84, WW_89, and WW_110) located on the West Branch DuPage River. Detailed annual water quality summaries of all the water quality data collected have been published by the District for the years 1979 through the present.

The water quality of West Branch of the DuPage River is identified as impaired by the IEPA. Segments IL_GBK_09 and IL_GBK_14 are reported in IEPA's 2010 Report as a 303(d) listed water body, with impairments to its designated uses of aquatic life and primary contact recreation due to zinc, pH, phosphorus, sedimentation/siltation, and fecal coliform. The causes identified by the 2010 Report are generally indicative of impairments associated with an urban stream environment.

The *Final Report Total Maximum Daily Loads for West Branch DuPage River, Illinois* (IEPA, 2004), highlights the status of water quality within the West Branch DuPage River Watershed. Although several impairments were identified for Segments IL_GBK-05, GBK-07, GBK-09, and GBK-12 (segments within DuPage County), TMDL development was only considered for those parameters with an established state water quality standard. These parameters included salinity, TDS, chlorides and copper. The primary cause of chloride exceedances was attributed to winter deicing activities. Chloride, TDS and salinity were considered to be related for purposes of TMDL development. Therefore, it was assumed that TDS and salinity were addressed by addressing chlorides, and specific TMDLs for these parameters were not developed. In addition, the development of another TMDL for dissolved oxygen, fecal coliform, manganese, pH, and silver is underway and is currently in Stage II.

According to a water permit discharge query by the USEPA, there is one NPDES permit issued by IEPA for discharges to West Branch DuPage River that appears to be active. This is the District's permit for discharge from the Hanover Park WWTP (IL0036137).

Municipalities discharging to Poplar Creek are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was instituted to improve water quality by requiring that municipalities develop six minimum control measures for limiting runoff pollution to receiving systems.

3.12.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the West Branch DuPage River Watershed study area. Wetland areas were identified using a modified NWI mapping that was prepared as described in Section 2.3.8. Based on the modified NWI mapping (which differs from the CMAP land use categories), there are approximately 165 acres of wetland areas in the West Branch DuPage River Watershed. Restoration and enhancement of wetlands were included when applicable as part of alternatives described below. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.12.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised based upon updated Cook County topographic information; but the effective models, which are used to estimate flood levels, generally were not updated. LOMRs were incorporated into revised floodplain areas. West Branch DuPage River is mapped in detail from the DuPage County Line to approximately 490 feet above Bradford Lane. Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.Stormwater Problem Data

Table 3.12.3 summarizes reported problem areas reviewed as a part of the DWP development. The problem area data was obtained primarily from Form B questionnaire response data provided by watershed communities, agencies, and stakeholders to the District. Problems are classified in Table 3.12.3 as regional or local. This classification is based on a process described in Section 2.2 of this report.

TABLE 3.12.3
Community Response Data for West Branch DuPage River

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
WBSC-1	Schaumburg	Pavement flooding	Terada Park, Salem Drive	Reported that park area and a small section of Salem Drive floods during heavy rain events.	Local	Problem is not located on a regional waterway and is confined to the local drainage system.
WBSC-2	Schaumburg	Storm sewer flow restriction	Campanelli Park	The Village of Schaumburg reported that an incorrectly installed outflow pipe causes flooding of the park.	Local	Problem is not located on a regional waterway and is confined to the local drainage system.
WBSC-3	Schaumburg, Hanover Park	Overbank flooding	Basin A – Atcher Park	The Village of Schaumburg reported that ponding and overbank flooding occurs at Basin A in Archer Park.	Regional	No flooding damages were identified in the vicinity of Atcher Park, but there are damages nearby and the alternatives developed involve providing storage in Atcher Park.
WBST-1	Schaumburg Township	Storm sewer flow restriction, pavement flooding	East of Wise Road and Parkview Drive	The sewer under Wise Road is overwhelmed during heavy rains and water ponds in the adjacent area.	Local	Problem is not located on a regional waterway and is confined to the local drainage system.

3.12.1.5 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. Hanover Park is considering the replacement of the Longmeadow Lane crossing. This could potentially benefit properties upstream of this crossing where there are minor damages. Upstream, Schaumburg is planning to replace the existing CMP arch culvert crossings at Braintree Drive and Syracuse Lane which are deteriorating. This information was not received in time to be incorporated into the Poplar Creek DWP hydraulic models as a future conditions scenario, or to be incorporated into the alternatives analysis.

3.12.2 Watershed Analysis

3.12.2.1 Hydrologic Model Development

Subbasin Delineation. The West Branch DuPage River drainage area was delineated based upon LiDAR topographic data developed by Cook County in 2003. Fifty-eight subbasins were delineated for the West Branch DuPage River Watershed, with an average size of 98.6 acres and total drainage area of 8.94 square miles (including areas outside of Cook County).

Reservoirs. The West Branch DuPage River model includes one flood control reservoir that was placed in service by the District in 1977. The Upper DuPage Reservoir in Hanover Park limits peak flows and detains stormwater runoff before pumping it back to the West Branch DuPage River. The reservoir was designed to provide 230 acre-feet of stormwater storage in the 100-year event. After storm events, the reservoir's pump station is manually activated if needed. The passive weir and storage provided by the reservoir were represented using the HEC-RAS model.

Hydrologic Parameter Calculations. CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The initial estimates for time of concentration and storage coefficient were determined as discussed in Section 1.3.2.1.

Adjustments made to hydrologic parameters during model calibration are discussed in Section 3.12.2.3. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.12.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. No hydraulic models that met District criteria were available for use in DWP development. The most recent modeling prepared for the watershed was in the mid 1990's. The existing hydrologic model included detailed stage-storage-discharge relationships for several detention basins and lakes in the watershed. In locations where new survey data was not obtained, these stage-storage-discharge relationships were verified for conformance with the current features and utilized in the HEC-HMS model. Surveys of the West Branch DuPage River, culvert or bridge crossings and instream weirs or dams were performed. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficients along the modeled stream length.

Boundary Conditions. The Metra railroad bridge provides a significant hydraulic restriction at the approximate location of the county line. The model was extended to 1000 downstream of this bridge and normal depth, assuming a friction slope of 0.005, was used as a downstream boundary condition of the model.

3.12.2.3 Calibration and Verification

Observed Data. There are no USGS stream gages on the West Branch DuPage River. However, the District has installed and operates two stream gages (level only) and one stage gage in the Upper DuPage Reservoir wet well. One stream gage is located directly adjacent to the reservoirs spillway, and the second stream gage (installed in May 2010) is on the pedestrian bridge at the Hanover Park WWTP. Complete gage records from the August 2007 event were unavailable, so the September 12, 2008 event and the July 23, 2010 were selected for calibration events. For West Branch DuPage River calibration, all rainfall was based on the records from the District's Hanover Park rain gage.

The September 12th to 14th, 2008 event resulted in 8.6 inches of rain at the Hanover Park rain gage. The July 23rd to 24th, 2010 event resulted in 4.58 inches of rainfall.

Calibration Adjustments. Model calibration was performed for the September 2008 and July 2010 storm events using stream gage records and observed high water marks. Flow and stage comparisons were made between the hydraulic model and the District's stream gages. The stream gages were surveyed to ensure that reported data was on the NAVD88 vertical datum.

The initial calibration runs resulted in low flood stages. Several model parameters were evaluated for potential adjustment including CN, Clark unit hydrograph time of concentration and Clark unit hydrograph storage coefficient. Adjustments were made to all three parameters. The final CN value selected represents AMC I plus 50% of the difference between CNs in the AMC I and AMC II condition. The time of concentration values were reduced by 10%. The storage coefficients were multiplied by a factor of 2.75.

Calibration Results. Table 3.12.4 presents the calibration results. There was only one gage active during the September 2008 storm, the monitored and modeled results are within 0.91 feet of each other. Figure 3.12.2 presents the stages on the river at the reservoir spillway. Figure 3.12.3 presents the monitored and modeled stages in the reservoir. The gage in the reservoir has a maximum upper limit of 782.7 feet, which is why the reported stage flatlines at this elevation for a portion of the stage hydrograph. Figure 3.12.4 presents the monitored and modeled stages for the July 2010 storm event. Reservoir stages did not track as closely during this event as during the 2008 event, however, the reservoir filled to less than half capacity and modeled storage was approximately 26% less than monitored storage volume at the end of the storm.

TABLE 3.12.4
West Branch DuPage River Calibration Summary

Date and Location	Monitored High Water Elevation (ft)	Modeled High Water Elevation (ft)	Difference (ft)
September 13, 2008 River at Reservoir	784.86	785.77	+0.91
September 13, 2008 Reservoir	782.7 maximum possible gage reading	785.76	n/a
July 23, 2010 River at Pedestrian Bridge adjacent to Hanover Park WWTP	785.86	785.58	-0.28
July 23, 2010 River at Reservoir	781.86	781.87	+0.01
July 23, 2010 Reservoir	772.10	769.71	-2.39

FIGURE 3.12.2
West Branch DuPage River Calibration for September 12, 2008 Event

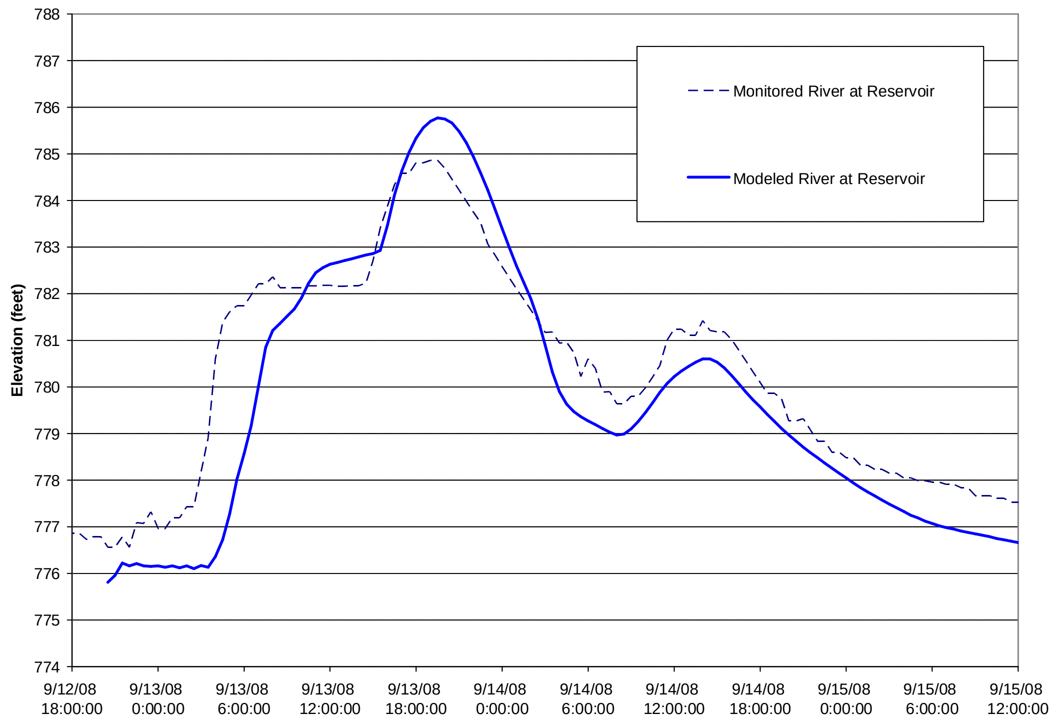


FIGURE 3.12.3
Upper DuPage Reservoir Calibration for September 12, 2008 Event

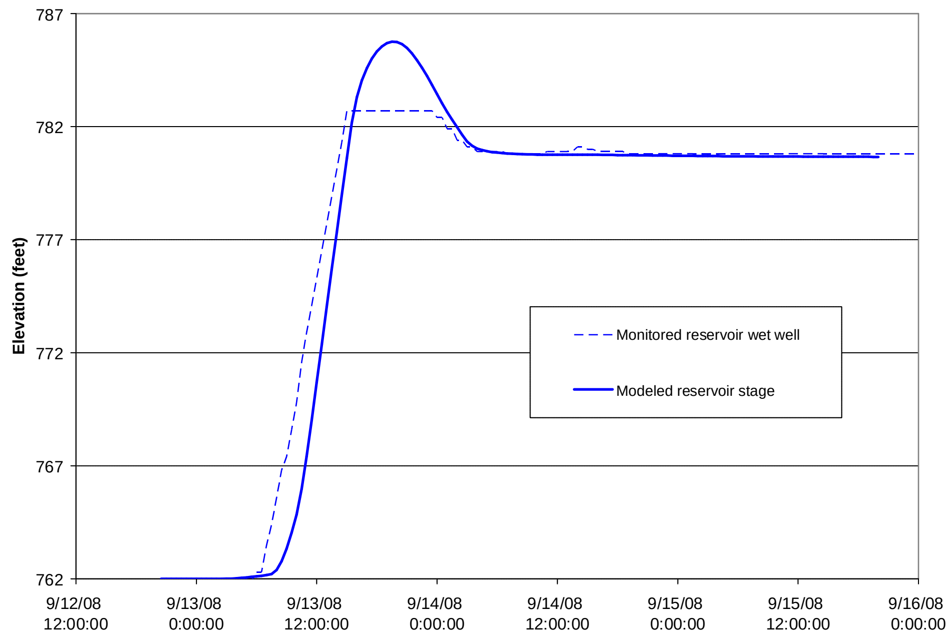
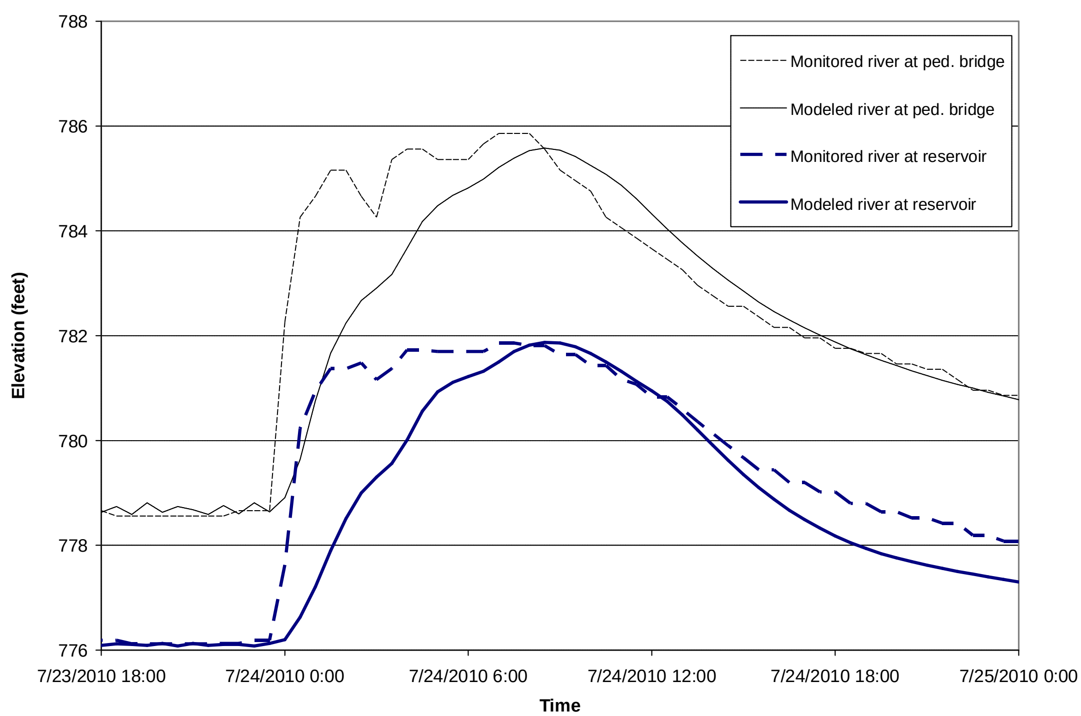


FIGURE 3.12.4
West Branch DuPage River Calibration for July 23, 2010 Event



In addition to the gage data, one WSEL measurement was taken on September 14, 2008. This measurement was taken over one day after the primary peak of the storm, during a smaller secondary peak. The measurement is indicative of reasonable model results and is summarized on Table 3.12.5.

TABLE 3.12.5
Observed Water Surface Elevation on West Branch DuPage River

Location	Observation Time	Observed Elevation	Model Elevation	Difference
Springinsguth Road	9/14/2008 15:05	794.0	793.7	-0.3

3.12.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Figure 3.12.1 shows inundation areas along West Branch DuPage River produced by the hydraulic model for the 100-year, 24-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions along the West Branch DuPage River. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

3.12.3 Development and Evaluation of Alternatives

3.12.3.1 Problem Definition

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. Table 3.12.6 summarizes problem areas identified through hydraulic modeling of the West Branch DuPage River. The first problem area, MPA-12, includes seven structures on Cornell Lane in Schaumburg. MPA-13 includes three structures that are located on Northway Drive in Hanover Park. MPA-14 includes three structures that are between Irving Park Road and Longmeadow Lane in Hanover Park.

TABLE 3.12.6
Modeled Problem Definition for West Branch DuPage River Watershed

Problem ID	Location	Recurrence Interval of Flooding (yr)	Related Form B (If any)	Resolution in DWP
MPA-12	Cornell Lane in Schaumburg	10, 25, 50, 100	none	All four alternatives that were considered benefit this area. No alternative was capable of solving flooding at the seven structures, but the depth and frequency of flooding was reduced. Additional measures such as floodproofing or acquisitions would be needed to eliminate the flood damages. MPA-12 includes $157,000 of property damages.
MPA-13	Along Northway Drive in Hanover Park	100	WBSC-3	Through provision of storage, alternatives WBMS-2 and WBMS-4 eliminates the computed damages associated with MPA-13. Due to shallow nature of flooding, properties are also candidates for protection using nonstructural flood control measures, such as floodproofing. MPA-13 includes $1,800 of property damages.
MPA-14	Along Edgebrook Lane in Hanover Park.	100	none	Through provision of storage, alternatives WBMS-2 and WBMS-4 eliminates damages at one structures and decreases the damages at two structures associated with MPA-14. Due to shallow nature of flooding, properties are also candidates for protection using nonstructural flood control measures, such as floodproofing. MPA-14 includes $6,500 of property damages.

3.12.3.2 Damage Assessment

Damages were assessed for the West Branch DuPage River over a 50-year period using the methodology outlined in Section 1.4.2 of this report and Section 6.6 of the CCSMP. Estimated damages are listed in Table 3.12.7.

TABLE 3.12.7
Estimated Damages for the West Branch DuPage River

Damage Category	Estimated Damage	Note
Property	$165,400	Includes 13 structures.
Transportation	$24,800	Assumed as 15% of property damage due to flooding.

3.12.3.3 Technology Screening

Flood control technologies were screened to identify those most appropriate for addressing the flooding problems along the West Branch DuPage River. Increased conveyance and, storage were identified as potential technologies for addressing the flooding problems. Due to the shallow flooding, floodproofing may also be appropriate for structures that are too low to be feasibly protected.

3.12.3.4 Alternative Development

Flood Control Alternatives. Alternative solutions to regional flooding were developed and evaluated consistent with the methodology described in Section 1.4 of this report. Four flood control alternatives were developed to address overbank flooding problems from the West Branch DuPage River. The alternatives are summarized in Table 3.12.8.

Alternative WBMS-1 proposes to improve the channel by lowering the bottom and removing woody vegetation along the sideslopes. The channel would be lowered starting at the west end of Atcher Park extending 4,400 feet to the west end of Jay Cee Park. The lowered channel invert results in a more uniform channel profile and expands the capacity of the Springinsguth Road culvert. According to the Village of Schaumburg, the invert of this culvert was installed several feet below the existing channel elevation. So the capacity of this culvert can be increased without modifying the structure itself. One pedestrian bridge is removed as part of the project and 4 acre-feet of compensatory storage must be constructed in Atcher Park. This alternative addresses the damages associated with MPA-12 while limiting downstream WSEL increases to less than 0.1 foot.

Alternative WBMS-2 proposes to construct a 37 acre-foot detention basin and relocate 1,000 feet of channel. This is a reduced version of the Basin A plan proposed by the District in the 1970's as part of the overall flood control plan for the West Branch DuPage River. The Basin A plan was a very aggressive proposal that involved a 35-foot deep facility that provided 110 acre-feet of storage and enclosed the channel in a concrete bypass culvert. The "reduced" version developed for the Poplar Creek DWP, provides 37 acre-feet of storage with a maximum depth of 26 feet. Also, the river is routed around the outside of the basin as open channel. The alternative solves four of the six damaged structures associated with MPA-13 and MPA-14 and slightly benefits the structures at MPA-12.

Alternative WBMS-3 extends the channel improvements in WBMS-1 in the upstream direction to a total length of 6,300 feet. The alternative includes replacing the existing CMP culvert crossings at Syracuse Lane and Braintree Drive with larger concrete box structures. The proposed alternative concrete box culverts are not consistent with the double 9-foot by 6-foot concrete box culvert replacements that are planned by Schaumburg. Additional analysis may be needed by Schaumburg or by a preliminary design team to accommodate the differences in the two plans. This alternative increases the benefits identified for WBMS-1 by further lowering the WSELs at MPA-12 while limiting downstream WSEL increases to less than 0.1 foot.

Alternative WBMS-4 is a combination of WBMS-1 and WBMS-2. While the cost for WBMS-4 is essentially the sum of the costs for WBMS-1 and WBMS-2, the associated benefits are not additive.

TABLE 3.12.8
Flood Control Alternatives for West Branch DuPage River

Alternative	Problem Addressed	Location	Description
WBMS-1	Flooding	4,400 feet of channel starting in Atcher Park and ending upstream of Springinsguth Road in Jay Cee Park	Improve channel by lowering and removing woody vegetation. The existing invert of the Springinsguth culvert is buried several feet below the channel bottom, so replacement of this structure is not necessary. Also remove one pedestrian bridge and provide 4 acre-feet of compensatory storage.
WBMS-2	Flooding	Atcher Park in Hanover Park	Construct a 37 acre-foot detention basin and relocate 1,000 feet of channel.
WBMS-3	Flooding	6,300 feet of channel starting in Atcher Park and ending adjacent to Cornell Lane cul-de-sac.	This alternative extends the channel improvements in WBMS-1 to a total length of 6,300 feet. Improve channel by lowering and removing woody vegetation. Remove one pedestrian bridge and provide 4 acre-feet of compensatory storage in Atcher Park. Replace river crossings at Syracuse Lane and Braintree Drive.
WBMS-4	Flooding	4,400 feet of channel starting in Atcher Park and ending upstream of Springinsguth Road in Jay Cee Park	This alternative is the combination of WBMS-1 and WBMS-2.

3.12.3.5 Alternative Evaluation and Selection

The alternatives listed in Table 3.12.8 were evaluated to determine their effectiveness and produce data required for the countywide prioritization of watershed projects. Each flood control alternative was modeled to evaluate its impact on water elevations and flood damages. Developed alternatives result in reduced stage and/or flow along the modeled waterways. Table 3.12.9 provides a comparison of the modeled maximum WSEL, and modeled flow at the time of peak at representative locations along the waterway for all four alternatives. Alternatives WBMS-1, WBMS-3 and WBMS-4 have benefits upstream of Atcher Park due to the channel improvements that are included. The developed alternatives are not fully capable of solving the identified property and transportation damages. Alternative 3 resulted in the largest benefits and the most favorable benefit cost ratio. Alternative 3 solves flooding at four properties, while 9 properties are still subject to damage by the 100-year event.

These properties are at risk of shallow flooding during both existing conditions and any of the alternative conditions. Such properties are candidates for protection using nonstructural flood control measures, such as flood-proofing or acquisition. These measures may be considered to address damages that are not fully addressed by capital projects recommended in the Poplar Creek DWP.

3.12.3.6 Data Required for Countywide Prioritization of Watershed Project

Appendix I presents conceptual level cost estimates for the recommended alternatives. Table 3.12.10 lists the total estimated cost, benefits, and B/C ratio for each alternative. Figure 3.12.5 shows the recommended alternative for the West Branch DuPage River and a comparison of the existing conditions inundation mapping and inundation mapping for recommended flood control alternative WBMS-1.

TABLE 3.12.9
West Branch DuPage River Existing and Alternative Condition Flow and WSEL Comparison

		Existing Conditions		WBMS-1		WBMS-2		WBMS-3		WBMS-4	
Location	**Station (ft)**	**Max WSEL (ft)**	**Max Flow (cfs)**	**Max WSEL (ft)**	**Max Flow (cfs)**	**Max WSEL (ft)**	**Max Flow (cfs)**	**Max WSEL (ft)**	**Max Flow (cfs)**	**Max WSEL (ft)**	**Max Flow (cfs)**
Cambridge Lane	17598.92	799.19	137	798.72	139	799.04	138	798.47	139	798.67	139
Braintree Drive	16867.32	798.87	266	798.25	269	798.67	268	798.13	269	798.17	270
Syracuse Lane	16019.88	798.28	274	797.45	277	798.01	275	797.41	277	797.31	278
Springinsguth Rd.	14134.45	796.98	357	796.00	362	796.26	360	795.98	361	795.56	364
Northway Drive	10369.74	793.92	581	793.94	588	792.86	558	793.93	587	792.98	571
Upstream of enclosed channel	8983.93	792.31	643	792.34	650	791.57	621	792.32	648	791.70	634
Longmeadow Lane	8983.93	788.14	726	788.17	733	787.80	707	788.17	732	787.84	720
Walnut Ave.	4025.060	786.20	794	786.26	802	785.83	778	786.26	801	785.84	791
Metra Railroad Bridge	1101.897	785.28	659	785.34	662	784.86	644	785.35	663	784.87	654

TABLE 3.12.10
West Branch DuPage River Project Alternative Matrix to Support District Capital Improvement Program Prioritization

Project	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures Protected	Water Quality Benefit	Recommended	Communities Involved
WBMS-1	Channel improvements	0.027	$83,700	$3,050,600	0	Slightly positive	No	Schaumburg, Hanover Park
WBMS-2	Construction of detention basin	0.003	$21,400	$6,728,900	4	Slightly positive	No	Hanover Park
WBMS-3	Channel improvements, replacement of two cross-ings	0.032	$141,500	$4,462,700	0	Slightly positive	Yes	Schaumburg, Hanover Park
WBMS-4	Channel improvements and construction of reservoir	0.009	$87,300	$9,779,500	4	Slightly positive	No	Schaumburg, Hanover Park

Note: Net Benefits values do not include local benefits or non-economic benefits.

4. Watershed Action Plan

This section summarizes the DWP recommendations. The recommendations and supporting information will be considered by the District's Board of Commissioners in their prioritization of a countywide Stormwater CIP. The recommendations within the DWP consist of maintenance activities (Section 4.1) and recommended capital improvements (Section 4.2).

4.1 Watershed Maintenance Activities

Review of reported stormwater problem data indicated that certain types of maintenance activities would be helpful in preventing these stormwater problems. The District, through its maintenance activities, has been actively removing blockages such as tree limbs and woody debris from channels throughout the Cook County. Local communities have reported benefits from these maintenance activities. It is recommended that the District maintenance activities be continued to address ongoing future maintenance needs.

Sedimentation is a dynamic process that is affected by soil protective measures taken in upland tributary areas as well as dynamic streambank conditions. The District's Watershed Management Ordinance will define standard practices for erosion protection on construction sites. Best management practices in upland areas should be paired with stream maintenance measures to reduce sediment delivered to waterways to reduce the need for extensive dredging programs.

Stormwater improvement projects recommended in the Poplar Creek DWP including culvert and bridge replacements, detention basins, channel improvements, or erosion control armoring, will require ongoing maintenance after construction. Costs associated with maintenance over a 50-year life-cycle period were included in cost estimates. It is recommended that the District develop maintenance plans for capital improvements, and where applicable, execute agreements with local governments, delegating certain maintenance responsibilities. Maintenance agreements will follow current District practice, where the District is responsible for operation and maintenance of structural, electrical, and mechanical facilities and grounds are the responsibility of partnering organizations.

Table 4.1.1 lists all problem area locations where standard stream maintenance activities are recommended primarily involving the monitoring and removal of debris and blockages, should they occur.

TABLE 4.1.1
Summary of Problem Areas where Debris Removal is Recommended

Problem Area ID or Modeled Problem Area	Waterway	Location	Type of Maintenance Activity Required
PCHE-1	Poplar Creek Mainstem	Golf Road crossing of Poplar Creek west of Barrington Road in Hoffman Estates	Pavement flooding reported by IDOT, but model results indicated it is not a result of overbank flooding when channel is freely flowing. However, the large debris pile upstream of this crossing indicates that there is possibility that the crossing has experienced debris problems in the past. Upstream face should be monitored for debris and removed when necessary.
MPA-8	Spring Creek	Penny Road crossing of Spring Creek	Monitor upstream face of this crossing for debris and remove when necessary. Debris was likely responsible for road inundation during September 2008 event.

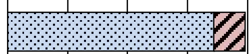
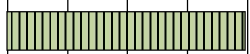
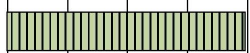
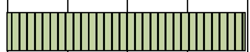
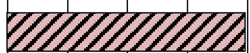
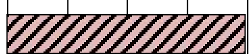
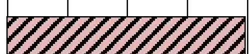
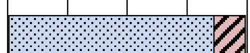
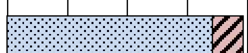
4.2 Recommended Capital Improvements

Table 4.2.1 lists all recommended improvements for the Poplar Creek DWP. The District will use data presented here to support prioritization of a countywide stormwater CIP.

4.3 Implementation Plan

Alternatives listed in Table 4.2.1 can be constructed independently. The data presented in Table 4.2.1, along with noneconomic factors, will allow the District to prioritize its CIP and to implement projects. A number of alternatives in Table 4.2.1 require the acquisition of land that currently may be unavailable. It is recommended that upon selecting an alternative for implementation, the District identify land acquisition needs and procedures.

TABLE 4.2.1
Poplar Creek DWP Prioritization Matrix

Project	B/C Ratio	Total Benefits ($)	Total Project Cost ($)	Probable Construction Cost ($)	Relative Damage Averted 25% 50% 75%	Acreage Removed from Inundation Area	Wetland or Riparian Area Impacted (acres)	Cumulative Structures Protected	Implementation Time [1] (months)	Water Quality Benefit	Communities Involved
PCMS-2	0.07	2.99 M	45.15 M	25.18 M		195.8	5.7	217	36	Slightly positive	Elgin (including portions of Elgin in Kane County)
PCMS-3	0.56	0.40 M	0.72 M	0.38 M		0	0.2	1	6	Slightly positive	Elgin
PCMS-4	0.47	0.35 M	0.75 M	0.40 M		0	0.2	1	6	Slightly positive	Elgin
PCMS-5	0.79	0.69 M	0.87 M	0.87 M		0	0.2	2	6	Slightly positive	Elgin
PCSH-1	0.08	0.25 M	3.28 M	1.92 M		0.8	<0.1	0	6	Slightly positive	Hoffman Estates
PCRR-1	0.002	0.002 M	1.49 M	0.95 M		1.6	<0.1	0	6	Slightly positive	Hoffman Estates
SCTD-1	0.18	0.32 M	1.65 M	1.05 M		0	<0.1	0	6	Slightly positive	Barrington Hills
BCMS-1	0.08	0.50 M	6.04 M	4.65 M		3.5	<0.1	12	12	Slightly positive	Bartlett
WBMS-3	0.03	0.14 M	4.46 M	3.04 M		4.4	8.7	0	18	Slightly positive	Schaumburg, Hanover Park

Property Damage | Erosion | Transportation | Recreation

1. Implementation time includes construction time, but does not include time for design, permitting or land acquisition.

5. Summary and Conclusions

The Poplar Creek DWP was developed in coordination with the Poplar Creek WPC. The coordination focused on integrating community knowledge of stormwater problems and ideas for feasible solutions into the District's regional stormwater plan. All stormwater problem data received from stakeholders was recorded in a spatial database, and classified as local or regional according to the criteria defined in Section 1. H&H models were developed to estimate flow and stage along regional waterways and assess the frequency and depth of flooding problems for a range of modeled recurrence intervals. Inundation mapping was developed for the 2-, 5-, 10, 25, 50, 100-year, and 500-year modeled storm events, identifying areas estimated to be at risk of flooding. Modeled water depths and inundation mapping were used to help estimate damages due to flooding within each tributary.

Stormwater improvements were developed to address regional problems throughout the Poplar Creek study area. Appropriate tributary-specific technologies were screened considering their applicability for addressing problem areas, constructability in the area required, and regulatory feasibility. The potential impact of future development conditions on recommended alternatives was considered. Damage estimates for proposed alternatives were performed to evaluate the alternative's effectiveness at reducing regional stormwater damages. The difference in damages between existing and alternative conditions was quantified as the alternative's benefit. In addition to numeric benefits, several other criteria were noted for each alternative, such as the number of structures protected, water-quality benefit, and wetland and riparian areas affected. Conceptual level cost estimates were developed to estimate the construction and maintenance cost of proposed alternatives over a 50-year period. The estimated benefits were divided by the conceptual cost to develop a B/C ratio for each alternative.

Table 5.1 illustrates the potential of alternatives within the DWP to address regional damages throughout the watershed. Subwatersheds that are not listed did not have any identified damages or they didn't have any recommended projects.

TABLE 5.1
Poplar Creek DWP Alternatives Summary

Subwatershed	Existing Conditions Damages	Benefits from Recommended Alternatives	Percent of Damages Addressed	Benefit Cost Ratio
Poplar Creek Mainstem	$5,839,700	$4,429,100	76%	0.09
Spring Creek	$1,006,000	$321,200	32%	0.19
Brewster Creek	$498,800	$498,800	100%	0.08
Poplar Creek Schaumburg Branch	$407,900	$252,000	62%	0.08
West Branch DuPage River	$190,200	$141,500	74%	0.03
Poplar Creek Railroad Tributary	$2,300	$2,300	100%	0.002
Total	$7,944,900	$5,644,900	71%	0.09

Recommended alternatives are estimated to reduce regional damages by $2,323,100 over a 50-year period, at an estimated cost of $64,497,700. Estimated damage reductions result from proposed stormwater improvements that increase storage in the watershed, thereby reducing peak flows and stage, increasing conveyance to receiving systems (only if increased flows do not cause downstream damages), or channel protection measures to reduce erosion damages. Floodproofing alternatives, though feasible for addressing isolated shallow flooding issues, are not included in the summary statistics due to the individualized way in which such measures would be implemented. Benefits from proposed projects are not distributed evenly throughout the watershed, but generally concentrated in subwatersheds with greater existing conditions damages where capital improvement projects are able to these grouped damages. Recommended solutions vary in their ability to address all damages from the 100-year inundation areas. Sufficient land is not always present in locations that can reduce floodwaters to eliminate inundation of structures along regional waterways. In some cases, the additional benefits derived by elimination of remaining areas of shallow flooding in the 100-year event were far outweighed by the marginal costs to expand the alternative under consideration. Benefit cost ratios were already generally low, and some damages (which could be addressed through non-structural alternatives) were allowed to remain to derive a more favorable project.

Stormwater problems, whether identified by stakeholders or identified by modeling of intercommunity waterways, indicate a need for regional stormwater management solutions throughout the Poplar Creek study area. Problems are concentrated in the more intensively developed, southern areas of the study area. In general, significant stormwater problems do not exist throughout the watershed. If constructed, the recommended alternatives in Table 4.2.1 are expected to reduce stormwater damages, although damages are expected to persist within the study area even following construction of those projects. However, implementation of the recommended projects should reduce the number of homes and businesses adversely affected by flooding, and also the severity of damages. Communities can continue to work toward reducing stormwater damage by ensuring that development is responsibly managed with consideration given to potential stormwater impacts and the existing stormwater problems within the watershed.

6. References

Applied Ecological Services. 2008. *Flint Creek Watershed-Based Plan.* Flint Creek Watershed Partnership, Barrington, Illinois.

Bartosova, Alena, Jaswinder Singh, Mustafa Rahim, and Sally McConkey. September 2007. Fox River Watershed Investigation: Stratton Dam to the Illinois River Phase II Hydrologic and Water Quality Simulation Models Part 3 Validation of Hydrologic Model Parameters, Brewster Creek, Ferson Creek, Flint Creek, Mill Creek, and Tyler Creek Watersheds. ISWS, Champaign, Illinois.

Bartosova, Alena, Jaswinder Singh, Mustafa Rahim, and Sally McConkey. September 2007. Fox River Watershed Investigation: Stratton Dam to the Illinois River Phase II Hydrologic and Water Quality Simulation Models Part 3 Validation of Hydrologic Model Parameters, Brewster Creek, Ferson Creek, Flint Creek, Mill Creek, and Tyler Creek Watersheds. ISWS, Champaign, Illinois

Bartosova, Alena, Jaswinder Singh, Mustafa Rahim, and Sally McConkey. June 2007. Fox River Watershed Investigation: Stratton Dam to the Illinois River Phase II Hydrologic and Water Quality Simulation Models Part 2 Blackberry and Poplar Creek HSPF Models, Calibration and Initial Simulation Results. ISWS, Champaign, Illinois

Chicago Metropolitan Agency for Planning (CMAP). July 2007. *Poplar Creek Watershed Action Plan.* CMAP, Chicago, Illinois.

Christopher B. Burke Engineering West, Ltd. December 22, 2005. *West Branch DuPage River Watershed Plan.*

CH2M Hill. October 2004. Total Maximum Daily Loads for West Branch DuPage River, llanos. IEPA, Springfield, Illinois.

Federal Emergency Management Agency (FEMA). 2003. Guidelines and Specifications for Flood Hazard Mapping, Appendix A: Guidance for Aerial Mapping.

FEMA. 2001. "What is a Benefit?" Guidance on Benefit Cost Analysis of Hazard Mitigation Projects.

Ford, Charles R. and John R. Scheaffer. 1988. *An Evaluation of Floodwater Storage.* Forest Preserve District of Cook County (FPDCC), River Forest, Illinois.

Huff, Floyd Al, and James R. Angel. 1992. *Rainfall Frequency Atlas of the Midwest*. Illinois State Water Survey, Champaign, Bulletin 71.

Illinois Department of Transportation (IDOT)-Division of Water Resources (DWR). 1998. Report on the Regulation of Construction within the Flood Plain of Poplar Creek and Tributaries, Cook and Kane Counties. IDOT, Springfield, Illinois.

Illinois Department of Transportation. 1980. Strategic Planning Study for Flood Control, Justice, Illinois. September.

Illinois Environmental Protection Agency (IEPA)- Bureau of Water. 2008. *Illinois Integrated Water Quality Report and Section 303(d) List - 2008 DRAFT.* IEPA, Springfield, Illinois

IEPA. 2002. Water Monitoring Strategy 2002 – 2006. IEPA, Springfield, Illinois

Harza, Inc. October 1971. Village of Hanover Park, Illinois, West Branch DuPage River Flood Control Plan. Harza, Chicago, Illinois

McConkey, Sally, Alena Bartosova, Lian-Shin Lin, Karla Andrew, Michael Machesky, and Chris Jennings. March 2004. Fox River Watershed Investigation – Stratton Dam to the Illinois River: Water Quality Issues and Data Report to the Fox River Study Group, Inc. ISWS, Champaign, Illinois.

Metropolitan Water Reclamation District of Greater Chicago (District). 2007. *Cook County Stormwater Management Plan*.

Metropolitan Water Reclamation District of Greater Chicago (District). 2006. *M&O Facilities Handbook*.

National Oceanic and Atmospheric Administration (NOAA). 2001. *Guidelines for Establishing GPS-Derived Ellipsoid Heights (Standards: 2 CM and 5 CM).* Technical Memorandum NOS NGS-58. Version 4.3.

NIPC. 2002. *Poplar Creek Stream Inventory.* NIPC, Chicago, Illinois.

Poplar Creek Steering Committee, US Department of Agriculture Soil Conservation and Forest Service, Metropolitan Sanitary District of Greater Chicago, and the State of Illinois. May 1976. *Floodwater Management Plan and Environmental Assessment – Poplar Creek, Cook and Kane Counties, Illinois.* Popular Creek Steering Committee.

Price, Thomas, Frank Lan, Jerry Robinson, and Erik Gil. January 2003. *Hydraulic Evaluation of HSPF Model for West Branch DuPage River Watershed*.

Conservation Design Forum, URS Corporation, and Christopher B. Burke Engineering Ltd., Illinois. Price, Thomas. September 1994. *Meteorological Database Extension and Hydrologic Model Verification of HSPF Model for DuPage County*. NIPC, Chicago, Illinois.

Price, Thomas. March 1994. Hydrologic Calibration of HSPF Model for DuPage County: Including Hydraulic Evaluation. NIPC, Chicago, Illinois.

Resource Coordination Policy Committee. *1998. Our Community and Flooding*. MWRD, Chicago, Illinois

US Army Corps of Engineers (US ACOE). June 1975. Flood Plain Information Report, West Branch DuPage River, Kress and Klein Creeks, DuPage County, Illinois.

U.S. Army Corps of Engineers. 2006. HEC-HMS Technical Reference Manual.

U.S. Army Corps of Engineers. 2003. *Technical Guidance Memorandum EGM 04-01*.

United States Department of Agriculture, Natural Resource Conservation Service. 1986. *Urban Hydrology for Small Watersheds.* Technical Release No. 55.

United States Geologic Survey. 1982. A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams.

United States Geologic Survey. 1996. Equations for Estimating Synthetic Unit-Hydrograph Parameter Values for Small Watersheds in Lake County, Illinois.

United States Geologic Survey. 2004. Estimating Flood-Peak Discharge Magnitude and Frequencies for Rural Streams in Illinois.

United States Geologic Survey. 2000. Equations for Estimating Clark Unit-Hydrograph Parameters for Small Rural Watersheds in Illinois, Water Resources Investigation Report 00-4184.

URS. 2003. FEQ Hydraulic Modeling of West Branch DuPage River.

Final Report

Detailed Watershed Plan for the Poplar Creek Watershed Study Area: Volume 2

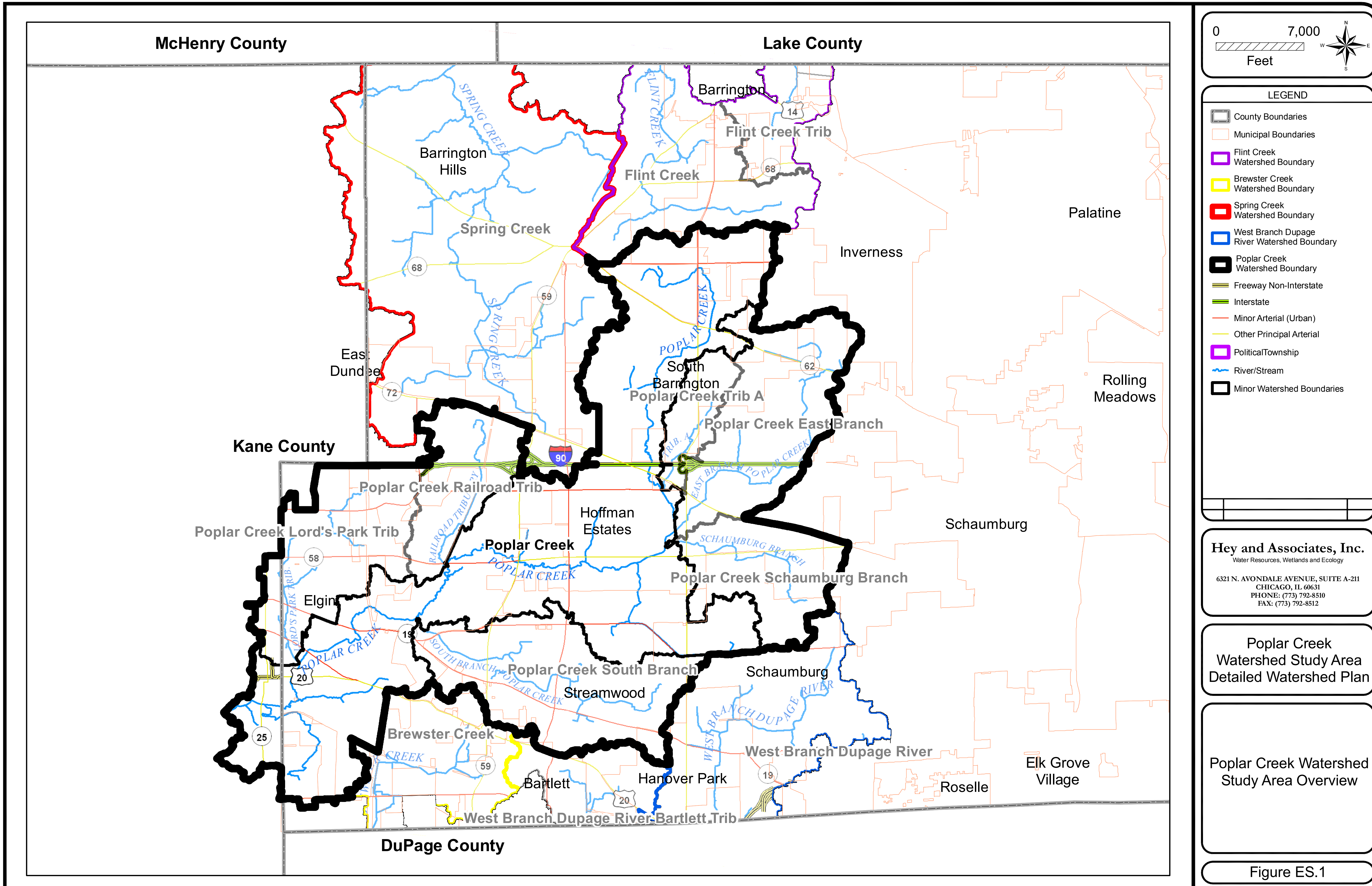
Figures and
Appendix H: Hydraulic Profiles for Existing Conditions

Prepared for

Metropolitan Water Reclamation District of Greater Chicago

December 2010

Hey and Associates, Inc.


McHenry County
Lake County
Kane County
DuPage County
Barrington
Barrington Hills
Flint Creek Trib
Flint Creek
Spring Creek
Palatine
Inverness
East Dundee
South Barrington
Poplar Creek Trib A
Poplar Creek East Branch
Rolling Meadows
Poplar Creek Railroad Trib
Poplar Creek Lord's Park Trib
Hoffman Estates
Poplar Creek
Schaumburg
Poplar Creek Schaumburg Branch
Elgin
Poplar Creek South Branch
Streamwood
Schaumburg
Brewster Creek
West Branch Dupage River
Bartlett
Hanover Park
Roselle
Elk Grove Village
West Branch Dupage River Bartlett Trib
0
7,000
Feet
LEGEND
County Boundaries
Municipal Boundaries
Flint Creek Watershed Boundary
Brewster Creek Watershed Boundary
Spring Creek Watershed Boundary
West Branch Dupage River Watershed Boundary
Poplar Creek Watershed Boundary
Freeway Non-Interstate
Interstate
Minor Arterial (Urban)
Other Principal Arterial
PoliticalTownship
River/Stream
Minor Watershed Boundaries
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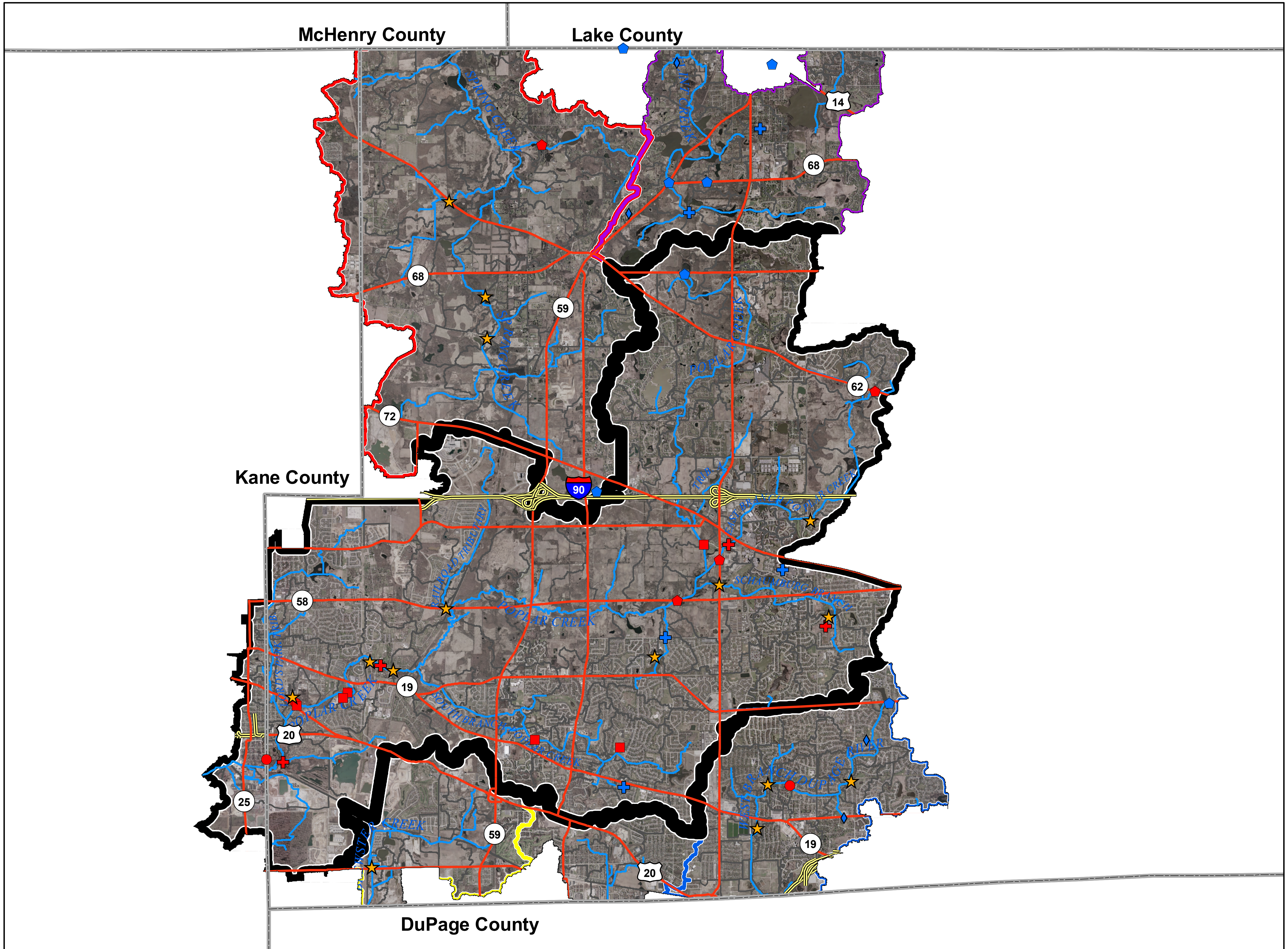
PHONE: (773) 792-8510
FAX: (773) 792-8512
Poplar Creek Watershed Study Area Detailed Watershed Plan
Poplar Creek Watershed Study Area Overview
Figure ES.1



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Feet

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LEGEND

Problem Area Identified Through Modeling

Problem Types
Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat

- Flint Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Spring Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Poplar Creek Watershed Boundary
- County Boundaries
- River/Stream
- Subbasins

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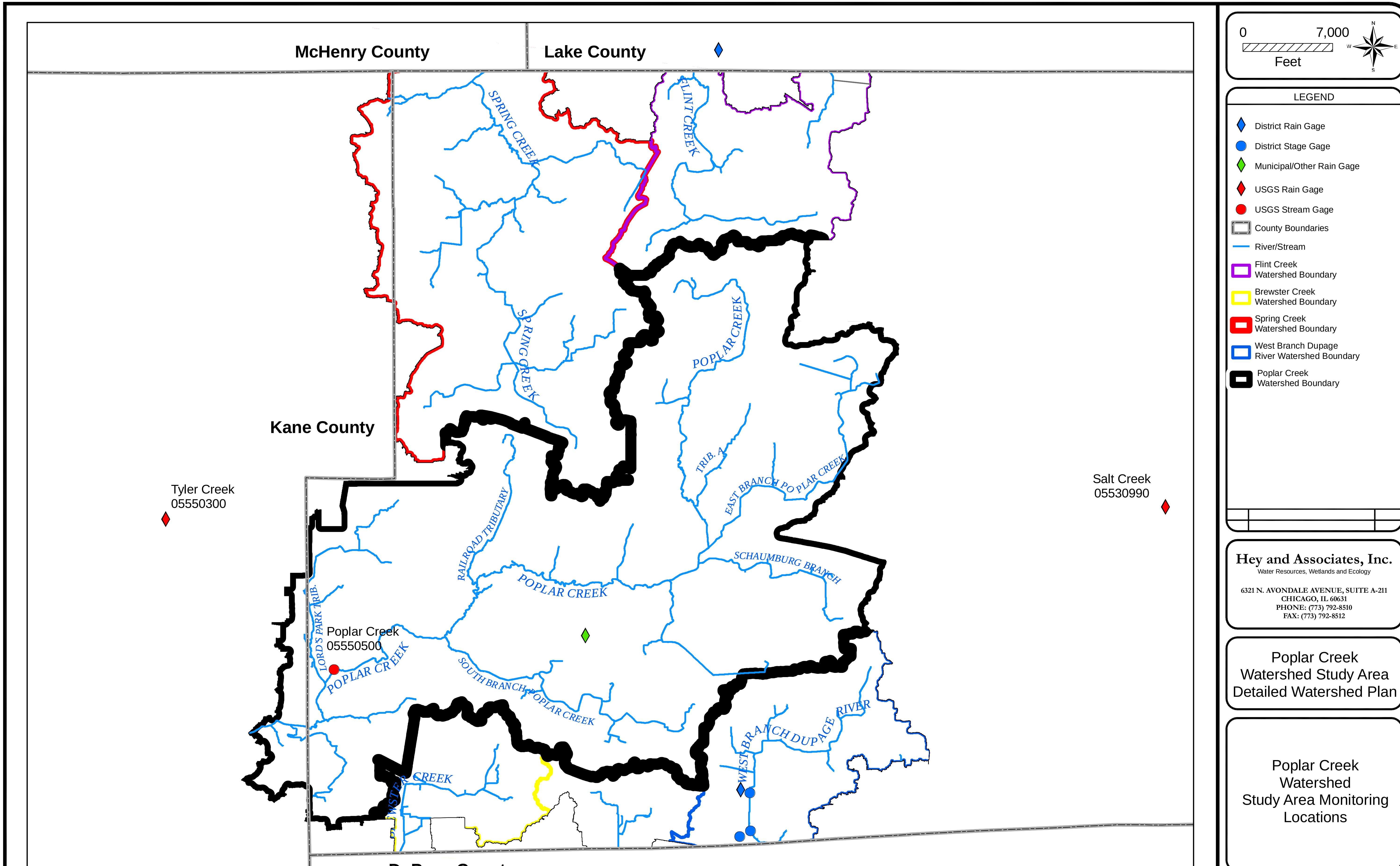
Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Watershed Study Area Problem Locations

Figure 2.2.1


McHenry County
Lake County
Kane County
DuPage County
Tyler Creek
05550300
Salt Creek
05530990
Poplar Creek
05550500
SPRING CREEK
FLINT CREEK
POPLAR CREEK
TRIB. A
EAST BRANCH POPLAR CREEK
SCHAUMBURG BRANCH
RAILROAD TRIBUTARY
LORD'S PARK TRIB.
SOUTH BRANCH POPLAR CREEK
WEST BRANCH DUPAGE RIVER
0
7,000
Feet
LEGEND
District Rain Gage
District Stage Gage
Municipal/Other Rain Gage
USGS Rain Gage
USGS Stream Gage
County Boundaries
River/Stream
Flint Creek Watershed Boundary
Brewster Creek Watershed Boundary
Spring Creek Watershed Boundary
West Branch Dupage River Watershed Boundary
Poplar Creek Watershed Boundary
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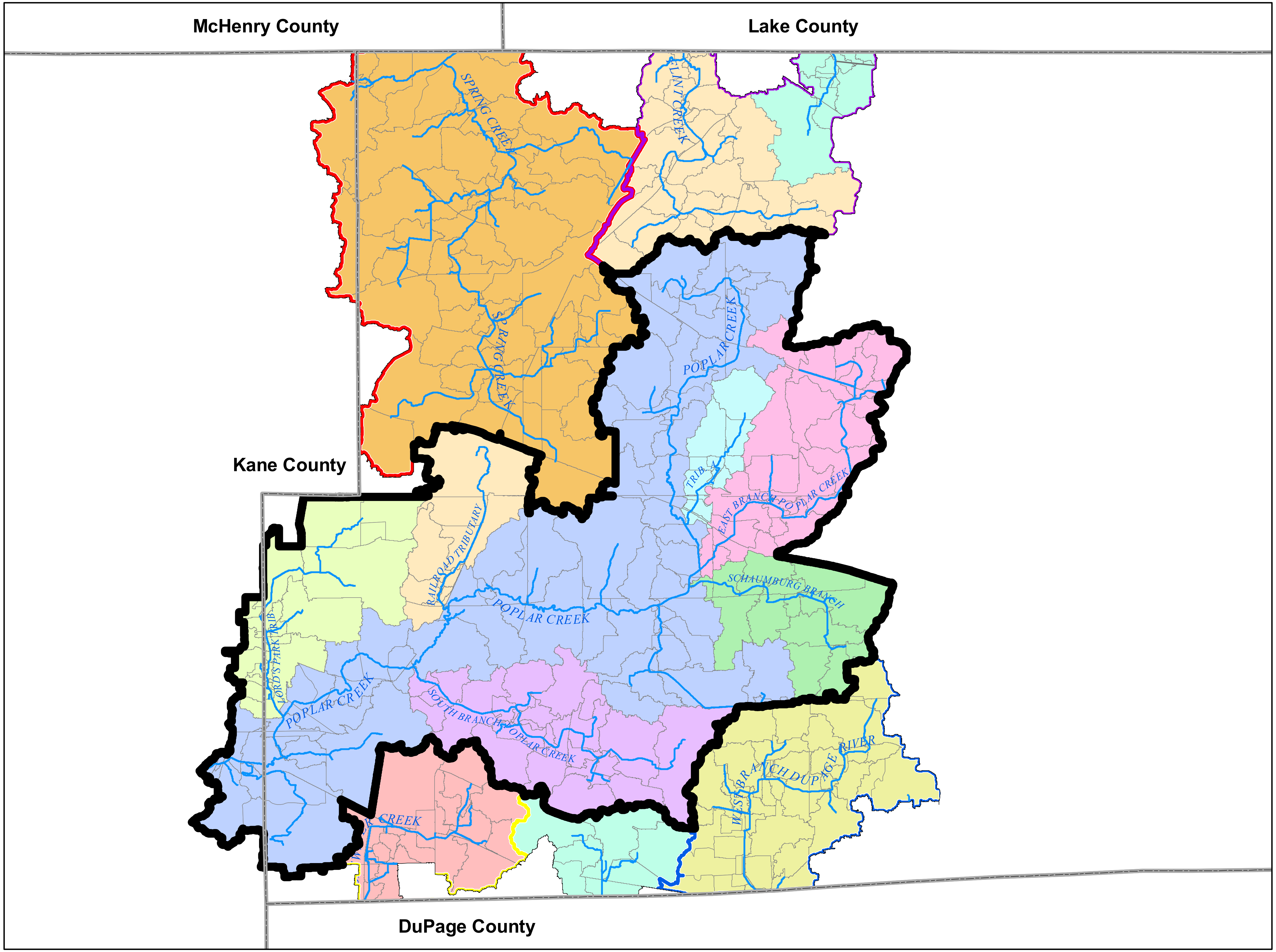
Poplar Creek Watershed Study Area Detailed Watershed Plan
Poplar Creek Watershed Study Area Monitoring Locations

Figure 2.3.1



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Feet

LEGEND

- County Boundaries
- River/Stream
- Flint Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Spring Creek Watershed Boundary
- Poplar Creek Watershed Boundary
- Subbasins

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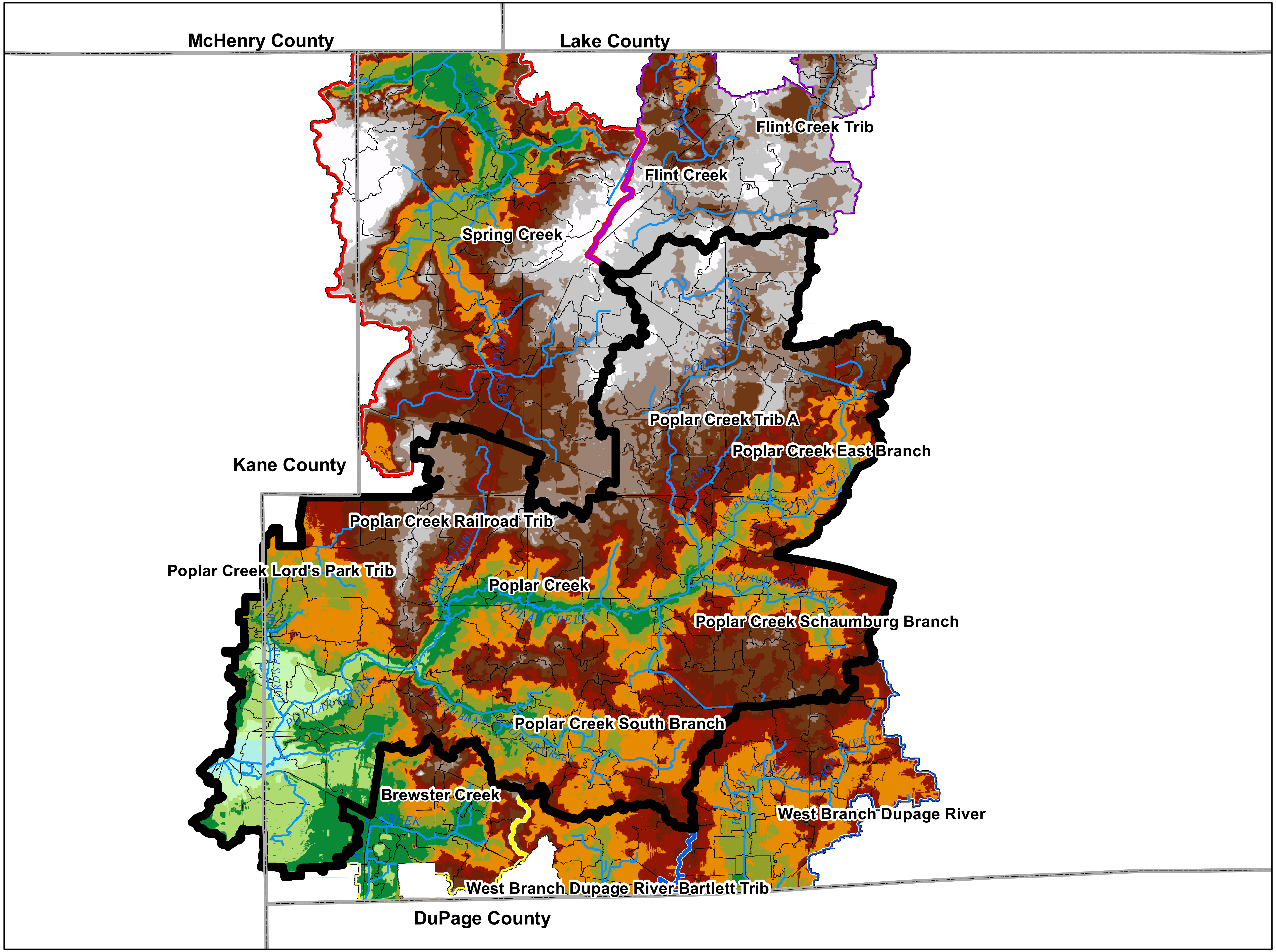
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek Watershed
Study Area
Subwatersheds

Figure 2.3.2



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Feet

LEGEND

- County Boundaries
- River/Stream
- Flint Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Spring Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Poplar Creek Watershed Boundary
- Subbasins

Elevation

- 690 - 720
- 720 - 740
- 740 - 760
- 760 - 780
- 780 - 795
- 795 - 810
- 810 - 820
- 820 - 830
- 830 - 845
- 845 - 860
- 860 - 885
- 885 - 948.4

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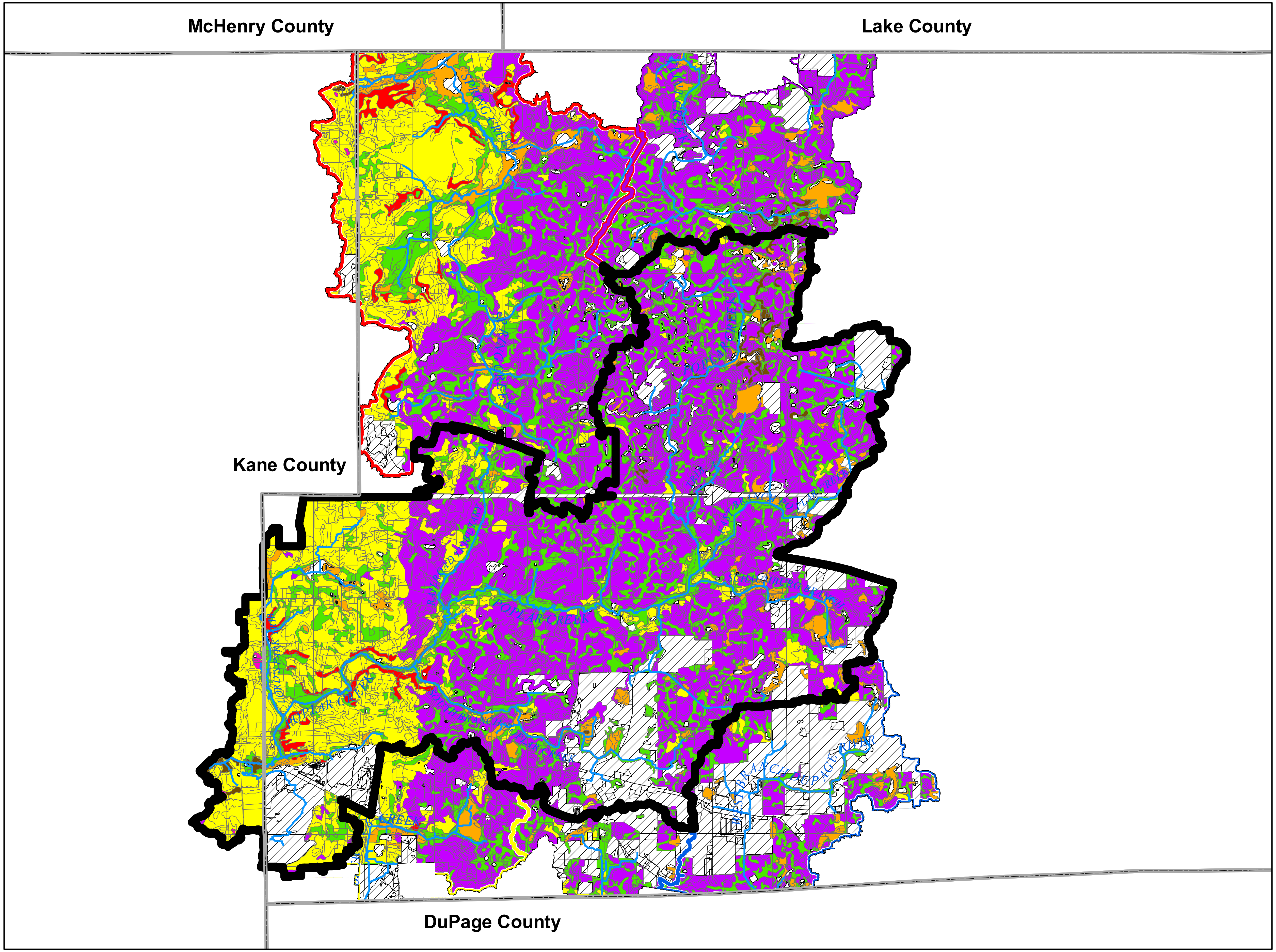
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek
Watershed
Study Area Topography
and Drainage Network

Figure 2.3.3



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Feet

LEGEND

- County Boundaries
- River/Stream
- Flint Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Spring Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Poplar Creek Watershed Boundary

Hydrologic Soil Group

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Unmapped Soil Area
- Subbasins

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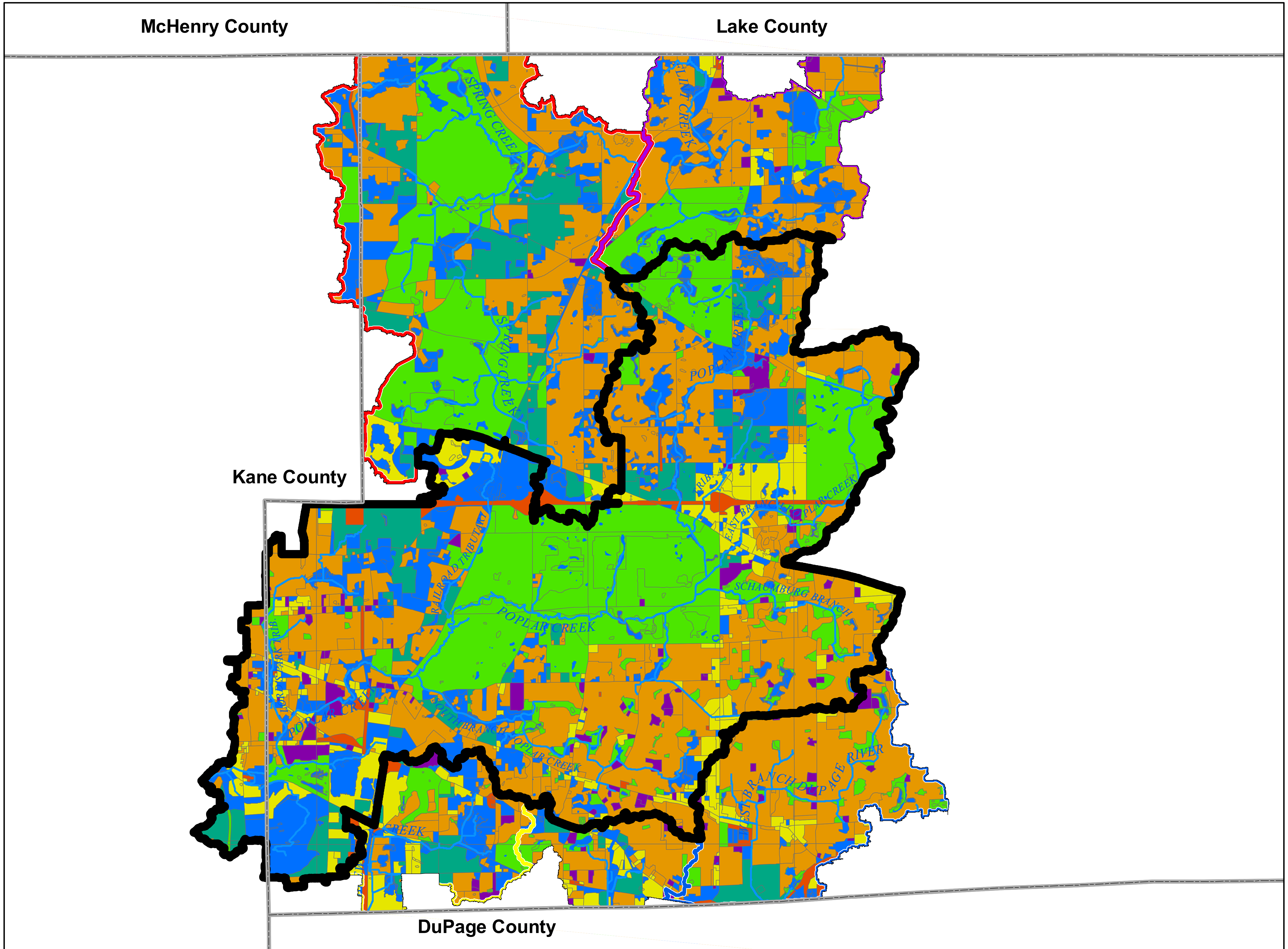
Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Watershed Study Area Hydrologic Soil Groups

Figure 2.3.4



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LEGEND

- County Boundaries
- River/Stream
- Flint Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Spring Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Poplar Creek Watershed Boundary

Landuse Category

- Agricultural
- Commercial/Industrial
- Forest/Open Land
- Institutional
- Residential
- Transportation/Utility
- Water/Wetland

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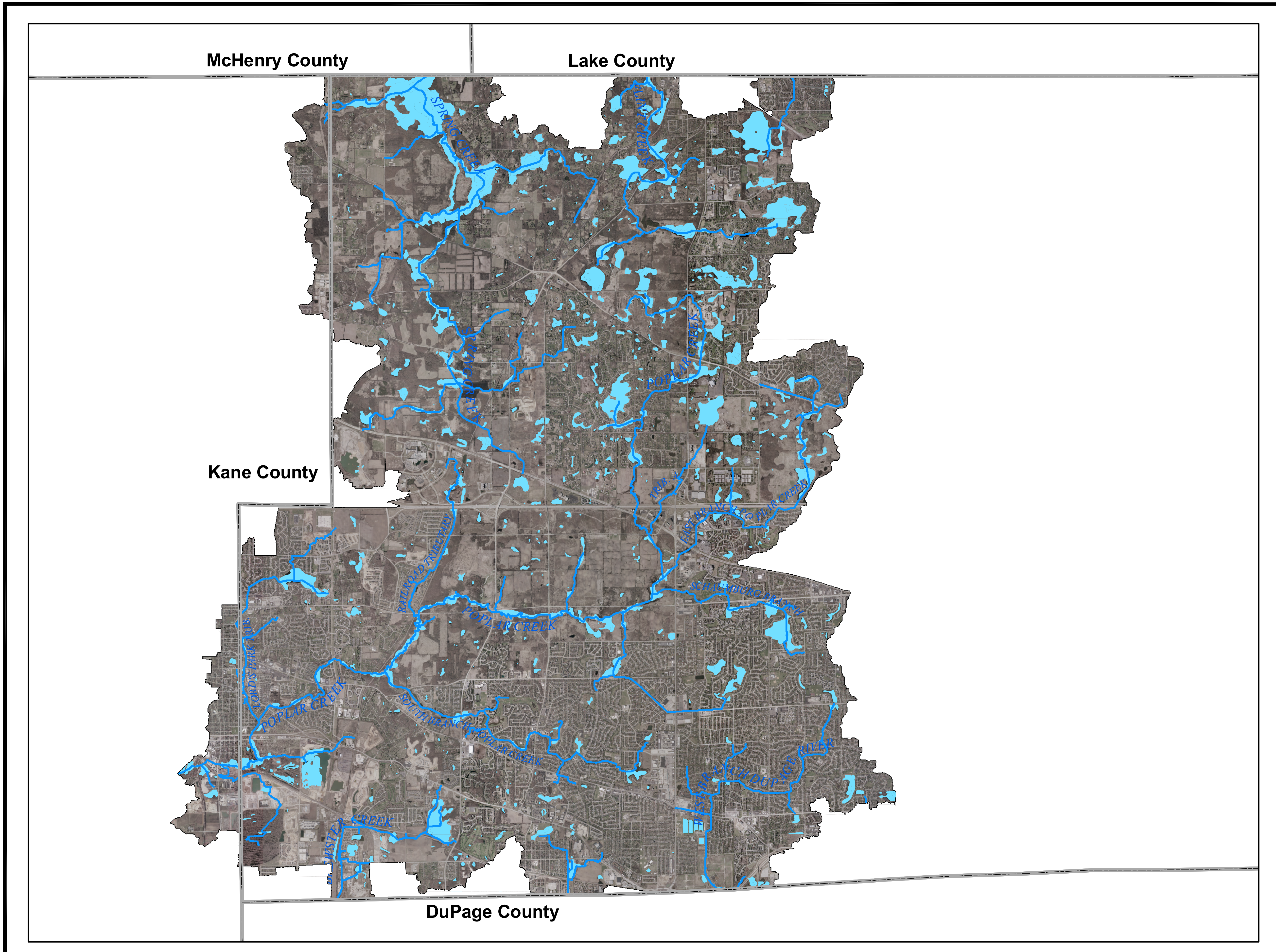
Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Watershed Study Area Land Use

Figure 2.3.5



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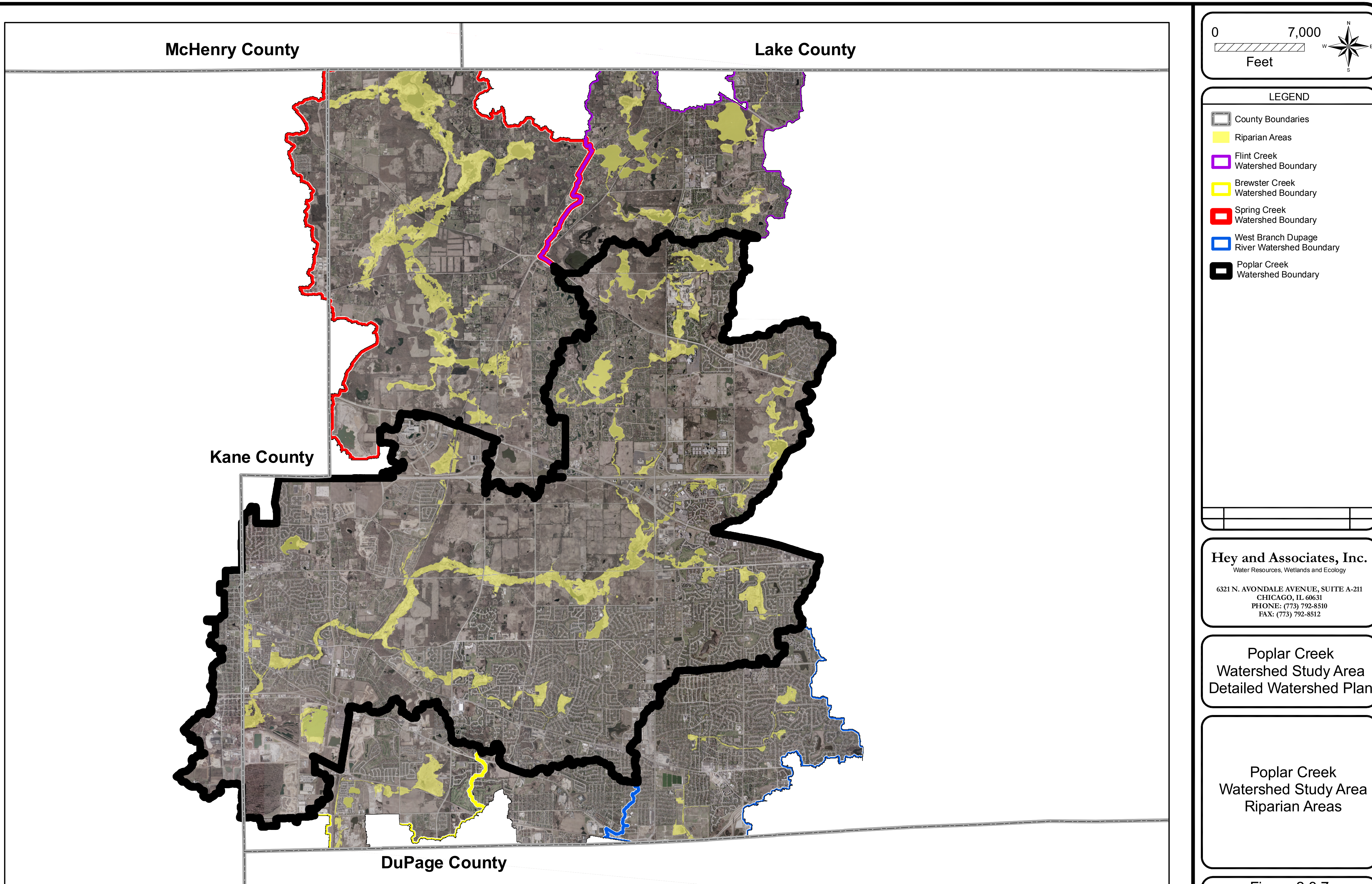
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek
Watershed Study Area
National Wetland
Inventory

Figure 2.3.6



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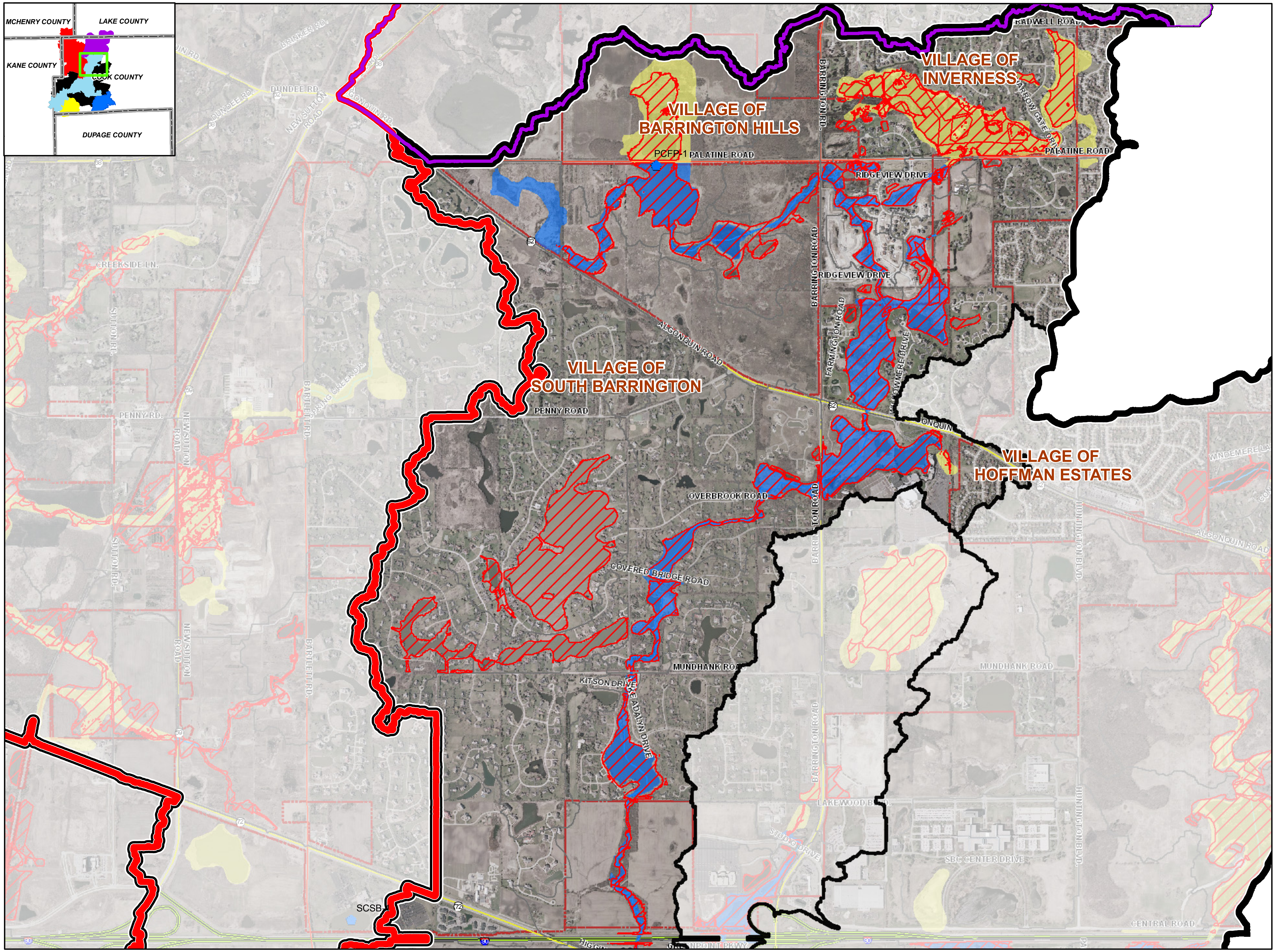
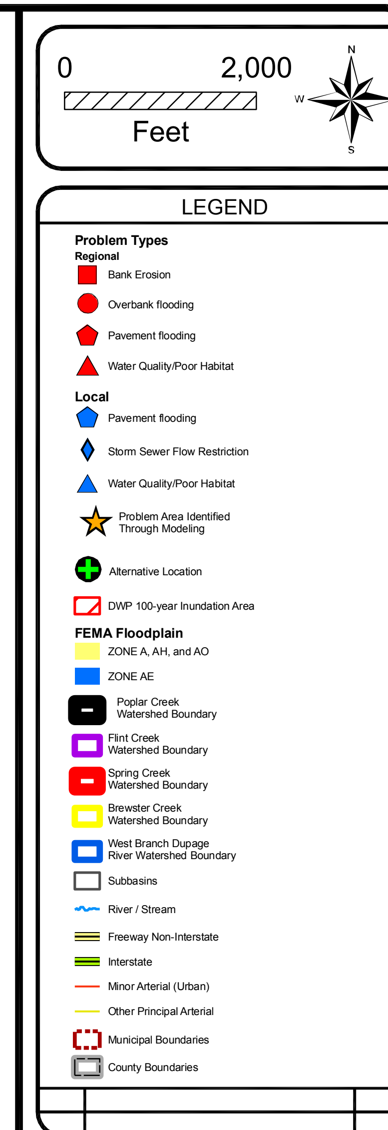
Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Watershed Study Area Riparian Areas

Figure 2.3.7





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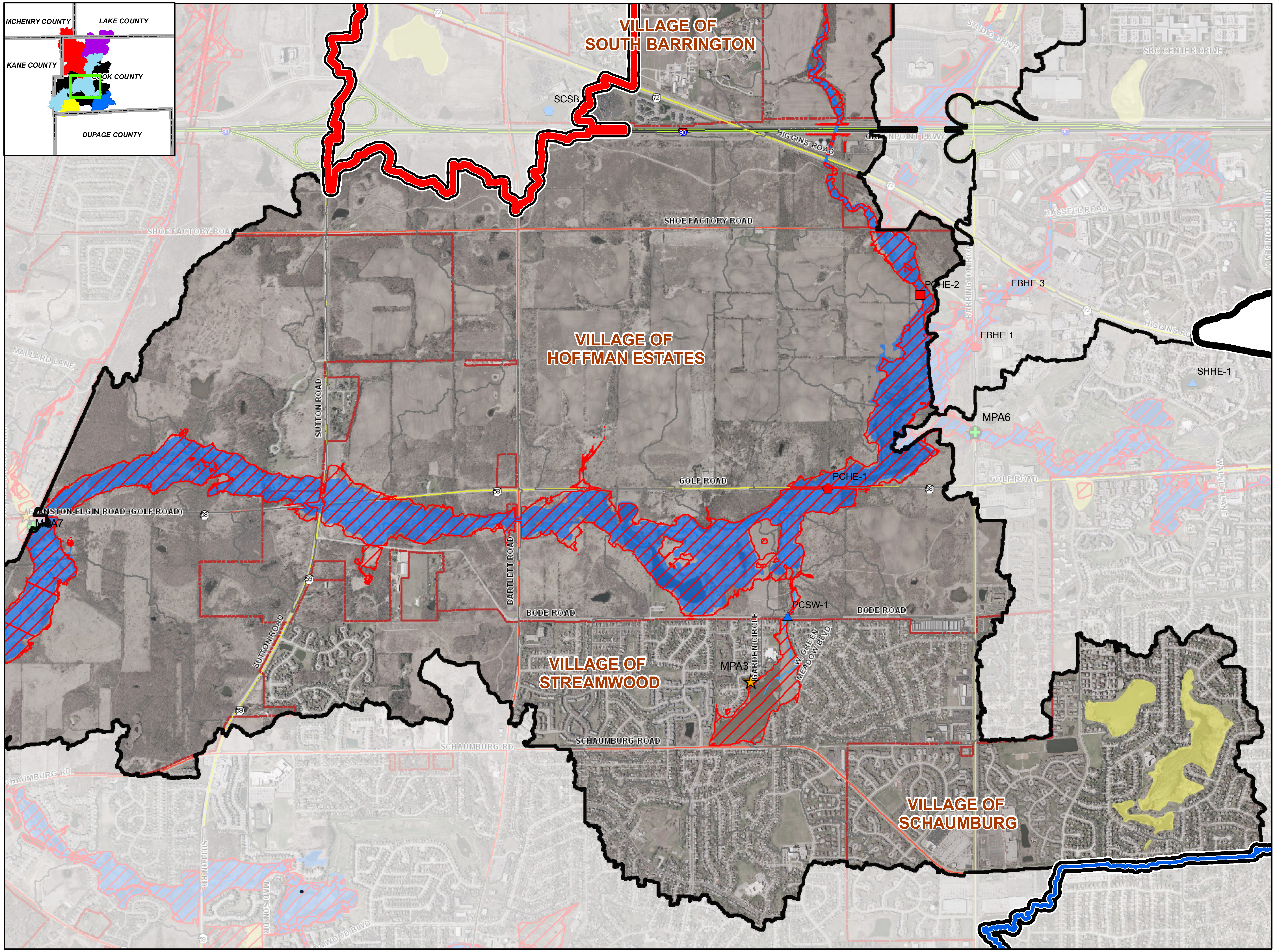
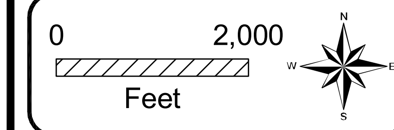
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek Mainstem
Overview (1 of 3)

Figure 3.1.1





LEGEND

Problem Types

Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling

- Alternative Location
- DWP 100-year Inundation Area

FEMA Floodplain
- ZONE A, AH, and AO
- ZONE AE

- Poplar Creek Watershed Boundary
- Flint Creek Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Subbasins
- River / Stream
- Freeway Non-Interstate
- Interstate
- Minor Arterial (Urban)
- Other Principal Arterial
- Municipal Boundaries
- County Boundaries

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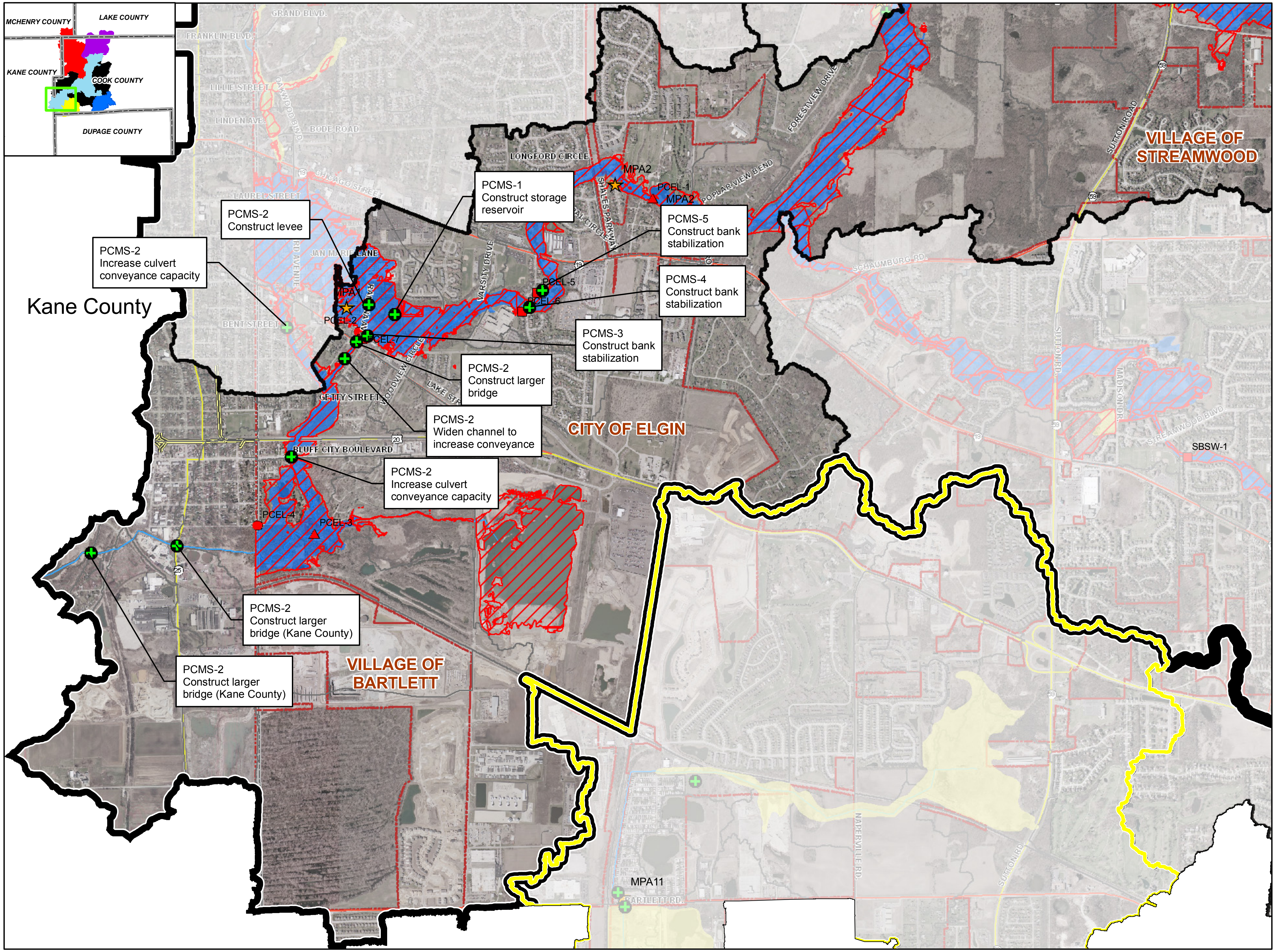
Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Mainstem Overview (2 of 3)

Figure 3.1.1



0 2,000
Feet

LEGEND

Problem Types
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling
- Alternative Location
- DWP 100-year Inundation Area

FEMA Floodplain
- ZONE A, AH, and AO
- ZONE AE
- Poplar Creek Watershed Boundary
- Flint Creek Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Subbasins
- River / Stream
- Freeway Non-Interstate
- Interstate
- Minor Arterial (Urban)
- Other Principal Arterial
- Municipal Boundaries
- County Boundaries

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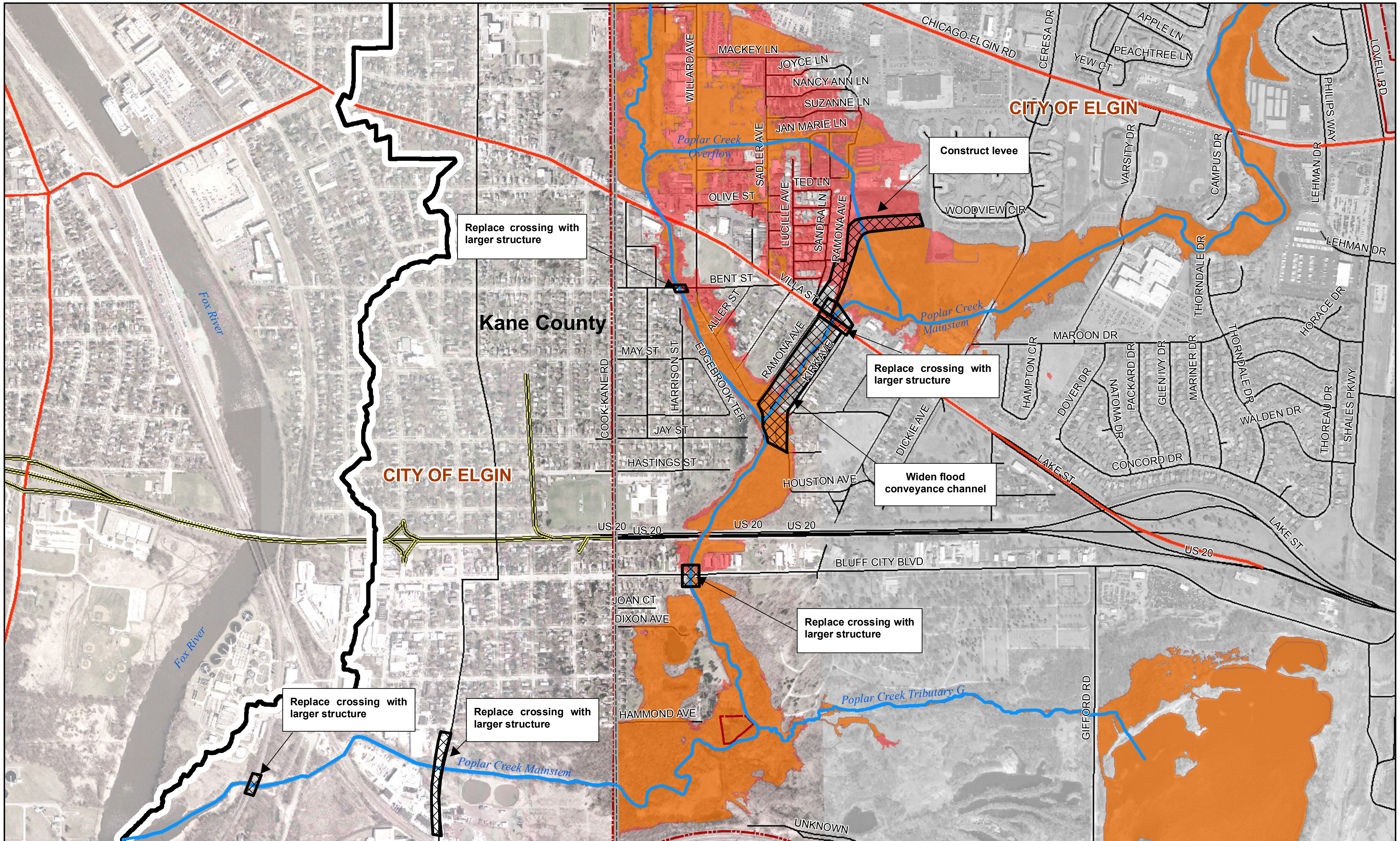
Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Mainstem Overview (3 of 3)

Figure 3.1.1



0 1,000 Feet

N W E S

LEGEND

- Channel Improvement
- Project Alternative Location
- 100-year Inundation Area with project
- 100-year Inundation Area without project
- River/Stream
- Freeway Non-Interstate
- Interstate
- Major Roads
- Other Streets
- Poplar Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Flint Creek Watershed Boundary

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Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Mainstem Alternative PCMS-2

Figure 3.1.4

Subwatershed: Poplar Creek Mainstem

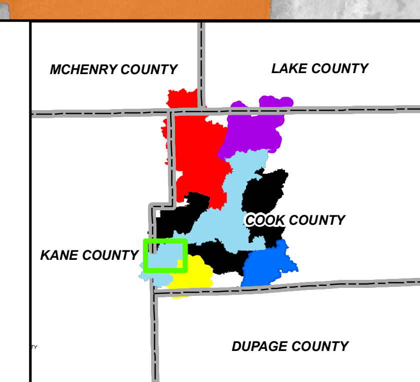
Alternative: PCMS-2

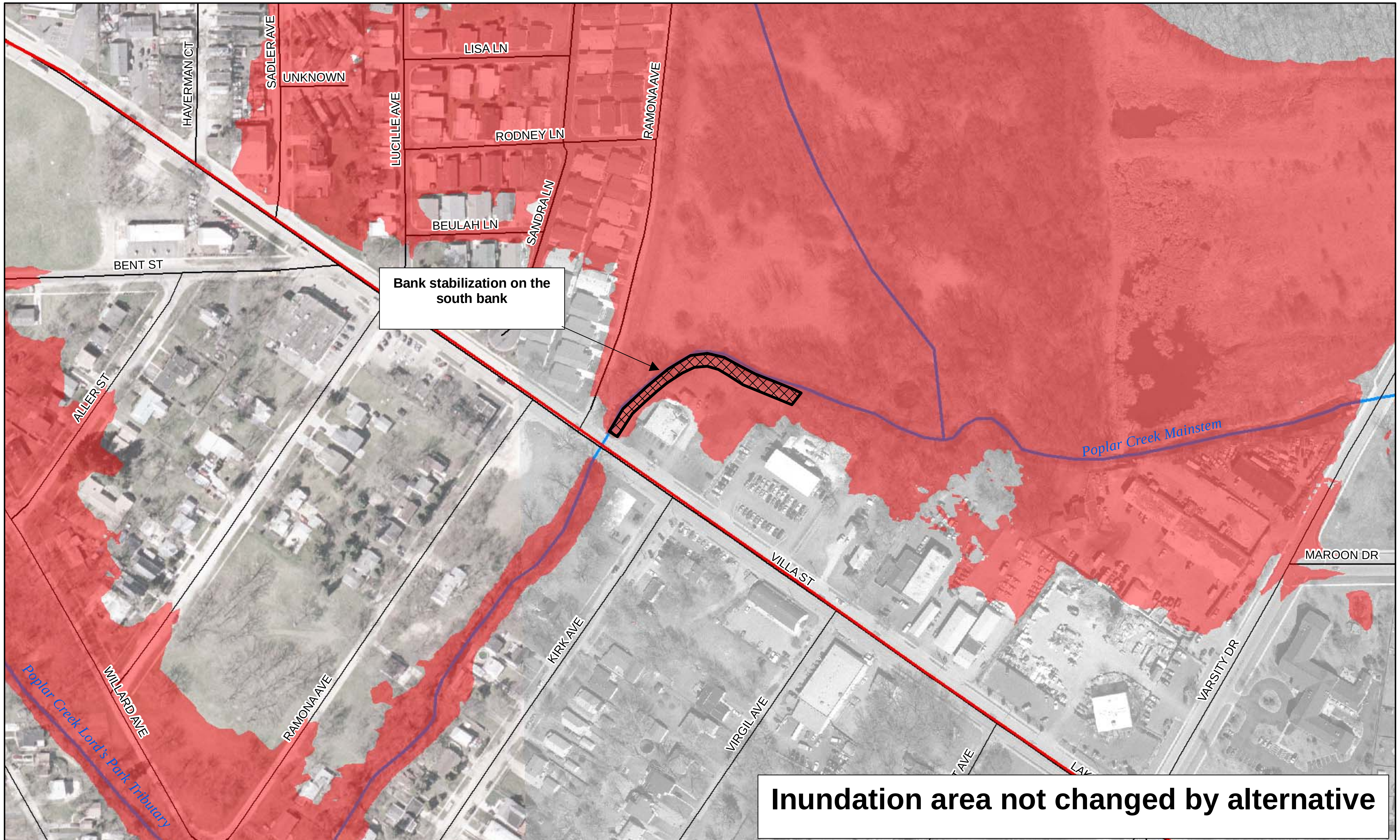
Problem Description: Extensive flooding and damaged structures along Lord's Park Tributary and Poplar Creek.

Alternative Descriptions: Construct levee north of Villa Street, replace Villa Street crossing and enlarge Poplar Creek flood conveyance channel between Villa Street and the confluence with Lord's Park Tributary. Replace or enlarge downstream structures to prevent increased downstream water surface elevations.

Conceptual Level Cost: $45,150,986

Benefits: $2,989,906 **B/C Ratio:** 0.07





LEGEND

- Channel Improvement
- Project Alterntative Locations
- DWP 100-year Inundation Area
- Major Road
- Other Streets
- River/Stream
- County Boundary
- Municipal Boundary

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Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Mainstem Alternative PCMS-3

Figure 3.1.5

Subwatershed: Poplar Creek Mainstem

Alternative: PCMS-3

Problem Description:

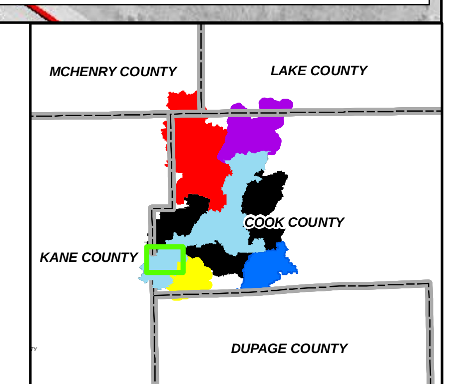
Bank erosion occurs 20 feet upstream of the Villa Street crossing, threatening one structure.

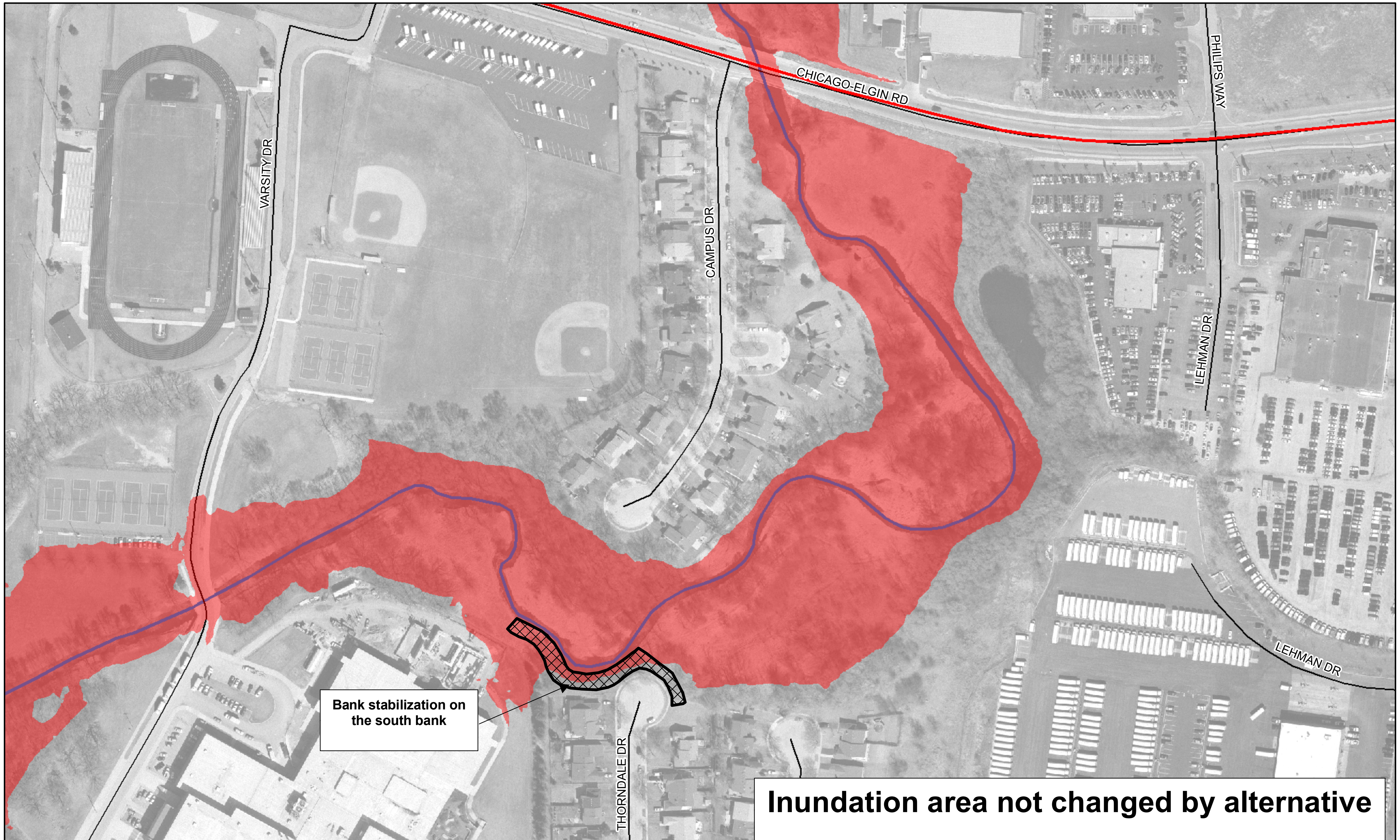
Alternative Descriptions:

Provide 400 feet of streambank stabilization upstream of Villa Street.

Conceptual Level Cost: $715,672

Benefits: $398,782 **B/C Ratio:** 0.56





0 200
Feet

LEGEND

- Project Alterntative Locations
- Channel Improvement
- DWP 100-year Inundation Area
- Major Road
- Other Streets
- River/Stream
- County Boundary
- Municipal Boundary

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Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Mainstem Alternative PCMS-4

Figure 3.1.6

Subwatershed: Poplar Creek Mainstem

Alternative: PCMS-4

Problem Description:

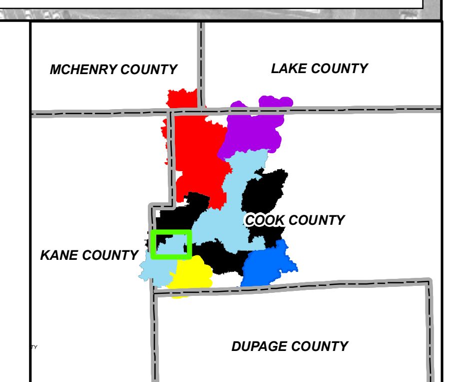
Bank erosion on the south bank just north of the Thorndale Drive cul-de-sac, threatening two structures.

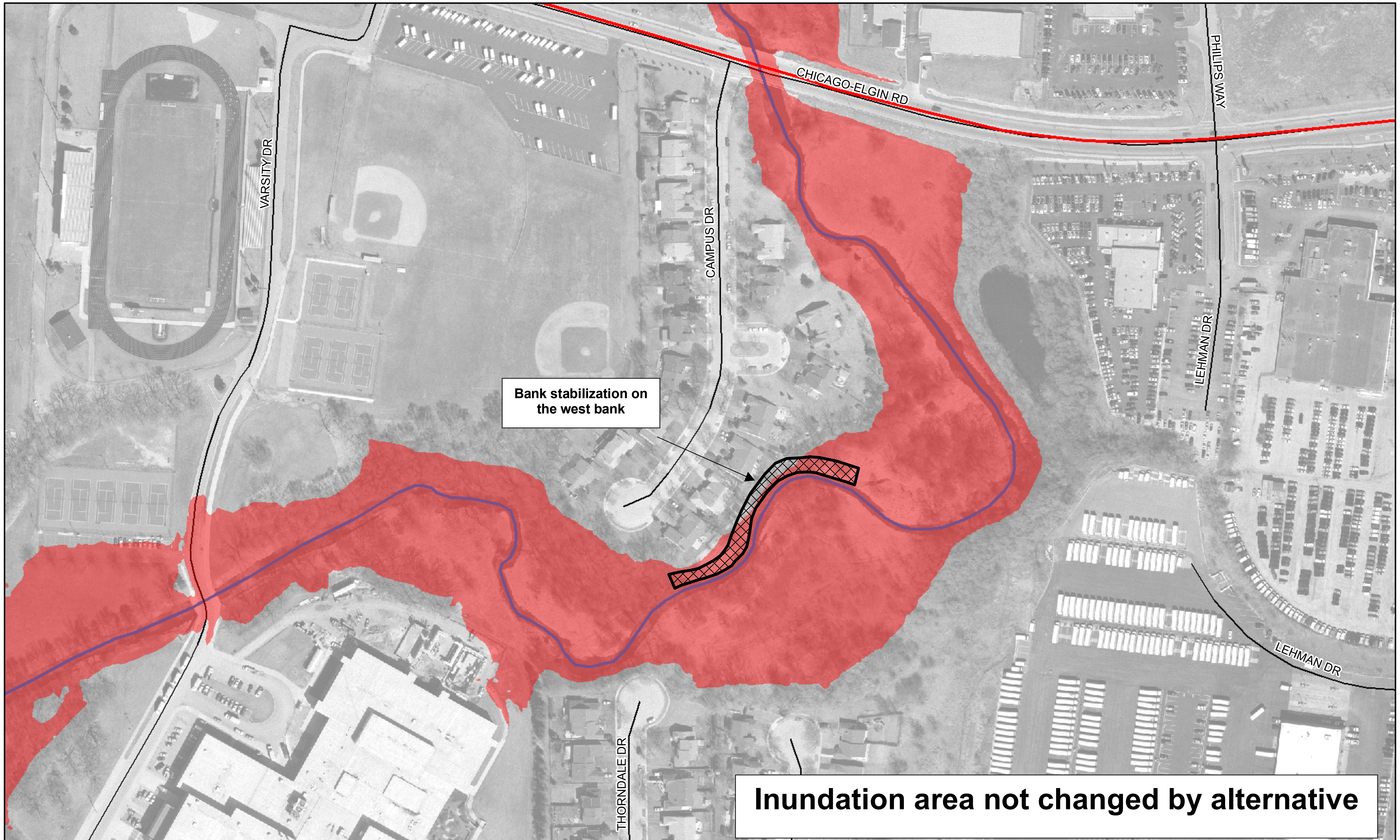
Alternative Descriptions:

Stabilize streambank for 400 feet to protect structures.

Conceptual Level Cost: $745,229

Benefits: $346,573 **B/C Ratio:** 0.47





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Feet

LEGEND
Project Alterntative Locations
Channel Improvement
DWP 100-year Inundation Area
Channel Improvement
Major Road
Other Streets
River/Stream
County Boundary
Municipal Boundary

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Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek Mainstem
Alternative PCMS-5

Figure 3.1.7

Subwatershed: Poplar Creek Mainstem

Alternative: PCMS-5

Problem Description:

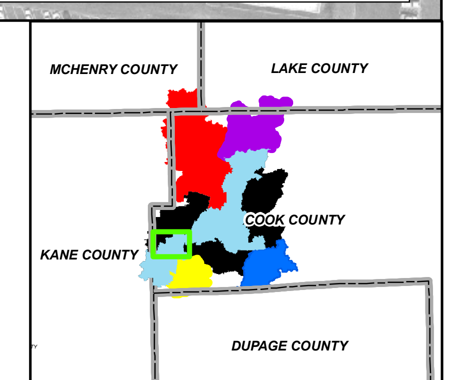
Bank erosion on the west bank of Poplar Creek, downstream of Route 19, threatening four structures.

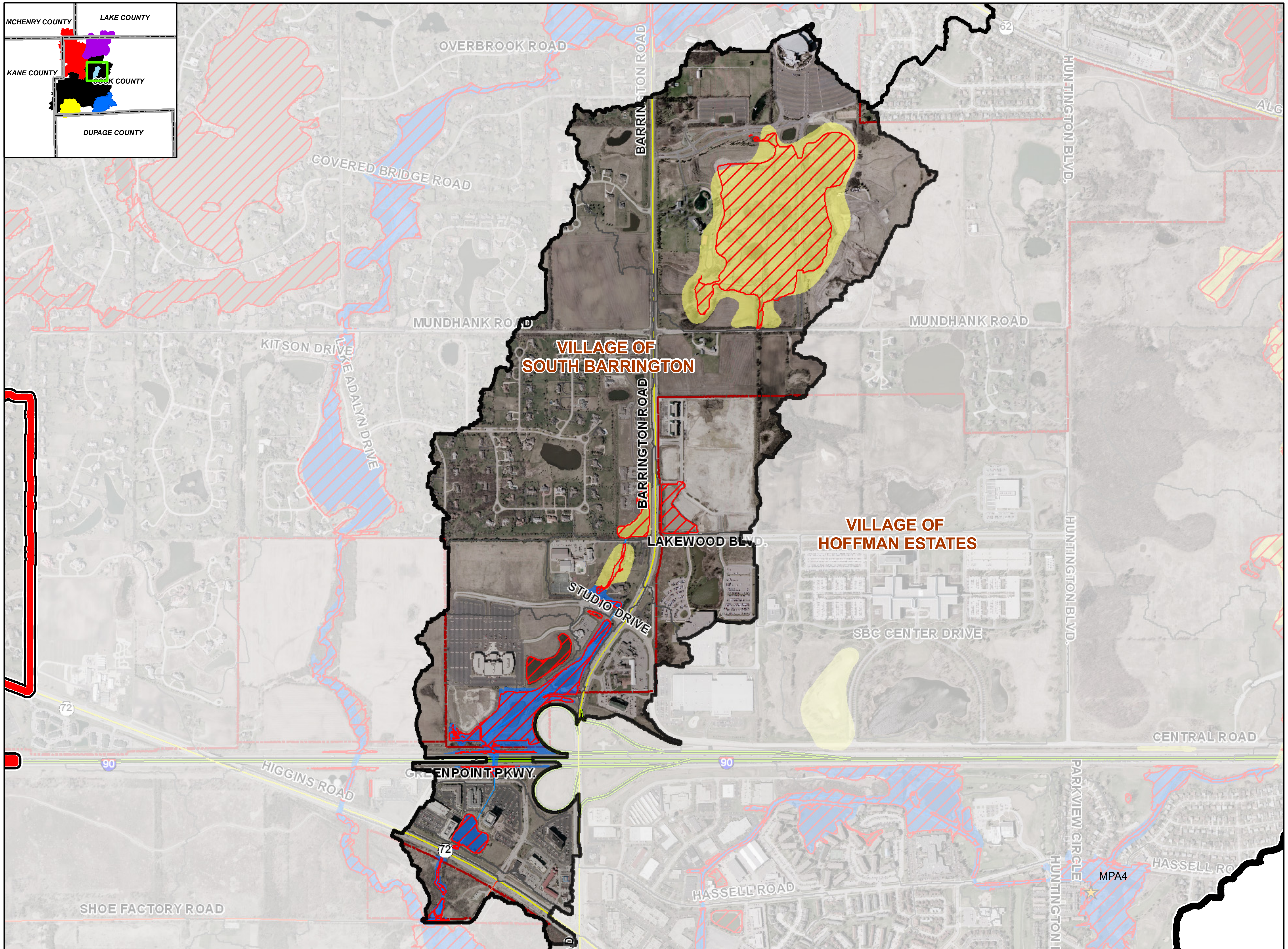
Alternative Descriptions:

Stabilize streambank for 450 feet to protect structures.

Conceptual Level Cost: $874,046

Benefits: $693,792 **B/C Ratio:** 0.79





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Feet

LEGEND

Problem Types

Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling
- Alternative Location
- DWP 100-year Inundation Area

FEMA Floodplain
- ZONE A, AH, and AO
- ZONE AE
- Poplar Creek Watershed Boundary
- Flint Creek Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Subbasins
- River / Stream
- Freeway Non-Interstate
- Interstate
- Minor Arterial (Urban)
- Other Principal Arterial
- Municipal Boundaries
- County Boundaries

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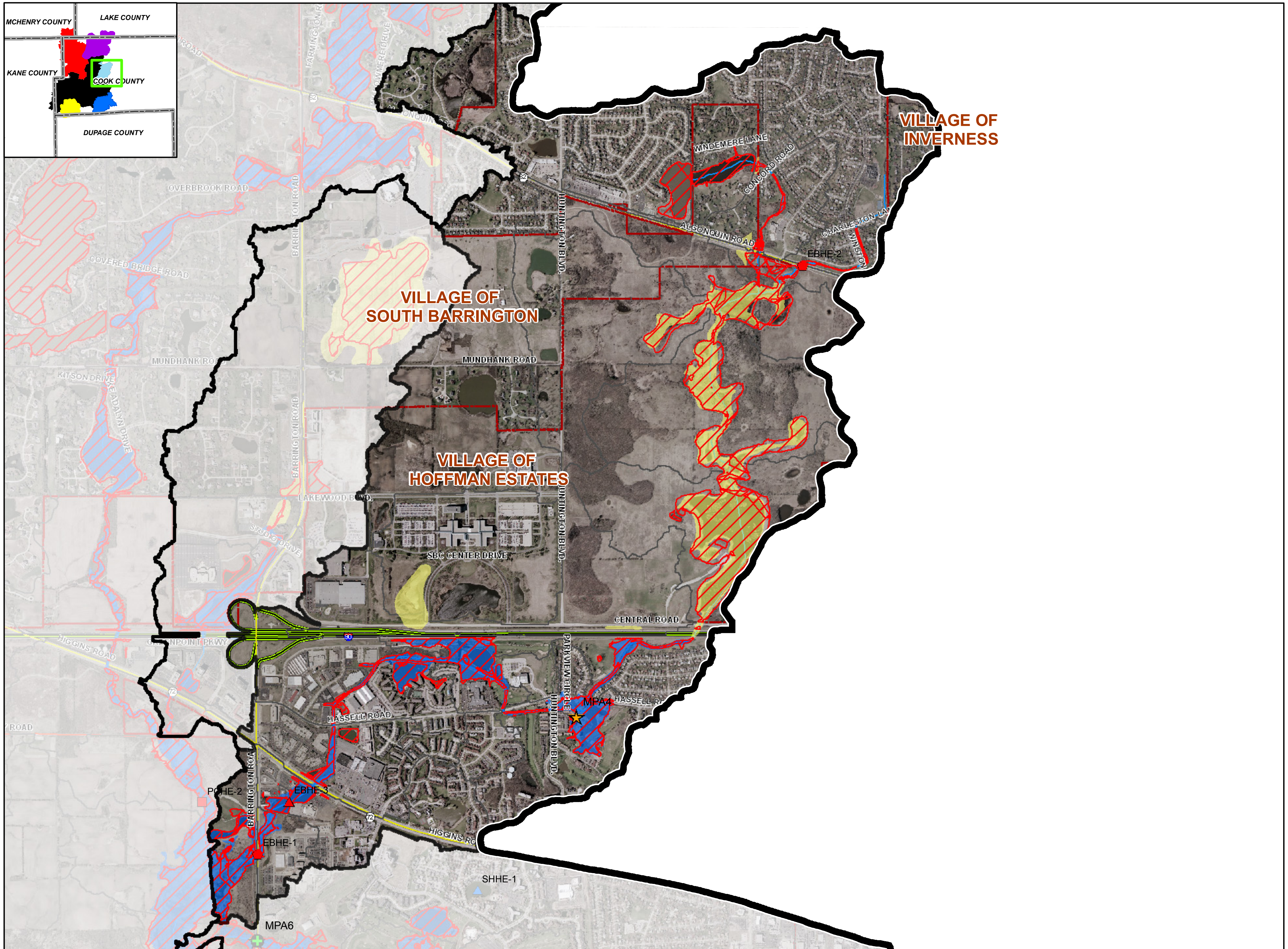
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek
Tributary A
Overview

Figure 3.2.1



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Feet

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S
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LEGEND

Problem Types

Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling
- Alternative Location
- DWP 100-year Inundation Area

FEMA Floodplain
- ZONE A, AH, and AO
- ZONE AE
- Poplar Creek Watershed Boundary
- Flint Creek Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Subbasins
- River / Stream
- Freeway Non-Interstate
- Interstate
- Minor Arterial (Urban)
- Other Principal Arterial
- Municipal Boundaries
- County Boundaries

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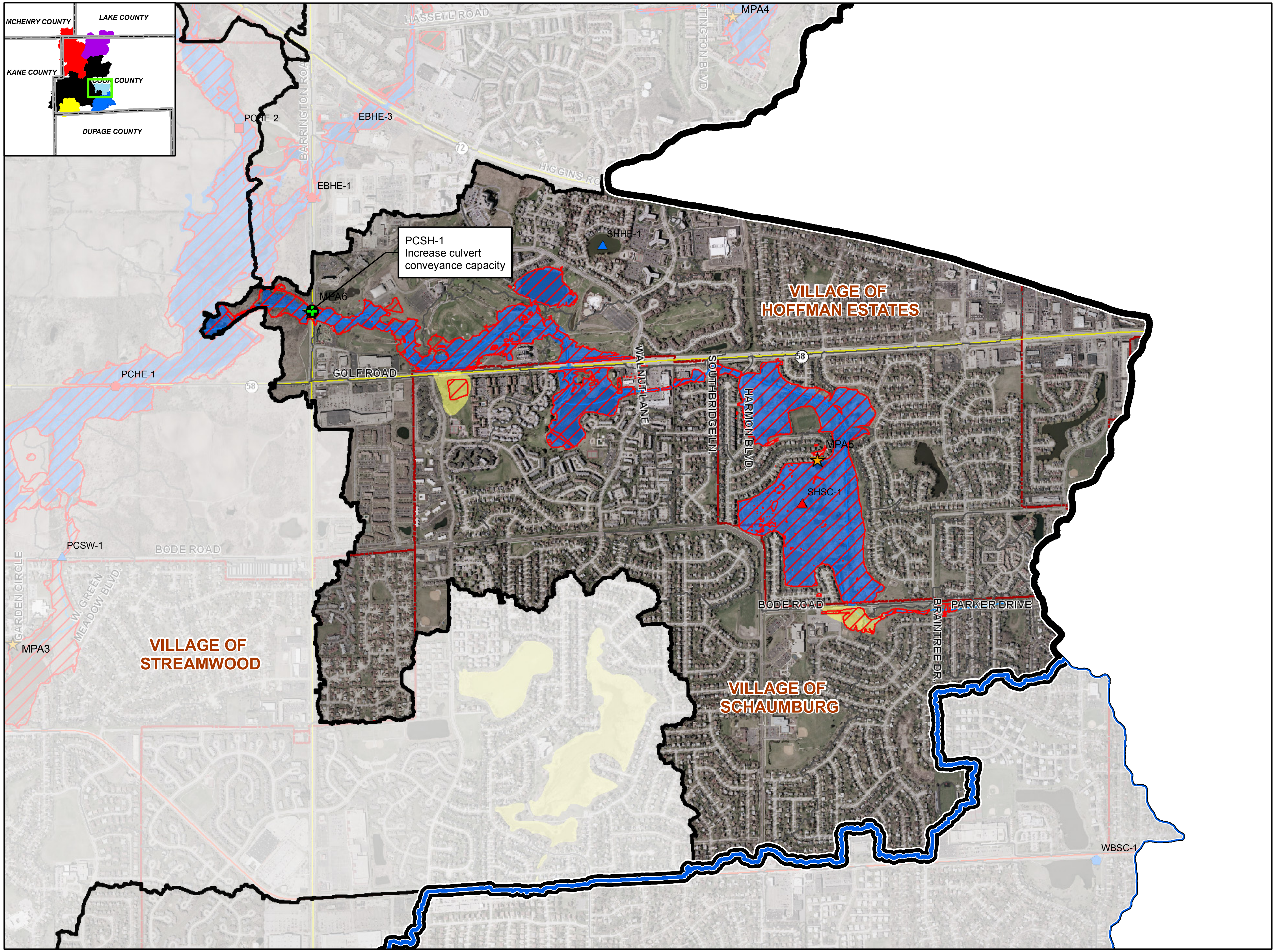
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek
East Branch
Overview

Figure 3.3.1



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Feet

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LEGEND

Problem Types

Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling
- Alternative Location
- DWP 100-year Inundation Area

FEMA Floodplain
- ZONE A, AH, and AO
- ZONE AE
- Poplar Creek Watershed Boundary
- Flint Creek Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Subbasins
- River / Stream
- Freeway Non-Interstate
- Interstate
- Minor Arterial (Urban)
- Other Principal Arterial
- Municipal Boundaries
- County Boundaries

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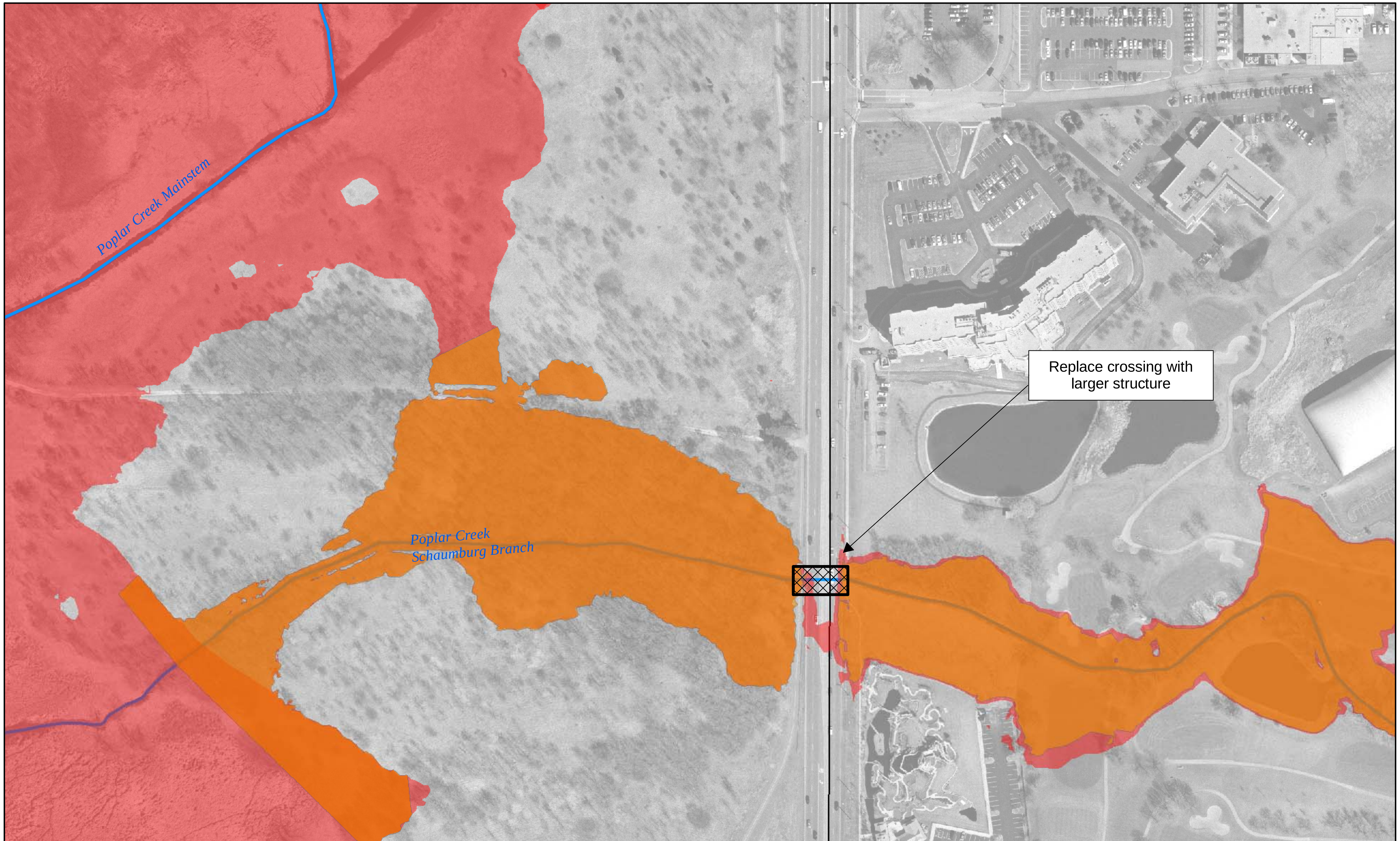
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek
Schaumburg Branch
Overview

Figure 3.4.1



0 200
Feet

LEGEND
- Channel Improvement
- Project Alternative Location
- 100-year Inundation Area with project
- 100-year Inundation Area without project
- River/Stream
- Freeway Non-Interstate
- Interstate
- Major Roads
- Other Streets
- Poplar Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Flint Creek Watershed Boundary

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Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Schaumburg Branch Alternative PCSH-1

Figure 3.4.2

Subwatershed: Poplar Creek Schaumburg Branch

Alternative: PCSH-1

Problem Description:

Barrington Road pavement is inundated by 0.7 feet in the 100-year event.

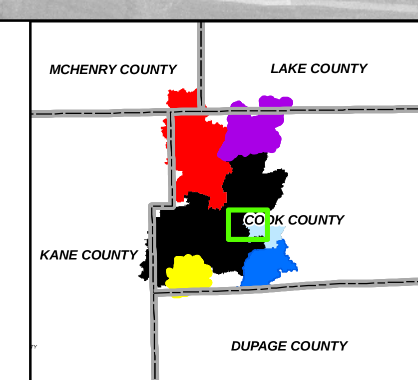
Alternative Descriptions:

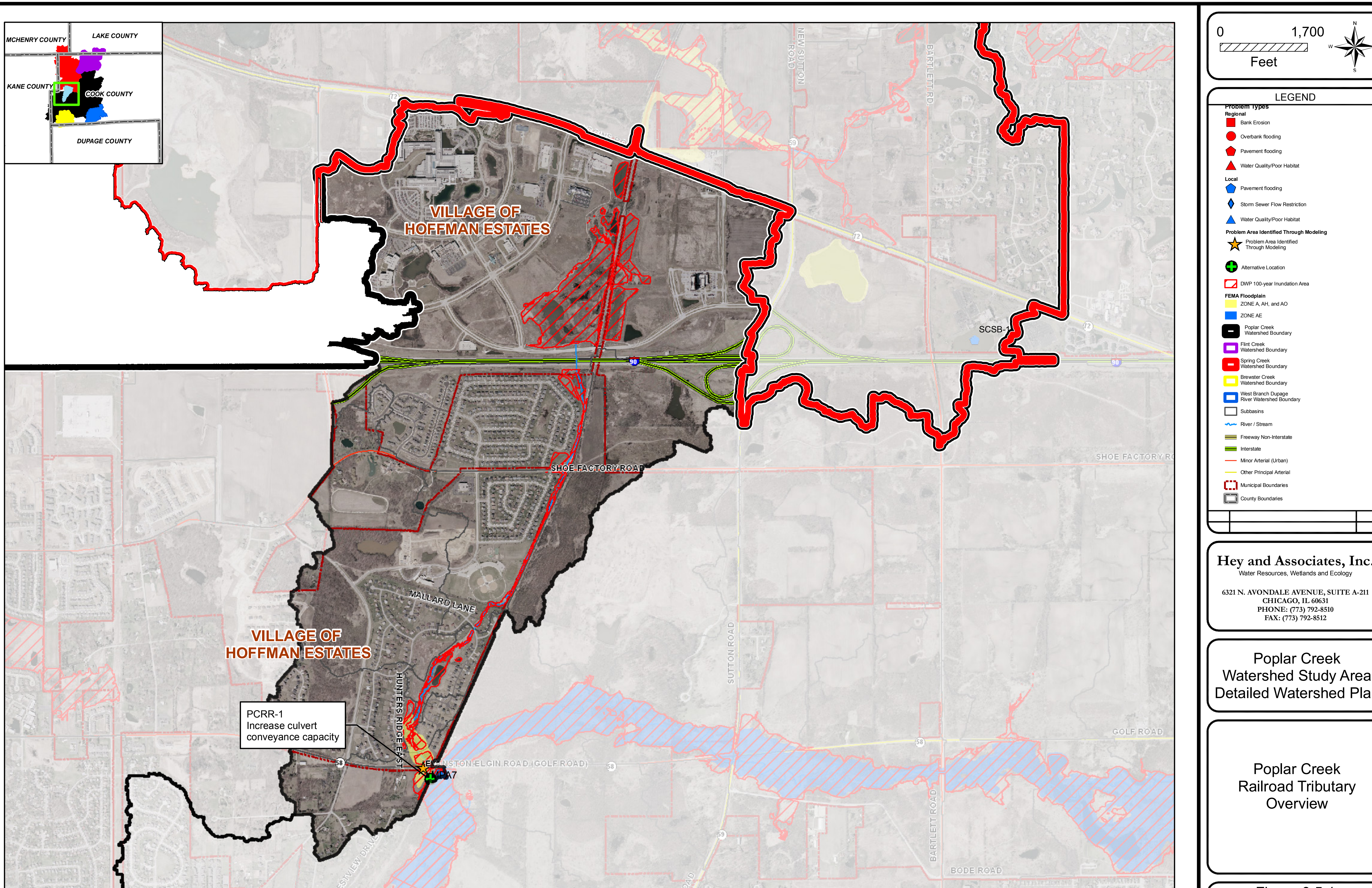
Replace the existing Barrington Road culvert with a larger culvert.

Conceptual Level Cost: $3,282,524

Benefits: $252,000

B/C Ratio: 0.08





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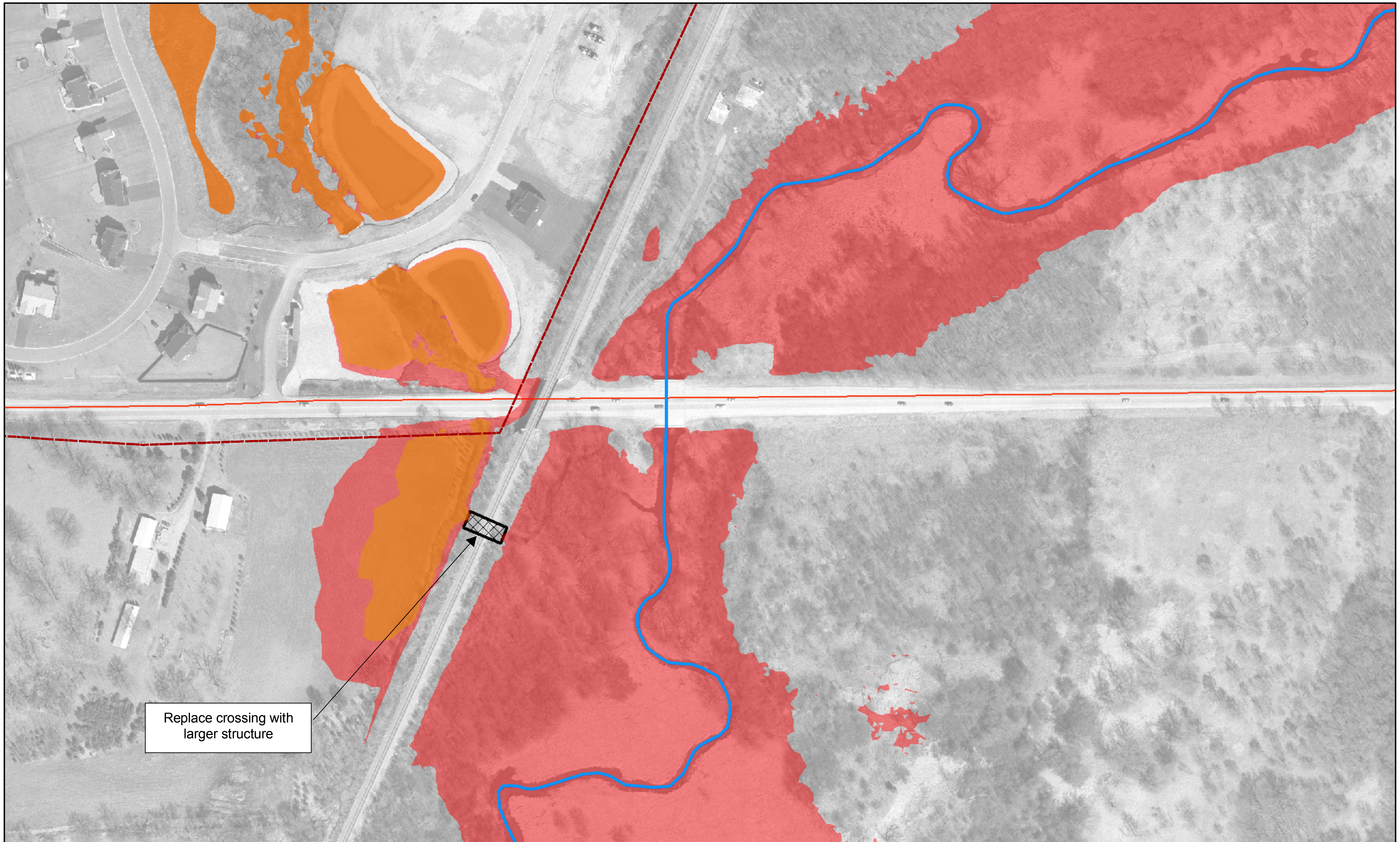
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek
Railroad Tributary
Overview

Figure 3.5.1



LEGEND

- Channel Improvement
- Project Alterntative Locations
- 100-year Inundation Area with project
- 100-year Inundation Area without project
- River/Stream
- Freeway Non-Interstate
- Interstate
- Major Roads
- Other Streets
- Poplar Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Flint Creek Watershed Boundary

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Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Subwatershed: Poplar Creek Railroad Branch

Alternative: PCRR-1

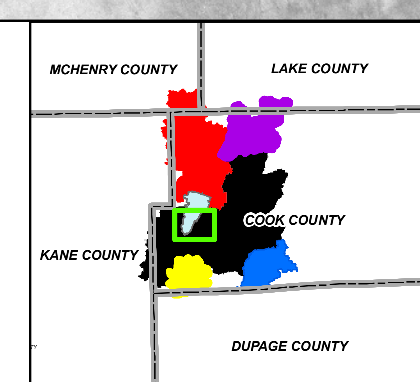
Problem Description:
Golf Road (IL 58) overtopped by the 100-year event.

Alternative Descriptions:
Increase culvert size under EJ & E Railroad.

Conceptual Level Cost: $1,486,352

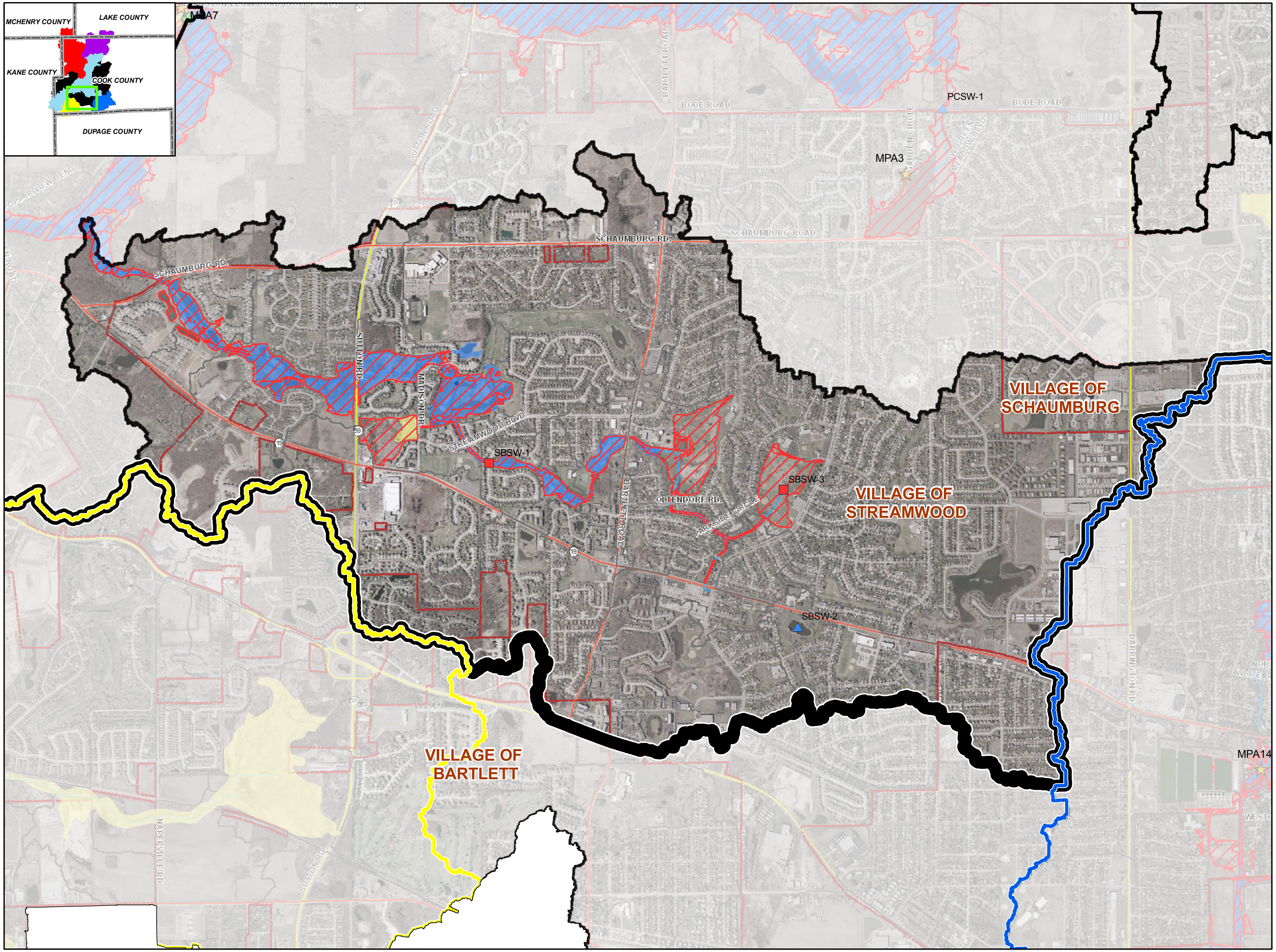
Benefits: $2,300

B/C Ratio: 0.002



Poplar Creek Railroad
Tributary Alternative
PCRR-1

Figure 3.5.2



0 2,000
Feet

LEGEND

Problem Types

Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling
- Alternative Location
- DWP 100-year Inundation Area

FEMA Floodplain
- ZONE A, AH, and AO
- ZONE AE
- Poplar Creek Watershed Boundary
- Flint Creek Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Subbasins
- River / Stream
- Freeway Non-Interstate
- Interstate
- Minor Arterial (Urban)
- Other Principal Arterial
- Municipal Boundaries
- County Boundaries

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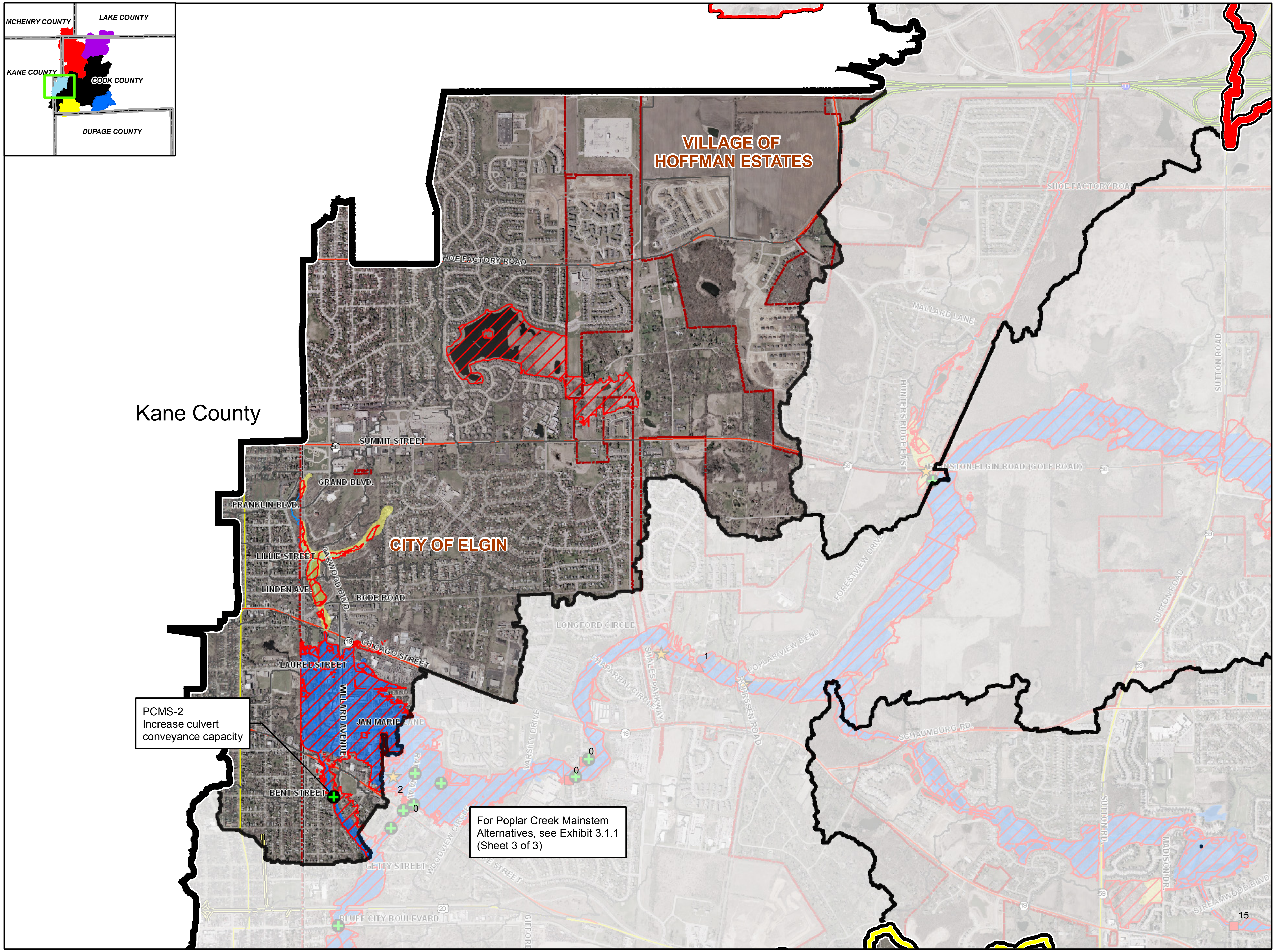
Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek South Branch Overview

Figure 3.6.1



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LEGEND

Problem Types

Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
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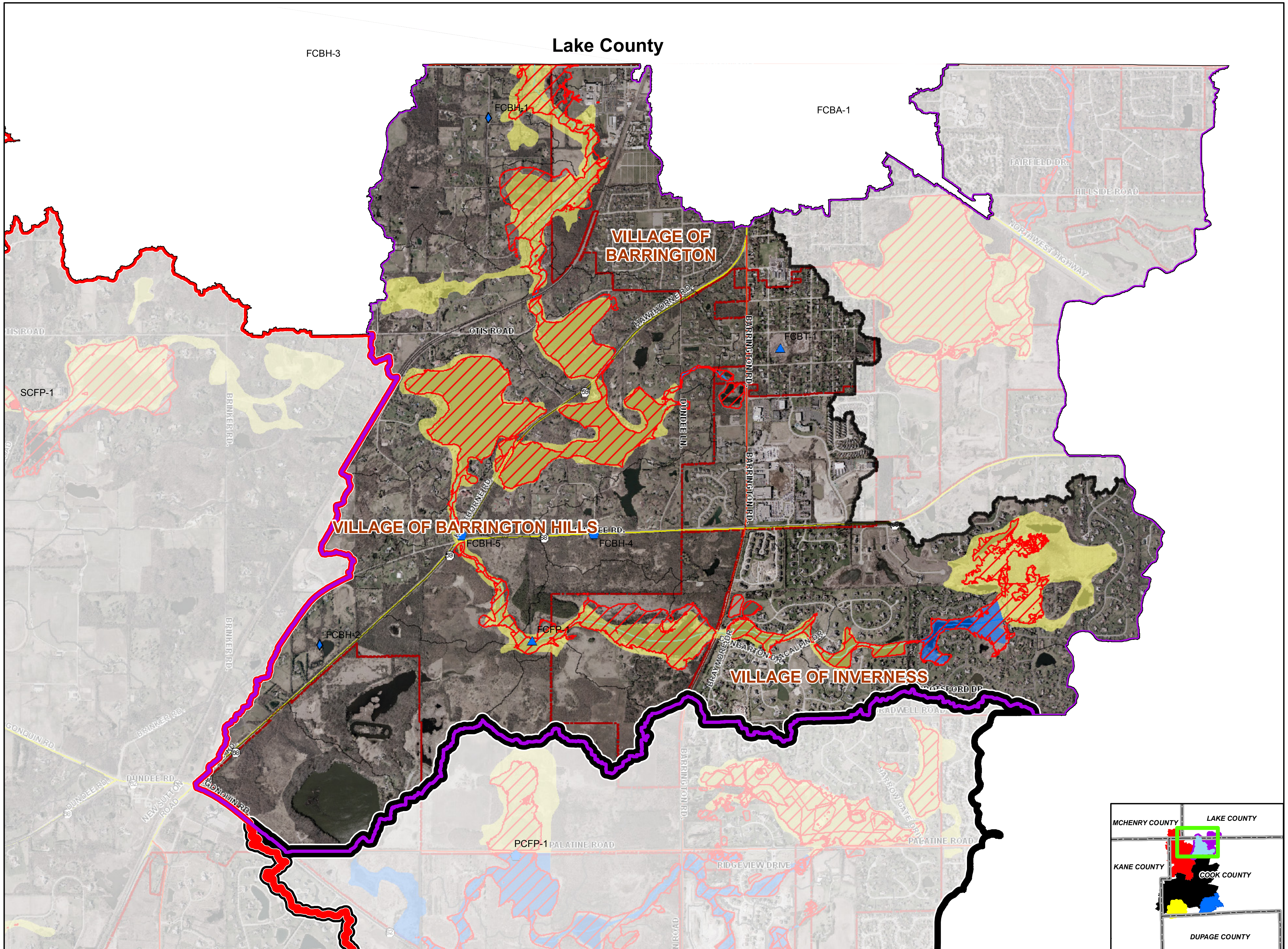
Poplar Creek Watershed Study Area Detailed Watershed Plan

Poplar Creek Lord's Park Tributary Overview

Figure 3.7.1



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LEGEND

Problem Types

Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling
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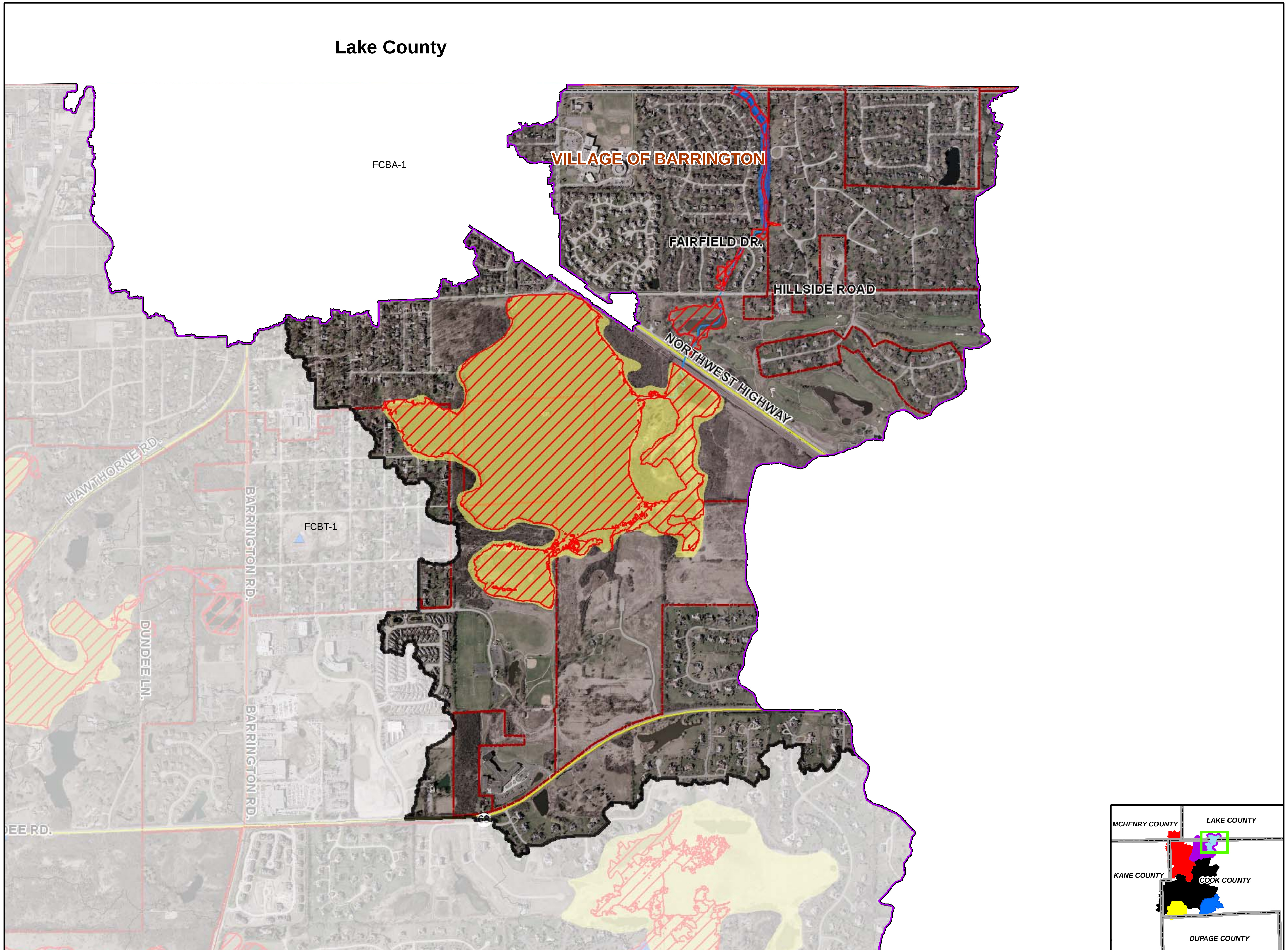
Poplar Creek Watershed Study Area Detailed Watershed Plan

Flint Creek Mainstem Overview

Figure 3.8.1



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LEGEND

Problem Types
Regional
- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local
- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling
- Alternative Location
- DWP 100-year Inundation Area

FEMA Floodplain
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- ZONE AE
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- Subbasins
- River / Stream
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- Interstate
- Minor Arterial (Urban)
- Other Principal Arterial
- Municipal Boundaries
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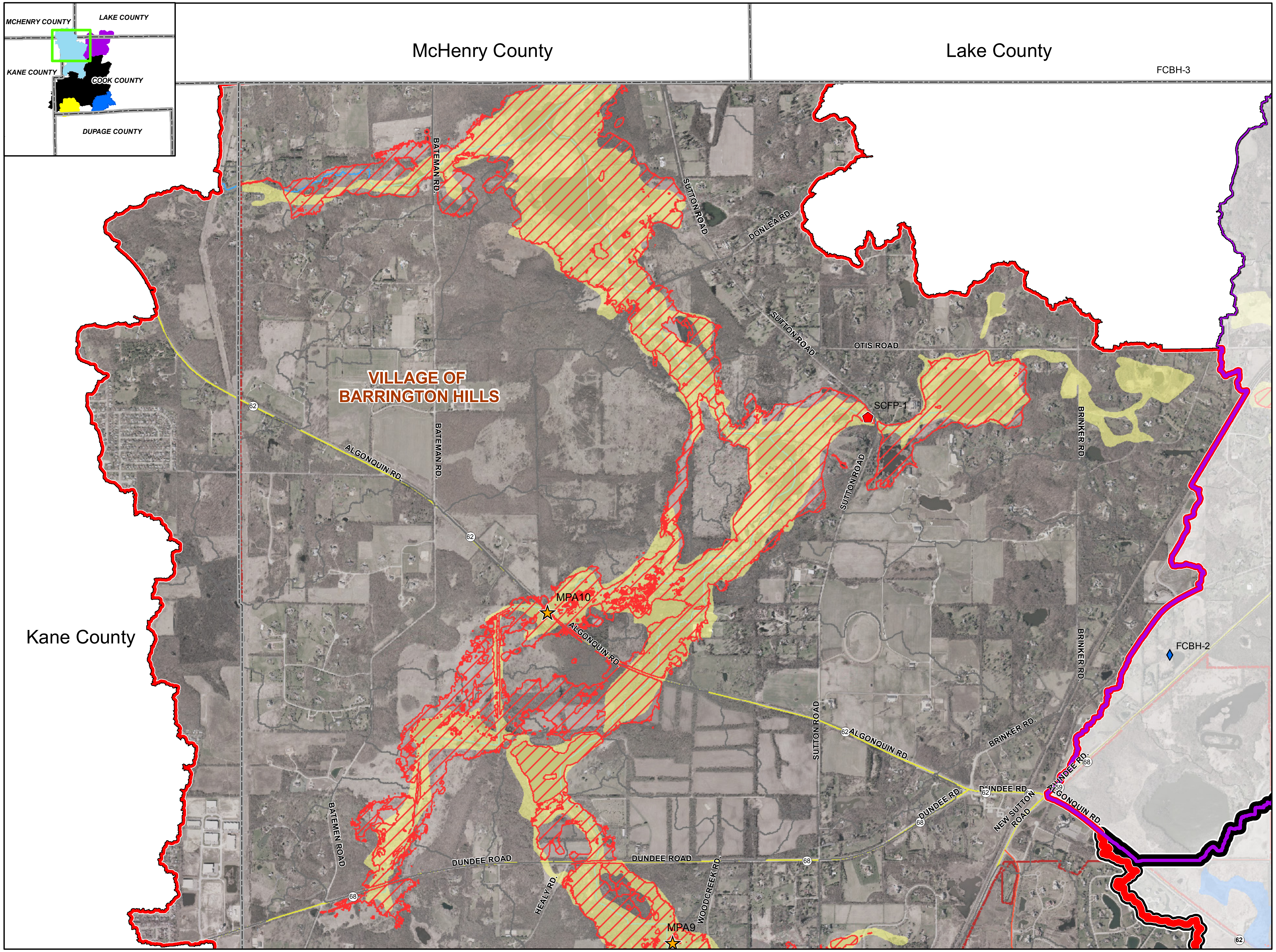
Poplar Creek Watershed Study Area Detailed Watershed Plan

Flint Creek Tributary Overview

Figure 3.9.1



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LEGEND

Problem Types
Regional
Bank Erosion
Overbank flooding
Pavement flooding
Water Quality/Poor Habitat
Local
Pavement flooding
Storm Sewer Flow Restriction
Water Quality/Poor Habitat
Problem Area Identified Through Modeling
Alternative Location
DWP 100-year Inundation Area
FEMA Floodplain
ZONE A, AH, and AO
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Poplar Creek Watershed Boundary
Flint Creek Watershed Boundary
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Brewster Creek Watershed Boundary
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Subbasins
River / Stream
Freeway Non-Interstate
Interstate
Minor Arterial (Urban)
Other Principal Arterial
Municipal Boundaries
County Boundaries

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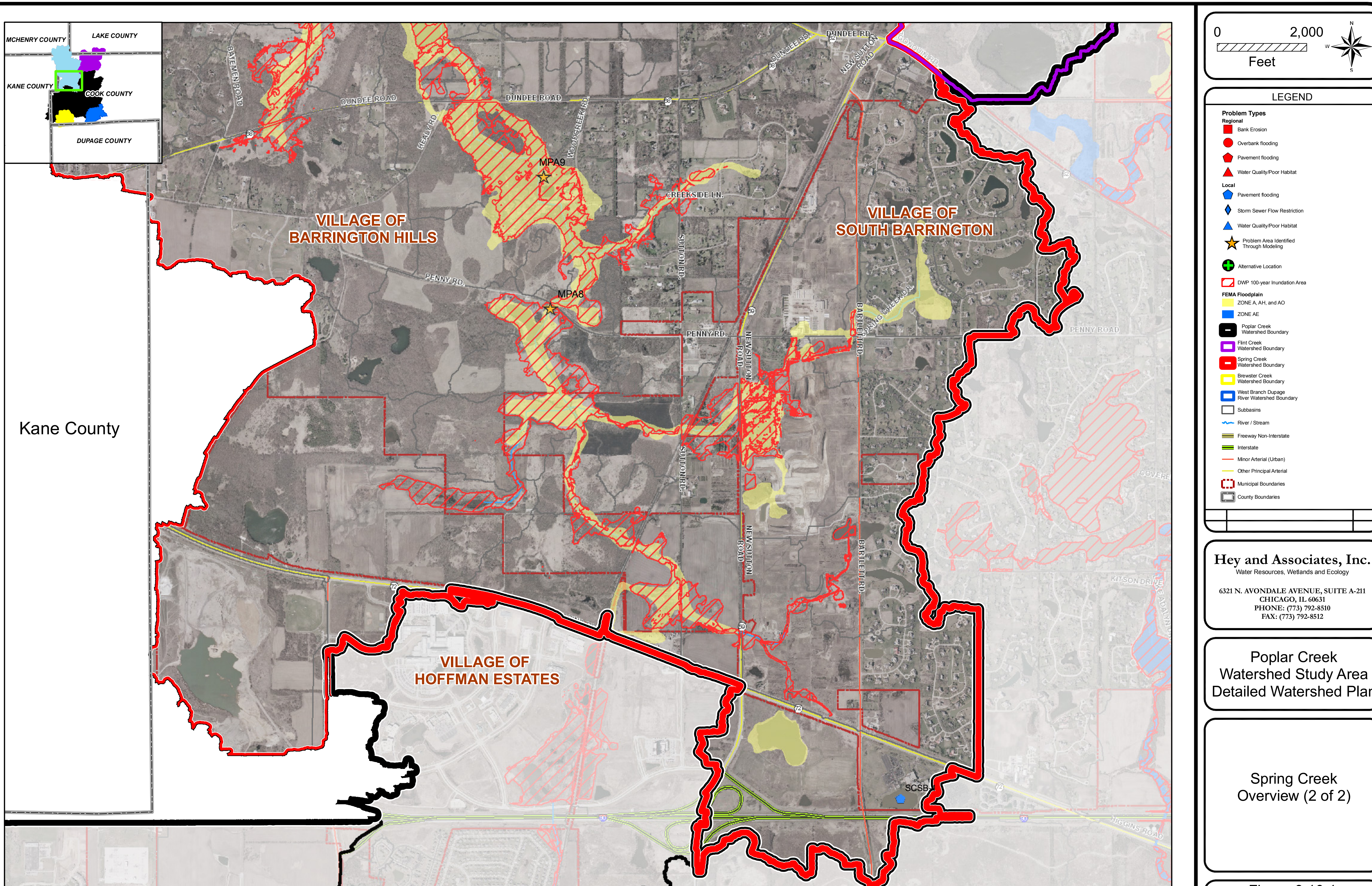
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Spring Creek
Overview (1 of 2)

Figure 3.10.1



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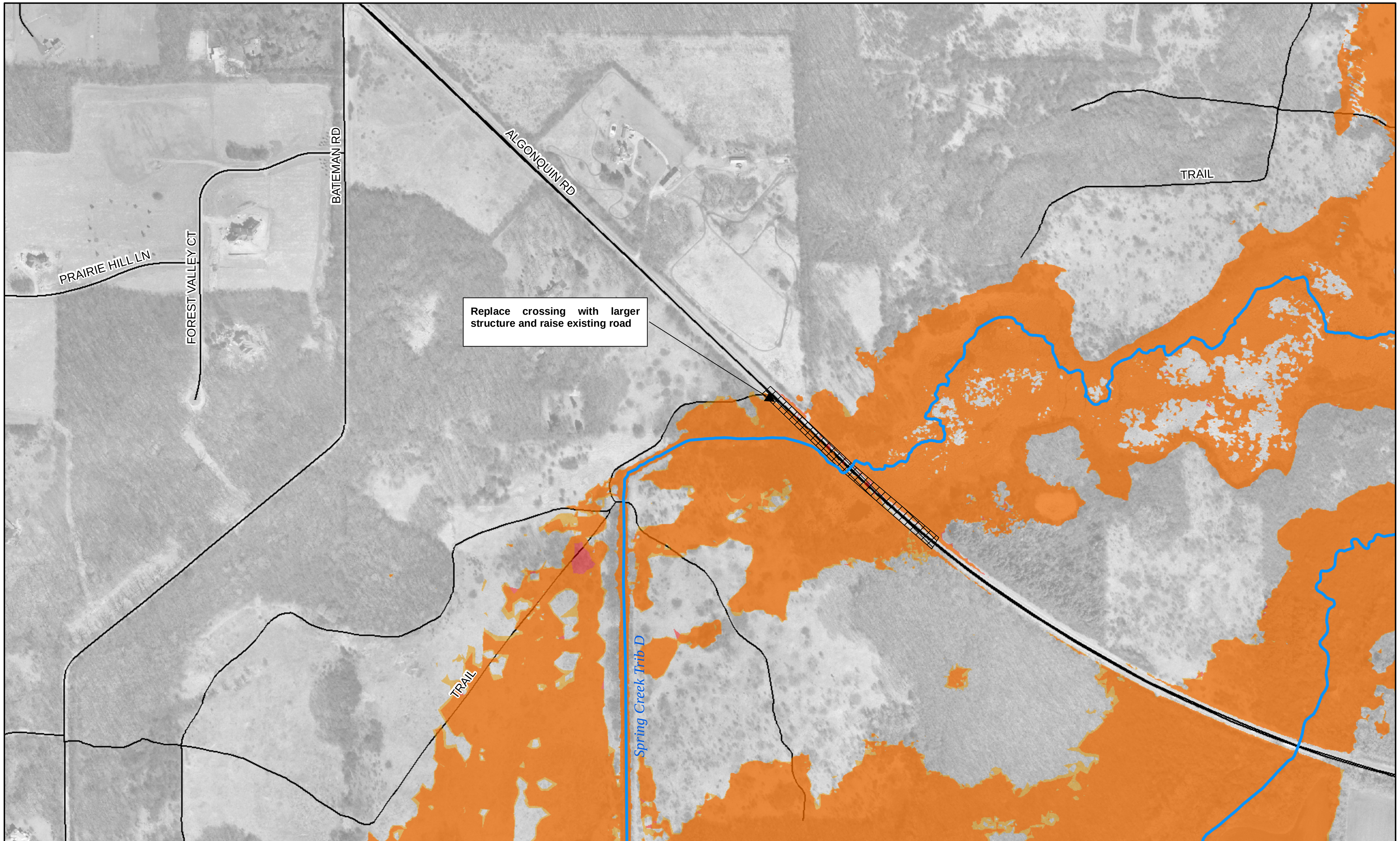
Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Spring Creek
Overview (2 of 2)

Figure 3.10.1



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LEGEND

- Channel Improvement
- Project Alterntative Locations
- 100-year Inundation Area with project
- 100-year Inundation Area without project
- River/Stream
- Freeway Non-Interstate
- Interstate
- Major Roads
- Other Streets
- Poplar Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary
- Spring Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Flint Creek Watershed Boundary

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Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Subwatershed: Spring Creek

Alternative: SCTD-1

Problem Description:

Algonquin Road (IL 62) is overtopped in the 5-, 10-, 25-, 50-, and 100-year events.

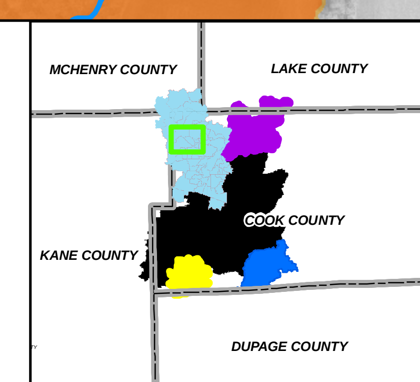
Alternative Descriptions:

Reconstruct culvert and raise the roadway elevation.

Conceptual Level Cost: $1,653,400

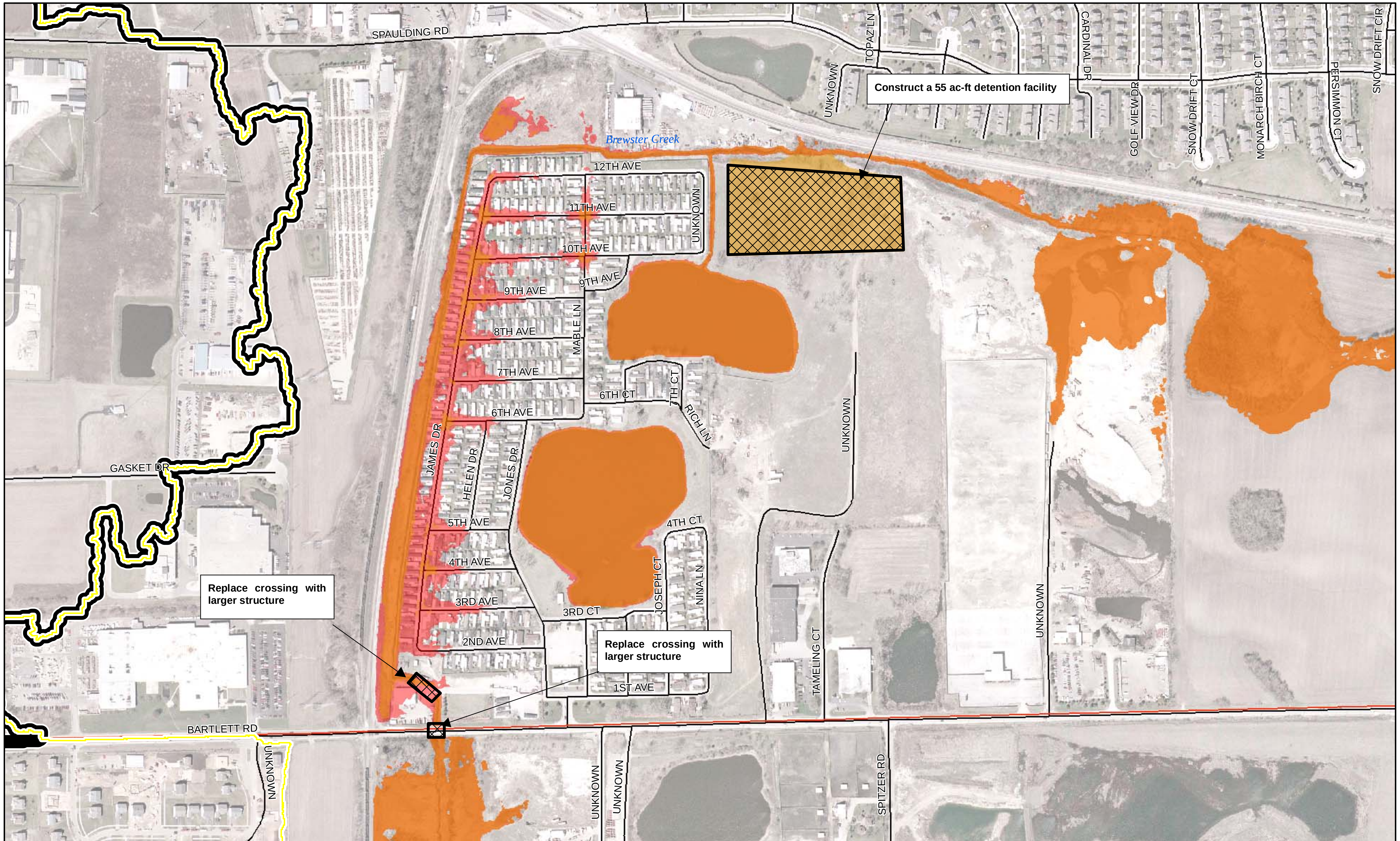
Benefits: $321,200

B/C Ratio: 0.19



Spring Creek
Alternative SCTD-1

Figure 3.10.2



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LEGEND

- Channel Improvement
- Project Alterntative Locations
- 100-year Inundation Area with project
- 100-year Inundation Area without project
- River/Stream
- Freeway Non-Interstate
- Interstate
- Major Roads
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Poplar Creek Watershed Study Area Detailed Watershed Plan

Brewster Creek Alternative BCMS-1

Figure 3.11.2

Subwatershed: Brewster Creek

Alternative: BCMS-1

Problem Description:

One commercial building and trailer park are inundated. 177 mobile homes are inundated by the 100-year floodplain.

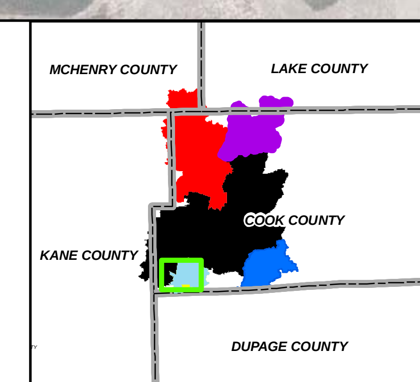
Alternative Descriptions:

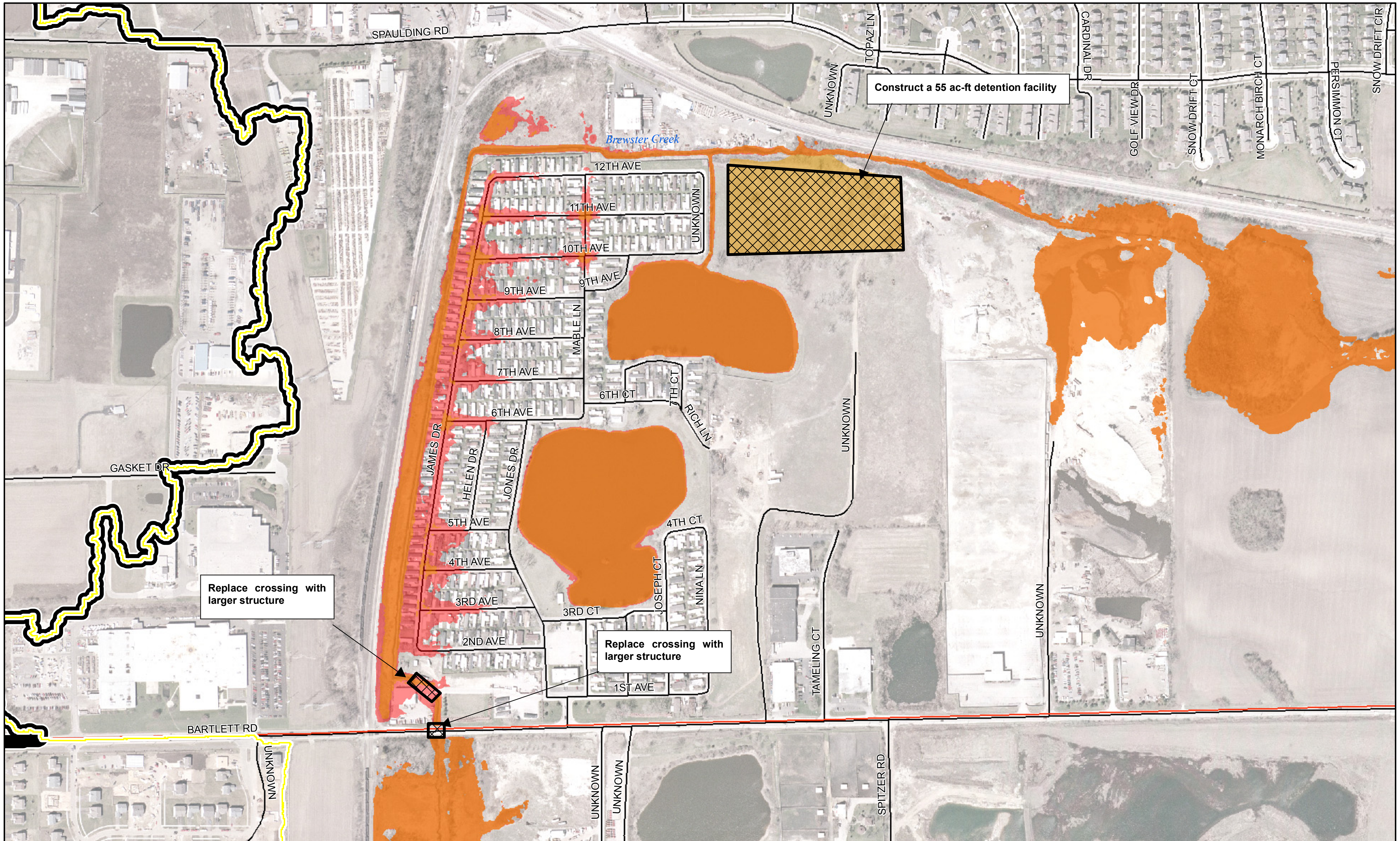
Reconstruct the Bartlett Road culvert and the private driveway culvert. Provide 55 ac-ft of detention storage.

Conceptual Level Cost: $6,043,990

Benefits: $498,829

B/C Ratio: 0.03





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Poplar Creek Watershed Study Area Detailed Watershed Plan

Brewster Creek Alternative BMCS-1

Figure 3.11.2.

Subwatershed: Brewster Creek

Alternative: BCMS-1

Problem Description:

One commercial building and trailer park are inundated.
177 mobile homes are inundated by the 100-year floodplain.

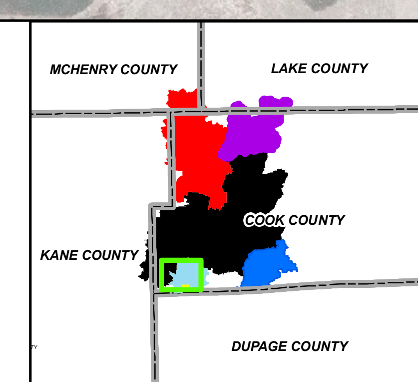
Alternative Descriptions:

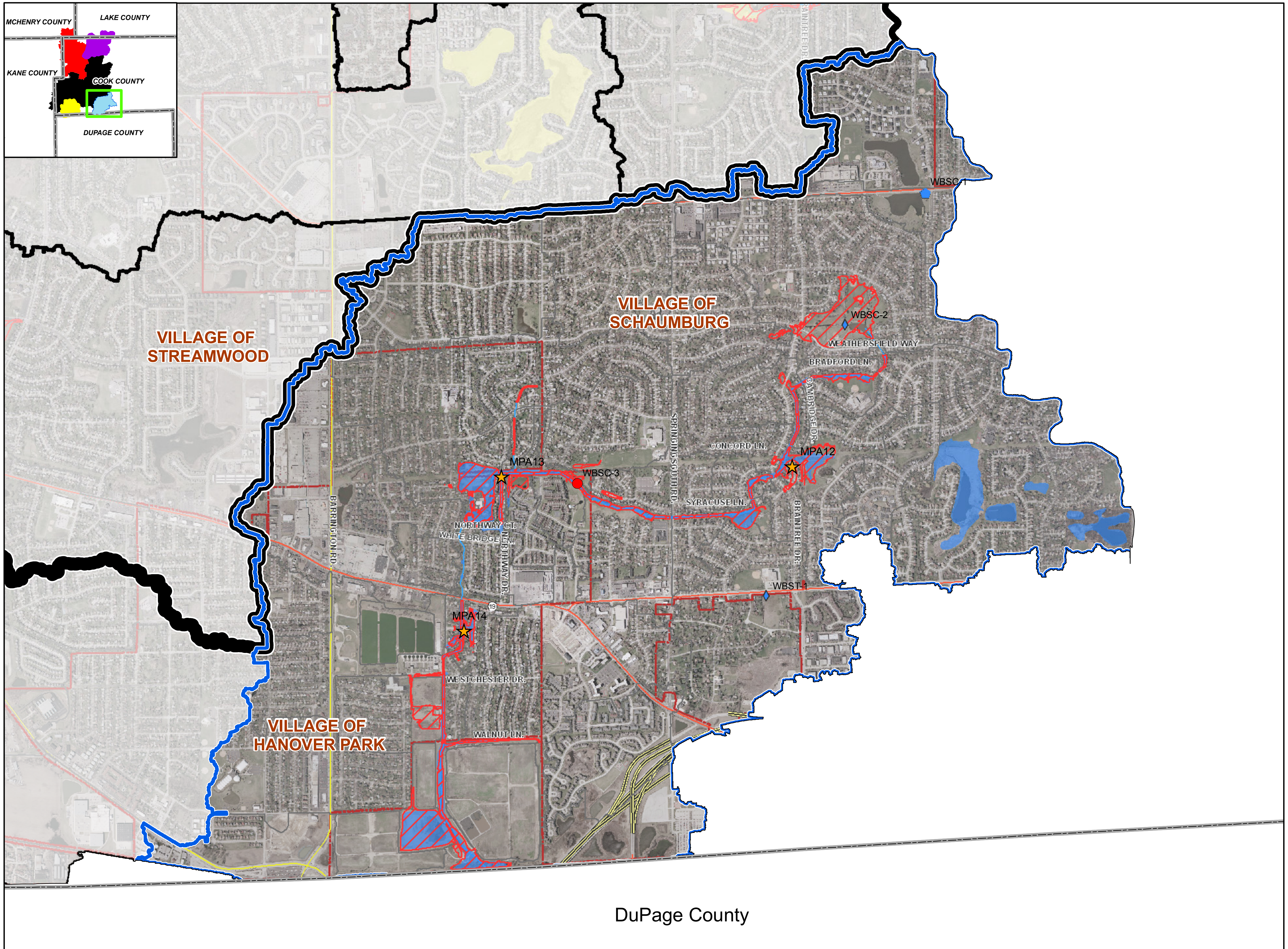
Reconstruct the Bartlett Road culvert and the private driveway culvert. Provide 55 ac-ft of detention storage.

Conceptual Level Cost: $6,044,000

Benefits: $498,800

B/C Ratio: 0.03





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LEGEND

Problem Types

Regional

- Bank Erosion
- Overbank flooding
- Pavement flooding
- Water Quality/Poor Habitat

Local

- Pavement flooding
- Storm Sewer Flow Restriction
- Water Quality/Poor Habitat
- Problem Area Identified Through Modeling
- Alternative Location
- DWP 100-year Inundation Area

FEMA Floodplain

- ZONE A, AH, and AO
- ZONE AE
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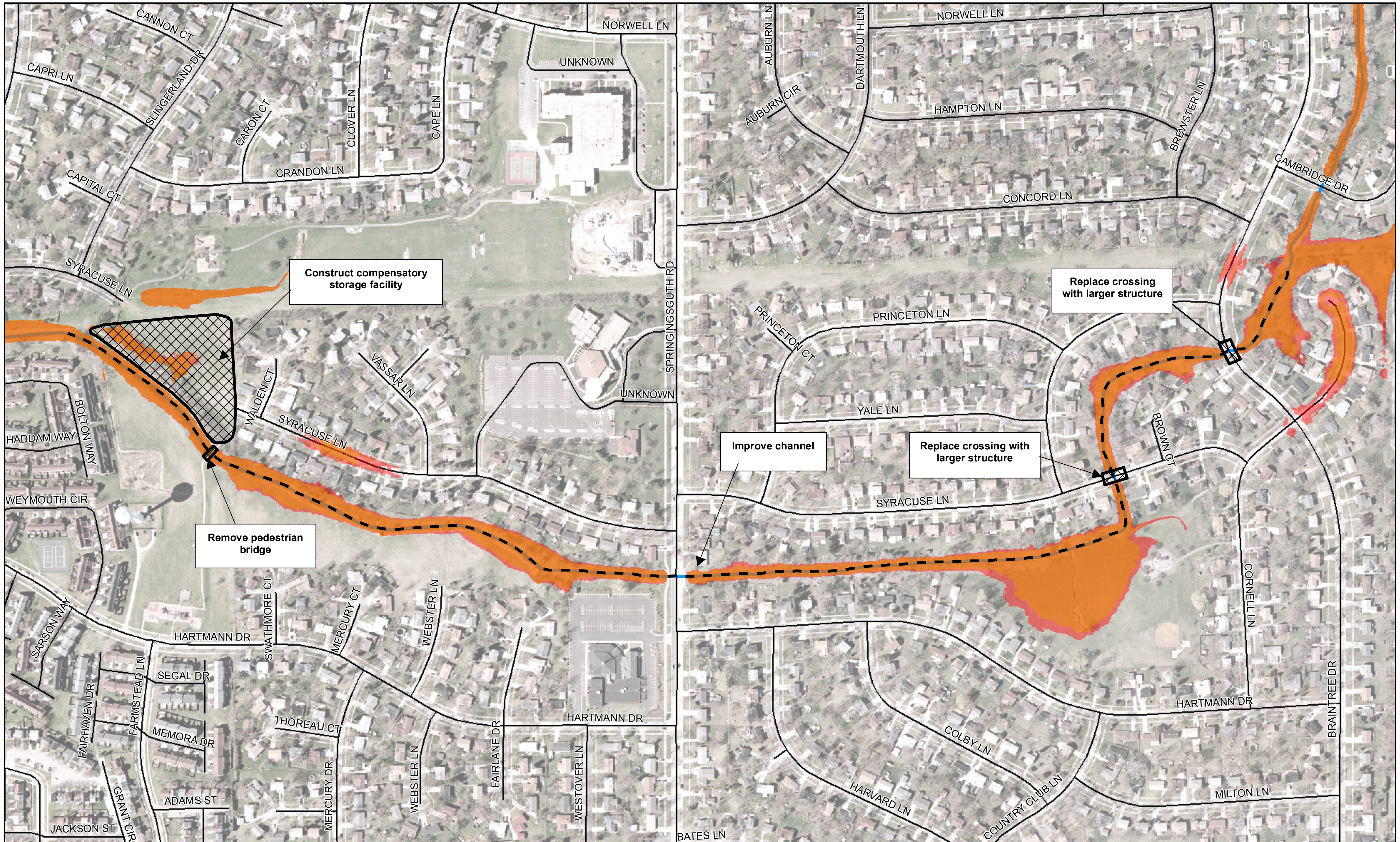
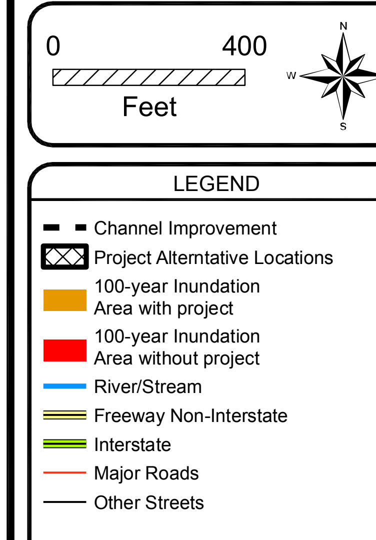
Poplar Creek Watershed Study Area Detailed Watershed Plan

West Branch DuPage River Overview

Figure 3.12.1





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Poplar Creek Watershed Study Area Detailed Watershed Plan

West Branch DuPage River Alternative WBMS-3

Figure 3.12.5

Subwatershed: West Branch DuPage River

Alternative: WBMS-3

Problem Description:

Seven residential structures in this vicinity subject to flooding under the 100-year event.

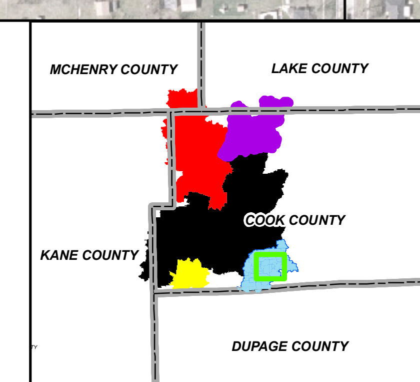
Alternative Descriptions:

Improve the channel for approximately 6,300 feet. Provide compensatory storage in Atcher Park. Remove pedestrian bridge upstream of the compensatory storagel ocation. Replace crossings at Syracuse Ln. and Braintree Dr.

Conceptual Level Cost: $4,462,712

Benefits: $141,519

B/C Ratio: 0.032



Introduction

As part of the Poplar Creek Watershed DWP development, inundation mapping was produced based on hydrologic and hydraulic modeling. Tables 1 and 2 include a comparison of the inundation mapping created for this DWP to the effective FEMA floodplain mapping, revised August 19, 2008 as part of the FEMA Map Modernization program. Only detailed study Zone AE and limited detail study Zone A special flood hazard areas (SFHA) are included in the comparison. Caution should be exercised when evaluating the numbers in both tables, as some differences in inundation area may result from differences in the extent of detailed hydraulic modeling.

In some locations, other discrepancies exist between this DWP inundation area maps and the FEMA floodplain maps, which may be attributed to differences in hydrologic and hydraulic modeling, as described in more detail in the following paragraphs.

Hydrologic Modeling Methodology

Hydrologic modeling methodologies utilized for the District's DWP are fundamentally different than those performed for DFIRM mapping, thus estimated peak flow rates may be significantly different. DFIRM hydrology was primarily based on regression equations and older hydrologic models (HEC-1, etc.) while this DWP utilized a current hydrologic model (HEC-HMS). Consequently, different approaches to channel and reservoir routing may have been taken, which may result in magnitude and timing differences.

Parameters of each hydrologic model may be quite different. This DWP computed NRCS Curve Numbers based on the latest CMAP land use maps and NRCS soil maps. Contrarily, hydrologic methods, utilized by the DFIRM mapping, likely referenced older land use and soil data. Additionally, different methodologies may have been used to calculate subbasin times of concentration.

This DWP utilized current ISWS Bulletin 71 rainfall data while previous hydrologic studies used for DFIRM mapping may have used older Technical Paper-40 rainfall data. Bulletin 71 rainfall data generally yields higher rainfall depths than Technical Paper-40. For example, Technical Paper-40 specifies a 100-year, 24-hour duration rainfall depth of approximately 6.0 inches while Bulletin 71 specifies a corresponding rainfall depth of approximately 7.60 inches.

Subbasin delineation is likely different between this DWP and the DFIRM mapping, as this DWP utilized the latest Cook County LiDAR data for topographic information to support subbasin delineation.

Differences in hydrologic modeling approaches may yield different flow rates, which will likely yield different flood surface profiles in the hydraulic model results.

Hydraulic Modeling Methodology

Hydraulic modeling methodologies utilized for this DWP are fundamentally different than those performed for DFIRM mapping, thus their associated flood surface profiles may be significantly different. Steady-state hydraulic modeling was generally performed in support of DFIRM mapping. This DWP utilized dynamic unsteady flow simulation. The difference in approaches between steady and unsteady hydraulic modeling may contribute to discrepancies between flood surface profiles.

Channel cross sections in the hydraulic models differ between this DWP and previous modeling. Cross sections developed under this DWP were generally obtained from field surveys. In a few cases, recent hydraulic models were available and modified under this DWP. Hydraulic models produced in support of DFIRM mapping used different cross section data, which may reflect outdated channel geometries. Likewise, bridge section geometries also vary from previous modeling. Differences in model cross sections may contribute to discrepancies between flood surface profiles.

Hydraulic model calibration may also contribute to discrepancies in flood surface profiles between this DWP and DFIRM mapping. This DWP was calibrated to recent storm events that have occurred since the development of DFIRM modeling. The calibration may contribute to discrepancies between flood surface profiles.

DWP and FEMA Floodplain Area Comparison

Table 1 below lists for comparison the floodplain area within each subwatershed as determined by the Poplar Creek DWP and the DFIRM mapping (for both FEMA Zone AE, and FEMA Zone A).

TABLE 1
Comparison of DWP Inundation Area and FEMA Floodplain by Subwatershed

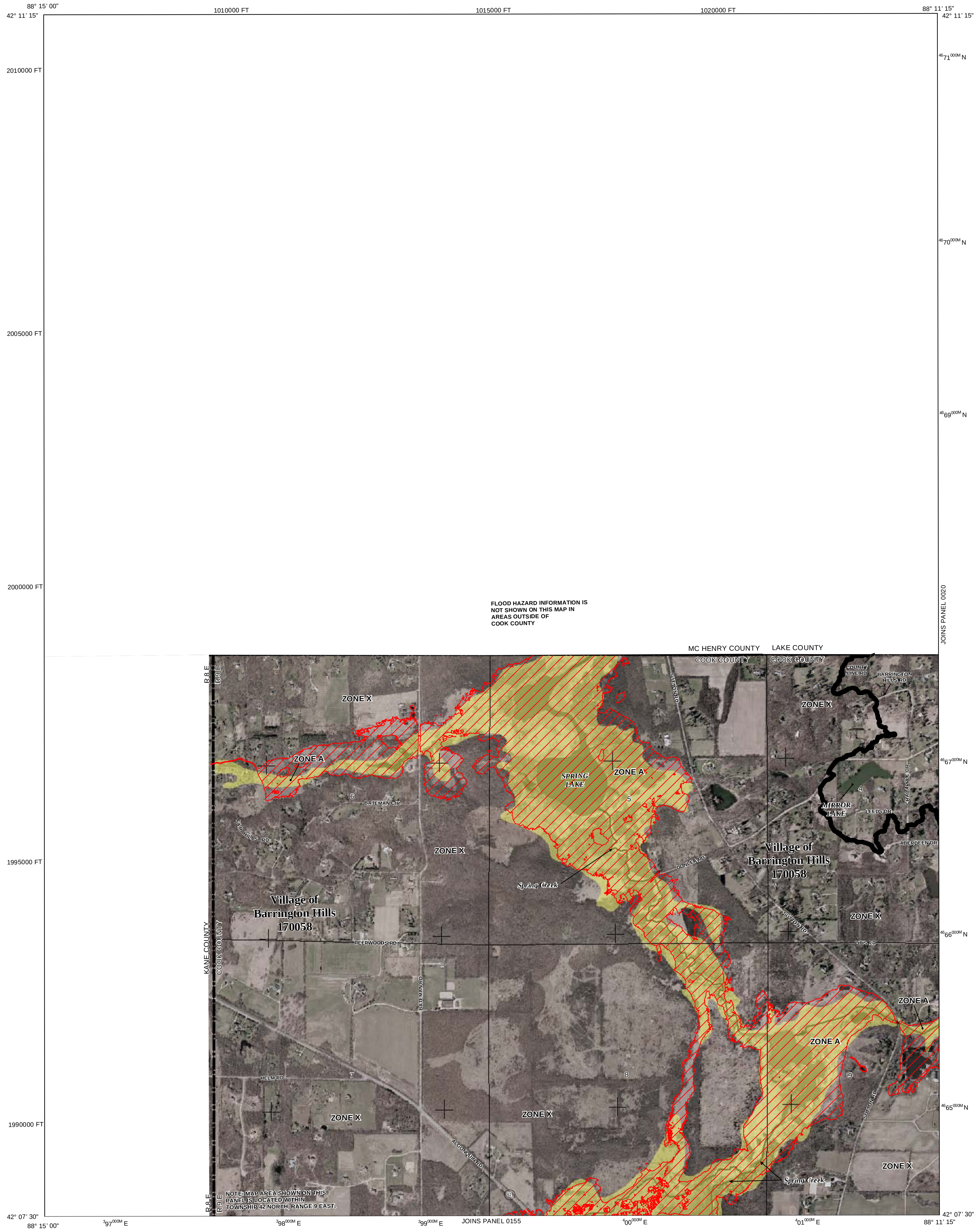
Subwatershed	DWP Floodplain Area (acres)	FEMA Zone AE Area (acres)	FEMA Zone A Area (acres)
Flint Creek	582.4	22.7	731.6
Spring Creek	1385.7		1258.1
West Branch DuPage River	161.4	125.6	
Poplar Creek Mainstem	1565.6	944.9	257.2
Poplar Creek Tributary A	90.1	28.5	92.6
Poplar Creek East Branch	281.5	103.2	138.8
Poplar Creek Schaumburg Branch	186.6	174.6	11.4
Poplar Creek Railroad Branch	92.4	1.0	9.4
Poplar Creek South Branch	212.5	125.1	4.1
Lord's Park Tributary	289.1	98.4	18.2
Brewster Creek	190.8		210.3
Total	**5038.2**	**1623.9**	**2731.7**

Table 2 below lists for comparison the floodplain area within each community within the Poplar Creek Study Area as determined by the Poplar Creek DWP and the DFIRM mapping (for both FEMA Zone AE, and FEMA Zone A).

TABLE 2
Comparison of DWP Inundation Area and FEMA Floodplain by Community

Community	DWP Floodplain Area (acres)	FEMA Zone AE Area (acres)	FEMA Zone A Area (acres)
Village of Barrington	143.5	4.7	159.4
Village of Barrington Hills	1509.7	0.6	1467.4
Village of Bartlett	132.2		113.2
City of Elgin	660.3	269.7	83.3
Village of Hanover Park	40.5	28.2	
Village of Hoffman Estates	855.9	561.3	153.5
Village of Inverness	252.6	68.1	243.4
Village of Schaumburg	90.8	90.2	82.6
Village of South Barrington	418.1	166.2	164.6
Village of Streamwood	239.9	117.5	4.1
Barrington Township [b]	77.8	20.8	57.7
Hanover Township [b]	109.6	25.7	38.7
Palatine Township [b]	0.1	0.4	0.1
Schaumburg Township [b]	63.2	32.5	2.2
FPDCC [c]	443.9	237.9	161.5
Total	**5038.1**	**1623.9**	**2731.6**

a Communities with no DWP inundation area mapping were omitted from the table, although some did have FEMA Zone A area.
b Only unincoporated areas of townships are included.
c Only areas of FPDCC not within municipal borders.



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0015G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

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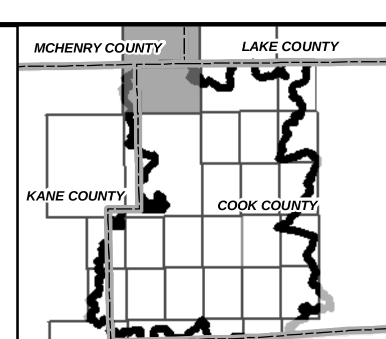

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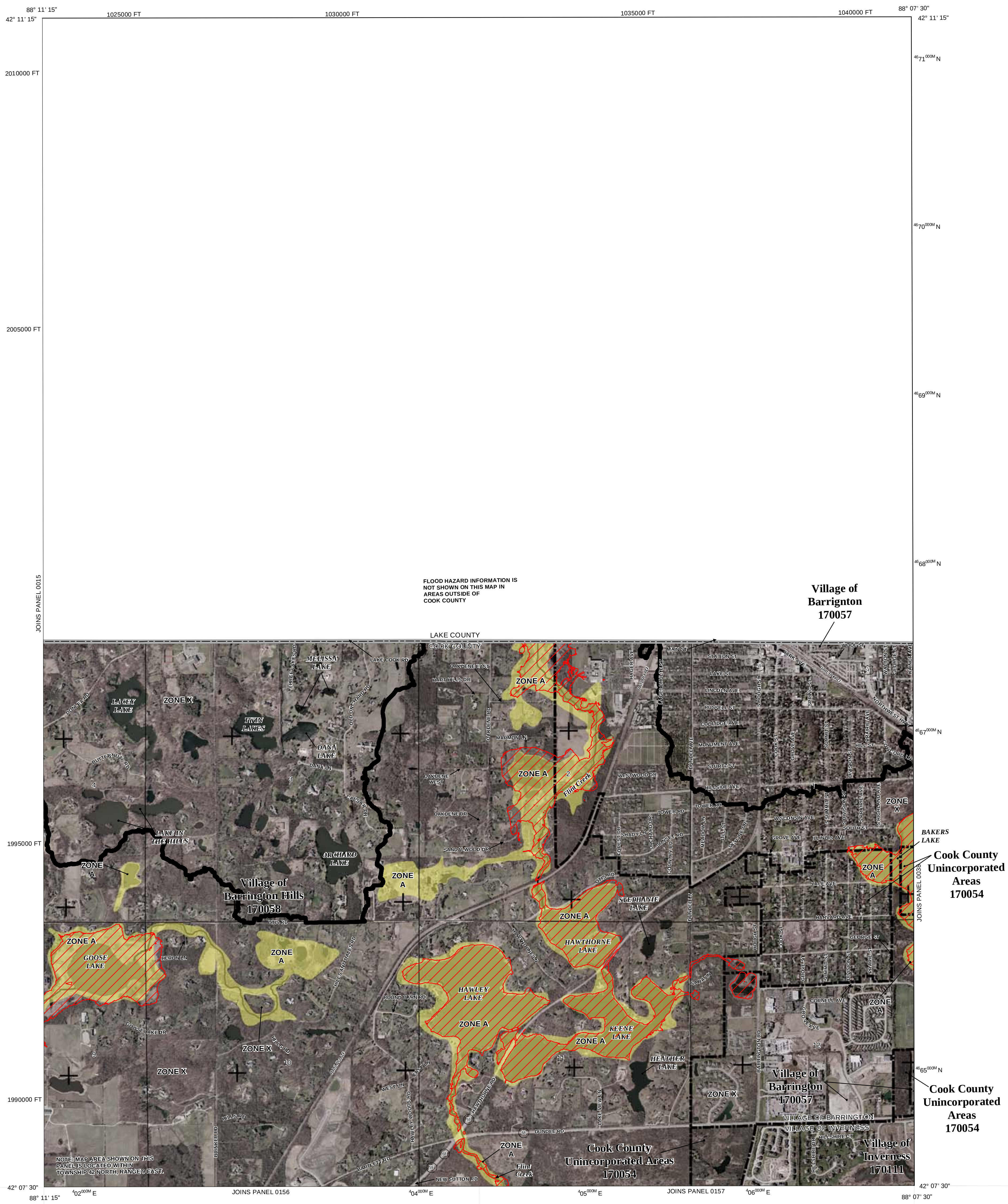
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

FIRM Panel: 17031C0020G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

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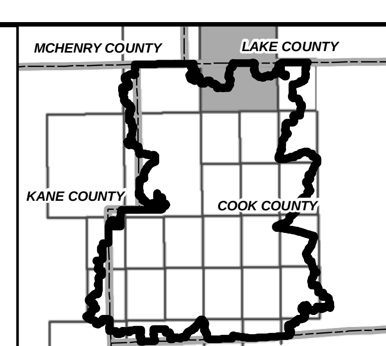

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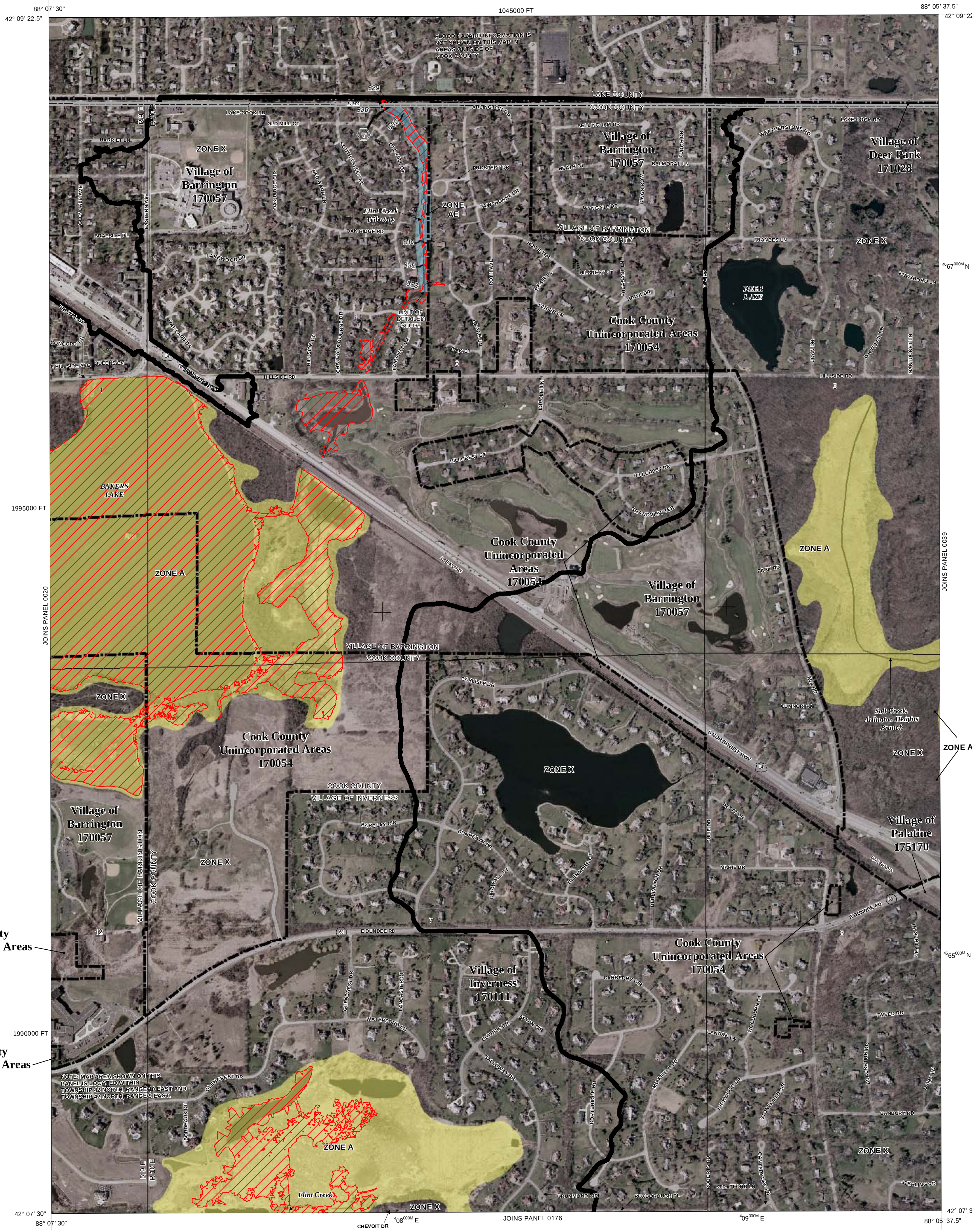
Detailed Watershed Plan



Legend

- DWP 100-year Inundation Area

FEMA Floodplain

- Zone A, AH, and AO
- Zone AE
- Area not included
- Cook County Boundary
- Municipal Boundaries
- River/Stream
- Poplar Creek DWP Study Area

FIRM Panel: 17031C0038G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

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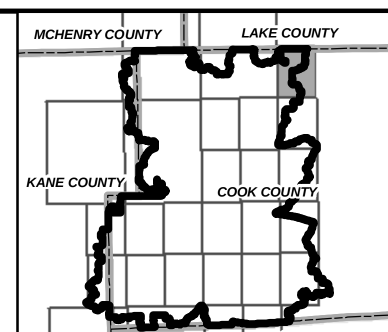

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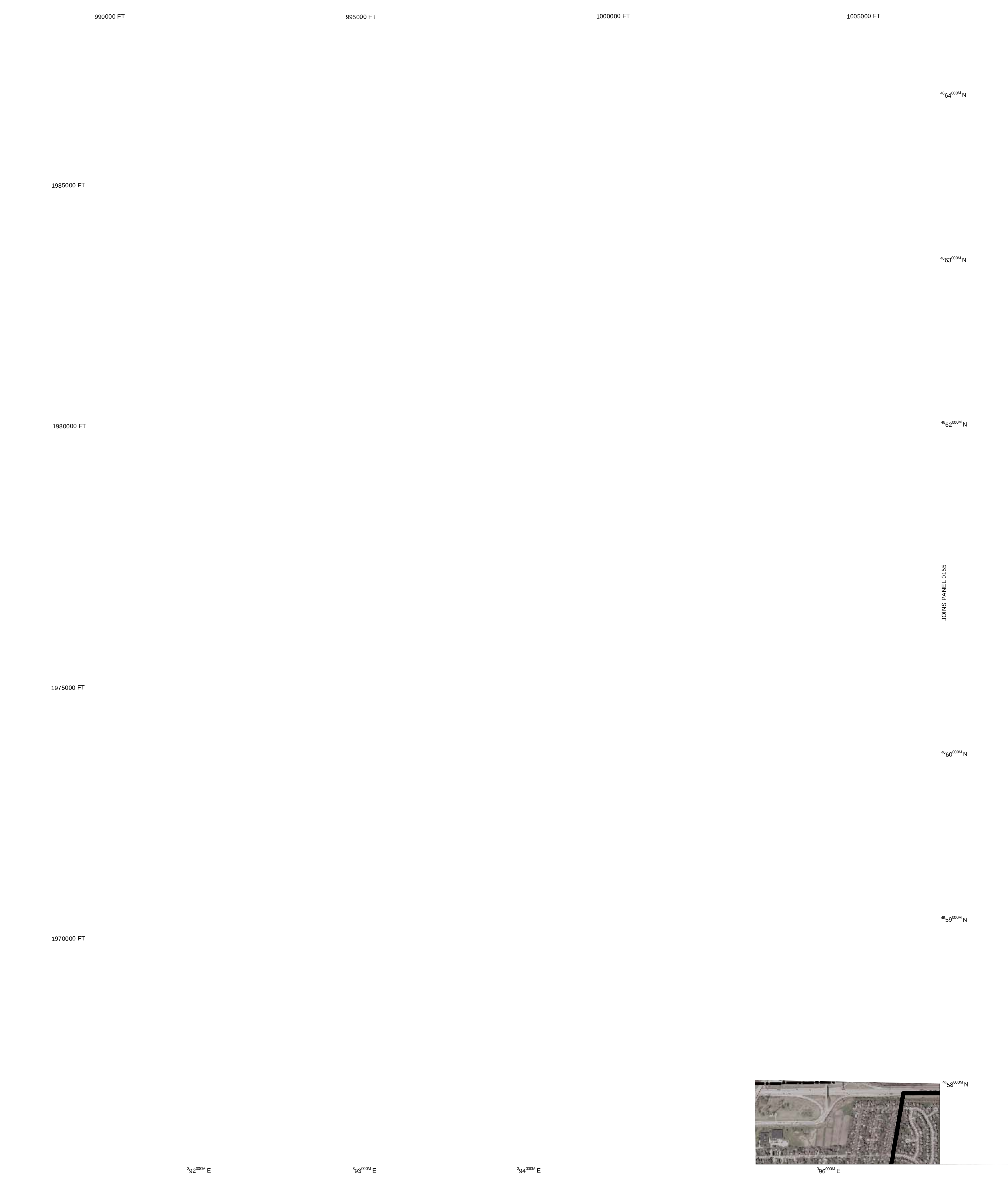
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0135G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 10/21/2010

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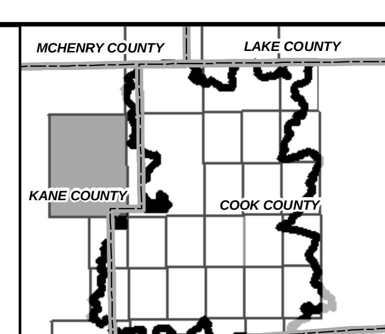

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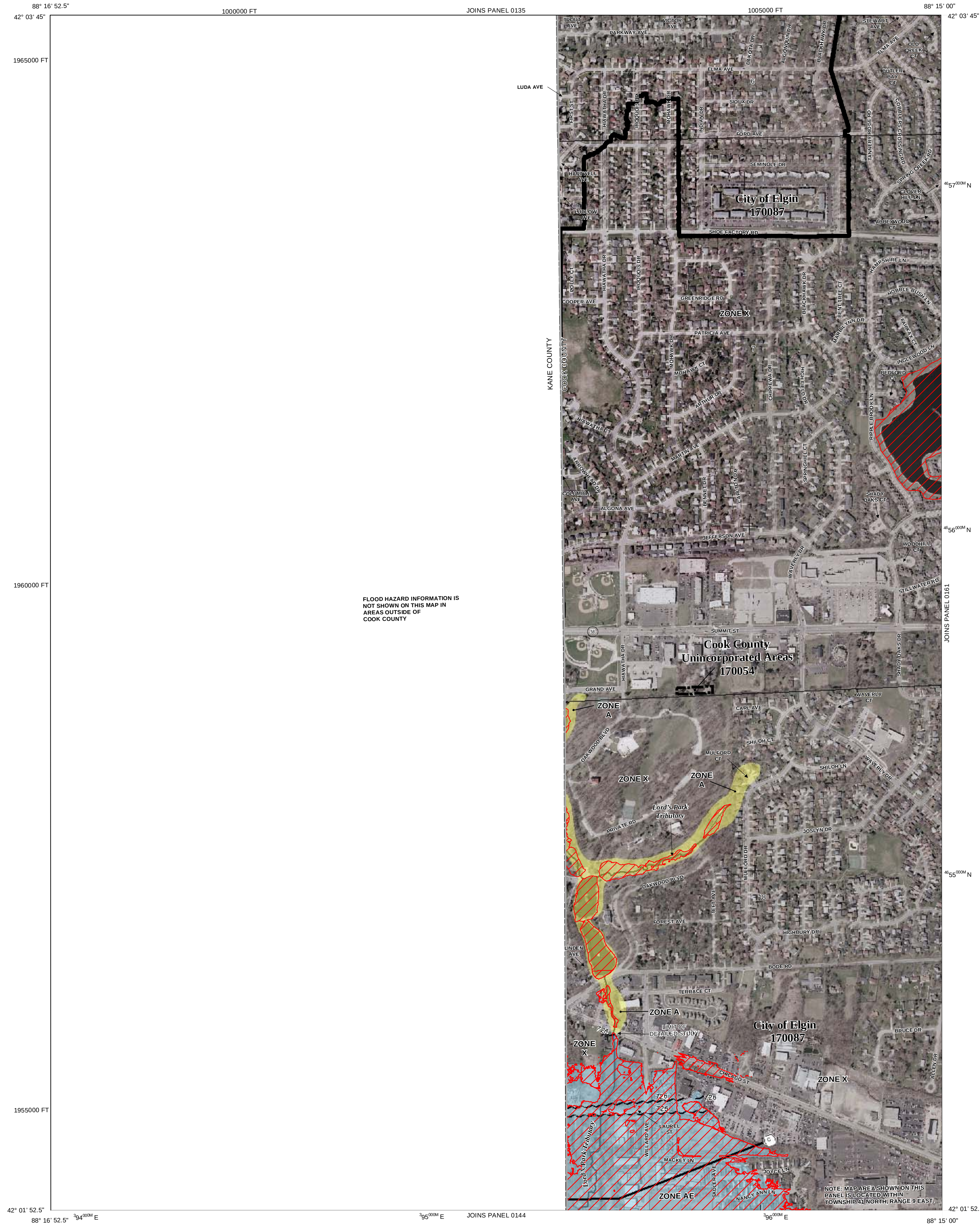
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

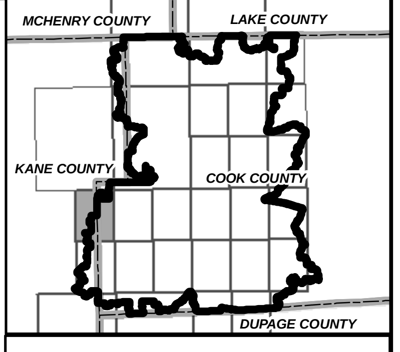
River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0142H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000
Feet



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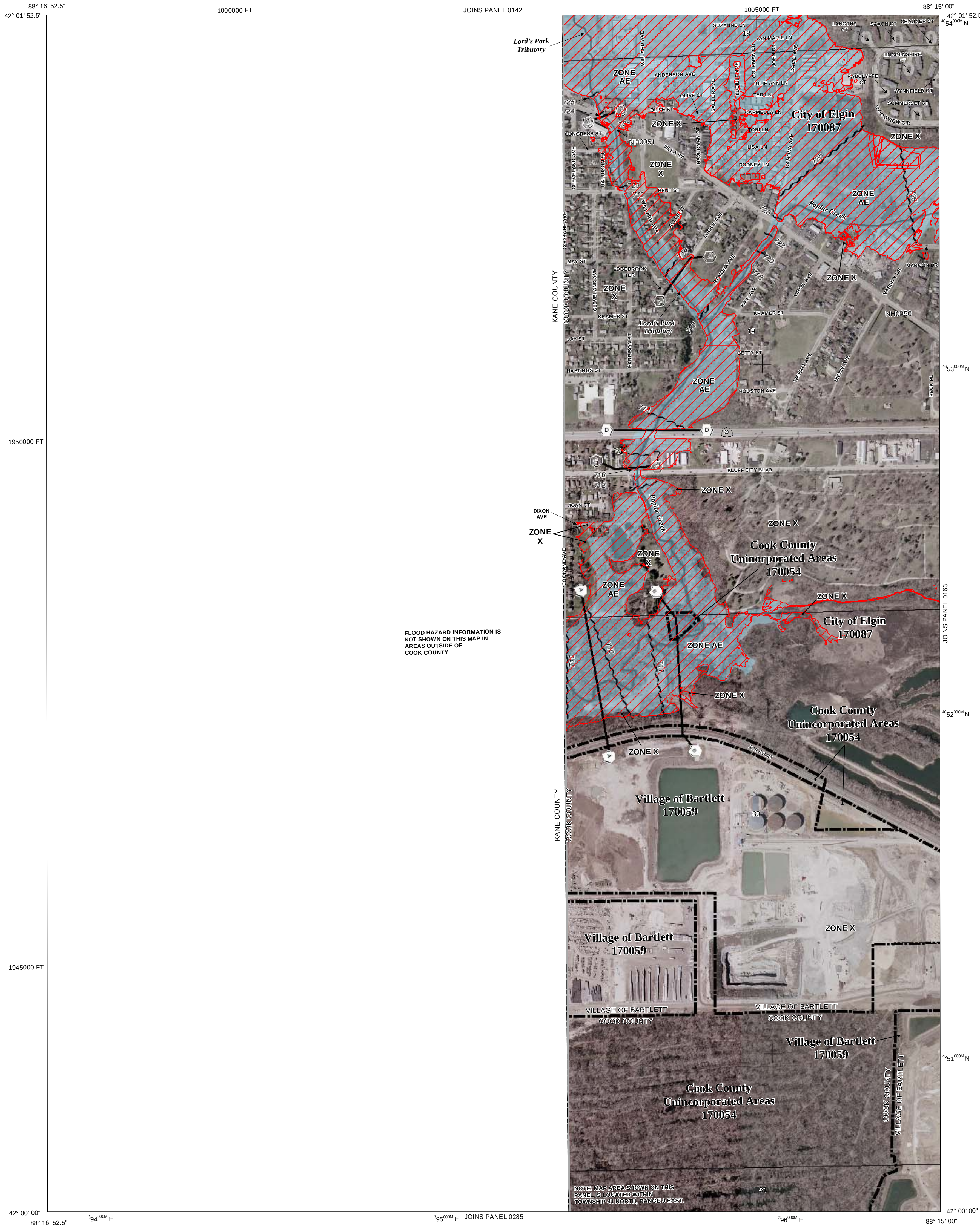
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

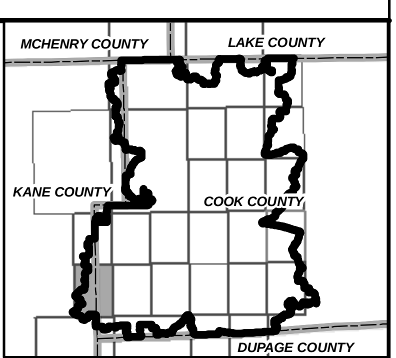
Poplar Creek DWP Study Area

FIRM Panel: 17031C0144H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000

Feet



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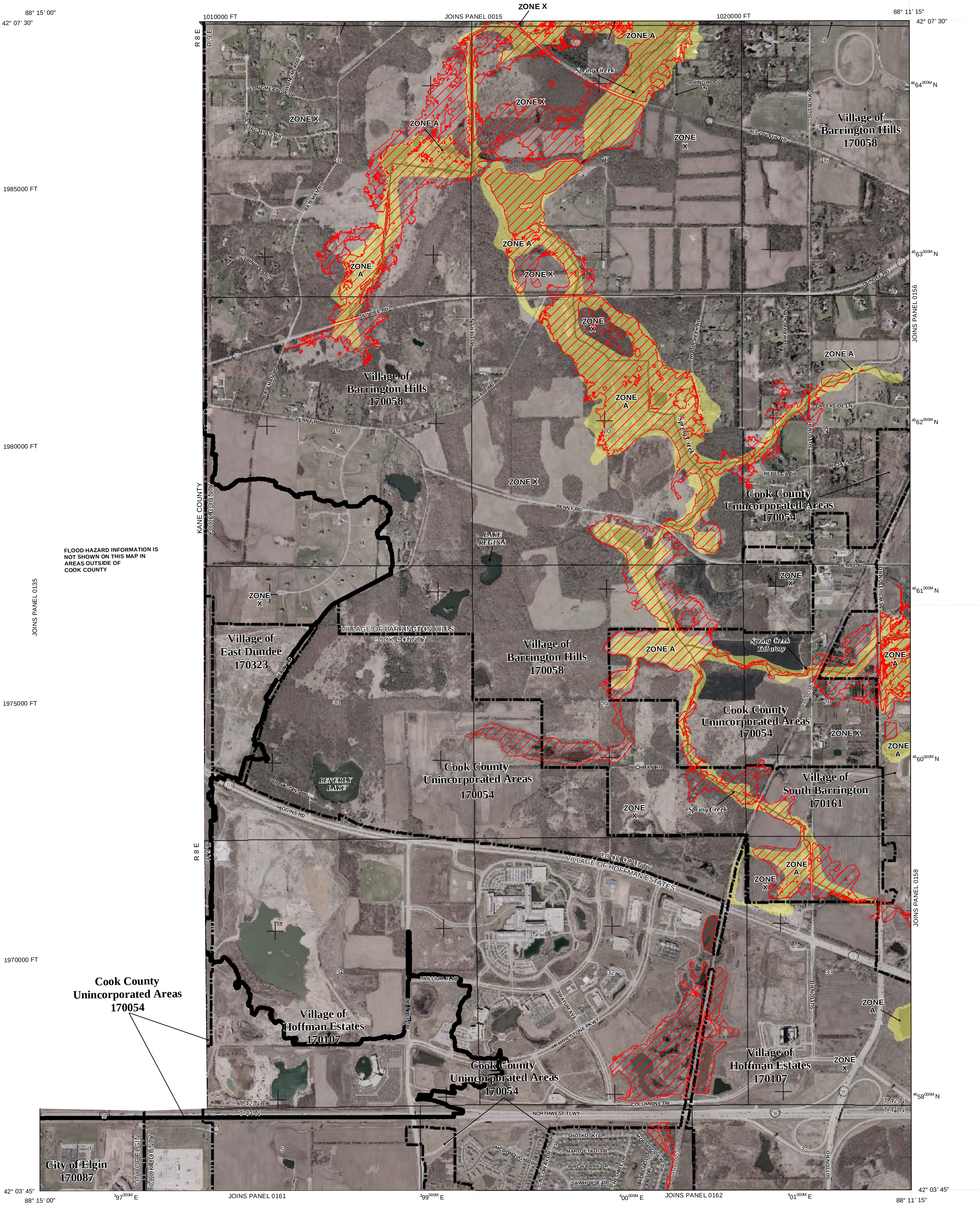
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0155H

Comparison of DWP 100-yr Inundation Mapping
and FEMA Effective FIRM Revised 10/21/2010

0 2,000

Feet

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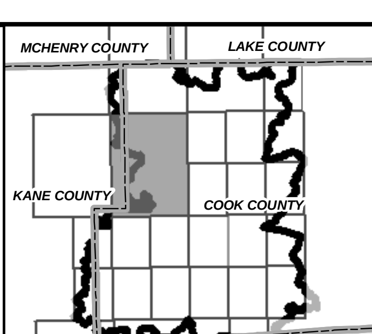

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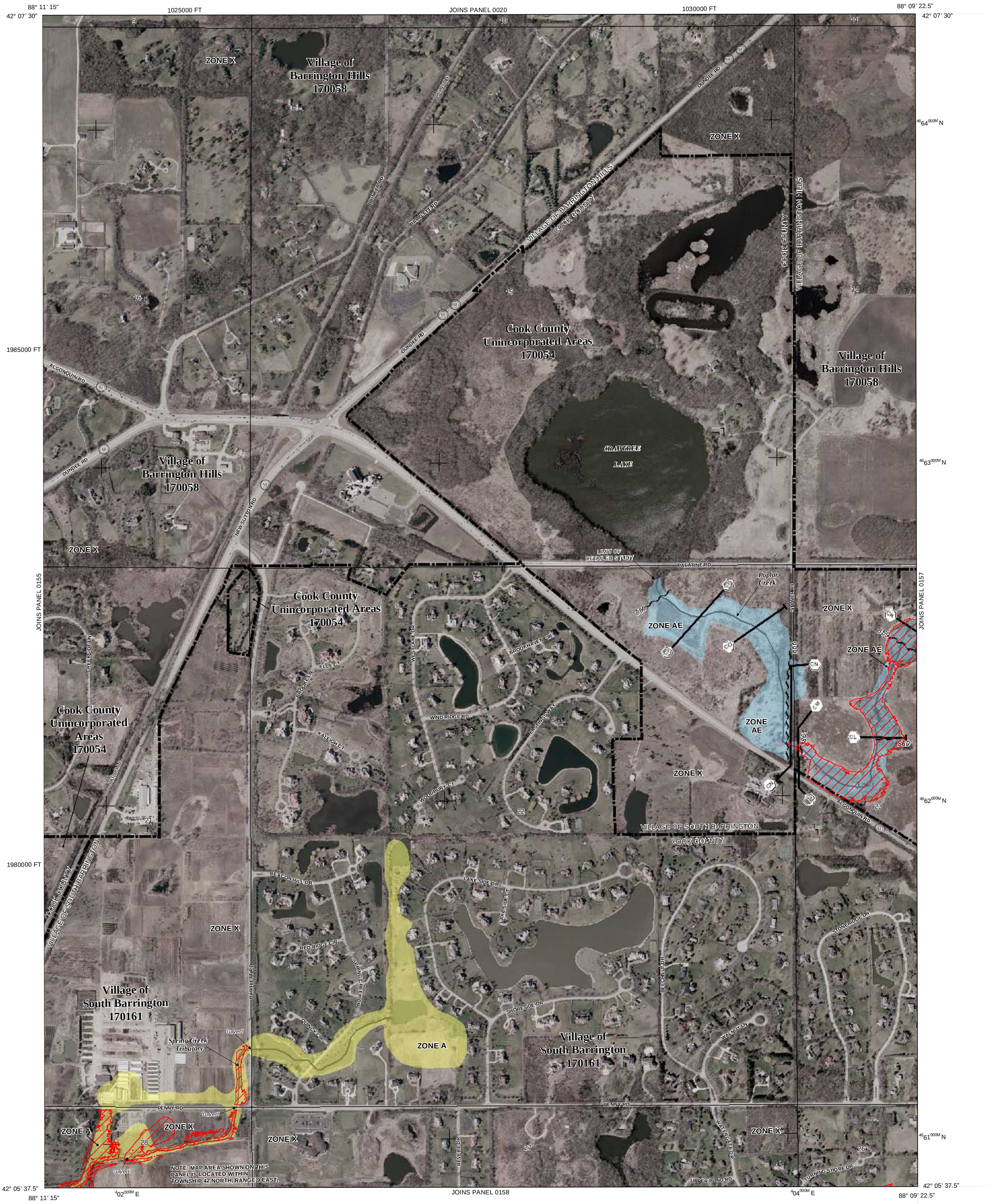
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

- DWP 100-year Inundation Area

FEMA Floodplain

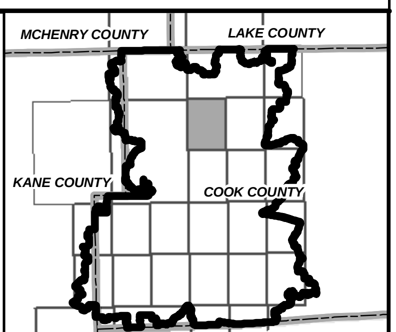
- Zone A, AH, and AO
- Zone AE
- Area not included
- Cook County Boundary
- Municipal Boundaries
- River/Stream
- Poplar Creek DWP Study Area

FIRM Panel: 17031C0156G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000
Feet

N W E S



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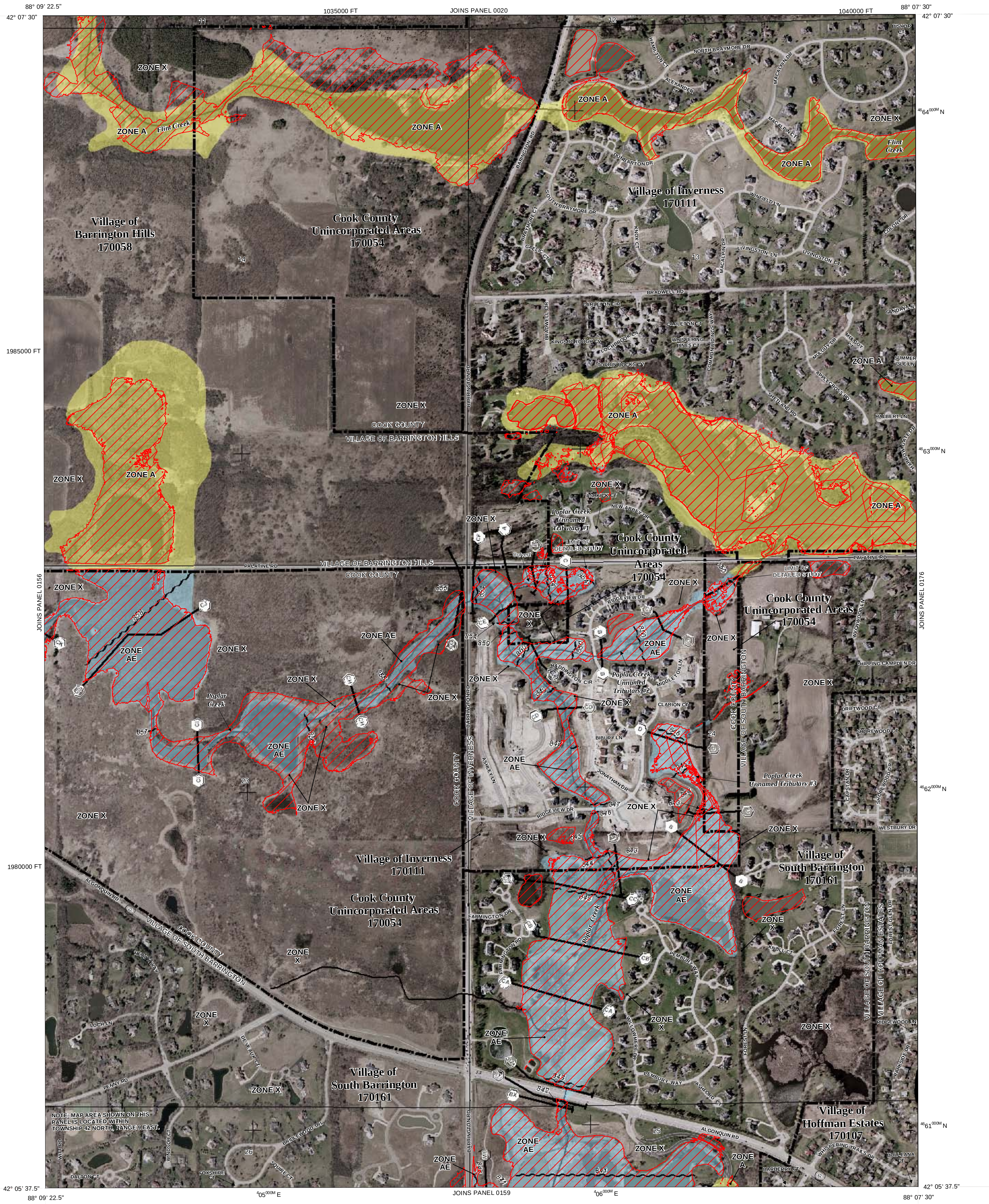
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

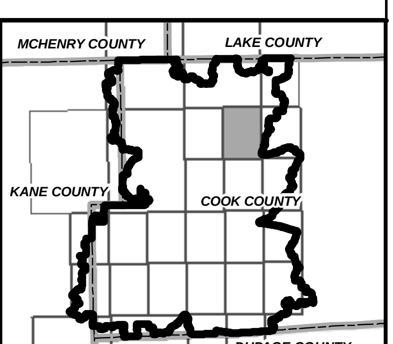
Poplar Creek DWP Study Area

FIRM Panel: 17031C0157G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000
Feet

N
W E
S



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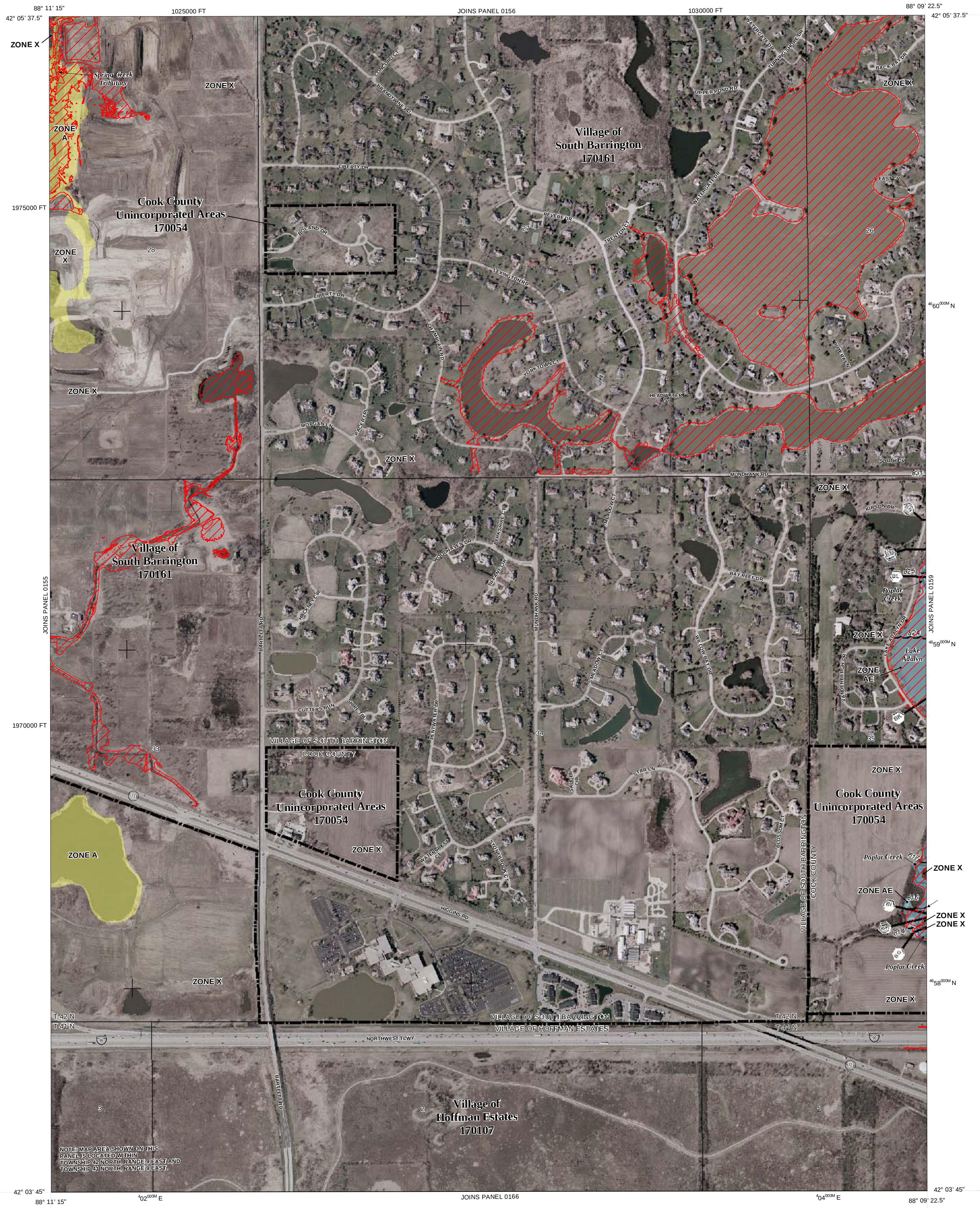
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

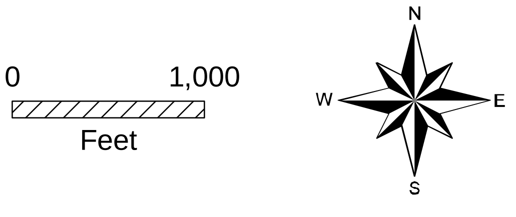
- DWP 100-year Inundation Area

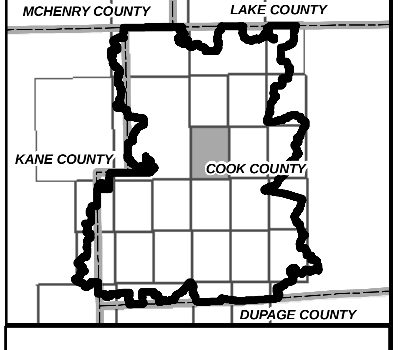
FEMA Floodplain

- Zone A, AH, and AO
- Zone AE
- Area not included
- Cook County Boundary
- Municipal Boundaries
- River/Stream
- Poplar Creek DWP Study Area

FIRM Panel: 17031C0158G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008





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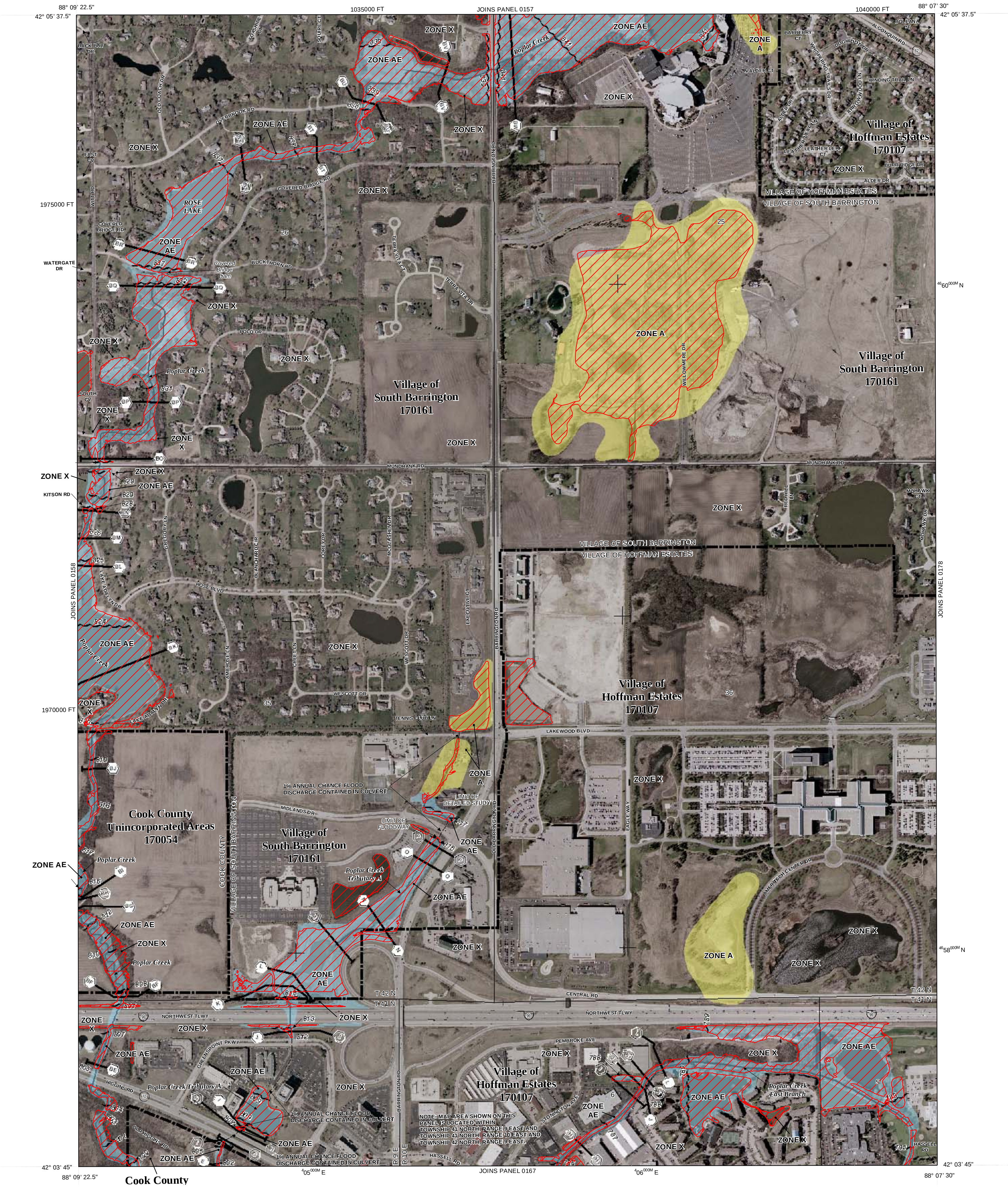
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

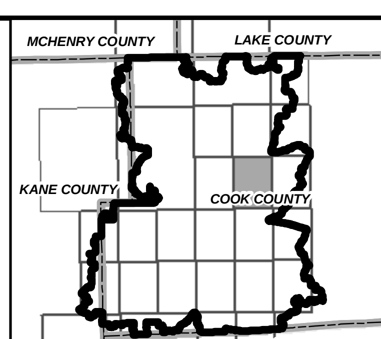
FIRM Panel: 17031C0159G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000

Feet

N E S W



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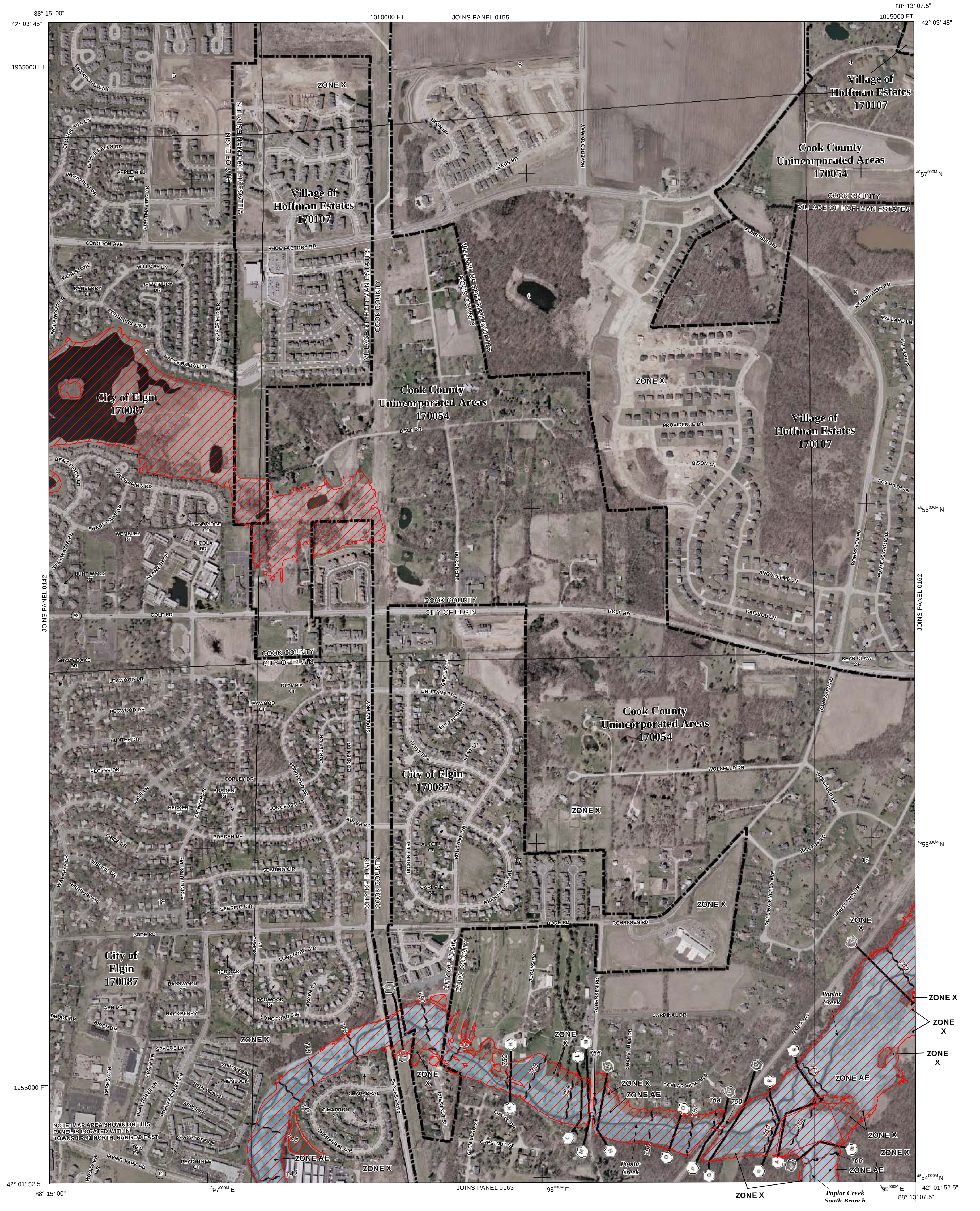
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

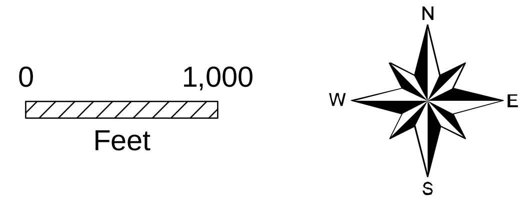
- DWP 100-year Inundation Area

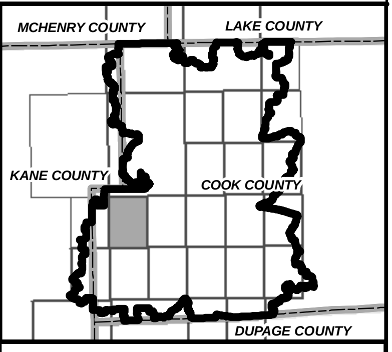
FEMA Floodplain

- Zone A, AH, and AO
- Zone AE
- Area not included
- Cook County Boundary
- Municipal Boundaries
- River/Stream
- Poplar Creek DWP Study Area

FIRM Panel: 17031C0161H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008





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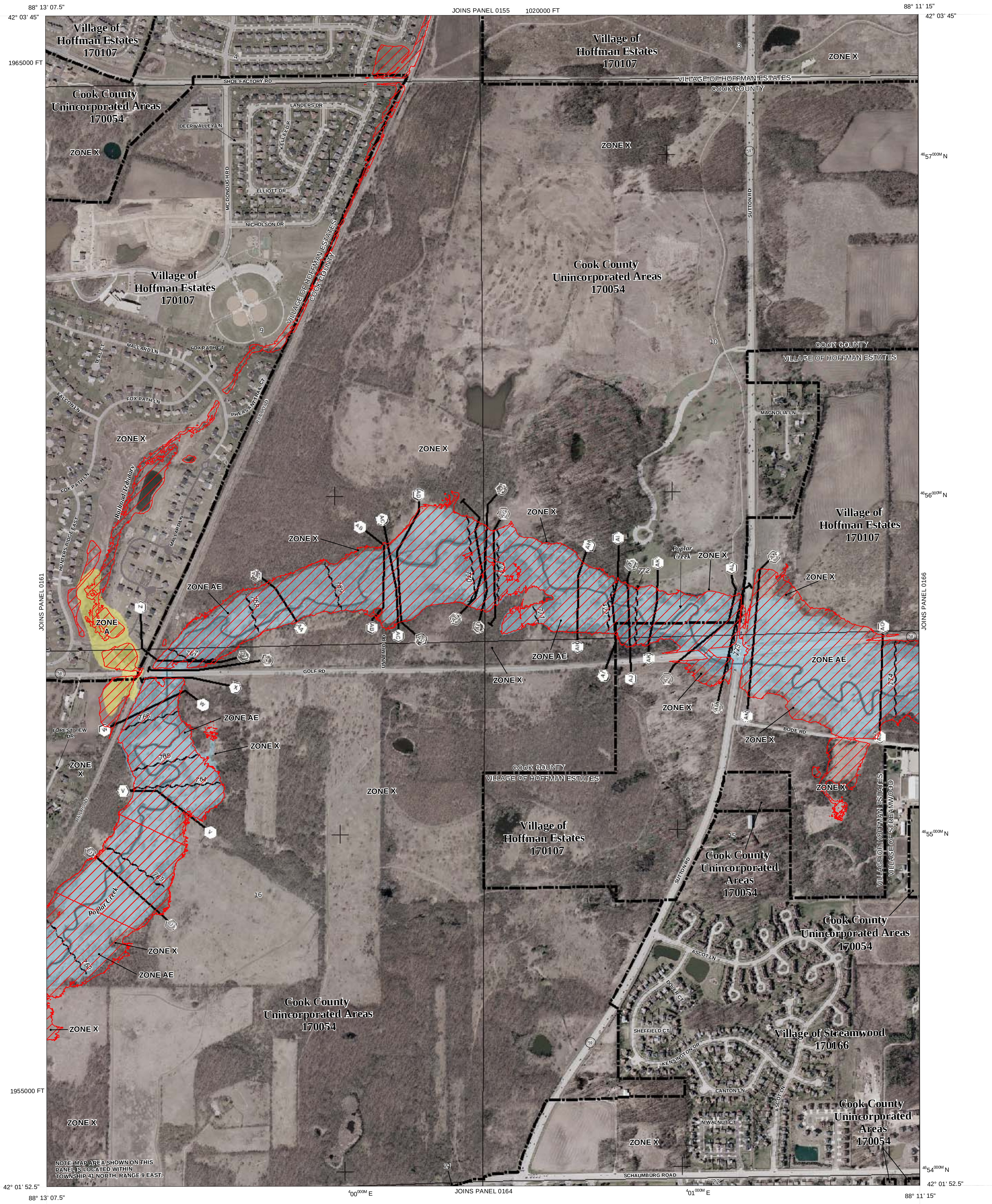
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

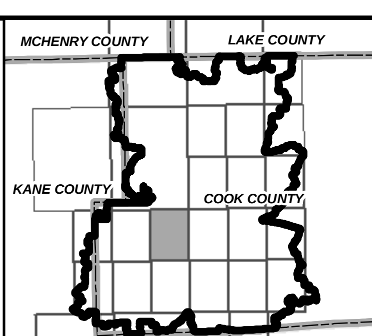
FIRM Panel: 17031C0162H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000

Feet

N E S W



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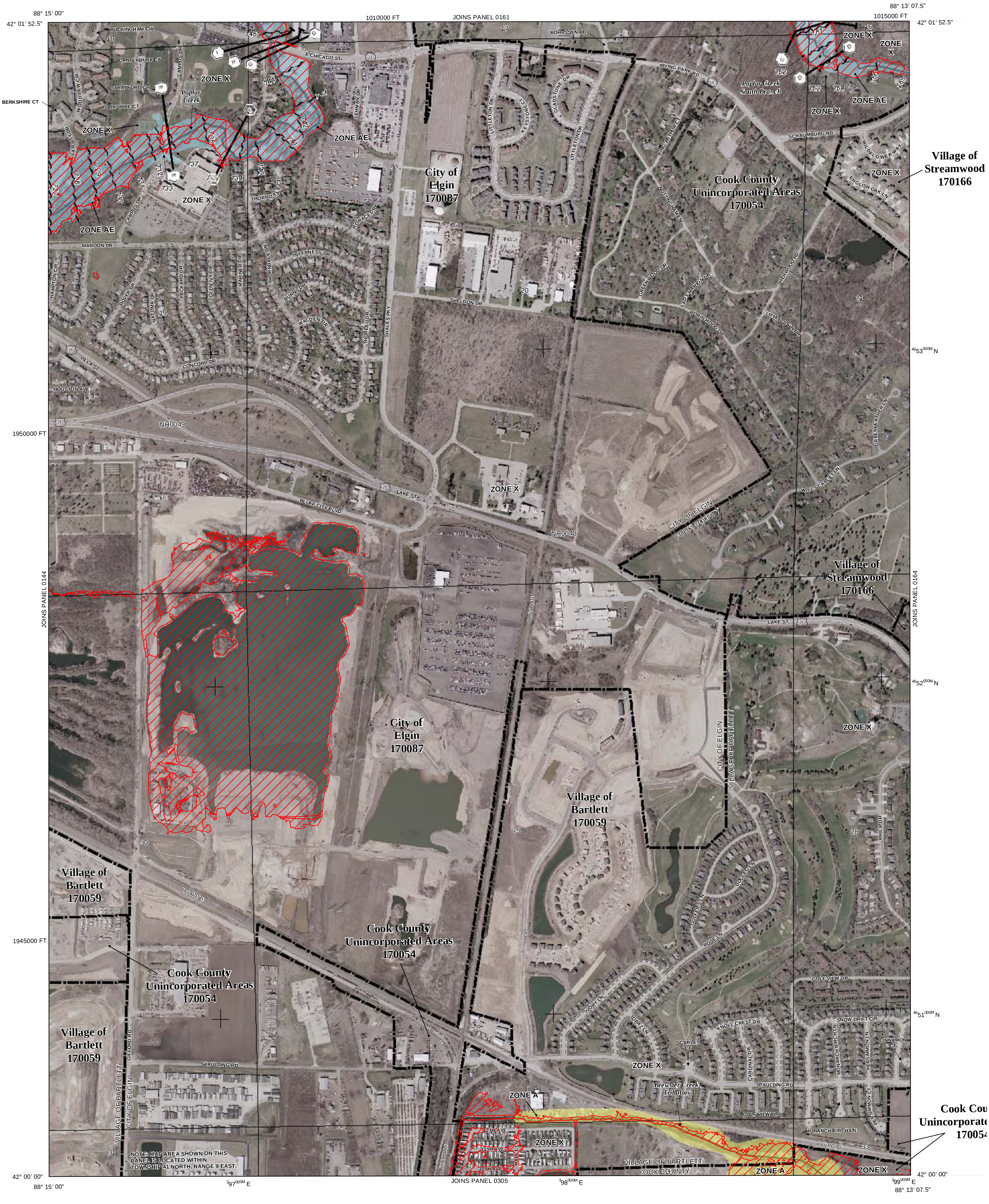
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

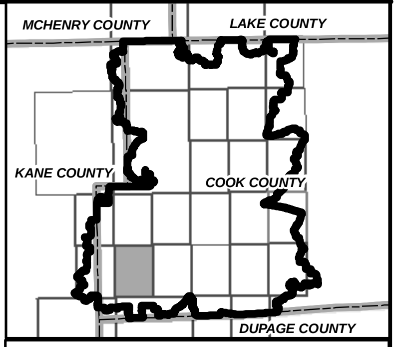
Poplar Creek DWP Study Area

FIRM Panel: 17031C0163H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000 Feet

N E S W



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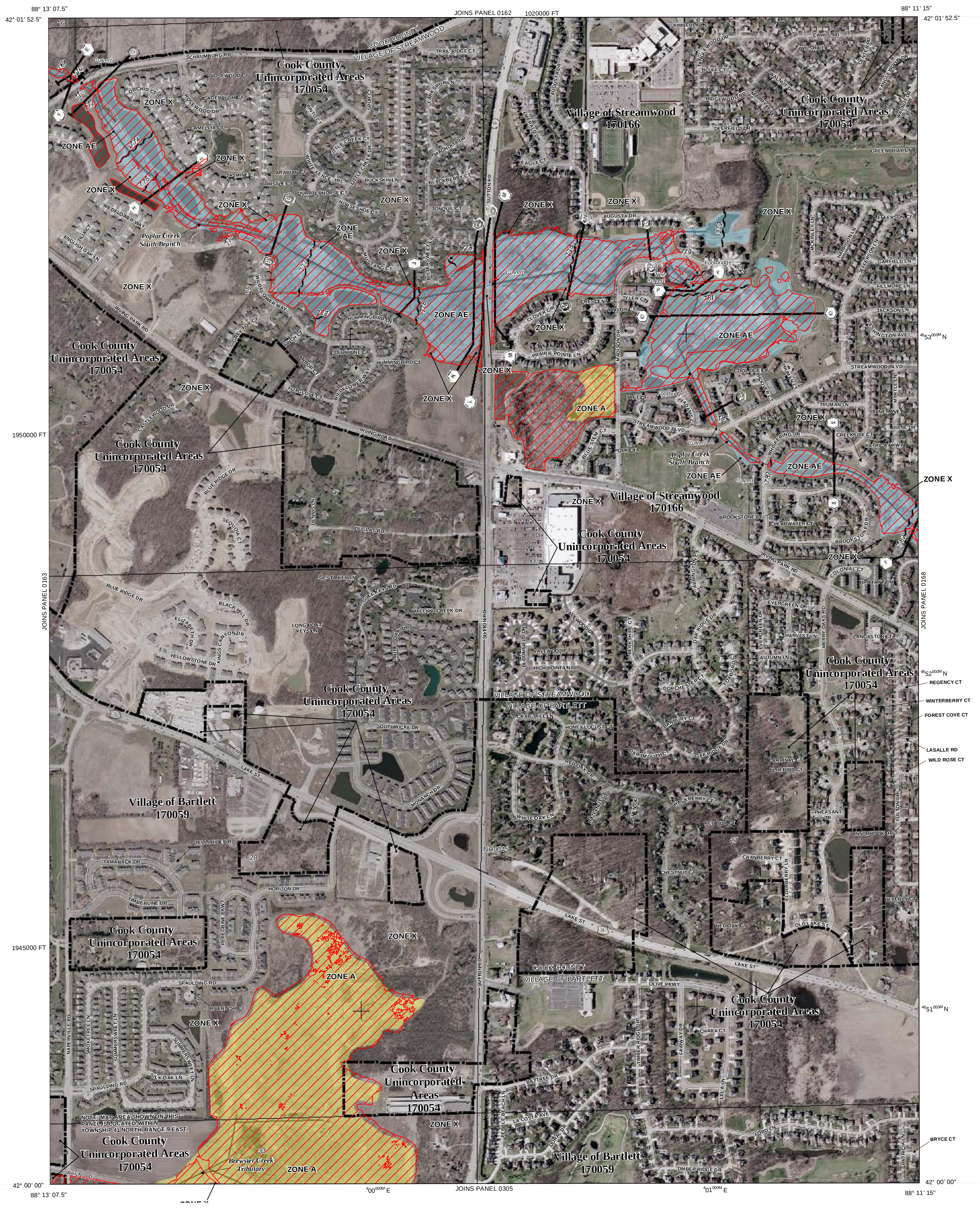
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

- DWP 100-year Inundation Area

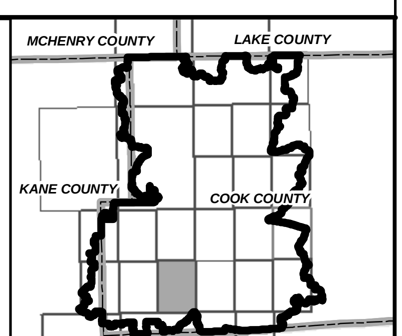
FEMA Floodplain

- Zone A, AH, and AO
- Zone AE
- Area not included
- Cook County Boundary
- Municipal Boundaries
- River/Stream
- Poplar Creek DWP Study Area

FIRM Panel: 17031C0164H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000
Feet



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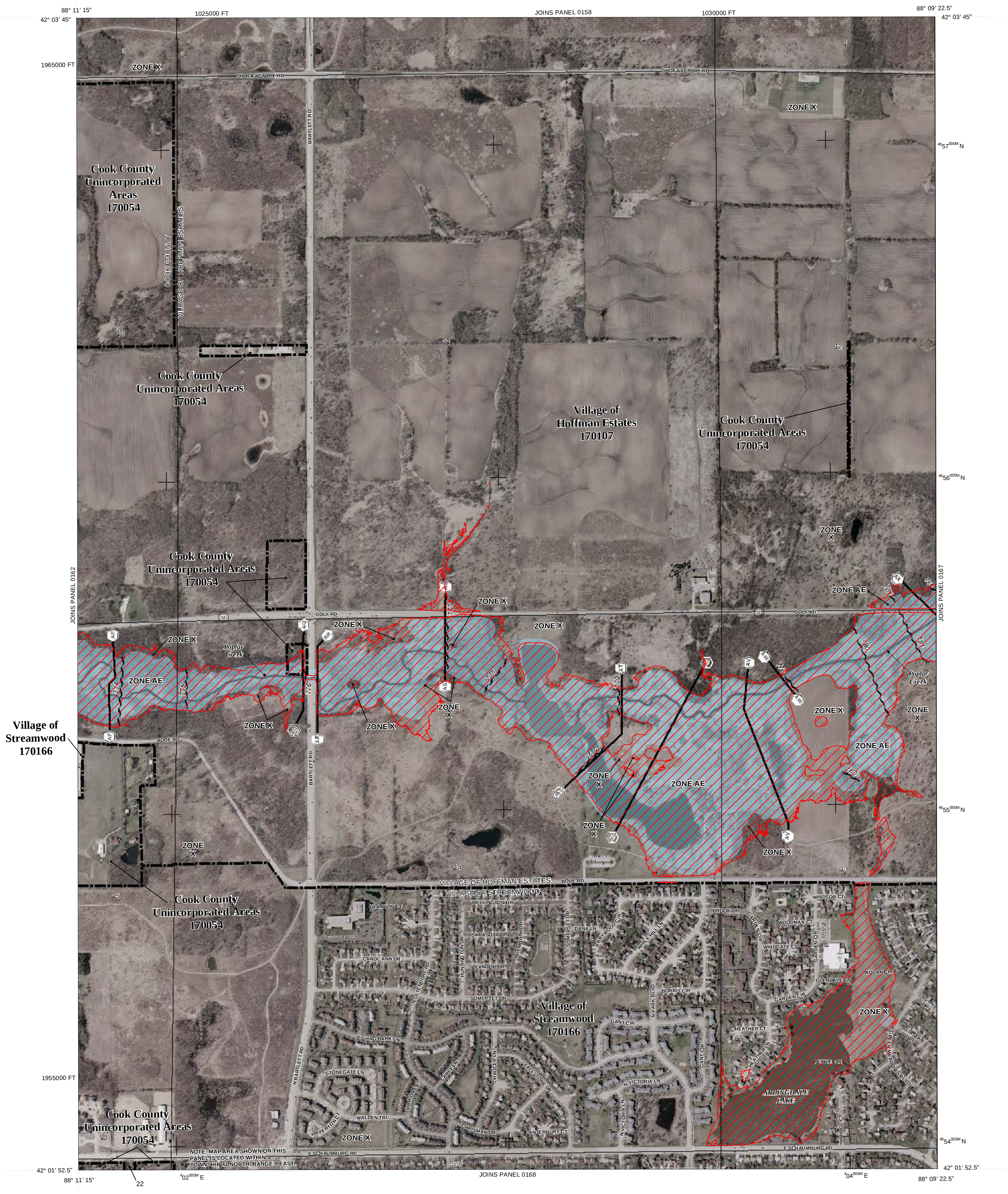
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

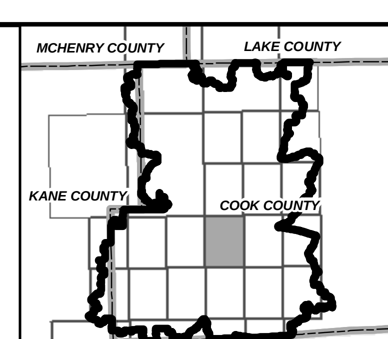
FIRM Panel: 17031C0166H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000

Feet

N E S W



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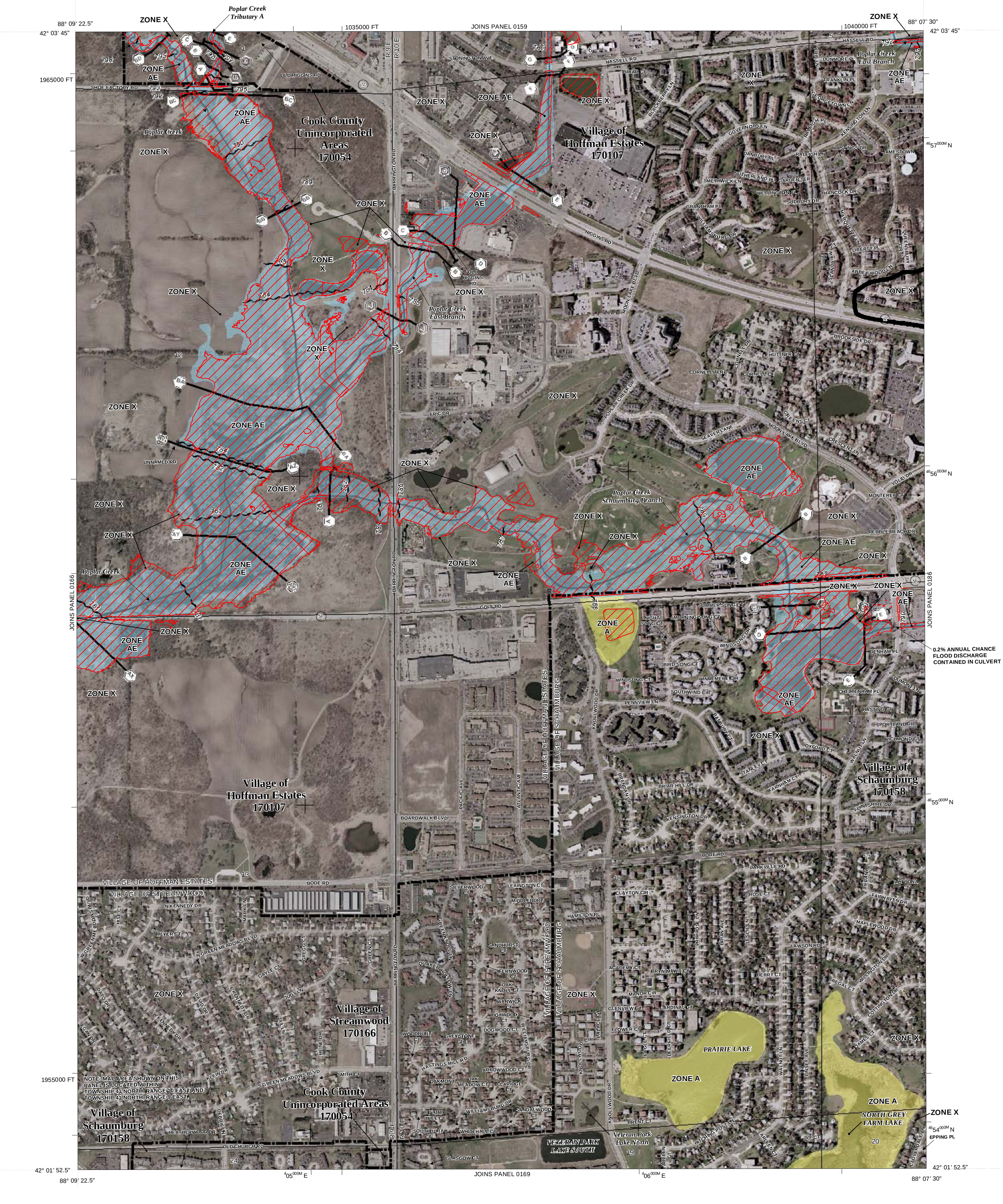
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

- Zone A, AH, and AO
- Zone AE
- Area not included

- Cook County Boundary
- Municipal Boundaries
- River/Stream
- Poplar Creek DWP Study Area

FIRM Panel: 17031C0167J

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000
Feet

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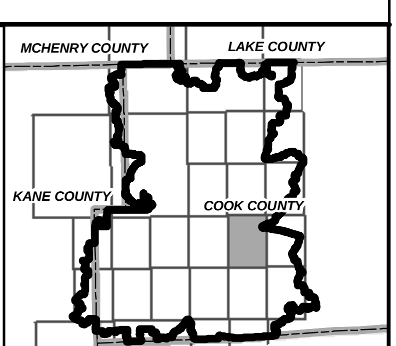

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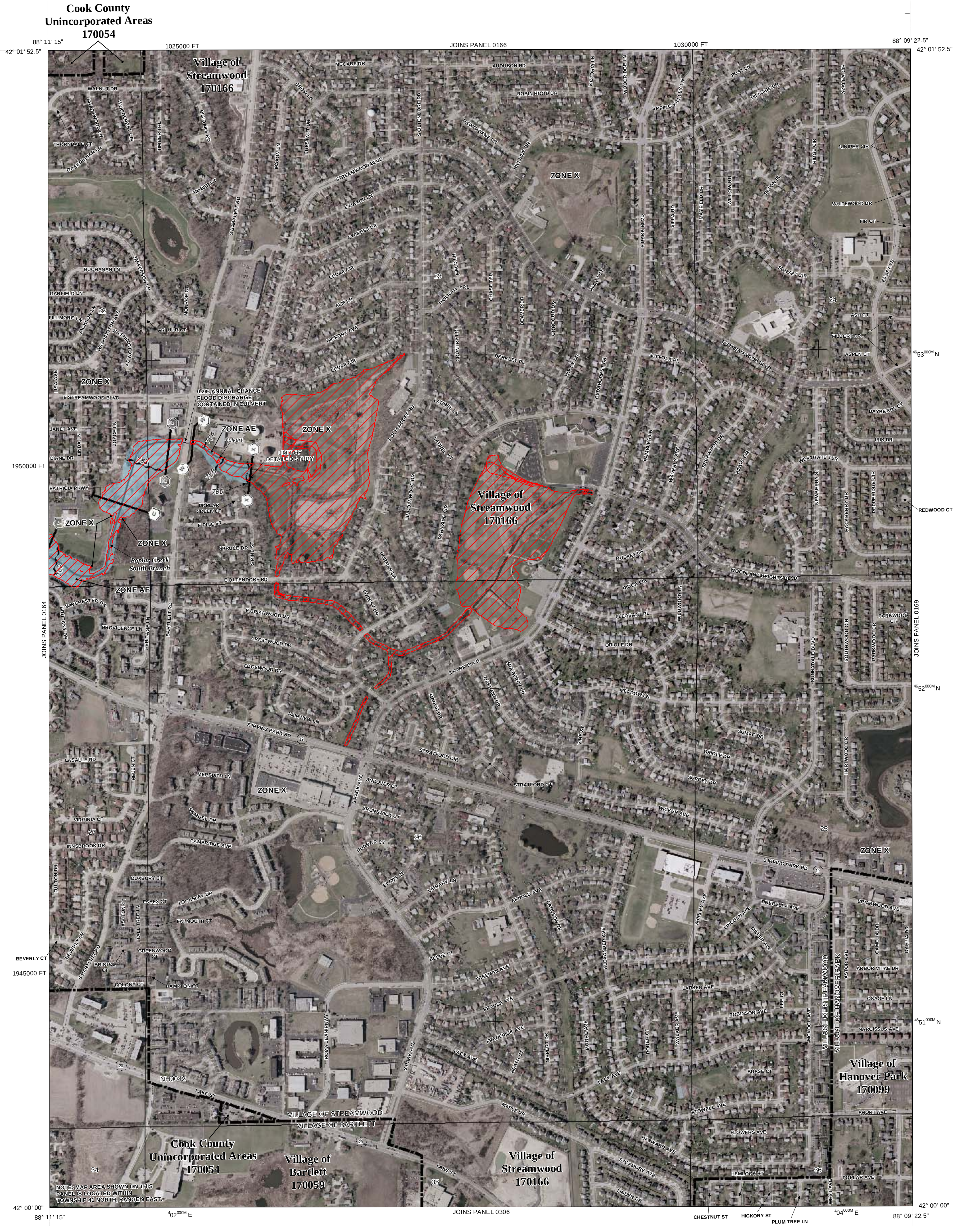
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

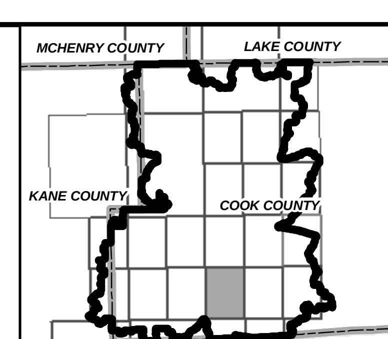
FIRM Panel: 17031C0168H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000

Feet

N
W E
S



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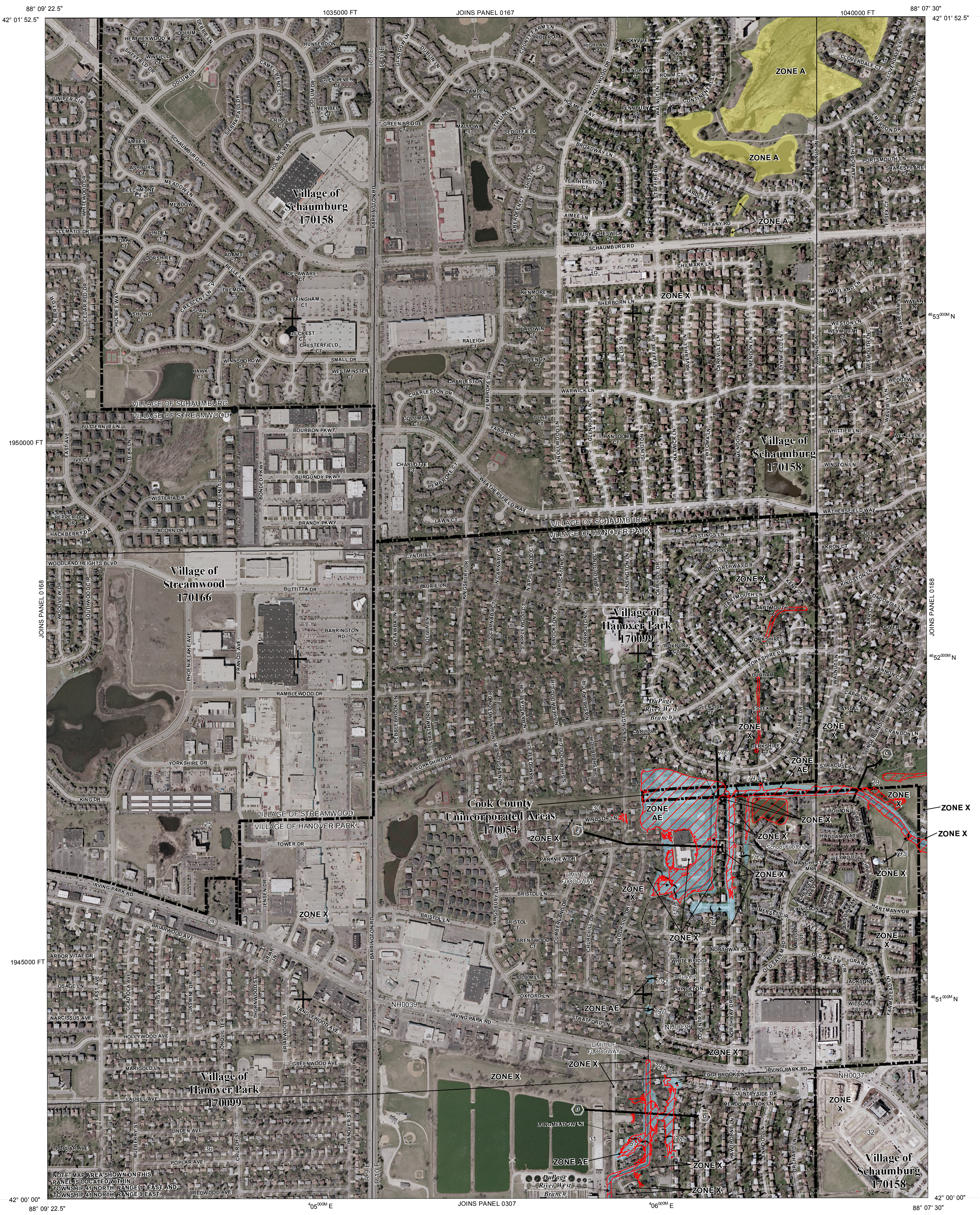
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

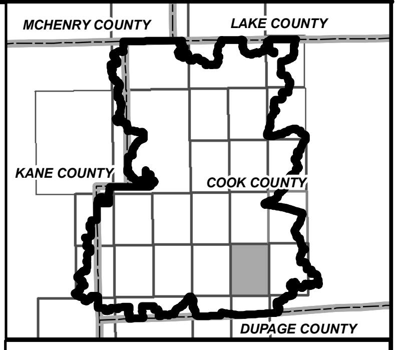
Poplar Creek DWP Study Area

FIRM Panel: 17031C0169J

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 940 Feet

Poplar Creek Watershed Study Area
Detailed Watershed Plan



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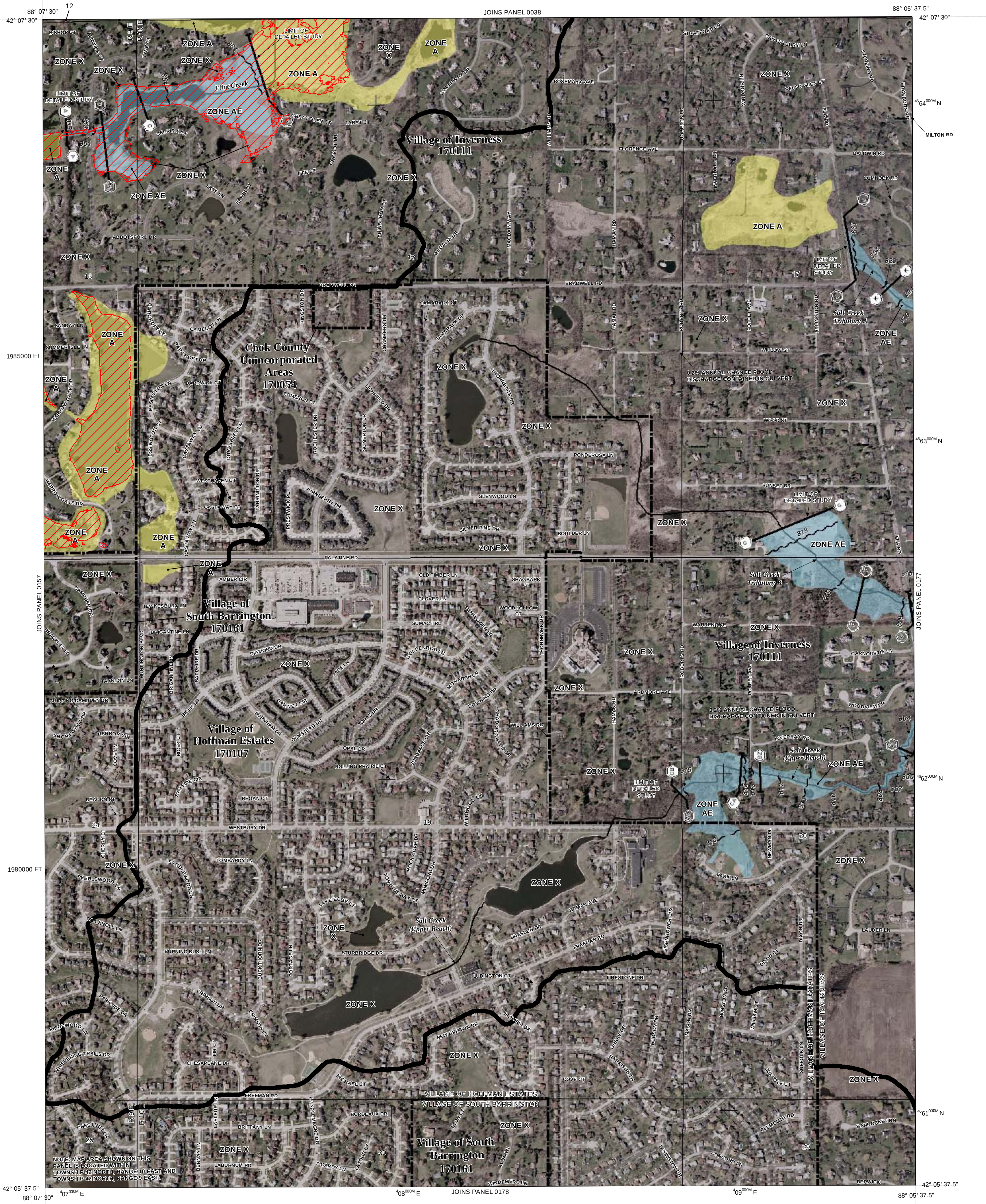

Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0176G

Comparison of DWP 100-yr Inundation Mapping
and FEMA Effective FIRM Revised 08/19/2008

0 1,000
Feet

N
W E
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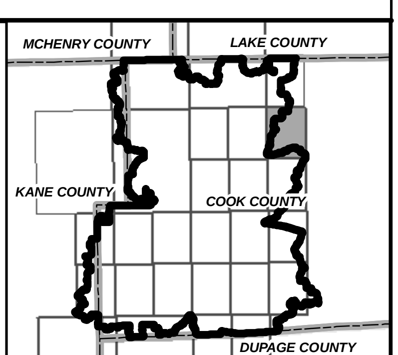

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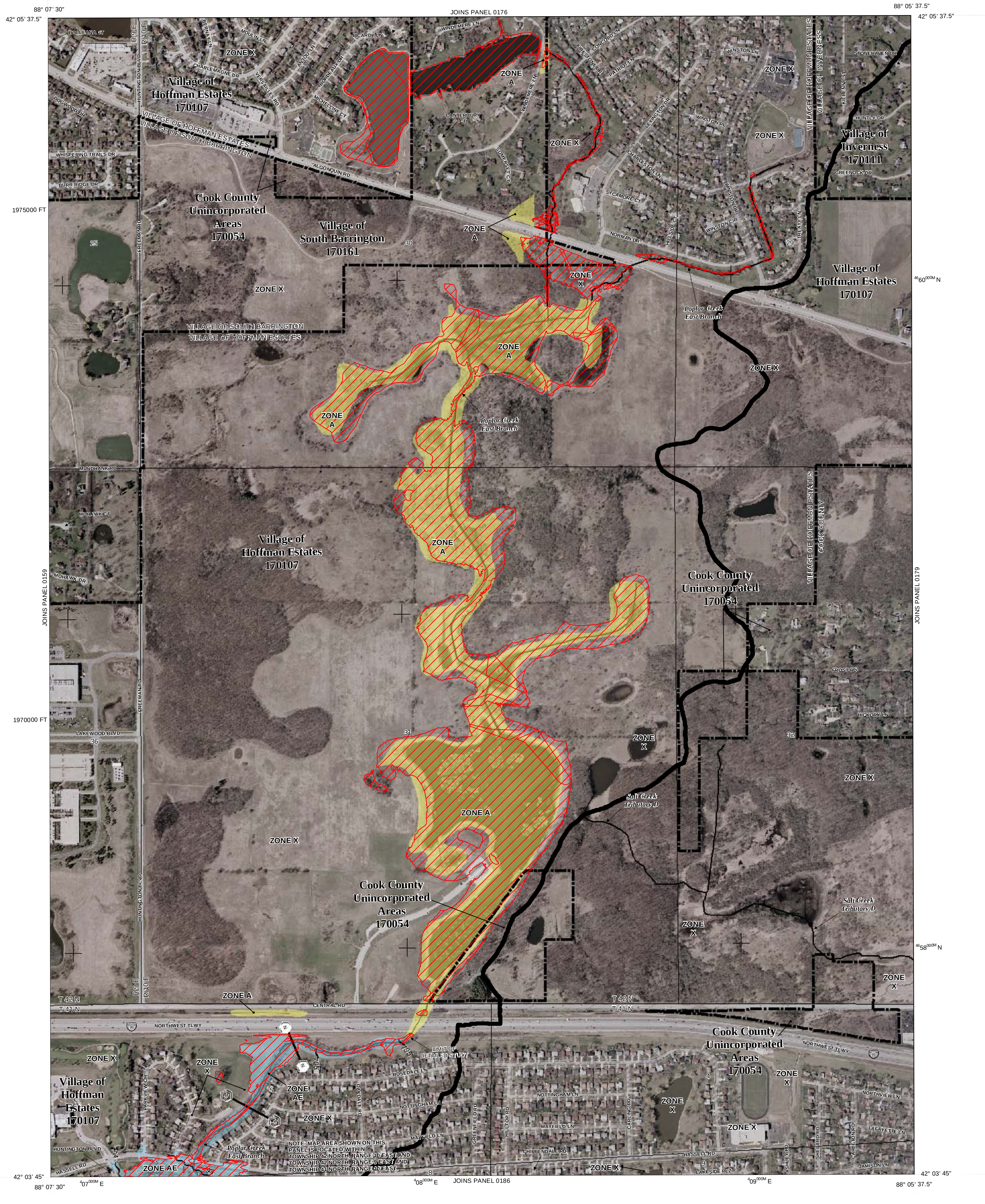
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

- DWP 100-year Inundation Area
- Cook County Boundary
- Municipal Boundaries
- River/Stream
- Poplar Creek DWP Study Area

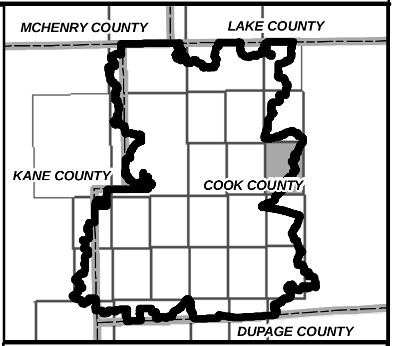
FEMA Floodplain

- Zone A, AH, and AO
- Zone AE
- Area not included

FIRM Panel: 17031C0178G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000
Feet



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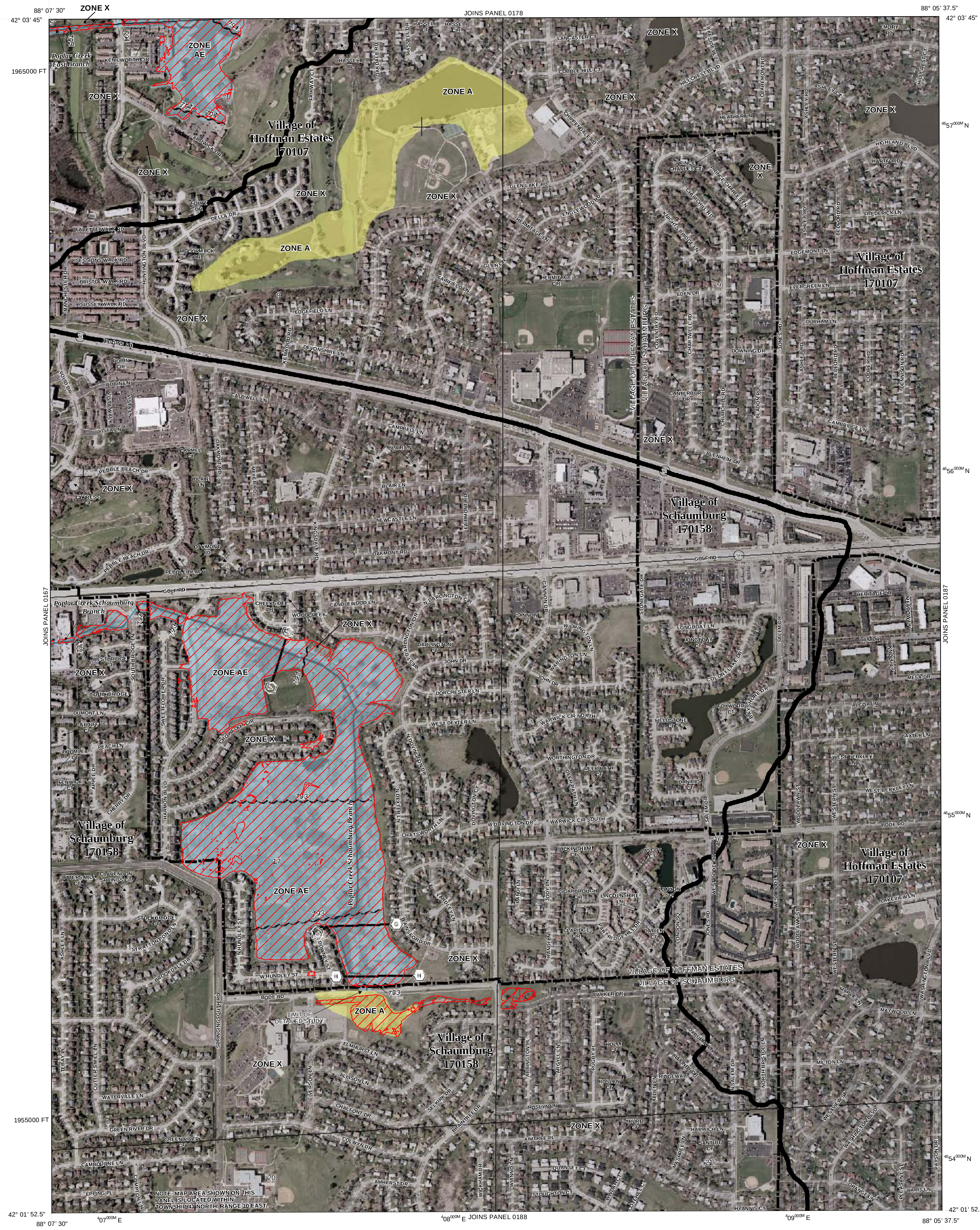
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

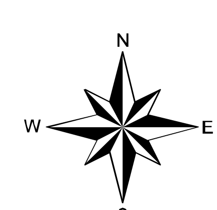
Poplar Creek DWP Study Area

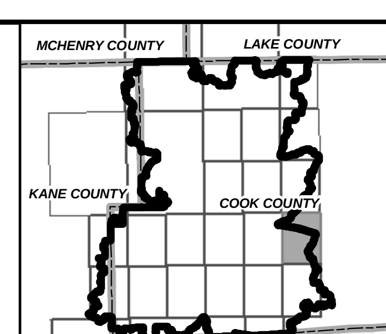
FIRM Panel: 17031C0186G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 975

Feet





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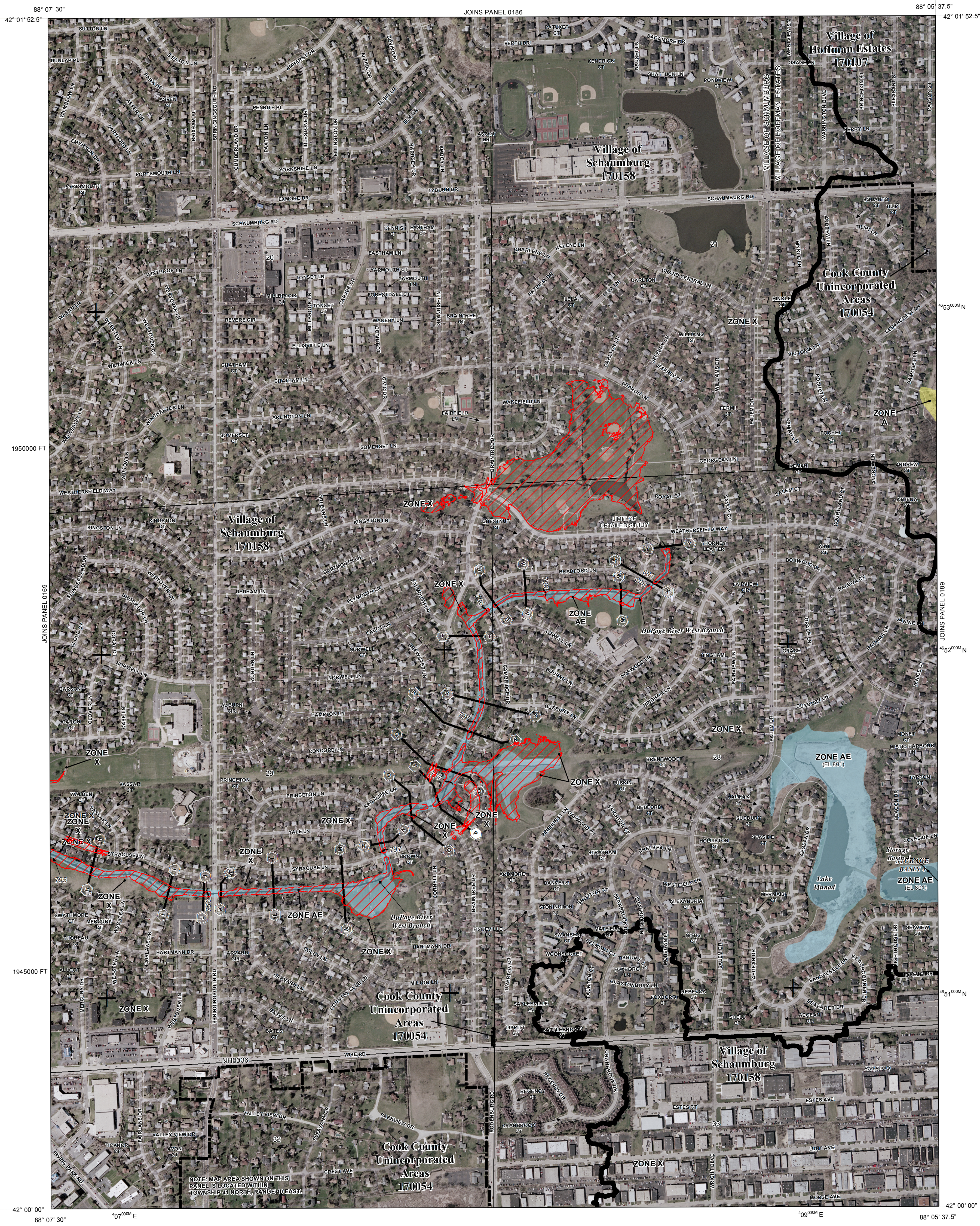
Detailed Watershed Plan



Legend

- DWP 100-year Inundation Area

FEMA Floodplain

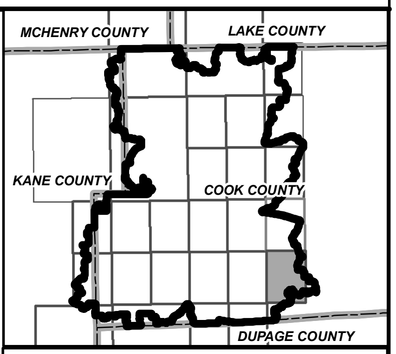
- Zone A, AH, and AO
- Zone AE
- Area not included
- Cook County Boundary
- Municipal Boundaries
- River/Stream
- Poplar Creek DWP Study Area

FIRM Panel: 17031C0188H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000
Feet

N S E W



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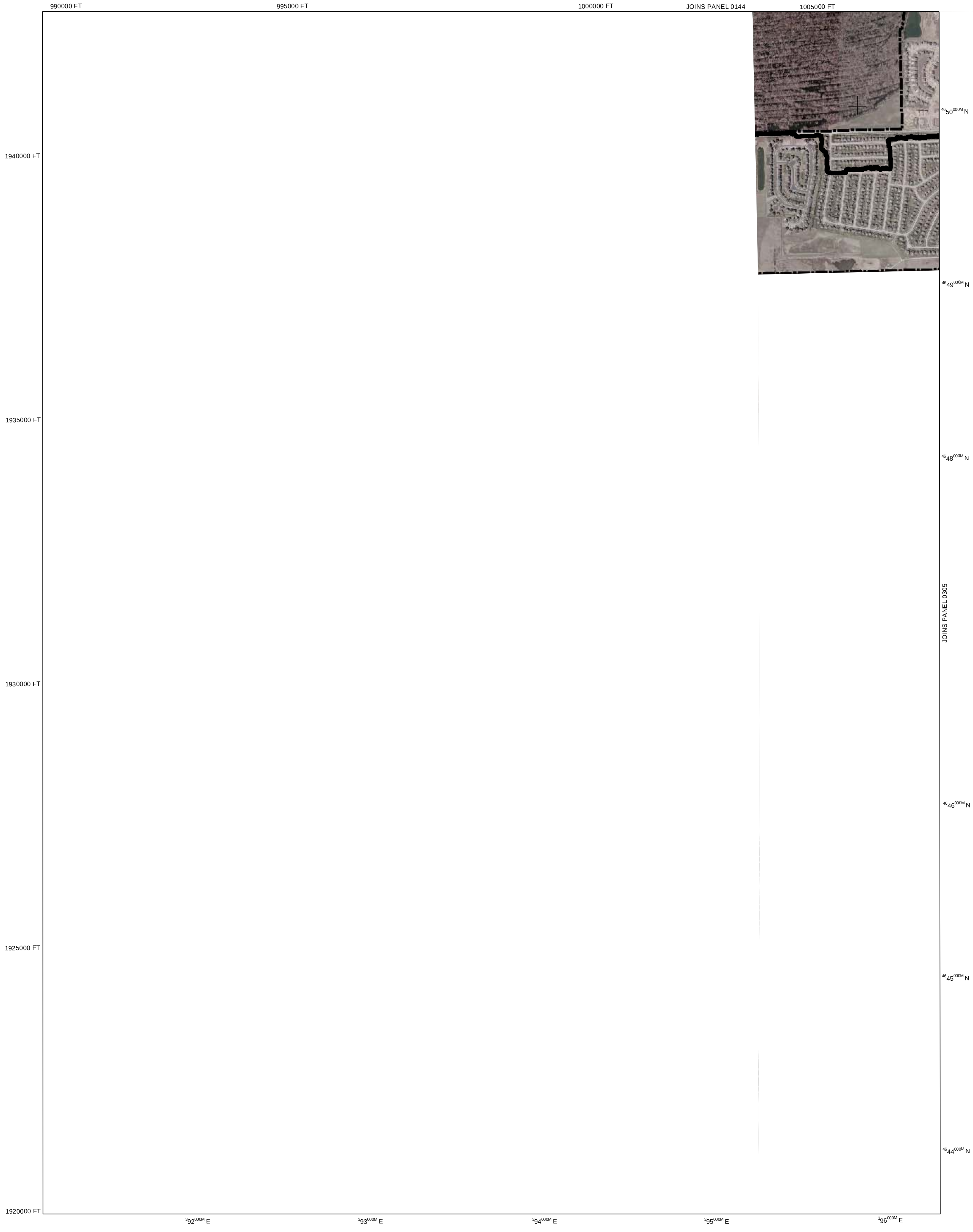
Poplar Creek Watershed Study Area
Detailed Watershed Plan



Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0285G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 10/21/2010

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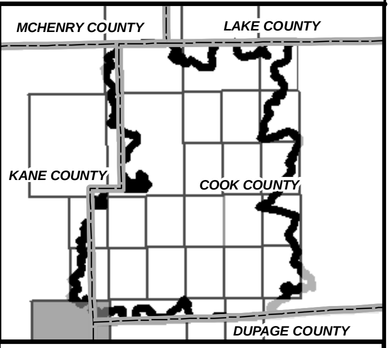

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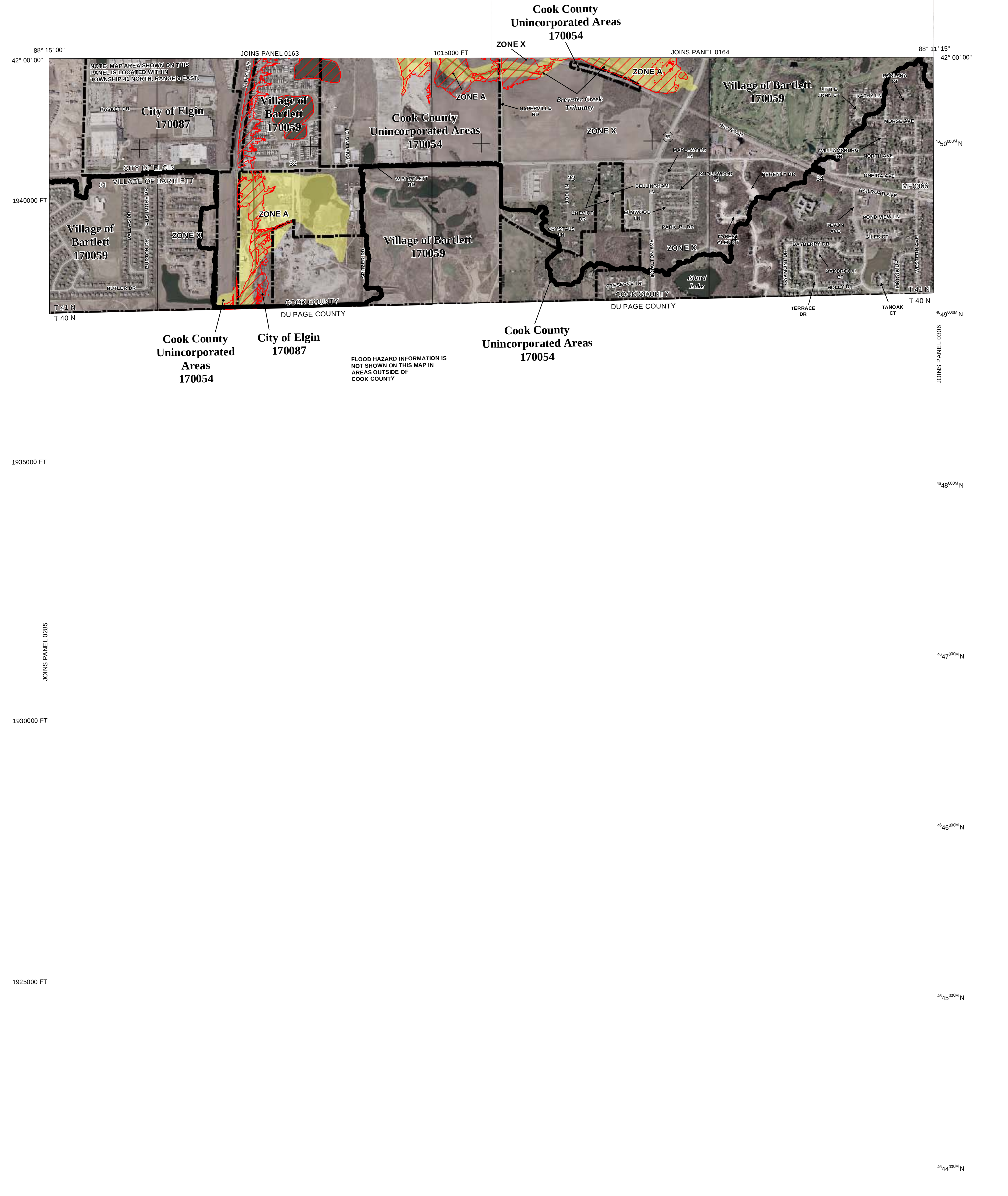

Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0305H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 10/21/2010

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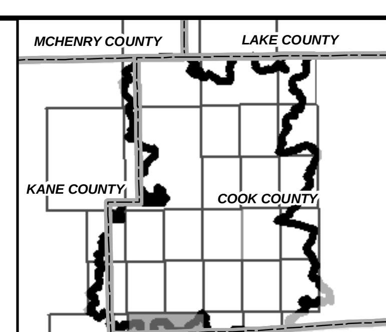

Poplar Creek Watershed Study Area
Detailed Watershed Plan

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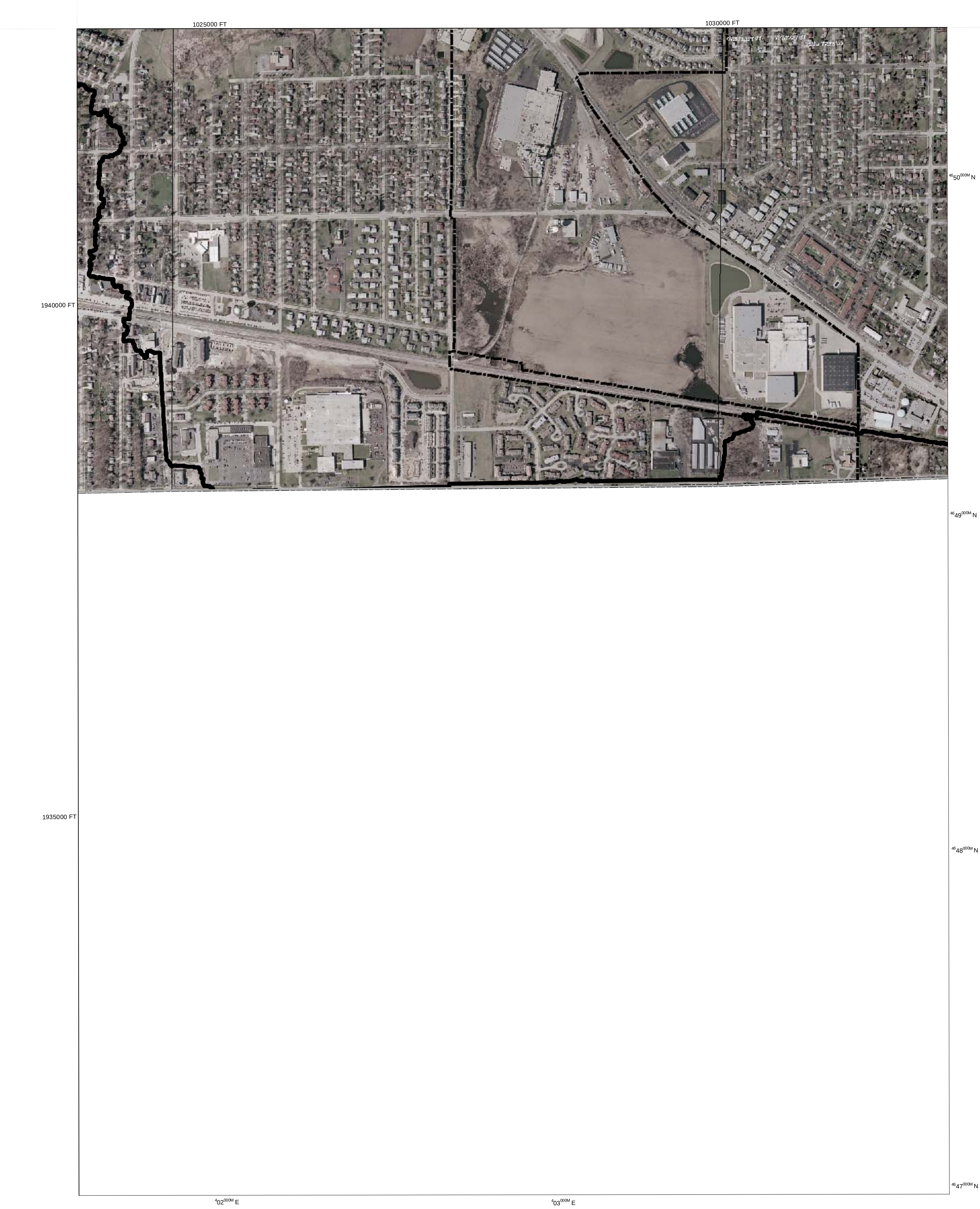

Legend

DWP 100-year Inundation Area

FEMA Floodplain

Zone A, AH, and AO

Zone AE

Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0306G

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

0 1,000

Feet

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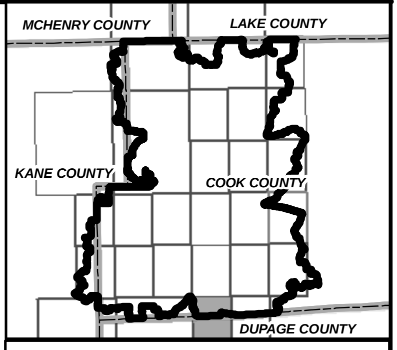

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Poplar Creek Watershed Study Area
Detailed Watershed Plan

Legend

DWP 100-year Inundation Area

FEMA Floodplain

- Zone A, AH, and AO
- Zone AE
- Area not included

Cook County Boundary

Municipal Boundaries

River/Stream

Poplar Creek DWP Study Area

FIRM Panel: 17031C0307H

Comparison of DWP 100-yr Inundation Mapping and FEMA Effective FIRM Revised 08/19/2008

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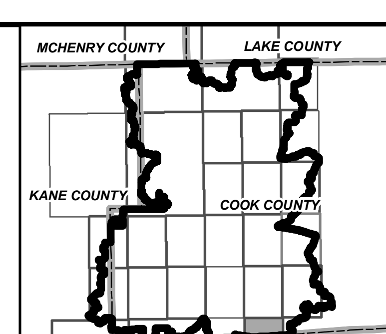
Feet

N W E S



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Poplar Creek Watershed Study Area
Detailed Watershed Plan

CHAPTER 6

WATERSHED PLANNING

Acronyms used in Chapter 6:

AA_B	Average Annual Benefits
AA_C	Average Annual Costs
AA_D	Average Annual Damages
ABM	Articulated Block Mat
BC	Benefit-to-Cost
CCSMP	Cook County Stormwater Management Plan
CDSA	Critical Duration Storm Analysis
CIP	Capital Improvement Program
CMAP	Chicago Metropolitan Agency for Planning
CUDD	Calumet Union Drainage District
DTM	Digital Terrain Model
DWP	Detailed Watershed Plan
FDA	Flood Damage Assessment
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	Geographic Information Systems
HEC	Hydrologic Engineering Center
H&H	Hydrologic and Hydraulic
HSPF	Hydrologic Simulation Program-Fortran
IDNR-OWR	Illinois Department of Natural Resources - Office of Water Resources
IDNR-SWS	Illinois Department of Natural Resources – State Water Survey
IDOT	Illinois Department of Transportation
IEMA	Illinois Emergency Management Agency
IEPA	Illinois Environmental Protection Agency
LCSMC	Lake County Stormwater Management Commission
NB	Net Benefits
NCDC	National Climactic Data Center
NRCS	Natural Resource Conservation Service
NWI	National Wetland Inventory
O&M	Operation and Maintenance
PV	Present Value
PV_B	Present Value of Benefits
PV_C	Present Value of Costs
RAS	River Analysis System
SCS	Soil Conservation Service
UAA	User Attainability Analysis
UDV	Unit Day Value
UNET	Unsteady NETwork Model
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WPC	Watershed Planning Council

CHAPTER 6

WATERSHED PLANNING

6.1 Introduction

A standardized approach to watershed planning is required throughout Cook County to coordinate the District's efforts to implement its Cook County Stormwater Management Plan (CCSMP). Detailed Watershed Plans (DWPs) will be developed for all major watersheds and will serve as standardized documents to help guide the District as it develops a Capital Improvement Program (CIP). Previous planning efforts have been conducted by various organizations, and will be used in the development of DWPs where applicable. This chapter provides guidance for merging findings from previous flood remediation efforts in Cook County with new data and evaluations done to develop effective and consistent DWPs.

6.2 Status of Watershed Planning in Cook County

Local, state, and federal agencies have conducted comprehensive stormwater planning (Table 6.1) efforts as a part of their watershed planning programs for the following watersheds within Cook County: the North Branch of the Chicago River, Lower Des Plaines Tributaries, Calumet-Sag Channel, Little Calumet River, Poplar Creek and Upper Salt Creek. Where possible, previous planning information should be included and built upon in developing DWPs to take advantage of earlier efforts.

6.3 Planning Methodology

6.3.1 Organization of Detailed Watershed Plans

DWPs will serve as the supporting documentation to the District's Stormwater Management CIP. The watershed planning methodologies and standards described herein will be used to develop a DWP for each major watershed in Cook County. The objective is to supply the District with information on existing conditions, stormwater problems, alternative improvements considered to address stormwater problems, and other relevant information necessary to prioritize projects on a countywide level. Table 6.2 is a standard outline of the content to be provided within DWPs.

6.3.2 Data Collection and Review

The initial step in DWP development is the collection and review of existing data. Data that will be collected and reviewed include stormwater problem data, existing watershed studies and models, monitoring data, geographic information systems (GIS) data and other sources of useful watershed mapping.

6.3.3 Use of Existing Data for Detailed Watershed Studies

The DWP report will include a summary of existing watershed data and information. As a part of DWP development, the District will collect and review watershed data from member communities, Watershed Planning Councils (WPCs), applicable state and federal agencies, available complaint records, and other relevant watershed stakeholders. Relevant stormwater data will be compiled within the DWP report. The following subsections provide means of summarizing data regarding stormwater problems (detailed in Section 6.3.3.1) and available studies that have compiled some of the existing stormwater data (detailed in Section 6.3.3.2).

Table 6.1 Summary of Watershed Planning In Cook County

Agency	Description of Watershed Planning
Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR)	At the request of local governments, IDNR-OWR performs flood control studies to identify flooding problems, analyze alternative solutions, and determine the economic feasibility of those solutions. Plans developed by IDNR-OWR focus on structural flood control measures, but nonstructural flood mitigation alternatives are also examined. IDNR-OWR administers other funding assistance. It has a small-projects program that is often used to address local drainage problems and can fund flood related improvements up to $100,000. A less rigorous quantification of benefits is allowed under this program. Its flood mitigation program administers funds for the acquisition of flood-prone structures and flood mitigation planning. IDNR-OWR is involved in assisting FEMA with the map modernization for Cook County, as explained further in Section 2.5.1.
Illinois Environmental Protection Agency (IEPA)	IEPA collects water quality and biological data on streams and lakes throughout the state. The data are reported in the biannual *Illinois Water Quality Report,* which documents the level to which water bodies are supporting their designated uses (such as swimming, aquatic life). IEPA also maintains the Illinois Water Quality Management Plan, which offers recommendations for stormwater, soil erosion and sediment control, and stream and wetland best management practices (BMPs). IEPA also provides grants annually for implementation of nonpoint source control plans and demonstration projects. These projects can include BMPs to curtail urban runoff and also instream activities to reduce erosion, sedimentation, and degradation of water quality, as detailed in Section 319 of the Clean Water Act. On the preventive side, activities such as ordinance implementation and workshops on stormwater BMPs have been funded by IEPA. The IEPA Illinois Clean Lakes Program provides annual grants for lake remediation projects where there is a realistic opportunity for restoration and protection for high quality lakes. IEPA encourages a watershed approach in addressing lake remediation and protection.
Federal Emergency Management Agency (FEMA)	FEMA has several flood hazard mitigation funding programs, administered by the Illinois Emergency Management Agency (IEMA) and described in Section 2.5.8. Some FEMA regulatory floodplain maps for Cook County are inadequate. They do not include water surface elevations or they are out of date because of significant land use and other topographic changes. FEMA has initiated a Flood Insurance Rate Map (FIRM) Modernization Program, which compiles hydrologic and hydraulic (H&H) modeling data for selected map panels in Cook County. IDNR-OWR serves as a local sponsor for this project. The data will be included in a countywide modernization of floodplain maps.
Chicago Metropolitan Agency for Planning (CMAP)	CMAP has historically performed watershed planning, including the Area Wide Water Quality Management Plan developed for all the major watersheds in northeastern Illinois under Section 208 of the Clean Water Act. CMAP assists local governments in developing watershed planning. CMAP has produced a watershed inventory (http://www.nipc.org/environment/sustainable/water/watershed/) that includes a list of watershed plans from various sources and active watershed groups.
IDNR, State Water Survey (IDNR-SWS)	IDNR-SWS runs research centers that gather and maintain scientific data resources used in watershed planning. IDNR-SWS is also involved in planning activities for FEMA map modernization.
U.S. Army Corps of Engineers (USACE)	USACE administers a program for cost-sharing funding for the study, design, and construction of flood control projects. These projects generally are limited to structural flood control measures. If a reconnaissance level study shows that a project is likely to be cost-effective, USACE proceeds with a project analysis, which must be funded locally by 50% matching funds. For approved projects, USACE funds up to

Table 6.1 Summary of Watershed Planning In Cook County

Agency	Description of Watershed Planning
	65% of design and construction costs; the remaining costs are funded by a local or nonfederal sponsor. Sponsors must furnish all required lands, easements, rights-of-way and utility relocations, and also operate and maintain the completed project in perpetuity. Cost-sharing agreements must be negotiated individually with USACE on a project-by-project basis. USACE also provides design services for floodproofing of residences as part of an overall flood control project. This work and most USACE studies are performed with in-house staff.
U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)	NRCS has planned, designed, and constructed flood control facilities to address overbank flooding in the Chicago metropolitan region with local sponsors, including the District. It also has performed floodplain management studies and updated floodplain mapping for local governments. In an effort partially funded by Section 319 of the Clean Water Act under the IEPA's direction, NRCS developed the *Illinois Urban Manual,* a technical reference for developers, planners, engineers, government officials and others involved in land use planning, building site development, and natural resource conservation. Applicable in rural, urban, and developing areas, the manual includes BMPs for soil erosion and sediment control, stormwater management, and special area protection. The manual was updated in 2002.
The District	The District designed and constructed the Tunnel And Reservoir Plan to address combined sewer overflow in the combined sewer areas of Cook County. The District has also been involved in many federal and state flood control projects, serving as the local sponsor or providing other forms of cost-sharing.
Municipalities and Townships	Most stormwater planning within a municipality is performed by the municipality itself or completed under its direction. Planning assistance on larger waterways may be initiated by state and federal agencies. Capital improvement projects that address local drainage problems are typically implemented by municipalities. Many communities within Cook County have ongoing stormwater planning efforts that could contribute to the development of DWPs.
Soil and Water Conservation Districts (SWCD)	Cook County has two Soil and Water Conservation Districts (SWCDs); the North Cook County Soil and Water Conservation District and the Will-South Cook Soil and Water Conservation District. The purpose of the SWCDs is to provide information, education and guidance on the conservation and wise use of natural resources.
Lake County Stormwater Management Commission (LCSMC)	SMC conducted a watershed assessment in conjunction with the Friends of the Chicago River. The watershed assessment pertains to the North Branch of the Chicago River within Cook County.
U.S. Geological Survey (USGS)	Through a cooperative program, in which the District participates, the USGS (Illinois Water Science Center) maintains a stream gauging network and publishes an annual report containing daily streamflow data and water quality information for selected sites around the state. The USGS administers funding for site-specific hydrologic and water quality data collection and analysis. Additionally, the USGS provides streamflow, stream elevations, and precipitation data in real-time at http://il.water.usgs.gov/nwis-w/IL/. Some mapping efforts may be fundable through the USGS. USGS funds up to 50% of a project's in-house labor and expenses. On this reimbursable basis, USGS provides technical assistance in developing watershed models and other hydrologic and water quality related assistance. In the past, the USGS has researched and completed studies on emerging technologies in the water resources field.
U.S. Environmental Protection Agency (USEPA)	USEPA provides grants for water quality related planning and demonstration projects under Section 319(h) and 104(b)(3) of the Clean Water Act, as discussed under IEPA's roles and resources in Section 2.5.7. USEPA routinely holds national conferences on stormwater-related topics.

Table 6.2 DWP Standard Outline

- 1. Executive Summary
- 2. Introduction
  - 2.1 Scope and Approach
  - 2.2 Goals and Objectives
  - 2.3 Jurisdictional Responsibilities
  - 2.4 Organization of Detailed Watershed Study
  - 2.5 Summary of Problem Areas
  - 2.6 Coordination with Watershed Planning Councils
- 3. Watershed Characteristics
  - 3.1 General Watershed Description
  - 3.2 Sources of Data
    - 3.2.1 Previous Studies
    - 3.2.2 Floodplain Mapping
    - 3.2.3 Wetland and Riparian Areas Data
      - 3.2.3.1 Wetland Areas
      - 3.2.3.2 Riparian Areas
    - 3.2.4 Water Quality Data
      - 3.2.4.1 Monitoring Data
      - 3.2.4.2 National Pollutant Discharge Elimination System (NPDES) Permits
      - 3.2.4.3 Impaired Waterways
      - 3.2.4.4 Nonpoint-Source Pollution
      - 3.2.4.5 Total Maximum Daily Load (TMDLs)
    - 3.2.5 Stormwater Problem Data
      - 3.2.5.1 Problem Data
      - 3.2.5.2 Watershed Planning Council Coordination
    - 3.2.6 Watershed Analysis Data
      - 3.2.6.1 Monitoring Data
      - 3.2.6.2 Sub-watershed Delineation
      - 3.2.6.3 Drainage Network
      - 3.2.6.4 Topography and Benchmarks
      - 3.2.6.5 Soil Classifications
      - 3.2.6.6 Land use
      - 3.2.6.7 Anticipated Development
    - 3.2.7 Model Selection
- 4. Watershed Analysis
  - 4.1 Hydrologic Model Development
    - 4.1.1 Sub-area Delineation
    - 4.1.2 Hydrologic Parameter Measurements and Calibration
    - 4.1.3 Model Setup and Unit Numbering
  - 4.2 Hydraulic Model Development
    - 4.2.1 Field Data, Investigation and Existing Modeling Data
    - 4.2.2 Physical Modeling Assumptions and Computational Settings
    - 4.2.3 Model Setup and Unit Numbering
  - 4.3 Calibration and Verification
    - 4.3.1 Gauge Data
    - 4.3.2 Modifications to Model Input Data
    - 4.3.3 Calibration Results
  - 4.4 Existing Conditions Evaluation
    - 4.4.1 Floodplain Delineation
    - 4.4.2 Hydraulic Profiles

Table 6.2 DWP Standard Outline

	4.5	Future Conditions Evaluation	
5.	Development and Evaluation of Alternatives		
	5.1	Problem Definition and Damage Assessment	
		5.1.1	Flood Damage Curves
		5.1.2	Erosion Damage Curves
	5.2	Technology Screening	
	5.3	Alternative Development	
		5.3.1	Flood Control Alternatives
		5.3.2	Erosion Control Alternatives
		5.3.3	Water Quality Improvement Alternatives
		5.3.4	Natural Resources and Environment Improvement Alternatives
		5.3.5	Alternative Cost Development Data
	5.4	Alternative Evaluation and Selection	
		5.4.1	Data Required for Countywide Prioritization of Watershed Projects
6.	Action Plan		
	6.1	Recommended Improvements	
	6.2	Implementation Plan	
7.	Summary and Conclusions		

6.3.3.1 Stormwater Problem Data

DWPs will include a comprehensive summary of stormwater problem data within a standardized table. Table 6.3 summarizes the typical fields required within the DWP watershed problem summary table. The watershed problem summary table will include relevant stormwater problem data compiled as part of DWP development, and recommendations on the use of stormwater problem data. Table 6.4 provides descriptions of standard problem categories to be used as a part of the watershed problem summary table. Additional problem categories may arise and will be considered by the District as necessary during the watershed planning process, however problem categories will generally be consistent with those listed in Table 6.4.

Table 6.3 Structure of Watershed Problem Summary Table for DWPs

Table Field	Description
Problem Category	*Refer to Table 6.4 for list of categories.*
Source of Information	Sources of problem information such as member communities, published reports, state and federal agencies, watershed stakeholders, complaints.
Date	Date upon which data were compiled or published.
Project Planned or Underway	In some cases, efforts are planned or underway to address the problem. Identify this in the table as a consideration on the path forward.
Resolution or Action Required	Describe how the data will be acted upon. Describe resolution or planned resolution of problem.

Table 6.4 Problem Category Description

Problem Category	Description
Intercommunity (regional) flooding	Flooding problems that affect more than one community.
Intracommunity (local) flooding	Flooding problems within a community that affect only part of a single community.
Streambank erosion on intercommunity waterways	Streambank erosion along regional waterways that threatens a structure or human health and safety.
Streambank erosion on intra-community (local) waterways	Streambank erosion along local waterways that threatens a structure or human health and safety.
Stream maintenance problems	Debris jams, system failure, restrictions on waterways, etc.
Water quality problems	Observed water quality problems such as odor, spill-related pollution, aesthetically objectionable debris (such as toilet waste), etc.
Environmental degradation issues	Wetland or riparian impacts observed by watershed stakeholders.

6.3.3.2 Existing Watershed Studies

Several local, state, and federal agencies have completed watershed studies and modeling for watersheds within Cook County. Studies and the models used to support them may contain data useful to the development of DWPs. Table 6.5 summarizes some known watershed studies developed by agencies such as IDNR-OWR, USACE, IEPA, or the Illinois Department of Transportation (IDOT). These studies and others will be reviewed as a part of DWP development.

Watershed modeling has been performed for many of the studies listed in Table 6.5. The models may be useful for the development of DWPs or other watershed planning activities to be coordinated by watershed stakeholder groups. Table 6.6 summarizes some of the existing models that were identified for watersheds within Cook County.

IDNR-OWR and IDNR-SWS personnel have identified several other models that have been developed for Cook County watersheds. Many of the models include data that are not fully documented to allow for a complete evaluation of their applicability to DWP development. As a part of developing each DWP, the District will review and discuss the usefulness of existing watershed models for supporting the definition of problem areas, the development and evaluation of improvement projects and possible floodplain mapping revisions. Table 6.7 lists key criteria to be considered in defining the scope of DWP modeling activities.

Table 6.5 Existing Watershed Studies Identified

Watershed	Subwatershed	Title of Study	Agencies	Date	Summary
Calumet-Sag	Stony Creek	Stony Creek, Oak Lawn, Illinois Detailed Project Report	USACE	October 2001	Completed USACE's planning process for a project to reduce overbank flooding along Stony Creek in Oak Lawn. The recommended plan consists of flow diversion, removal of a small weir, and channel clearing downstream.
Calumet-Sag	(Report addresses tributaries)	Calumet-Sag Watershed Floodwater Management Plan Environmental Assessment	The District, NRCS, IDOT (Division of Water Resources)	June 1979	The study estimates floodwater damage in the watershed due to urbanization. It addresses erosion problems, lack of open space and recreational facilities, wetlands, and channel maintenance. Although somewhat dated, the report may be most useful in providing relevant background information.
Chicago River	Chicago River and Waterway System	Draft Use Attainability Analysis (UAA)	IEPA	November 2004	The UAA will help the IEPA understand the changing circumstances of the Chicago River and Waterway System in order to better set water quality standards for the system.
Des Plaines River	Upper Des Plaines River	Final Feasibility Report and Environmental Impact Statement	USACE	June 1999	Evaluated feasibility of, and federal interest in, implementation of a flood damage reduction plan for the Upper Des Plaines watershed located within Lake and Cook Counties. Recommended a plan consisting of the construction of two levee units, expansion of two reservoirs, construction of one lateral storage area, and modification of one earthen dam to add flood storage.
Des Plaines River	Salt Creek TMDLs	Total Maximum Daily Loads for Salt Creek, Illinois	IEPA	October 2004	Describes methods and procedures used to develop chloride and dissolved oxygen TMDLs for Salt Creek. The focus of the report is on water quality, but it contains rainfall, hydrologic, hydraulic, and stream flow information. Salt Creek and its watershed span both Cook and DuPage counties.
Des Plaines River	Farmers/Prairie Creek	Farmers/Prairie Creek Preliminary Strategic Planning Study	IDNR-OWR	October 2005	Studied alternatives for relieving flooding on Farmers/Prairie Creek, a tributary to the Des Plaines River with a watershed in areas of Des Plaines, Park Ridge, Niles, Glenview, and unincorporated Maine Township.
Des Plaines River	Addison Creek	Addison Creek Flood Control Study	IDOT (Division of Water Resources)	1993	Studied existing conditions and alternatives for relieving flooding on Addison Creek, a tributary of Lower Salt Creek. The affected area for the study includes Bellwood, Bensenville, Broadview, Elmhurst, Hillside, Maywood, Melrose Park, North Lake, North Riverside, Stone Park, and Westchester.

Table 6.5 Existing Watershed Studies Identified

Watershed	Subwatershed	Title of Study	Agencies	Date	Summary
Des Plaines River	(Report addresses tributaries)	Des Plaines River Watershed Floodwater Management Plan Environmental Assessment	The District, NRCS, IDOT (Division of Water Resources)	January 1976	The purpose of the study was to reduce flood damage, reduce erosion and sedimentation, protect wildlife habitat, improve water quality, enhance fisheries, provide additional recreation sites and open space. The study includes Lower Salt Creek, located primarily in DuPage County. Recommended flood control facilities, some of which have since been built, are described, as are anticipated impacts. The report contains useful background information.
Little Calumet River	(Report addresses tributaries)	Little Calumet River Watershed Floodwater Management Plan and Environmental Assessment	The District, NRCS, U.S. Forest Service, Illinois Department of Conservation	May 1975	The purpose of the study was to reduce flood damages, provide increased water based recreation, and provide watershed protection and environmental enhancement. Background information may be useful.
Little Calumet River	(Report addresses tributaries)	Little Calumet River Watershed Plan and Environmental Impact Statement	The District, Will-South Cook SWCD, Calumet-Union Drainage District (CUDD), Cook County Board of Commissioners, Villages, Park Districts, IDNR-OWR, NRCS, U.S. Forest Service	November 1978	This study was developed to achieve goals similar to those of the May 1975 study. Planned projects and their impacts are described. Some of the projects have been implemented. Discussion of project impacts is included. Background information is potentially useful.
Lower Des Plaines Tributaries	(Report addresses tributaries)	Lower Des Plaines Tributaries Final Watershed Plan – EIS	The District, SWCDs, NRCS, U.S. Forest Service, Municipalities	September 1987	The purpose of the study was to solve flooding and associated erosion and sedimentation problems, and to address the shortage of water-based recreation. Structural and nonstructural improvement measures are recommended, several of which have been built. Background information may be useful.
North Branch Chicago River	(Report addresses tributaries)	North Branch Chicago River Floodwater Management Plan	The District, NRCS, IDNR-OWR	October 1974	The purpose of the study was to reduce flood damages, provide increased recreational uses, and provide watershed protection and environmental enhancement. The southern limit of the study is Touhy Ave. Alternatives are suggested, including construction of flood control reservoirs that have now been built. The report may be most useful in providing relevant background information.

Table 6.5 Existing Watershed Studies Identified

Watershed	Subwatershed	Title of Study	Agencies	Date	Summary
North Branch Chicago River	(Report addresses tributaries)	North Branch Chicago River Open Space (Green Infrastructure) Plan	LCSMC, Friends of the Chicago River, IDNR-OWR	June 2005	Identifies high quality natural resources recommended for preservation, and open lands suitable for watershed improvement projects. Study is based on analysis of individual parcels. Includes listing of funding sources for land preservation and restoration.
Poplar Creek	(Report addresses tributaries)	Poplar Creek Watershed Floodwater Management Plan Environmental Assessment	The District, NRCS, IDOT (Division of Water Resources)	May 1976	The study estimates floodwater damage in the watershed due to urbanization. It addresses erosion problems, lack of open space and recreational facilities, wetlands, and channel maintenance. Some flood control measures are recommended. Although somewhat dated, the report may be most useful in providing relevant background information.
Upper Salt Creek	(Report addresses tributaries)	Upper Salt Creek Watershed Floodwater Management Plan	The District, North Cook SWCD, Forest Preserve District of Cook County, Villages, Park Districts, IDOT (Division of Water Resources)	May 1973	The purpose of the study was to reduce flood damages and create water related recreation facilities. Five flood control facilities, one multipurpose facility, and channel improvements were recommended and have been implemented. The report contains useful background information.

Table 6.6 Existing Modeling Data For Watersheds Within Cook County

Watershed	Subwatershed	Model Description
Chicago River	Chicago River and Chicago Waterway System	Unsteady flow and water quality model of entire 76-mile navigable waterway system, developed by Marquette University. More information is available at http://www.chicagoareawaterways.org/ Unsteady NETwork Model (UNET) and Hydrologic Simulation Program-Fortran (HSPF) model developed by the USACE.
Des Plaines River	Des Plaines River	Hydrologic Engineering Center-1 (HEC) and HEC-River Analysis System (RAS)
Des Plaines River	Farmers/Prairie Creek	HEC-1 and HEC-RAS
Chicago River	North Branch	HEC-1 and HEC-2
Chicago River	Middle Fork and West Fork	HEC-1 and HEC-2
Little Calumet River	Little Calumet River	HEC-1 and Unsteady-RAS; Illinois Department of Natural Resources-State Water Survey (IDNR-SWS) is updating
Little Calumet River	Stony Creek	HEC-1 and UNET

Table 6.7 Existing Model Use Criteria for DWPs

Category	Criteria for Use in DWPs
Date developed	Model must have been developed reflecting current conditions or have been updated to reflect current conditions unless otherwise accepted by the District to be used for DWPs.
Regulatory acceptance	Model must be the current regulatory model for watershed or otherwise accepted by the District to be used as a part of DWPs.
Data development requirements	Documentation of H&H model data are available and show that the data were developed to be consistent with District and IDNR-OWR minimum standards.
Calibration requirements	Must have been calibrated to a network of rainfall and stream monitoring gauges. Calibration must be documented and show that minimum District standards were met. Alternatively, radar derived precipitation could be used as approved by the District. Exceptions to the calibration requirement must be approved by the District.
Consistency with District modeling application requirements	Must have been developed using a modeling application that meets the District's minimum requirements, or is otherwise approved by the District.

Existing Monitoring Data. Rainfall, stream flow (and stage), and water quality data are available for all the major watersheds within Cook County. Some of the data may be used to support DWP modeling evaluations. Table 6.8 summarizes sources of existing monitoring data. In addition to the data listed, the District collects monitoring data that will be reviewed and utilized as appropriate as a part of DWP development.

Descriptions of USGS stream flowmeters and National Climactic Data Center (NCDC) rain gauge data are provided in Appendixes C and D, respectively.

Geographic Information Systems Data. Several sources of GIS data exist and are available to support watershed planning activities that will occur as a part of DWP development. One primary source of GIS data is Cook County. GIS data from Cook County will be obtained and used as appropriate as a part of DWP development. Section 6.4 identifies several Cook County GIS data sets to be used in DWP development.

Table 6.8 Sources of Existing Monitoring Data

Data	Owning Agency	Description
USGS Stream Flow Data	USGS	USGS stream flow data are available at http://waterdata.usgs.gov/nwis/sw. Appendix C contains a comprehensive list of gauge locations.
IDNR-OWR Stage Data	IDNR-OWR	The IDNR-OWR maintains a network of stage gauges that may have data useful for model calibration.
Rain Gauge Data	IDNR-SWS, NCDC, and USGS	The Cook County Precipitation Network is a dense rain gauge network that the IDNR-SWS has operated in Cook County since the fall of 1989 to provide accurate precipitation data for use in simulating runoff for Lake Michigan diversion accounting. The network consists of 25 rain gauges throughout Cook County, approximately every 5 to 7 miles and representative of the various watersheds within the county. The data are available in digital format at hourly increments from 1989 through 2000, and at 10-minute increments from 2001 to the present. There are 74 locations of rainfall gauges for which data are available within Cook County through the NCDC. Some gauges are no longer active, but past data are available. The time increments of the data vary from gauge to gauge. Table B-1 in Appendix D lists all gauges and information related to the type of data available. Information about obtaining data from all these gauges and associated fees can be found at the NCDC website: http://www.ncdc.noaa.gov. The USGS operates and publishes data from approximately 42 rain gauges in northeastern Illinois, of which 6 are located in Cook County. This data, almost all available in real-time, together with data from other agency rain gauges can be found at http://il.waterdata.usgs.gov/nwis/current/?type=precip&group-key=NONE.
Water Quality Monitoring Data	IEPA	Available from the IEPA Ambient Water Quality Monitoring Network of 213 monitoring sites. More information is available at: http://www.epa.state.il.us/water/surface-water/river-stream-mon.html

6.4 Watershed Data Development

New data developed for DWPs must meet the District standards and specifications described in Table 6.9.

Table 6.9 Watershed Data Development Standards And Specifications

Data Type	Standards Documentation	Summary
GIS Data	District GIS Data Development Standards	Data developed to support DWPs will be consistent with latest available District GIS Standards and Specifications.
Survey Data	District Vertical Datum	Survey data will be developed using the NAD 1983 coordinate system with the Chicago City Datum (CCD) for vertical coordinates (579.48 feet above 1925 mean sea level). DWPs will contain a survey standards document subject to District review prior to initiating any field surveys. If necessary, the District may allow changes to these standards in order to be consistent with unique conditions in watersheds such as those that have upstream or downstream boundary condition models that have been developed in a different coordinate system.
Survey Data	FEMA Guidelines	Survey standards will be consistent with FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix A, "Guidance for Aerial Mapping and Surveying*," available at WWW.FEMA.GOV/FHM/DL_CGS.SHTML
DWP Data	Cook County Stormwater Management Plan	All data developed to support DWPs will be consistent with standards provided as a part of this document, or other scoping documents provided by the District.

6.4.1 Watershed Analysis and Floodplain Mapping

The District has developed the following goals for watershed analysis and floodplain mapping that will be applied to the development of DWPs. It is understood that meeting some of these goals may not be possible as a part of DWP development. These goals will be considered and applied wherever the District deems applicable:

- H&H analyses must be consistent with IDNR-OWR and FEMA map revision requirements.
- Hydrology for watershed plans will be determined by a hydrologic model that, where necessary, considers online and offline storage, infiltration, interflow, depressional storage, overland flow, nonuniform rainfall distribution, evapotranspiration, and soil moisture. The output from the hydrologic model must be compatible with the hydraulic model.
- Hydrologic analyses may require cooperative plans for water bodies that cross the District's corporate boundaries, such as the North Branch Chicago River, Little Calumet River, Des Plaines River, Poplar Creek, and Upper Salt Creek.
- Hydraulic conditions for the major watershed plans will be determined by a model that can, at a minimum, analyze the effects of floodplain encroachment, online and offline storage, diversions, channel improvements, bridges, culverts, dams, weirs, and other impediments to flow. The input to the hydraulic model will be compatible with the output from the hydrologic model. Fully dynamic models will be used when channel conditions are extremely flat (for example, slope is less than 5 feet per 1,000) and subject to backwater conditions that make it difficult to approximate storage accurately.

6.4.2 Watershed Modeling

The object of a DWP is to support the development and documentation of a countywide CIP. Understanding stormwater problems and evaluating scenarios to correct them requires the use of models and other watershed analysis tools. The following includes standards for application selection, data development, and calibration of H&H models.

Several steps are involved in applying models to the development of DWPs. First, a model of existing conditions is developed to support calibration and an understanding of existing problems. Second, a baseline conditions model is developed to reflect the conditions expected to be current when the District begins to implement the countywide CIP. This may include modifications to the existing conditions model that reflect projects that are under way and near completion. Finally, the model is modified to evaluate the effectiveness of alternative improvement projects. The guidance provided in Section 6.4.2 applies to all these steps.

6.4.2.1 Screening Considerations

Several H&H modeling applications in the public and private domain are accepted by FEMA and IDNR-OWR to determine floodplain and floodway areas for the National Flood Insurance Program. The applications are summarized in Tables 6.10 and 6.11. Table 6.12 summarizes considerations in the selection of H&H modeling applications. For DWPs, the District will specify the most appropriate H&H modeling application based on the considerations listed in Table 6.12 and specific watershed modeling requirements. In some cases, it may be acceptable to use two or more separate H&H modeling applications within the same DWP.

6.4.2.2 Hydrologic Model Data Development

Hydrologic model data developed as a part of a DWP will be consistent with minimum District standards. District standards have been developed to be consistent with the countywide stormwater management program needs and wherever possible with IDNR-OWR preferences.

Subarea Delineations. Subarea Delineations will be performed using the best available topographic mapping to a level necessary to accurately simulate hydrologic conditions within the watershed. The best available topographic data are those developed by Cook County. Cook County GIS photogrammetry data includes a digital, geospatial GIS file that depicts (through the use of a digital terrain model (DTM), and modeled by a triangulated irregular network) a general surface description for Cook County with a 300-foot buffer beyond the county boundary. The data have been made available to the District and will be used to support Subarea Delineations.

Table 6.10 Hydrologic Models Accepted by FEMA for the National Flood Insurance Program

Type	Program	Developer	Public Domain?
Single event	HEC-1 4.0.1 and upa (May 1991)	USACE	Yes
	HEC-HMS 1.1 and up (March 1998)	USACE	Yes
	MIKE 11 UHM	DHI Water and Environment	No
	PondPack v.8	Haestad Methods, Inc.	No
	SWMM (RUNOFF) 4.30 (May 1994), and 4.31 (January 1997)	USEPA and Oregon State University	Yes

Table 6.10 Hydrologic Models Accepted by FEMA for the National Flood Insurance Program

Type	Program	Developer	Public Domain?
	SWMM 5 Version 5.0.005 (May 2005)	USEPA	Yes
	TR-20 (February 1992)	USDA NRCS	Yes
	TR-20 Win 1.00.002 (Jan. 2005)	USDA NRCS	Yes
	TR-55 (June 1986)	USDA NRCS	Yes
	WinTR-55 1.0.08, (Jan. 2005)	USDA NRCS	Yes
	XP-SWMM 8.52 and up	XP Software	No
Continuous event	DR3M	USGS	Yes
	HSPF 10.10 and up	USEPA, USGS	Yes
	MIKE 11 RR	DHI Water and Environment	No
	PRMS Version 2.1	USGS	Yes
Interior drainage	HEC-IFH 1.03 and up	USACE	Yes

[a]Enhancement of these programs in editing and graphical presentation can be obtained from several private companies.

Note: FEMA periodically updates its list of approved hydrologic models.

Table 6.11 Hydraulic Modeling Applications Accepted by FEMA for the National Flood Insurance Program

Type	Program	Developer	Public Domain?
One-dimensional steady flow models	Culvert Master v.2.0	Haestad Methods, Inc.	No
	HEC-2 4.6.2a(May 1991)	USACE	Yes
	HEC-RAS 3.1.1 and up	USACE	Yes
	HY8 4.1 and up (November 1992)	U.S. Department of Transportation, Federal Highway Administration	Yes
	PondPack v.8	Haestad Methods, Inc.	No
	QUICK-2 1.0 and up (January 1995)	FEMA	Yes
	StormCAD v.4 and v.5	Haestad Methods, Inc.	No
	WSPGW 12.96 (October 2000)	Los Angeles Flood Control District and Joseph E. Bonadiman & Associates, Inc.	No
	WSPRO (June 1988 and up)	USGS, Federal Highway Administration	Yes
	XP-SWMM 8.52 and up	XP Software	No

Table 6.11 Hydraulic Modeling Applications Accepted by FEMA for the National Flood Insurance Program

Type	Program	Developer	Public Domain?
One-dimensional unsteady flow models	FEQ 9.98 and FEQUTL 5.46 (2005, both), FEQ 8.92 and FEQUTL 4.68 (1999, both)	Delbert D. Franz of Linsley, Kraeger Associates; and Charles S. Melching, USGS	Yes
	FLDWAV (November 1998)	National Weather Service	Yes
	FLO-2D v. 2003.6 (July 2003) and 2004.10 (November 2004)	Jimmy S. O'Brien	No
	HEC-RAS 3.1.1 and up	USACE	Yes
	ICPR 2.20 (October 2000) and 3.02 (November 2002)	Streamline Technologies, Inc.	No
	MIKE 11 HD	DHI Water and Environment	No
	Storm Water Management Model (SWMM) 4.30 and 4.31	USEPA and Oregon State University	Yes
	SWMM 5.0.005 (May 2005)	USEPA	Yes
	UNET 4.0	USACE	Yes
	XP-SWMM 8.52 and up	XP Software	No
Two-dimensional steady/unsteady flow models	FESWMS 2DH 1.1 and up	USGS	Yes
	FLO-2D v. 2003.6 (July 2003) and 2004.10 (November 2004)	Jimmy S. O'Brien	No
	MIKE Flood HD 2002 D and 2004	DHI Water and Environment	No
	TABS RMA2 v.4.3 RMA4 v4.5	USACE	Yes
Floodway analysis	PSUPRO	Pennsylvania State University/USACE/FEMA	Yes
	SFD	USACE/FEMA	Yes

[a] Enhancement of these programs in editing and graphical presentation can be obtained from several private companies.

Note: FEMA periodically updates its list of approved hydraulic models.

Table 6.12 H&H Modeling Application Selection Considerations

Consideration	Description
Familiarity to regulatory community	FEMA requirements for modeling to support regulatory floodplain mapping do not exclude the use of many models, but it is clear that many are more acceptable to regulatory review staff than others. The familiarity of regulatory staff at IDNR-OWR and FEMA will be considered as a part of specific H&H modeling application selection.
User base for consistent type of projects	It is common for modelers to look to a broader community of users for advice and support as a part of modeling projects. For example, a SWMM users' e-mail group is commonly used to troubleshoot problems with the application and draw upon the experience of a broad group of users. SWMM users commonly are focused on the application of SWMM to sewer system evaluations. Similar user groups exist for Hydrologic Engineering Center (HEC) modeling applications. Local, regional, and national training seminars and conferences focus on some applications more than others. The existence of an active user base will be considered in the selection of a modeling application.
History of use on floodplain mapping projects	This will be considered as part of the modeling application selection to project ease of permitting for any regulatory activities. The use of an application for projects similar to those faced by the District likely will lead to tools and support programs developed by others that will benefit the District. HEC is the most commonly used national tool for supporting flood control programs similar to the District.
Number of options for simulating open channel hydraulics	Having several options for modeling open channel hydraulics allows for a more accurate representation of field conditions. HEC applications have extensive bridge and culvert crossing options that allow users to develop confidence in results through the application of alternative hydraulic simulation approaches.
Consistency with data developed for existing regulatory models	It may be important to integrate new modeling with existing models. The ability of model output to be used between models may be important. Conversations with IDNR-OWR and experience in the area confirms that HEC software is the most commonly applied modeling application for flood control projects and regulatory floodplain mapping. This is an important consideration in the selection of any modeling application for the District's Stormwater Management Program.
Ability to perform fully dynamic unsteady flow analysis	This may be an important feature that could affect the model results and magnitude of flood control projects identified as a part of this program. Because of the flat terrain of Cook County and surrounding areas, the regulatory floodplains and floodways contain significant storage volumes. Traditional modeling applications use approaches that simulate this storage in a simplified and typically conservative manner. Fully dynamic unsteady flow modeling applications allow for a more explicit simulation of this storage that often leads to results showing more accurate lower floodway elevations.
Availability of vendor provided proprietary interface applications that enhance usability of product	Some models include proprietary modules to increase the functionality of the model. This may be useful as modeling exercises become more complex.
GIS interface capabilities	An important component of watershed modeling will be to integrate the application with GIS software. Most modeling applications listed in Tables 6.10 and 6.11 have GIS interfaces that have been developed to support data development and visualization.

Subarea boundaries will be developed as closed polygons with attribute data that at a minimum include their watershed designation, model name, total area and source of data used for delineation and any other fields specified by the District. Subarea delineation data will be in a format compatible with the District's stormwater GIS. The overall watershed delineation developed as a part of DWPs will be used as the District's official watershed delineation for administrative as well as technical purposes.

Rainfall Data. Observed and design event rainfall data may be used to support H&H modeling performed as a part of a DWP. Observed rainfall data are used as a part of hydrologic model data calibration. Two approaches are typically used to define observed rainfall data. These are the use of rain gauge data or rainfall data developed using radar technology. Both approaches are acceptable and will be used where appropriate as a part of DWPs developed by the District. Table 6.13 specifies how observed rainfall data will be used. Design event rainfall data are used to define flood damages, evaluate alternative improvement projects, and recommend capital improvements. Observed and design event rainfall data developed and used as a part of a DWP will be organized in a database format. Fields required in the table where rainfall data are stored will include year, month, day, hour, minute, and depth (inches).

GIS applications will be used to determine influence areas for rainfall data. For rain gauges, GIS applications will be used to develop Theissen polygon areas that can be intersected with subarea delineations to assign rainfall data for hydrologic modeling. Theissen polygon areas will be created in a GIS format consistent with District standards. If radar derived rainfall data are used, influence areas of rainfall data sets will be provided to the District in a GIS format consistent with District standards.

Table 6.13 Observed Rainfall Data Utilization Criteria

Source of Observed Rainfall Data	Criteria for Application
Rain gauges	Rain gauges that log rainfall data on a 10- to 15-minute increment will be used to support hydrologic model data calibration during storms where spatial distribution of rainfall appears to be adequately captured by the rain gauge network in place. The Cook County Precipitation Network operated by IDNR-SWS records data at 10-minute increments at 25 rain gauges (see Table 6.8). Research was developed to determine the appropriate minimum spacing and coverage requirements, which determined the locations of the rain gauges.
Radar-derived rainfall data	Radar derived rainfall data may be used in large watersheds where the rain gauge network in place is unlikely to sufficiently define the spatial distribution of rainfall occurring over the watershed. The District will review the existing and proposed rain gauge network and historic spatial rainfall distribution patterns to provide justification for the use of radar derived rainfall data.

Design Event Rainfall Data. Design event rainfall data are used as a part of the H&H modeling that is performed to support the identification of flooding problem areas, flood damage curves and the development and evaluation of alternative improvement projects. The standard source of rainfall depth and distribution data for H&H model evaluations will be the sectional frequency distribution of rainfall for given recurrence intervals as listed in Bulletin 70 or Bulletin 71 with Huff Distribution or the data most recently adopted by IDNR-OWR for use in hydrologic modeling. Bulletin 71 provides guidance on which Huff distribution will be used (1st, 2nd, 3rd, or 4th quartiles) with storms of various durations.

To determine the critical or most extreme duration storm for each recurrence interval storm considered as a part of DWP development, a critical duration analysis will be conducted. To be consistent with IDNR-OWR requirements, the critical duration analysis must include at least the simulations of 1-, 3-, 6-, 12- and 24-hour duration storms.

Infiltration Rates and Capacities. The most common method used to determine loss rates and runoff volumes in Cook County has been the Soil Conservation Service (SCS) Curve Number method. The method is acceptable for the hydrologic modeling that is performed as part of a DWP. Other methods may be used when appropriate at the discretion of the District. When using the SCS Curve Number method, the modeler will follow guidance contained in Urban Hydrology for Small Watersheds (USDA NRCS, TR-55, June 1986) or as approved by the District.

Runoff and Overland Flow Parameters (Existing and Future). Impervious area coverage, aerial photography, topographic mapping, soils groups mapping and other soils data, land use mapping, and other land use data all will be used to determine watershed areas, flow paths, slopes, lengths, time of concentration, and any other parameters necessary to support developing stormwater runoff hydrographs consistent with the guidance within USDA NRCS TR-55 or as approved by the District.

Unit Hydrograph/Routing. Unit hydrographs acceptable for routing runoff include SCS dimensionless, Clark, or Snyder. A user-specified unit hydrograph may be used for a watershed if enough quality data are available for it to be properly derived from observed rainfall and runoff.

6.4.2.3 Hydraulic Model Data Development

Channel Cross Section Data. Channel cross sections used within hydraulic modeling applications will be obtained through field surveys that meet survey standards described in Table 6.9. Field survey efforts will include the determination of the appropriate Manning's roughness parameters based on observations of characteristics that include surface roughness, vegetation, channel size, channel shape, channel alignment, and obstructions. If observed water surface profile information is available in the form of gauge data, calibration of Manning's "n" values is possible and desirable.

Open Channel Hydraulics by V. T. Chow (McGraw-Hill 1959; reissued 1988) contains excellent guidance for determining Manning's "n" values for a wide range of rivers and streams. The USGS Illinois Water Science Center has computed Manning's "n" values at many representative urban and rural sites in Illinois, available at http://il.water.usgs.gov/proj/nvalues/. Figure E-1 in Appendix E is an example of the type of form to be used to document Manning's "n" values in the field. Separate Manning's "n" values are generally appropriate to be used for the channel and the overbanks. The typical channel cross section template form in Figure E-2 in Appendix E is an example of the type of form that will be used to gather cross-sectional data during a survey.

Bridge and Culvert Crossings. Bridges and culverts generally will be modeled as existing. For the baseline conditions model, bridge or culvert replacement projects that are under construction or in the late stages of the planning process and unlikely to be revised may be modeled as proposed. The model must account for bridge deck, piers, abutments, and embankment side slopes.

Storage Areas. Storage areas that are simulated as a part of hydraulic modeling will be represented with stage-area or stage-volume relationships developed from best available topographic information and discharge rating curves developed according to hydraulic properties of the controlling device.

Downstream Boundary Conditions. Downstream boundary conditions for hydraulic analysis will be based on known water surface elevations when available. If the water surface elevation is unknown at the downstream end of the study reach, normal depth will be used at a location further downstream so as not to have influence on the profile. To test whether the starting cross section is sufficiently downstream for a given discharge, the distance is varied until the water elevation at the project boundary does not change appreciably, which indicates that the profile will not be affected by the starting elevation.

6.4.2.4 Steady State vs. Unsteady Flow Analysis

If there is reason to believe that a steady-state model would inadequately represent actual hydraulic conditions, such as extremely flat slopes (Froude number < 0.1) or flow restrictions that may cause significant storage within the channel or situations with reverse flow, then unsteady-state modeling will be considered and used where necessary.

6.4.2.5 Critical Duration Storm Analysis

A critical duration storm analysis (CDSA) will be performed and documented as a part of design event simulations performed to develop flood damage curves. A CDSA is performed for each problem area to identify the duration storm that produces the critical water surface elevation and level of damage. CDSA involves running a range of duration storm events for a given recurrence interval to determine which duration storm is critical. Generally, this duration is somewhere near the time of concentration of the watershed tributary to a given point. The IDNR-OWR generally requires a CDSA as a part of the regulatory map revision process.

6.4.2.6 Model Calibration and Verification

Calibration must be performed in developing defensible H&H models representative of actual conditions. High water marks, historic floods, or other stream gauge data will be used to compare with model results and adjust model parameters, typically the roughness coefficients. The final calibrated model must not contain model parameters outside their “reasonable” bounds, although it may be permitted when performing model sensitivity analyses. If enough data exist, the model will be validated by comparing calibrated model results to a set of data that was not included in the calibration.

H&H model data will be calibrated to a point where the runoff volume and stream flow rates are within roughly 30 percent of the data recorded at stream gauges. Water surface elevations will match within 6 inches. In some cases, where rain gauge data are used to support calibration, it is not possible to adjust H&H model data with confidence when the spatial distribution of rainfall appears to be inadequately captured and reflected in the model.

6.4.3 Floodplain Mapping

To ensure that H&H modeling performed as a part of a DWP can be utilized for future FEMA FIRM remapping efforts, the District will require that all modeling performed be consistent with current IDNR-OWR and FEMA standards. Both agencies have published standards that will be followed: *Floodplain Map Revision Manual* (March 1996) published by IDNR-OWR and *Guidelines and Specifications for Flood Hazard Mapping Partners* published by FEMA, available at http://www.fema.gov/fhm/gs_main.shtm. It is not a specific goal of the DWPs to replace or revise the current FEMA FIRM maps. However, if a substantial error in the current regulatory maps is identified during a DWP, the District may consider requesting a map revision from FEMA. As the CIP progresses, a decision will be made as to whether the District or the benefiting local government entity will pursue map revisions necessary to reflect the implementation of future flood control projects.

6.5 Problem Area Identification

Stormwater problem areas will be identified through stakeholder involvement, such as WPC meetings, discussion with other agencies, and logs of complaints. They will also be identified and confirmed as a part of the DWP. DWP reports will summarize relevant and known stormwater problem areas and also watershed analyses to confirm the magnitude of flooding problems.

6.5.1 Flooding Problem Areas

Flooding problems are defined as flooding of residential, commercial, industrial and public buildings, or transportation facilities that are critical to the economy and emergency services. H&H models will be the primary method for evaluating flooding problem areas. H&H models will be used to define water surface elevations for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms. These elevations will be compared with top of foundation and first floor elevations for properties within the floodplain to develop flood damage curves. The methodology for developing flood damage curves and data required to support them are described in Section 6.6.

In some instances flooding may result from non-riverine sources, such as depressions in the ground surface that are inundated by the water table. The majority of such depressional flooding instances are expected to be confined to a single community, and therefore will not be addressed in a DWP. However, cases where depressional inundation results in inter-community flooding will be addressed with the DWP, in conjunction with the District, on a case by case basis.

6.5.2 Erosion Problem Areas

Erosion problems are defined as streambank erosion along waterways that could result in property damage or a risk to human health and safety. As part of a DWP, the District will require an evaluation of streambank conditions to generally identify areas where erosion appears to meet these criteria. Special attention will be paid to areas where the District or other stakeholders have received complaints about erosion problems that are threatening structures or posing a risk to human health and safety. The District will visit the erosion problem areas identified and document existing conditions to support the evaluation of alternatives. Site visits will include the collection of survey data that is necessary to prepare conceptual level plans and cost estimates for alternative improvement scenarios.

6.5.3 Maintenance Problem Areas

Maintenance problems are defined as restrictions on drainage caused by accumulation of debris. They will be identified through field visits by District staff or through stakeholder identification. Further information on maintenance can be found in Section 5.4. Efforts to identify the agencies responsible for maintenance within the watershed will be undertaken in the DWPs.

6.5.4 Water Quality Problem Areas

Water quality problem areas are identified in the IEPA's 303d Report. As discussed in Chapter 4, the report provides a comprehensive summary of waterways within the state of Illinois where water quality standards or listing criteria are not met. Water quality benefits provided by projects planned as a part of DWPs will be shown in qualitative terms as a part of the documentation of improvement projects identified. During development of the draft CCSMP, the District went to great lengths to identify methods accepted by other agencies, such as the USACE and the IDNR-OWR, for determining the economic value of ecosystem impacts and water quality improvement to no avail. Therefore, until an acceptable method is identified and approved by the District, the water quality improvement and ecosystem impact facets of a project will be considered as non-economic factors.

6.5.5 Wetlands, Floodplains, and Riparian Environment at Risk

Wetland, floodplain, and riparian areas will be identified as a part of a DWP. Wetland areas are identified on National Wetland Inventory (NWI) mapping. GIS data for NWI mapping are available on the Web (http://www.fws.gov/nwi/) for download and incorporation into DWPs. Floodplain areas are delineated for many of the Cook County regional waterways and will be summarized as a part of a DWP.

Riparian zones generally are not delineated for Cook County waterways and will be defined as a part of a DWP. Wherever possible, a desktop evaluation of aerial photography or other available field data will be the method for identifying riparian zones. Riparian zones generally are defined as the interfaces between terrestrial and aquatic ecosystems. For the purpose of DWP development, riparian areas will be defined as any vegetated area adjacent to a waterbody that is occasionally inundated by floodwaters resulting in periodic hydric soil conditions. The frequency of inundation impacts the nutrient loads of riparian areas, as well as the soil conditions and plant community composition. The 10-yr delineated floodplain will be used to characterize inundation. For stream reaches where flood frequency data is not available, riparian delineation will attempt to capture the functional relationship between periodic inundation and species diversity in the floodplain.

6.6 Estimates of Existing Damage

Estimating existing damages is the first step in defining the extent of problem areas. Damage estimates defined as a part of a DWP will focus on the economic damages caused by flooding and streambank erosion. Economic damages are estimated by summing damages from four categories:

- Property damage resulting from flooding (residential and commercial)
- Streambank erosion damage
- Transportation damage
- Recreation damage

The following subsections provide guidance on the economic valuation of damages and benefits that will be included as a part of DWP development.

6.6.1 Property Damage

Property damage caused by flooding includes structural damage to buildings (residential, commercial, industrial, and public) and loss of building contents (equipment, furnishings, raw materials, and inventory). The extent of property damage depends on the severity of the flood. For riverine flooding typical of Cook County, severity is dictated primarily by flooding levels and by high flow velocities and the duration of flooding. A floodplain inventory is necessary to understand the assets that are at risk. H&H modeling is used to define water surface elevations for several storm events of varying probability of occurrence and to understand the impact on properties within the floodplain.

Table 6.14 summarizes data requirements for this analysis and suggested data sources. Several public domain applications are available to support the development of average annual damages (AA_D) curves using the data listed in Table 6.14 and consistent with the USACE's National Economic Development (NED) methodology.

Table 6.14 Property Damage Calculations

Data Requirement	Source
Flood stage elevations for 2-, 5-, 10-, 25-, 50-, and 100-year storms.	H&H modeling based on guidance contained in Section 6.4. For DWPs, flood stage elevation (floodplain boundaries) will be developed consistent with GIS standards and specifications provided by the District.
Surveyed property and structure Locations	Based on surveys performed during DWP development or acceptable estimates based on topographic data and visual inspections.
Zero-damage elevations for each structure	Based on surveys performed during DWP development or acceptable estimates based on topographic data and visual inspections.
Assessed value of each asset	Cook County tax parcel data.
Valuation of contents of structures	Recommended assumptions: For residential structures, contents are 50% of the replacement value of the structure. For commercial, industrial, or public facilities, contents are 90% of the replacement value of the structure. More specific information can be substituted, if it can be easily obtained through interviews or additional data gathering.

In general, based on the flood stage calculated using H&H models, damages are calculated for six storm events: 2-, 5-, 10-, 25-, 50-, and 100-year. Once the damages are calculated, a damage curve is developed by plotting the value of damages versus the exceedance probability. The AA_D value, which can be determined by calculating the area under the damage curve, is essentially the sum of all the damages weighted by their probability of occurrence.

Appendix F contains a more detailed description of the NED methodology for determining property damages including the development of damage curves and performing benefit-to-cost (BC) analysis.

6.6.2 Streambank Erosion Damage

Streambank erosion damage will be calculated in a manner similar to property damage calculations. Surveys performed by the District will determine where streambank erosion is likely to cause property damage. In such cases, the valuation of the structure and the contents of structures deemed to be at imminent risk will be included. Therefore, frequency determinations are unnecessary, and evaluations will focus on effectiveness for the full range of expected flows, particularly bank full-flow ranges. Only actual property damage to structures will be included in the damage calculation. Loss of land will not be considered.

6.6.3 Transportation Damage

The following damages in the transportation category will be quantified for the purposes of damage assessment:

- Physical damages to roads, bridges, traffic signal installations, and sewers
- Emergency response costs
- Traffic delay or disruption

Transportation damages will be calculated using the following tiered approach:

Tier 1—If avoided transportation damages are not expected to be a significant component of the project, then a 15 percent markup of total property damage should be used to account for indirect damages. This methodology is consistent with the IDNR-OWR's common approach to damage assessment, which includes physical damages, emergency response costs, and traffic delays or disruptions, and is intended to cover such costs as public works staff time, lost wages for residents, and other associated damages.

Tier 2—If the traffic delay component of the project is expected to be more significant, then a more detailed traffic delay analysis will be performed and included as an addition to the 15 percent markup. The methodology used for this analysis will be site-specific and will be approved by the District.

Tier 3—If historic information obtained during DWP preparation shows that flooding in the area has been known to cause significant transportation damage, then project-specific transportation damage curves will be developed in place of the 15 percent markup. An example of this may be that bridges in a particular project area are of high value and vulnerable to flood damages; therefore, the 15 percent markup would not be high enough to account for the damage expected to these bridges. These project-specific damages will be calculated using the formula

$$D_x = F_x Q_x$$

where:

- D_x = the monetary damages derived from a particular flood event; e.g., damages for a 2-year flood
- F_x = multiplication factor incorporating cost; e.g., cost of project-specific bridge replacement
- Q_x = the quantity of the particular facility affected by the flood event; e.g., number of bridges affected by the flood

Specific cost factors and inputs to be used to calculate damages for each transportation cost component will be developed using historic information. As with property damages, transportation damages will be calculated for each flooding event, developed into a damage curve, and then converted into an AA_D. The AA_D is determined by calculating the area under the damage curve. Appendix F contains a detailed explanation of this procedure.

6.6.4 Recreation Damages and Benefits

Recreation damages are incurred through the loss of the use of parks, forest preserves, or other recreational facilities. Recreation benefits can accrue from damages avoided and by the creation of recreation areas as part of a flood control project. Several methods have been developed to calculate recreational damage/benefit. The unit day value (UDV) method will be used for recreational damage or benefit calculation as a part of DWPs. The UDV method relies on annually published studies by the USACE that estimate dollar damages per day ($ person-day) that are accrued based on a point rating. The point rating system includes five criteria related to: available activities, facilities, relative scarcity, ease of access, and aesthetics. Appendix G contains USACE's 2006 published study, which is updated annually. The general formula for calculating damages is:

$$D_x = F_x V_x L_x$$

where:

D_x = the monetary damages derived from a particular flood
F_x = multiplication factor incorporating the UDV
V_x = the average number of daily visitors to a recreational facility
L_x = Length of impact in days

Unless site-specific information can be readily developed, the values contained in Appendix H (Table H-1) will be used to calculate recreational damages or benefits. This table will be evaluated annually to determine if updates are required.

Similar to property and transportation damages, recreation damages must be calculated for each flood event, developed into a damage curve, and then converted into an AA_D for recreation facilities. The AA_D can be determined by calculating the area under the damage curve. Appendix F contains a detailed explanation of the procedure.

6.6.5 Final Calculation

Once damages are calculated for each flood event, a damage curve will be developed for the sum of all damages from each category, and then converted into an overall AA_D. The AA_D can be determined by calculating the area under the damage curve. Appendix F contains a more detailed explanation of this procedure. Table 6.15 summarizes the valuation of damages and benefits proposed in the sections above.

Table 6.15 Summary Recommendation for Economic Valuation

Type of Damage and Benefit	Description	Valuation Method
Property Damage from Flooding		
Residential property —structural damage	Avoided structural damage to residences.	Follow USACE NED guidance. Use HEC-Flood Damage Assessment (FDA) or IDNR-OWR's damages model. Property valuation will be based on assessed value obtained from Cook County tax records.
Residential property—contents	Avoided damage to contents within residences.	Assume 50% of structural damage to account for residential contents.
Industrial commercial property—structural damage	Avoided structural damage to industrial/commercial property.	Follow USACE NED guidance. Use HEC-FDA software or IDNR-OWR's damages. Research individual building types through interviews and other data collection.
Industrial/ commercial property—contents	Avoided damage to contents within industrial/commercial property.	Assume 90% of structural damage unless information can be obtained through interviews and other data collection.

Table 6.15 Summary Recommendation for Economic Valuation

Type of Damage and Benefit	Description	Valuation Method
Streambank Erosion Damage		
Erosion damage	Damages from erosion.	Similar to structural damage, except include damage in areas where erosion is the cause of structural damage rather than flooding. Only structural damage will be included in the valuation, loss of land will not be considered.
Transportation Damage		
Transportation—physical damage and emergency response costs	Physical damage to roads, bridges, and utilities, as well as damages resulting from police, fire and emergency rescue costs.	Assume 15% of property damages (structural plus contents) for indirect transportation damages (this includes both physical damage and emergency response costs).
Transportation damage—operation and delay costs	Damage from additional vehicle operation, and loss of productivity.	Operational delay is considered when the flood elevation reaches 0.5 foot above the low roadway elevation. If significant, estimate damages based on estimated cost of delay.
Transportation damage—vehicles	Damage to vehicles.	Not included for District transportation damage calculations. Assume most vehicles will be removed from flooded areas before damage can occur.
Other damages—income loss	Damage from lost wages of workers that cannot be transferred out of a flooded area.	Not included. Assume that work can be transferred out of the flooded area. (*Note:* The likelihood of an event extreme enough to cause income loss is small.)
Other damages — relocation costs	Damages from additional living expenses of residences required to temporarily relocate.	Not included for District transportation damage calculations. Assume that living expenses are small relative to property damage.
Recreation Damage and Benefit		
Parks and forest preserves	Damage incurred from the loss of use of parks, forest preserves, or other recreation areas. Benefits accrued from the development of new recreation areas created by an alternative will be valued (see Section 6.6.4)	USACE Economics Guidance Memorandum, 07-03 dated November 20, 2006, unit day values for recreation, fiscal year 2007, which estimates $/person-recreation day. This calculation can be used to calculate damages in recreation areas as well as benefit from recreation area created.
Wetland and Riparian Areas		
Wetlands and riparian habitat	Existing damage to wetlands and riparian habitats will not be included in the baseline damages valuation. Damage caused by an alternative will be mitigated and included in the overall cost of an alternative. Benefit from additional wetlands or riparian habitat created by an alternative will be valued (see Section 6.7.3.1).	Not included in damage calculation. For benefit calculations use the market rate of wetlands and riparian habitat from a wetland bank in the appropriate watershed.
Water Quality		
Water quality	Damages from impaired water quality, both ecological and regulatory.	Not included until an acceptable method is developed.

6.7 Alternative Development and Evaluation

Once problem areas are defined (Section 6.5) and damages quantified (Section 6.6), then alternatives to reduce the damages associated with the problems will be developed and evaluated. Several alternatives will be developed and evaluated for each problem area. For flooding problem areas, alternatives will provide a varying level of protection. In other words, some alternatives will address lower recurrence interval storms such as the 15-year storm, and others will address higher recurrence interval storms such as the 100-year storm. Once alternatives are developed, they will be evaluated based on their BC ratio or net benefit.

The enacting legislation, Public Act 93-1049, in which authority was granted to the District for the responsibilities of stormwater management for Cook County, stipulates that BC analysis is required during deliberations for capital project selection. However, the District's Board of Commissioners is not required to select projects solely on BC analysis. They may also decide to consider noneconomic criteria in the selection of alternatives for each problem areas. Information about noneconomic criteria will be summarized for each project so that it can be included as a consideration in the countywide prioritization of stormwater improvement projects. The ultimate decision for funding of any capital project is at the discretion of the District's Board of Commissioners.

Section 6.7 is generally organized according to the steps to be followed as a part of alternative development and evaluation. Alternative development and evaluation will be performed as a part of DWPs. Table 6.16 summarizes the general steps for development and evaluation of alternatives.

Table 6.16 Summary of Alternative Development Sections

CCSMP Section Number	Alternative Development and Evaluation Step	General Overview
6.5	Define problem areas	Use guidance in Section 6.5 to identify and define the magnitude of problem areas.
6.7.1	Identify alternatives	Use technology guidance provided in Section 6.7.1 and information on watershed to identify alternatives that can help resolve problems in problem areas.
6.7.2	Evaluate alternatives	Evaluate alternatives for effectiveness addressing problem areas. This will primarily focus on the evaluation of the effectiveness of flood control alternatives using H&H modeling consistent with protocol established in Section 6.4. Streambank erosion control alternatives will focus on bank-full conditions.
6.7.3	Estimate conceptual cost of alternatives	Use unit costs, markups, and other guidance provided by the District to estimate the conceptual cost of alternatives.
6.7.3	Evaluate cost-effectiveness of alternatives	Use the damages defined in Section 6.6 and the conceptual cost estimates to determine the BC ratio for each alternative. Use the BC ratio to determine whether alternatives address problem areas cost-effectively.
6.8	Summarize recommended projects for each problem area and define noneconomic criteria	Develop lists of projects recommended throughout the watershed for each problem area. Alternatives that have the highest BC ratio (net benefit) generally will be recommended for each problem area. Also summarize noneconomic data for each problem area to be used as a part of District's countywide prioritization of improvement projects.

6.7.1 Technology Guidance and Alternative Identification

Many acceptable technologies can be used alone or in combination to form project alternatives to remediate existing stormwater problems. Where opportunities exist, projects funded by the District will incorporate BMPs that provide secondary water quality benefits. Section 6.7.1 provides guidance on the use of technologies in developing alternatives to remediate flooding and erosion problems.

6.7.1.1 Flood Control Technologies

As described in Section 6.5, flooding problems occur when flood waters reach structures, transportation facilities, utilities, critical facilities, or recreation areas. Damages arise from the effects on the facilities and their contents, as well as the consequences of loss of service. Table 6.17 contains descriptions of technologies that can remediate flooding problems and also general guidance on their use for the development of alternatives. The technologies will be used as appropriate for the development of flood control alternatives as a part of a DWP.

Technologies listed in Table 6.17 are summarized in terms of their ability to remediate flooding problems. It is assumed that these technologies would be implemented along with a regulatory program that requires measures to prevent future flooding problems. Without measures to prevent future flooding problems, such as site discharge restrictions, the technologies may not prove as effective in the future as when they originally were designed and implemented.

Table 6.17 Summary of Flood Control Options

Flood Control Option	Description
Detention/Retention	
Detention facilities	Impoundments to temporarily store stormwater. This centralized technology includes wet basins, stormwater wetlands, regional facilities, and flood control reservoirs.
Retention facilities (Wet basins)	Impoundments to permanently store stormwater and remove it through infiltration and evaporation. Retention facilities generally have an outfall to the receiving waterway that is located at an elevation above the permanent pool.
Underground detention	A specialized form of storage where stormwater is detained in underground facilities such as vaults or tunnels.
Bioretention	Decentralized microbasins distributed throughout a site or watershed to control runoff close to where it is generated. Runoff is detained in the bioretention facilities and infiltrated into the soil and removed through evapotranspiration.
Conveyance Improvement	
Culvert/bridge re-placement	Enhancement of the hydraulic capacity of culverts or bridges serving as stream crossings through size increase, roughness reduction, and removal of obstacles (for example, piers).
Channel improvement	Enhancement of the hydraulic capacity of channels by enlarging cross sections (for example, floodplain enhancement), reducing roughness (for example, lining), or channel realignment.
Flood Barriers	
Levees	Earth embankments built along rivers and streams to keep flood waters within the channel.
Floodwalls	Vertical walls typically made of concrete or other hard materials built along rivers and streams to keep flood waters within the channel.
Relocation	
Buyouts	Acquisition and demolition of properties in the floodplain to eliminate flood damages.
Building relocation	Relocation of buildings (typically houses) to higher ground to remove them from the floodplain. This technology requires purchasing new land and transporting buildings to new locations.
Elevation	Modification of a structure's foundation to elevate the building above a given flood level. Typically applied to houses.
Floodproofing	
Dry floodproofing	Installation of impermeable barriers and flood gates along the perimeter of a building to keep flood waters out. Typically deployed around commercial and industrial buildings that cannot be elevated or relocated.
Wet floodproofing	Implementation of measures that do not prevent water from entering a building but minimize damages; for example, utility relocation and installation of water resistant materials.

Note that sometimes applications of flood control technologies to address problems in one location may aggravate problems in another location (for example, conveyance improvements reduce flooding upstream but may worsen conditions downstream). Therefore, the potential applications of flood control technologies to address problems will not be analyzed in isolation. No alternative recommended as a part of a DWP may create negative impacts within the watershed or outside of the watershed, including areas lying outside of Cook County.

6.7.1.2 Erosion Control Technologies

As described in Section 6.5, streambank erosion can result in property damage or a risk to human health and safety. Damages arise from the effects on the facilities and their contents, as well as the consequences of loss of service. A description of appropriate technologies that can remediate existing streambank erosion problems and general guidance on their utilization for the development of alternatives, is presented in Table 6.18.

Table 6.18 Streambank Erosion Control Options

Control Option	Description
Natural (vegetated or bioengineered) stabilization	The stabilization and protection of eroding overland flow areas or streambanks with selected vegetation using bioengineering techniques. The practice applies to natural or excavated channels where the streambanks are susceptible to erosion from the action of water, ice, or debris and the problem can be solved using vegetation. Vegetative stabilization is generally applicable where bankfull flow velocity does not exceed 5 ft/sec and soils are more erosion resistant, such as clayey soils. Combinations of the stabilization methods listed below and others may be used.
Vegetating by sodding, seeding or planting	Establishing permanent vegetative cover to stabilize disturbed or exposed areas. Required in open areas to prevent erosion and provide runoff control. This stabilization method often includes the use of geotextile materials to provide stability until the vegetation is established and able to resist scour and shear forces.
Vegetated armoring (joint planting)	The insertion of live stakes, trees, shrubs and other vegetation in the openings or joints between rocks in a riprap or articulated block mat (ABM). The object is to reinforce riprap or ABM by establishing roots into the soil. Drainage may also be improved through extracting soil moisture.
Vegetated cellular grid (erosion blanket)	Lattice-like network of structural material installed with planted vegetation to facilitate the establishment of the vegetation, but not strong enough to armor the slope. Typically involves the use of coconut or plastic mesh fiber (erosion blanket) that may disintegrate over time after the vegetation is established.
Reinforced grass systems	Similar to the vegetated cellular grid, but the structural coverage is designed to be permanent. The technology can include the use of mats, meshes, interlocking concrete blocks, or the use of geocells containing fill material.
Live cribwall	Installation of a regular framework of logs, timbers, rock, and woody cuttings to protect an eroding channel bank with structural components consisting of live wood.
Structural stabilization	Stabilization of eroding streambanks or other areas by use of designed structural measures. Structural stabilization is generally applicable where flow velocities exceed 5 ft/sec or where vegetative streambank protection is inappropriate.
Riprap	A section of rock placed in the channel or on the channel banks to prevent erosion. Riprap typically is underlain by a sand and geotextile base to provide a foundation for the rock, and to prevent scour behind the rock.
Interlocking concrete	Interlocking concrete may include A-Jacks®, ABM, or similar structural controls that form a grid or matrix to protect the channel from erosion. A-Jacks armor units may be assembled into a continuous, flexible matrix that provides channel toe protection against high velocity flow. The matrix of A-Jacks can be backfilled with topsoil and vegetated to increase system stability and to provide in-stream habitat. ABM can be used with or without joint planting with vegetation. ABM is available in several sizes and configurations from several manufacturers. The size and configuration of the ABM is determined by the shear forces and site conditions of the channel.

Table 6.18 Streambank Erosion Control Options

Control Option	Description
Gabions	Gabions are wire mesh baskets filled with river stone of specific size to meet the shear forces in a channel. The gabions are used more often in urban areas where space is not available for other stabilization techniques. Gabions can provide stability when designed and installed correctly.
Grade Control	Grade control measures may be used to prevent stream incision into the channel bed or upstream nickpoint migration. Grade control measures involve some means of stabilizing the channel bed at a desired elevation with natural materials such as rocks or logs, or in some situations concrete. Rock vortex weirs, rock cross vanes, and log drops are means of grade control that impede channel incision and often result in scour pools developing downstream of the grade control measure.
Concrete channels	A constructed concrete channel designed to convey flow at a high velocity (greater than 5 ft/sec) where other stabilization methods cannot be used. May be suitable in situations where downstream areas can handle the increase in peak flows and there is limited space available for conveyance.
Outlet stabilization	Prevent streambank erosion from excessive discharge velocities where stormwater flows out of a pipe. Outlet stabilization may include any method discussed above.

USDA NRCS and IEPA. *Illinois Urban Manual.* 2002

Sometimes applications of streambank erosion control technologies to address problems in one location may aggravate problems in another location (for example, lining a channel in one location may exacerbate streambank erosion at another location). Therefore, application of streambank erosion or grade control technologies to address problems must not be analyzed in isolation. As stated previously, no alternative recommended as a part of a DWP may create negative impacts in the watershed or outside of the watershed including areas outside of Cook County.

Bioengineering techniques for stabilizing water body shorelines provide more natural solutions than hard armoring. Hard armoring, which protects the bank with concrete, riprap, or other nonnatural materials, is sometimes necessary when a bioengineered solution will not provide the necessary level of protection or cannot withstand flow velocities. In preparing a DWP, consideration will be made to allow only the minimum necessary amount of hard armoring. The DWP will consider the use of bioengineering techniques where appropriate. A combination of treatments will likely be suggested to maximize durability.

6.7.2 Alternative Evaluation

Alternatives developed to address flooding will be evaluated using H&H modeling consistent with methodologies described in Section 6.4. Modeling will determine the avoided damages or benefit for each alternative. The avoided damage or benefit will be used to calculate the BC ratio for each alternative.

Frequency determinations are unnecessary in evaluating alternatives developed to address erosions problems. Evaluations will focus on effectiveness for the full range of expected flows, particularly the bank full flow ranges. Costs will be considered, but not using the multistorm approach applied for flood damages.

6.7.3 Evaluating Cost Effectiveness of Alternatives

BC ratio is determined by calculating the benefit of a project in terms of avoided damages or benefit added, and the construction and operation and maintenance (O&M) costs associated with a project. Section 6.6 provides a description of the process to be followed to determine the benefit or damages for problem areas. Benefits are then divided by the cost to obtain an indicator of the cost effectiveness of each project. Net benefit can also be calculated by subtracting the cost from the benefit.

6.7.3.1 Benefit Calculation

In economic terms, benefit is the dollar value of the damages avoided because of implementation of an alternative (flood control project, soil stabilization project, buyouts). Benefits are calculated by determining damages without a project minus damages with a project; that is, damages avoided. Benefits can include the added value of recreation facilities, wetlands, or riparian areas. As explained in Appendix F, benefits can be expressed as a present value, PV_B, or can be annualized to obtain the average annual benefits AA_B.

Recreation Areas. If the project creates recreation areas, the value will be included as a benefit to the project using the economic valuation method described in Section 6.6.4. Recreation benefit, once created, can be assumed to accrue annually over the life of the project.

Wetlands and Riparian Areas. If the project creates wetlands or riparian areas, their value will be included as an economic benefit of the project. The value of wetlands and riparian areas is calculated based on the market rate of wetlands in the watershed. Appendix H provides the 2006 market rate for wetlands by watershed (Table H-2). The values are variable and will be confirmed annually.

6.7.3.2 Costing Assumptions

Project costs involve all expenditures necessary for implementation. For traditional flood control projects such as levees or reservoirs, they include study, design, land acquisition, construction, and O&M costs. For a residential buyout, there is a one-time cost to purchase structures in the floodplain, including demolition of the structures, restoration of the land, relocation and closing costs. Floodproofing costs may be represented by one-time costs of utility relocation and the occasional complete replacement of flood shields.

Flood protection projects provide benefits throughout a defined period of time that depends on the useful life of a project. A levee may have a useful life of 50 years, whereas relocation of a house outside the floodplain is a permanent solution. Every year that the project performs its functions, it provides benefits and, in principle, requires some expenditure, although most of the cost is incurred during construction. Therefore, the concept of annualizing is applied to compare these unevenly distributed benefits and costs.

Annualizing benefits and costs is a basic concept of engineering economics that accounts for the time value of money. To calculate the annual payment, benefits accrued and the costs incurred every year are discounted using compound interest procedures. The typical discount rate is set by the federal government and is also used by IDNR-OWR. Recently it has varied between 3 and 7 percent. In 2005, the value used by IDNR-OWR for discounting was 5.375 percent. The District will validate the discount rate annually. If the life expectancy of facilities is less than the period for which benefits are calculated, then replacement costs must be incorporated to account for the total cost of facilities for the entire time period.

Standard engineering economics textbooks provide formulas for converting a present value or a future value into a uniform series of "payments." For example, a capital expenditure can be converted into an annual payment using the formula

$$AAc = PV \frac{i(1+i)^n}{(1+i)^n - 1}$$

where:

AAc = annual cost
n = useful life of the project in years
PV = total cost or benefit in the present
i = discount rate

To calculate costs accurately, it is necessary to have an assumption of the life expectancy of a project. Table 6.19 lists the standard assumptions to be used to estimate project life for purposes of alternative evaluation.

Table 6.19 Life Expectancy and O&M Requirements for Alternative Evaluation

Project	Life Expectancy (yr)	Inspection and Routine O&M (yr)	Additional O&M (YR)
Flood Control Projects			
Detention pond	50	Every 2-3	Every 10
Underground detention	50	Every 2-3	Every 5
Levee with detention	100	Every 3	Every 15
Channel enlargement with detention	50	Every 2-3	Every 5
Floodproofing	20	Every 1	Every 2
Buyouts	Permanent		
Detention pond	50	Every 2-3	Every 10
Underground detention	50	Every 2-3	Every 5
Soil Stabilization Projects			
Natural stabilization	30	Every 1	Every 2
Riprap	30	Every 2-3	Every 5
Reno gabions	30	Every 1	Every 5
Basket gabions	30	Every 1	Every 5
Sloped vertical concrete wall	30	Every 2-3	Every 5
Rectangular concrete channel	50	Every 2-3	Every 5
Trapezoidal concrete channel	50	Every 2-3	Every 5

6.7.3.3 Unit Costs for Alternative Development

The District will develop a current list of unit costs to use as part of alternative cost estimation. Unit cost items will be developed by the District and evaluated annually to determine if updates are required. In addition to the list of unit costs, the District will also establish consistent markups for items such as mobilization, engineering, and contingencies. Unless a customized or site-specific approach to include these costs is approved by the District, standard unit cost items and markups will be used for DWP alternative development to provide for consistency during the countywide prioritization of projects.

6.7.3.4 Calculating Benefit-to-Cost Ratio

Once the average annual benefits (AA_B) and average annual cost (AA_C) have been estimated, the BC ratio is computed using the formula:

$$BC = \frac{AA_B}{AA_C}$$

where:

AA_B = the average annual benefit
AA_C = the average annual costs

Note that the BC ratio can also be computed using benefits and costs expressed as present values:

$$BC = \frac{PV_B}{PV_C}$$

where:

PV_B = the present value of the benefits
PV_C = the present value of the costs

The BC ratio will be used to evaluate whether a project is cost-effective. If the BC ratio is greater than one, the project benefits exceed the costs and the project can be considered cost-effective. Other factors may be considered that would favor a project that did not have a BC ratio greater than one.

Similarly, the net benefits of the project are equal to:

$$NB = PV_B - PV_C$$

If the net benefits are positive, the project is cost-effective and the BC ratio greater than one.

6.7.4 Alternative Selection for Problem Area

As stated previously, the District is required to consider the BC ratio when selecting projects for implementation. In addition the District will consider noneconomic criteria in selecting alternatives. All projects which meet the District's absolute requirements for capital project funding will be prioritized on a countywide basis, with final decision for funding made at the discretion of the District's Board of Commissioners.

6.8 Summary of Recommended Alternatives

Recommended projects will be summarized to describe the economic and noneconomic data to be used as a part of the District's countywide prioritization of improvements. The economic data will focus on the BC ratio defined for each problem area, consistent with the documentation provided in Sections 6.6 and 6.7. Noneconomic data to be developed for each project are summarized in Section 6.8.1.

Exhibit 6.1 depicts the documentation that will be prepared as a part of each DWP to support the countywide prioritization of projects. Only alternatives that meet the District's minimum criteria for funding (see Chapter 1) will be developed and evaluated. For each project that meets the minimum criteria, a BC analysis will be developed, as will information on the development of noneconomic data. That information will be summarized in a manner consistent with what is shown in Exhibit 6.1 for incorporation into the District's countywide prioritization of improvement projects. Note that all costs and net benefits shown in Exhibit 6.1 shall be expressed as present values.

6.8.1 Other Noneconomic Evaluation Criteria

In addition to the BC ratio, the following information will be compiled for the District to use as a part of the countywide prioritization of projects:

- Total cost to the District
- Area (in acres) removed from the floodplain
- Number of structures protected
- Probability that funding will be provided by outside agencies (identify funding source, and percent of project to be funded, if known)
- Implementation time (in months)
- Water quality benefit, based on the qualitative scale described in Section 6.8.2
- Cook County communities involved
- Wetland or riparian area protected (ac)

6.8.2 Water Quality Benefit

To determine the water quality benefit of a flood control or erosion control project, the following questions must be addressed:

- Does the project contribute to the implementation of a TMDL established for the watershed?
- Does the project improve water quality concerns identified as a part of an NPDES Phase II Stormwater Permit?
- Does the project improve water quality related to a pollutant or pollution identified in the state's 303(d) Report?
- Does the project have an effect on habitat?

Once these questions are addressed, water quality benefit will be evaluated qualitatively using the scale in Table 6.20.

Table 6.20 Water Quality Benefit Evaluation Scale

Rating	Description
No Impact	No notable impact on water quality.
Slightly Positive	Project partly addresses or affects an NPDES Phase II Stormwater Permit, a TMDL established for the watershed, violations in water quality standards or listing criteria, or habitat.
Positive	Project fully addresses or impacts an NPDES Phase II Stormwater Permit, a TMDL established for the watershed, violations in water quality standards or listing criteria, or habitat.

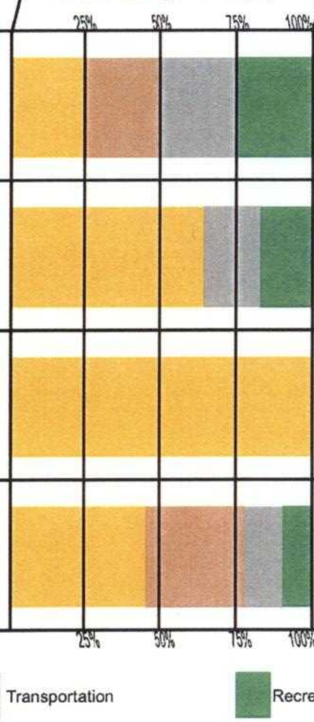
6.9 Implementation Plan

Each DWP will include an implementation plan that identifies issues critical to implementation of watershed recommendations. The recommendations will include stormwater improvement projects to address watershed problems, data management needs and responsibilities, special coordination requirements identified as a part of DWP development, scheduled updates to DWPs, and any other issues identified as critical to the District.

Exhibit 6-1 Example CIP Prioritization Matrix

Metropolitan Water Reclamation District of Greater Chicago
Example Prioritization Matrix

	B/C Ratio	Total Benefits ($)	Total Project Cost ($)	Total Cost To MWRDGC ($)	Relative Damage Averted (%)	Area Removed from Floodplain (ac)	Wetland or Riparian Area Protected (ac)	Number of Structures Protected	Possibility of Funding Provided by Outside Agencies	Implementation Time (months)	Water Quality Benefit	Communities Involved
Project A	1.25	5.0 M	4.0 M	3.2 M		5.0	40	6	Very Likely	6	Positive	Oak Park Berwyn Cicero
Project B	2.5	7.5 M	3.0 M	3.0 M		2.6	8	10	Not Likely	28	Slightly Positive	Park Ridge Des Plaines Mount Prospect
Project C	1.2	12.0 M	10.0 M	7.8 M		13.0	0	50	Somewhat Likely	3	No Impact	Oak Lawn Chicago Ridge
Project D	1.0	15.0 M	15.0 M	14.0 M		3.9	15	25	Not Likely	24	Slightly Postive	Buffalo Grove Wheeling Des Plaines Mount Prospect Prospect Heights



Note: This prioritization matrix may be expanded to include additional non-economic criteria. All values are hypothetical and for demonstration purposes only.

Calumet-Sag Watershed SCS Curve Number Generation

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DATE: August 14, 2007

SCS hydrology uses the empirical curve number (CN) parameter as a part of calculating runoff volumes based on landscape characteristics such as soil type, land cover, imperviousness, and land-use development. Areas characterized by saturated or poorly infiltrating soils, or impervious development, have higher CN values, converting a greater portion of rainfall volume into runoff. The principle data sources used to develop CN values for the Calumet-Sag watershed are the Natural Resource Conversation Service (NRCS) soil data for Cook County and the 2001 Northeast Illinois Planning Commission (NIPC) land-use mapping for Cook County. This technical memorandum documents the procedure used to develop a CN grid for use in hydrologic modeling for the Calumet-Sag watershed and the assumptions inherent in this procedure.

Approach

CN values are dependent on a number of factors, including the soil infiltration characteristics and condition, as well as land cover characteristics such as directly connected impervious area and cover type. Therefore both soil data and land-use data are required to estimate CN. The best available soil and land-use data for Cook County are the NRCS soil data and NIPC land-use data. Table 1 lists curve numbers based on combinations of land-use data and soil data for small urban watersheds.

Table A.1 Curve Number Generation for Small Urban Watersheds

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94

Table excerpted from Technical Release 55, Urban Hydrology for Small Watersheds, June 1986

A slightly modified version of this table will be used for curve number generation in the Calumet-Sag watershed, shown in table A.2. Both the NRCS soil data and the land use data require preprocessing before generating curve numbers using the lookup table.

Table A.2 Modified Curve Number Generation for Calumet-sag Watershed.

Description	Average % Impervious	Curve Number by Hydrologic Soil Group				Typical Land Uses
		A	B	C	D	
Residential (High Density)	65	77	85	90	92	Multi-family, Apartments, Condos, Trailer Parks
Residential (Med. Density)	30	57	72	81	86	Single-Family, Lot Size ¼ to 1 acre
Residential (Low Density)	15	48	66	78	83	Single-Family, Lot Size 1 acre and Greater
Commercial	85	89	92	94	95	Strip Commercial, Shopping Ctrs, Convenience Stores
Industrial	72	81	88	91	93	Light Industrial, Schools, Prisons, Treatment Plants
Disturbed/Transitional	5	76	85	89	91	Gravel Parking, Quarries, Land Under Development
Agricultural	5	67	77	83	87	Cultivated Land, Row crops, Broadcast Legumes
Open Land – Good	5	39	61	74	80	Parks, Golf Courses, Greenways, Grazed Pasture
Meadow	5	30	58	71	78	Hay Fields, Tall Grass, Ungrazed Pasture
Woods (Thick Cover)	5	30	55	70	77	Forest Litter and Brush adequately cover soil
Woods (Thin Cover)	5	43	65	76	82	Light Woods, Woods-Grass combination, Tree Farms
Impervious	95	98	98	98	98	Paved Parking, Shopping Malls, Major Roadways
Water	100	100	100	100	100	Water Bodies, Lakes, Ponds, Wetlands

Data from http://gis2.esri.com/library/userconf/proc00/professional/papers/PAP657/p657.htm

Data is for average antecedent moisture condition II- dormant season (5-day) rainfall averaging from 0.5 to 1.1 inches and growing season rainfall from 1.4 to 2.1 inches

NRCS Soil data

Soil mapping for Cook County was downloaded from the NRCS website at http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/, representing 2002 conditions. The data downloaded includes a GIS shapefile of the soil groups and numerous text files that can be imported into an Access database and linked to the GIS data via a field called 'Mapunit Key.' The data field most relevant for SCS hydrology is the 'Hydrologic Group.' The hydrologic soil group (HSG) indicates the minimum infiltration of a specific soil group following wetting, and represented by four soil groups, shown in Table A.3.

TABLE A.3. HYDROLOGIC SOIL GROUPS

Hydrologic Soil Group	Description	Texture	Infiltration Rates (in/hr)
A	Low runoff potential and high infiltration rates even when wetted	Sand, loamy sand, or sandy loam	> 0.30
B	Moderate infiltration rates when wetted	Silt loam or loam	0.15 – 0.30
C	Low infiltration rates when wetted	Sandy clay loam	0.05 – 0.15
D	High runoff potential and very low infiltration when wetted	Clay loam, silty clay loam, sandy clay, silty clay, or clay	0 – 0.05
		clay, or clay	

All data from Technical Release 55, Urban Hydrology for Small Watersheds, June 1986

Soil groups with drainage characteristics impacted by a high water table are indicated with a '/D' designation, where the letter preceding the slash indicates the hydrologic group of the soil under drained conditions. Thus an 'A/D' indicates that the soil has characteristics of the A soil group if drained, but the D soil group if not drained. 'A/D', 'B/D', or 'C/D', occur throughout the Calumet-Sag study area and represent a cumulative area of 9.11 mi^2 of the 152 square-mile watershed. Due to the difficulty of establishing the extent of drainage of these soils for each mapped soil polygon, it was assumed that 50% (by area) of these soil types were drained.

The City of Chicago is not mapped within the NRCS data set and thus does not have an assigned HSG. Based on previous studies, a minimum infiltration rate of 0.1 in/hr is reasonable in much of Chicago which corresponds to a 'C' HSG. In addition, a number of other soil features lacked HSG data, however these were generally open water or unmapped areas, for which CN values would not be stratified by HSG. When intersected with land-use data, the CN values are averaged across A, B , C and D values for the specified land-use type to estimate CN.

NIPC Land Use Data

NIPC land-use data contains delineation of land-use categories at an average scale of 0.10 acres for features in the Calumet-Sag watershed. To generate CN values, these land-use categories must be converted to analogous land-use categories for which CN data has previously been developed. Table A.4 demonstrates the field mapping used to convert NIPC land-use categories into categories for which CN data exists.

Table A.4. NIPC field mapping to land use field.

NIPC Code	NIPC Land USE	SCS Land Use	A	B	C	D	A/D	B/D	C/D	NULL
1110	1110 RES/SF	Residential (High Density)	77	85	90	92	84.5	88.5	91	86
1120	1120 RES/FARM	Residential (Low Density)	48	66	78	83	65.5	74.5	80.5	68.75
1130	1130 RES/MF	Residential (Med. Density)	57	72	81	86	71.5	79	83.5	74
1140	1140 RES/MOBILE HM	Residential (High Density)	77	85	90	92	84.5	88.5	91	86
1211	1211 MALL	Commercial	89	92	94	95	92	93.5	94.5	92.5
1212	1212 RETAIL CNTR	Commercial	89	92	94	95	92	93.5	94.5	92.5
1221	1221 OFFICE CMPS	Commercial	89	92	94	95	92	93.5	94.5	92.5
1222	1222 SINGL OFFICE	Commercial	89	92	94	95	92	93.5	94.5	92.5
1223	1223 BUS. PARK	Commercial	89	92	94	95	92	93.5	94.5	92.5
1231	1231 URB MX W/PRKNG	Commercial	89	92	94	95	92	93.5	94.5	92.5
1232	1232 URB MX NO PRKNG	Industrial	81	88	91	93	87	90.5	92	88.25
1240	1240 CULT/ENT	Commercial	89	92	94	95	92	93.5	94.5	92.5
1250	1250 HOTEL/MOTEL	Commercial	89	92	94	95	92	93.5	94.5	92.5
1310	1310 MEDICAL	Industrial	81	88	91	93	87	90.5	92	88.25
1320	1320 EDUCATION	Industrial	81	88	91	93	87	90.5	92	88.25
1330	1330 GOVT	Commercial	89	92	94	95	92	93.5	94.5	92.5
1340	1340 PRISON	Industrial	81	88	91	93	87	90.5	92	88.25
1350	1350 RELIGOUS	Commercial	89	92	94	95	92	93.5	94.5	92.5
1360	1360 CEMETERY	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
1370	1370 INST/OTHER	Residential (Low Density)	48	66	78	83	65.5	74.5	80.5	68.75
1410	1410 MINERAL EXT	Disturbed/Transitional	76	85	89	91	83.5	88	90	85.25
1420	1420 MANUF/PROC	Industrial	81	88	91	93	87	90.5	92	88.25
1430	1430 WAREH/DIST/WHOL	Industrial	81	88	91	93	87	90.5	92	88.25
1440	1440 INDUST PK	Industrial	81	88	91	93	87	90.5	92	88.25

NIPC Code	NIPC Land USE	SCS Land Use	A	B	C	D	A/D	B/D	C/D	NULL
1511	1511 INTERSTATE/TOLL	75 % Impervious/25 % Open Land	83.25	88.75	92.00	93.50	88.38	91.13	92.75	89.38
1512	1512 OTHER ROADWY	75 % Impervious/25 % Open Land	83.25	88.75	92.00	93.50	88.38	91.13	92.75	89.38
1520	1520 OTH LINEAR TRAN	I75 % Impervious/25 % Open Land	83.25	88.75	92.00	93.50	88.38	91.13	92.75	89.38
1530	1530 AIR TRANSPORT	50 % Impervious/ 50% Open Lands	68.50	79.50	86.00	89.00	78.75	84.25	87.50	80.75
1540	1540 INDEP AUTO PRK	Commercial	89	92	94	95	92	93.5	94.5	92.5
1550	1550 COMMUNICATION	Agricultural	67	77	83	87	77	82	85	78.5
1560	1560 UTILITIES/WASTE	Disturbed/Transitional	76	85	89	91	83.5	88	90	85.25
2100	2100 CROP/GRAIN/GRAZ	Agricultural	67	77	83	87	77	82	85	78.5
2200	2200 NRSRY/GRNHS/ORC	Agricultural	67	77	83	87	77	82	85	78.5
2300	2300 AG/OTHER	Agricultural	67	77	83	87	77	82	85	78.5
3100	3100 OPENSP REC	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
3200	3200 GOLF COURSE	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
3300	3300 OPENSP CONS	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
3400	3400 OPENSP PRIVATE	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
3500	3500 OPENSP LINEAR	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
3600	3600 OPENSP OTHER	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
4110	4110 VAC FOR/GRASS	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
4120	4120 WETLAND	Meadow	30	58	71	78	54	68	74.5	59.25
4210	4210 CONST RES	Disturbed/Transitional	76	85	89	91	83.5	88	90	85.25
4220	4220 CONST NONRES	Disturbed/Transitional	76	85	89	91	83.5	88	90	85.25
4300	4300 OTHER VACANT	Open Land – Good	39	61	74	80	59.5	70.5	77	63.5
5100	5100 RIVERS/CANALS	Water	100	100	100	100	100	100	100	100
5200	5200 LAKE/RES/LAGOON	Water	100	100	100	100	100	100	100	100
5300	5300 LAKE MICHIGAN	Water	100	100	100	100	100	100	100	100
9999	9999 OUT OF REGION	Water	100	100	100	100	100	100	100	100

Note: not all NIPC land use types exist within the Calumet-Sag watershed.

Steps for Generating Curve Number Grid

Following the preparation of the land-use and soil data is described in the preceding two sections, three steps are followed to generate the CN Grid

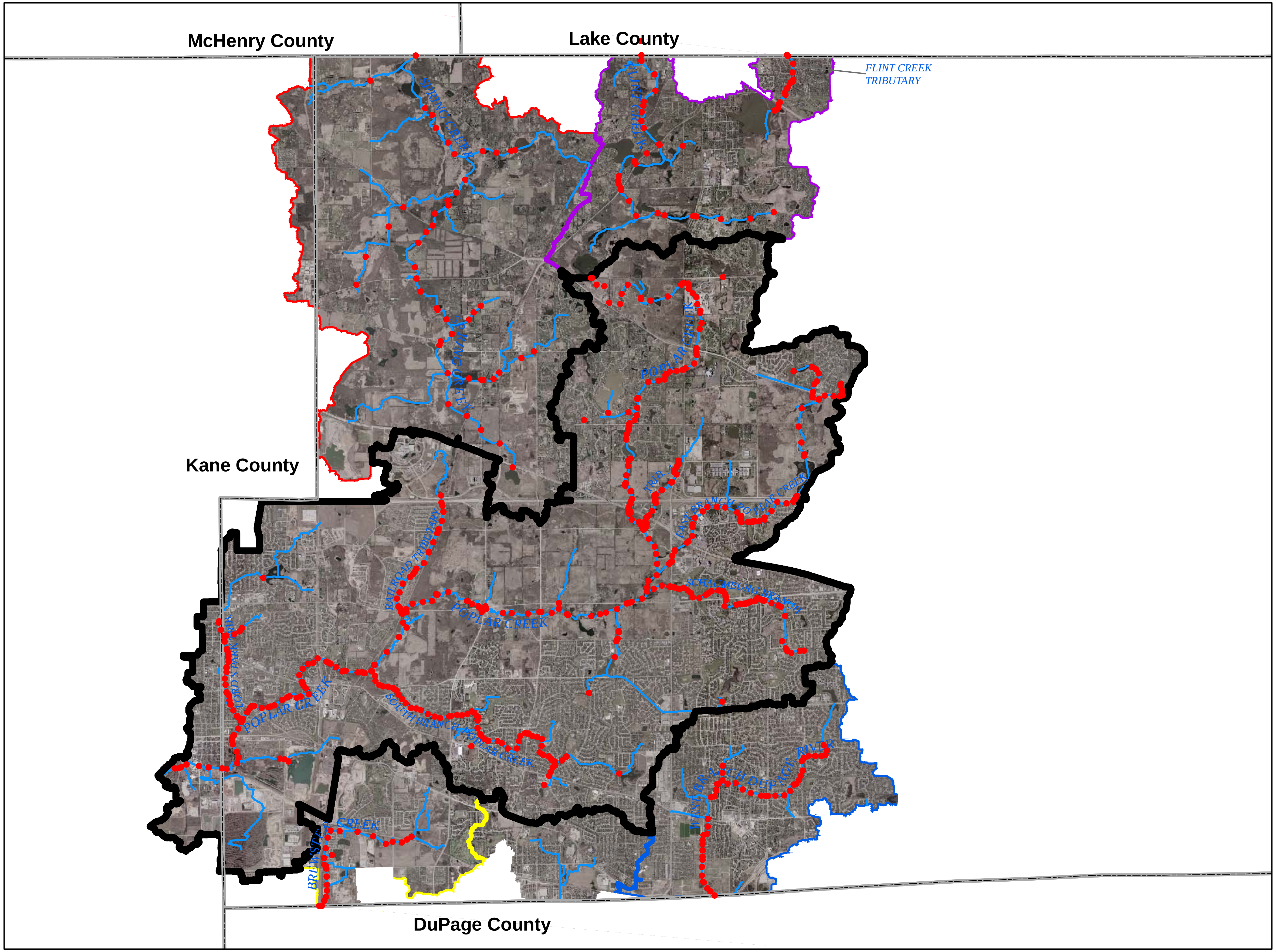
1) Perform an intersection of the NRCS soil mapping polygon feature class with the NIPC land use polygon feature class. This produces a polygon feature class that has both land-use type and HSG. This feature class was output into a personal geodatabase so that Access queries could be performed on it.

2) Add a field called CurveNumber to the intersected feature class

3) Assign a CN value to each intersected polygon feature based upon HSG and land use. This was performed using an Access update query on the CurveNumber field. The soil groups impacted by high water table (e.g. 'A/D') were estimated to be 50% drained, using the average of the D CN and the drained (e.g. A) CN.

4) Use the "feature to raster" function in ArcToolbox to create a CN grid based on the CurveNumber value at the center of each grid pixel. A 20 ft x 20 ft grid, the same resolution as digital terrain model uses for watershed delineation, was used for this purpose.

The included figure shows the final CN grid for the Calumet-Sag watershed.



0 7,000
Feet

LEGEND

- Survey Points
- County Boundaries
- River/Stream
- Poplar Creek Watershed Boundary
- Flint Creek Watershed Boundary
- Brewster Creek Watershed Boundary
- Spring Creek Watershed Boundary
- West Branch Dupage River Watershed Boundary

Hey and Associates, Inc.
Water Resources, Wetlands and Ecology

6321 N. AVONDALE AVENUE, SUITE A-211
CHICAGO, IL 60631
PHONE: (773) 792-8510
FAX: (773) 792-8512

Poplar Creek
Watershed Study Area
Detailed Watershed Plan

Poplar Creek
Watershed Study Area
Survey Points

Appendix D

CERTIFICATION OF COMPLIANCE	
Project Name:	Poplar Creek Detailed Watershed Plan Phase B
Statement/Agreement Date:	Land Surveying Services, Inc. – 12/17/2009
Certification Date:	

Tasks/Activities Covered by This Certification (Check All That Apply)

☐	**Entire Project**
☐	**Survey deliverable date:** 1-19-09 to 4-10-09
☐	**Other (Specify):**

This is to certify that the work summarized above was completed in accordance with the Contract and Scope of Work and all amendments thereto between Land Survey Services, Inc. and Hey and Associates, Inc., and that all such work has been accomplished to meet accuracy guidelines contained in *Guidelines and Specifications for Flood Hazard Mapping Partners* cited in the survey scope of work document, and in accordance with sound and accepted engineering practices within the contract provisions for respective phases of the work.

Name: GLORIA JEAN KOTER

Title: PRESIDENT

Firm/Agency Represented: Land Surveying Services, INC

Registration No.:

Signature: [signature]

STATE OF ILLINOIS
GLORIA JEAN KOTER
035-003323
REGISTERED LAND SURVEYOR

Seal

This form must be signed, stamped, and dated by the surveyor in responsible charge from the firm contracted to perform the work who is registered as a Professional Land Surveyor in the State of Illinois.

CERTIFICATION OF COMPLIANCE

Project Name:	Poplar Creek Detailed Watershed Plan Phase B
Statement/Agreement Date:	DB Sterlin – 12/10/2008
Certification Date:	12-15-2009

Tasks/Activities Covered by This Certification (Check All That Apply)

- [x] **Entire Project**
- [x] **Survey deliverable date:** August, 2009
- [ ] **Other (Specify):**

This is to certify that the work summarized above was completed in accordance with the statement/agreement cited above and all amendments thereto, together with all such modifications, either written or oral, as directed by Hey and Associates, Inc., as such modifications affect the statement/agreement, and that all such work has been accomplished to meet accuracy guidelines contained in *Guidelines and Specifications for Flood Hazard Mapping Partners* cited in the survey scope of work document, and in accordance with sound and accepted engineering practices within the contract provisions for respective phases of the work.

Name: Thomas J. Galbreath

Title: Land Survey Manager

Firm/Agency Represented: D.B. Sterlin Consultants

Registration No.: 3134

Signature: [signature]

THOMAS J. GALBREATH 035-003134 PROFESSIONAL LAND SURVEYOR STATE OF ILLINOIS AURORA, IL

Seal

This form must be signed, stamped, and dated by the surveyor in responsible charge from the firm contracted to perform the work who is registered as a Professional Land Surveyor in the State of Illinois.

CECW-PG 10 October 2003

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Economic Guidance Memorandum (EGM) 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements.

1. Purpose. The purpose of this memorandum is to release, and provide guidance for the use of, generic depth-damage curves for use in U.S. Army Corps of Engineers flood damage reduction studies.

2. Background. Proper planning and evaluation of flood damage reduction projects require knowledge of actual damage caused to various types of properties. The primary purpose of the Flood Damage Data Collection Program is to meet that requirement by providing Corps district offices with standardized relationships for estimating flood damage and other costs of flooding, based on actual losses from flood events. Under this program, data have been collected from major flooding that occurred in various parts of the United States from 1996 through 2001. Damage data collected are based on comprehensive accounting of losses from flood victims' records. The generic functions developed and provided in this EGM represent a substantive improvement over other generalized depth-damage functions such as the Flood Insurance Administration (FIA) Rate Reviews.

3. Results. Generic damage functions are attached for one-story homes with basement, two or more story homes with basement, and split-level homes with basement. Generic damage functions for similar structures without basements were published in 2000 and are included as enclosure 1 for ready reference.

a. Regression analysis was used to create the damage functions. While several independent variables, such as flood duration and flood warning lead-time, were examined in building the models, the models that were most efficient in explaining the percent damage to structure and contents were quadratic and cubic forms with depth as the only independent variable.

b. Content damage was modeled with the dependent variable being content damage as a percentage of structure value. This differs from the previous technique of first developing content valuations and then content damage relationships as a function of content valuations. The generic content damage models are statistically significant and their use eliminates the need to establish content-to-structure ratios through surveys.

c. While the data collected include information on all aspects of National Economic Development (NED) losses, only results and recommendations related to the structure and content damages for homes with basements are included in this EGM.

Direct costs for cleanup expenses, unpaid hours for cleanup and repair, emergency damage prevention actions, and other flood-related costs are not included in these damage functions. Information on other residential flood costs, beyond those included in these damage functions will found the summary report, discussed in paragraph 5. These costs should be developed using site-specific historical information.

4. Application. The following paragraphs provide information on the application of the generic curves within the HEC-FDA damage calculation program.

a. The economic section of HEC-FDA divides the quantification of flood damages into a direct method and an indirect method. The direct method allows the user to directly enter a stage-damage relationship for any structure. This approach is commonly used for large or unique properties such as industrial or pubic buildings. The indirect method quantifies the stage-damage relationship for a group of structures that have significant commonality. Typically damage to residential structures is calculated using the indirect method. The procedures described in the following paragraphs apply only when using the indirect method to determine the stage-damage relationship.

b. The traditional approach to quantifying damage to contents by the indirect method relies on three pieces of information: 1) structure value; 2) content-to-structure value ratio; and 3) the content depth-damage relationship. The content-to-structure value ratio and content depth-damage relationship are unique to the structure occupancy type to which a structure is assigned. The content depth-damage relationship provides the estimate of content flood damage as a percentage of content value. Thus, to calculate a content stage-damage function for an individual structure, the structure value for an individual structure is first multiplied by the content-to-structure value ratio to provide an estimate of the content value. This content value is then multiplied by each percent damage value of the content depth-damage relationship.

c. The new content depth-damage functions provided herein are different from those used by the Corps in the past in one important aspect. The new functions calculate content damage as a percent of structure value rather than content value. Using these functions within HEC-FDA requires care in specifying a content-to-structure value ratio. To understand the requirements for using the new content depth-damage functions requires a basic understanding of how HEC-FDA calculates content damage.

(1). To calculate damages by the indirect method, each structure must be assigned to a structure occupancy type. For each structure occupancy type a content-to-structure value ratio and content depth-damage relationship are defined. These data for calculating content damage within HEC-FDA is entered on the "Study Structure Occupancy Type" screen. As long as a content value is not entered for a structure in the Structure Inventory Data, HEC-FDA calculates the content stage-damage by first calculating content using the structure value multiplied by the content-to-structure value ratio.

In some instances, however, analysts develop unique estimates of content values for a structure, which are entered for the individual structure on the Structure Inventory Data screen. For each structure that has a content value entered, calculating a content value by using the content-to-structure value ratio is ignored and the user entered content value is used to calculate content damage.

(2). The new content depth-damage functions do not require this intermediate step of calculating content values. Therefore, the content-to-structure value ratio for each structure occupancy type using the new content depth-damage relationships must be set to one hundred percent (100). This forces the content depth-damage function to be multiplied by the structure value as required. Also, the “Error Associated with Content/Structure Value” on the “Study Structure Occupancy Type” screen should be left blank. This implies that the error in content-to-structure value ratio is part of the new content depth-damage relationship.

(3). Because entering a content value on the Structure Inventory Data window overrides the content-to-structure value ratio, the new content depth-damage relationships should not be used for structures that have separately entered content values.

(4). Questions concerning the use of the generic curves within the HEC-FDA model can be addressed to Dr. David Moser, Institute of Water Resources (IWR), (703) 428-8066.

5. Report. A report summarizing the data collection effort and analyses performed to derive these curves will shortly be available on the IWR website. More information may be obtained by contacting the program’s principal investigator, Stuart Davis, (703) 428-7086.

6. Waiver to Policy. These curves are developed for nation-wide applicability in flood damage reduction studies. When using these curves, the requirement to develop site-specific depth-damage curves contained in ER 1105-2-100, E-19q.(2) is waived. Additionally, the requirement to develop content valuations and content-to-structure ratios based on site-specific or comparable floodplain information, ER 1005-2-100, E-19q.(1)(a), is also waived. Note these waivers currently apply only to single-family homes with and without basements for which generic curves have been published, and not other categories of flood inundation damages for which no generic curves exist. Feasibility reports must state the generic curves are being used in the flood damage analysis for residential structures with and/or without basements. Use of these curves is optional and analysts should always endeavor to use the best available information to accurately quantify the damages and benefits in inundation reduction studies.

7. Point of Contact. Administrators of the Flood Damage Data Collection Program continue to collect and analyze flood-related damages to both residential and commercial properties. The HQUSACE program monitor is Lillian Almodovar, (202) 761-4233, who can address any questions concerning the program.

FOR THE COMMANDER:

/s/

Encl

WILLIAM R. DAWSON, P.E.
Chief, Planning and Policy Division
Directorate of Civil Works

DISTRIBUTION:
North Atlantic Division, ATTN: CENAD-ET-P
South Atlantic Division, ATTN: CESAD-ET-P
Great Lakes/Ohio River Division: ATTN: CELRD-E-P
Northwestern Division, ATTN: CENWD-PNP-ET-P
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Mississippi Valley Division: ATTN: CEMVD-PM

DAMAGE FUNCTIONS
FOR SINGLE FAMILY RESIDENTIAL
STRUCTURES WITH BASEMENTS

Structure Depth-Damage

Table 1 Structure One Story, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0%	0
-7	0.7%	1.34
-6	0.8%	1.06
-5	2.4%	0.94
-4	5.2%	0.91
-3	9.0%	0.88
-2	13.8%	0.85
-1	19.4%	0.83
0	25.5%	0.85
1	32.0%	0.96
2	38.7%	1.14
3	45.5%	1.37
4	52.2%	1.63
5	58.6%	1.89
6	64.5%	2.14
7	69.8%	2.35
8	74.2%	2.52
9	77.7%	2.66
10	80.1%	2.77
11	81.1%	2.88
12	81.1%	2.88
13	81.1%	2.88
14	81.1%	2.88
15	81.1%	2.88
16	81.1%	2.88

Table 2 Structure Two or More Stories, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	1.7%	2.70
-7	1.7%	2.70
-6	1.9%	2.11
-5	2.9%	1.80
-4	4.7%	1.66
-3	7.2%	1.56
-2	10.2%	1.47
-1	13.9%	1.37
0	17.9%	1.32
1	22.3%	1.35
2	27.0%	1.50
3	31.9%	1.75
4	36.9%	2.04
5	41.9%	2.34
6	46.9%	2.63
7	51.8%	2.89
8	56.4%	3.13
9	60.8%	3.38
10	64.8%	3.71
11	68.4%	4.22
12	71.4%	5.02
13	73.7%	6.19
14	75.4%	7.79
15	76.4%	9.84
16	76.4%	12.36

Table 3 Structure Split Level, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8		
-7		
-6	2.5%	1.8%
-5	3.1%	1.6%
-4	4.7%	1.5%
-3	7.2%	1.6%
-2	10.4%	1.6%
-1	14.2%	1.6%
0	18.5%	1.6%
1	23.2%	1.7%
2	28.2%	1.9%
3	33.4%	2.1%
4	38.6%	2.4%
5	43.8%	2.6%
6	48.8%	2.9%
7	53.5%	3.2%
8	57.8%	3.4%
9	61.6%	3.6%
10	64.8%	3.9%
11	67.2%	4.2%
12	68.8%	4.8%
13	69.3%	5.7%
14	69.3%	5.7%
15	69.3%	5.7%
16	69.3%	5.7%

Content Depth-Damage

Table 4 Content One Story, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0.1%	1.60
-7	0.8%	1.16
-6	2.1%	0.92
-5	3.7%	0.81
-4	5.7%	0.78
-3	8.0%	0.76
-2	10.5%	0.74
-1	13.2%	0.72
0	16.0%	0.74
1	18.9%	0.83
2	21.8%	0.98
3	24.7%	1.17
4	27.4%	1.39
5	30.0%	1.60
6	32.4%	1.81
7	34.5%	1.99
8	36.3%	2.13
9	37.7%	2.25
10	38.6%	2.35
11	39.1%	2.45
12	39.1%	2.45
13	39.1%	2.45
14	39.1%	2.45
15	39.1%	2.45
16	39.1%	2.45

Table 5 Content Two or More Stories-With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0%	0
-7	1.0%	2.27
-6	2.3%	1.76
-5	3.7%	1.49
-4	5.2%	1.37
-3	6.8%	1.29
-2	8.4%	1.21
-1	10.1%	1.13
0	11.9%	1.09
1	13.8%	1.11
2	15.7%	1.23
3	17.7%	1.43
4	19.8%	1.67
5	22.0%	1.92
6	24.3%	2.15
7	26.7%	2.36
8	29.1%	2.56
9	31.7%	2.76
10	34.4%	3.04
11	37.2%	3.46
12	40.0%	4.12
13	43.0%	5.08
14	46.1%	6.39
15	49.3%	8.08
16	52.6%	10.15

Table 6 Content Split-Level-With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0.6%	2.09
-7	0.7%	1.49
-6	1.4%	1.14
-5	2.4%	1.01
-4	3.8%	1.00
-3	5.4%	1.02
-2	7.3%	1.03
-1	9.4%	1.04
0	11.6%	1.06
1	13.8%	1.12
2	16.1%	1.23
3	18.2%	1.38
4	20.2%	1.57
5	22.1%	1.76
6	23.6%	1.95
7	24.9%	2.13
8	25.8%	2.28
9	26.3%	2.44
10	26.3%	2.44
11	26.3%	2.44
12	26.3%	2.44
13	26.3%	2.44
14	26.3%	2.44
15	26.3%	2.44
16	26.3%	2.44

ENCLOSURE
DAMAGE FUNCTIONS
FOR SINGLE FAMILY RESIDENTIAL

STRUCTURES WITHOUT BASEMENTS

Structure One Story, No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	2.5%	2.7%
0	13.4%	2.0%
1	23.3%	1.6%
2	32.1%	1.6%
3	40.1%	1.8%
4	47.1%	1.9%
5	53.2%	2.0%
6	58.6%	2.1%
7	63.2%	2.2%
8	67.2%	2.3%
9	70.5%	2.4%
10	73.2%	2.7%
11	75.4%	3.0%
12	77.2%	3.3%
13	78.5%	3.7%
14	79.5%	4.1%
15	80.2%	4.5%
16	80.7%	4.9%

Structure Two or More Stories-No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	3.0%	4.1%
0	9.3%	3.4%
1	15.2%	3.0%
2	20.9%	2.8%
3	26.3%	2.9%
4	31.4%	3.2%
5	36.2%	3.4%
6	40.7%	3.7%
7	44.9%	3.9%
8	48.8%	4.0%
9	52.4%	4.1%
10	55.7%	4.2%
11	58.7%	4.2%
12	61.4%	4.2%
13	63.8%	4.2%
14	65.9%	4.3%
15	67.7%	4.6%
16	69.2%	5.0%

Structure Split-Level-No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	6.4%	2.9%
0	7.2%	2.1%
1	9.4%	1.9%
2	12.9%	1.9%
3	17.4%	2.0%
4	22.8%	2.2%
5	28.9%	2.4%
6	35.5%	2.7%
7	42.3%	3.2%
8	49.2%	3.8%
9	56.1%	4.5%
10	62.6%	5.3%
11	68.6%	6.0%
12	73.9%	6.7%
13	78.4%	7.4%
14	81.7%	7.9%
15	83.8%	8.3%
16	84.4%	8.7%

Content One Story, No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	2.4%	2.1%
0	8.1%	1.5%
1	13.3%	1.2%
2	17.9%	1.2%
3	22.0%	1.4%
4	25.7%	1.5%
5	28.8%	1.6%
6	31.5%	1.6%
7	33.8%	1.7%
8	35.7%	1.8%
9	37.2%	1.9%
10	38.4%	2.1%
11	39.2%	2.3%
12	39.7%	2.6%
13	40.0%	2.9%
14	40.0%	3.2%
15	40.0%	3.5%
16	40.0%	3.8%

Content Two or More Stories-No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	1.0%	3.5%
0	5.0%	2.9%
1	8.7%	2.6%
2	12.2%	2.5%
3	15.5%	2.5%
4	18.5%	2.7%
5	21.3%	3.0%
6	23.9%	3.2%
7	26.3%	3.3%
8	28.4%	3.4%
9	30.3%	3.5%
10	32.0%	3.5%
11	33.4%	3.5%
12	34.7%	3.5%
13	35.6%	3.5%
14	36.4%	3.6%
15	36.9%	3.8%
16	37.2%	4.2%

Content Split-Level-No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	2.2%	2.2%
0	2.9%	1.5%
1	4.7%	1.2%
2	7.5%	1.3%
3	11.1%	1.4%
4	15.3%	1.5%
5	20.1%	1.6%
6	25.2%	1.8%
7	30.5%	2.1%
8	35.7%	2.5%
9	40.9%	3.0%
10	45.8%	3.5%
11	50.2%	4.1%
12	54.1%	4.6%
13	57.2%	5.0%
14	59.4%	5.4%
15	60.5%	5.7%
16	60.5%	6.0%

Poplar Creek Study Area Hydrologic Parameters

Tributary	Sub-basin	Area (sq mi)	Curve Number	Time of concentration (hr)	Storage Coefficient (hr)
BCMS	BCMS0100	0.259	80.84	0.92	1.54
BCMS	BCMS0200	0.147	71.09	0.57	1.14
BCMS	BCMS0300	0.136	74.24	1.00	1.61
BCMS	BCMS0400	0.308	74.62	1.18	1.77
BCMS	BCMS0500	0.176	62.17	1.88	2.79
BCMS	BCMS0600	0.358	71.17	1.56	2.16
BCMS	BCMS0700	0.192	86.69	2.67	2.64
BCMS	BCMS0800	0.004	83.84	2.60	2.64
BCMS	BCMS0900	0.058	74.10	0.97	1.57
BCMS	BCMS1000	0.219	73.93	3.34	3.37
BCMS	BCMS1100	0.133	71.84	0.81	1.46
BCMS	BCMS1200	0.115	75.24	10.81	7.35
BCMS	BCMS1300	0.831	66.74	0.52	1.27
BCMS	BCMS1400	0.053	62.81	0.35	0.97
BCMS	BCMS1500	0.035	60.66	0.37	1.16
BCMS	BCMS1600	0.074	72.52	0.68	1.68
BCMS	BCMS1700	0.179	70.68	0.35	1.26
BCMS	BCMS1800	0.047	77.60	0.42	0.95
BCMS	BCMS1900	0.025	73.88	0.38	1.03
BCMS	BCMS2000	0.064	71.76	0.51	1.29
BCMS	BCMS2100	0.039	96.02	4.82	3.82
BCMS	BCMS2200	0.147	79.34	2.40	4.20
BCMS	BCMS2300	0.063	81.95	2.55	3.54
BCMS	BCMS2400	0.048	69.31	2.20	3.51
FCMS	FCMS0100	0.410	86.98	3.64	3.98
FCMS	FCMS0200	0.190	82.65	1.75	3.03
FCMS	FCMS0300	0.258	79.81	1.58	2.33
FCMS	FCMS0400	0.290	81.45	1.62	2.07
FCMS	FCMS0500	0.140	67.84	3.51	3.66
FCMS	FCMS0600	0.184	63.11	3.84	4.16
FCMS	FCMS0700	0.163	57.78	3.26	3.89
FCMS	FCMS0800	0.250	68.56	0.92	1.80
FCMS	FCMS0900	0.348	61.34	5.38	8.79
FCMS	FCMS1000	0.185	62.78	3.83	4.34
FCMS	FCMS1100	0.198	76.84	2.16	2.77
FCMS	FCMS1200	0.117	79.14	3.65	3.43
FCMS	FCMS1300	0.305	89.54	1.11	2.01
FCMS	FCMS1400	0.013	92.70	0.63	1.03
FCMS	FCMS1500	0.348	87.32	1.58	2.66
FCMS	FCMS1600	0.299	71.70	2.60	3.00
FCMS	FCMS1700	0.146	86.40	0.70	1.17
FCMS	FCMS1800	0.063	82.77	1.18	1.62
FCMS	FCMS1900	0.023	81.58	2.54	2.64
FCMS	FCMS2000	0.189	82.83	3.04	3.02
FCMS	FCMS2100	0.211	75.89	1.68	2.19
FCMS	FCMS2200	0.116	85.39	3.86	3.41
FCMS	FCMS2300	0.150	77.16	0.82	1.37
FCMS	FCMS2400	0.011	79.29	2.48	2.64
FCMS	FCMS2500	0.300	69.27	5.57	5.60
FCMS	FCMS2600	0.048	82.64	0.93	1.48
FCMS	FCMS2700	0.046	77.95	0.41	0.93
FCMS	FCMS5100	0.552	76.51	1.84	2.50
FCMS	FCMS5200	0.056	79.85	0.89	1.37
FCMS	FCMS5300	0.024	82.33	0.82	1.18

Poplar Creek Study Area Hydrologic Parameters

Tributary	Sub-basin	Area (sq mi)	Curve Number	Time of concentration (hr)	Storage Coefficient (hr)
FCTA	FCTA0100	0.971	75.36	2.34	3.31
FCTA	FCTA0200	0.095	75.36	3.10	3.29
FCTA	FCTA0300	0.113	70.42	0.69	1.75
FCTA	FCTA0400	0.022	81.54	0.60	1.06
FCTA	FCTA0500	0.027	79.62	0.70	1.19
FCTA	FCTA0600	0.302	71.20	1.85	2.43
FCTA	FCTA0700	0.045	78.28	0.67	1.16
FCTA	FCTA0800	0.049	82.42	0.68	1.14
FCTA	FCTA0900	0.127	78.44	0.74	1.47
FCTA	FCTA1000	0.114	80.39	0.91	1.42
PCEB	PCEB0001	0.263	74.03	1.23	2.92
PCEB	PCEB0002	0.185	80.64	0.79	1.47
PCEB	PCEB0003	0.202	79.15	1.26	2.11
PCEB	PCEB0004	0.263	75.05	1.21	2.09
PCEB	PCEB0005	0.160	71.15	0.87	1.48
PCEB	PCEB0006	0.007	73.89	0.37	1.06
PCEB	PCEB0007	0.058	69.50	0.46	1.07
PCEB	PCEB0008	0.016	63.25	0.72	1.37
PCEB	PCEB0009	0.031	60.07	0.87	1.60
PCEB	PCEB0010	0.227	63.82	3.68	3.97
PCEB	PCEB0011	0.524	78.44	3.89	4.27
PCEB	PCEB0012	0.406	64.73	6.22	6.84
PCEB	PCEB0013	0.403	63.85	6.10	7.07
PCEB	PCEB0014	0.358	67.44	6.02	6.59
PCEB	PCEB0015	0.331	89.73	2.35	2.50
PCEB	PCEB0016	0.327	71.10	1.30	2.45
PCEB	PCEB0017	0.120	76.83	0.71	1.41
PCEB	PCEB0018	0.239	66.63	0.99	1.78
PCEB	PCEB0019	0.023	71.49	0.61	1.28
PCEB	PCEB0020	0.042	81.31	0.64	1.27
PCEB	PCEB0021	0.048	75.98	0.38	0.84
PCEB	PCEB0022	0.043	79.10	0.39	0.82
PCEB	PCEB0023	0.004	90.92	1.20	1.56
PCEB	PCEB0024	0.017	79.18	0.39	1.10
PCEB	PCEB0025	0.294	81.63	1.01	1.80
PCEB	PCEB0026	0.188	79.85	0.76	1.29
PCEB	PCEB0027	0.175	84.00	0.76	1.40
PCEB	PCEB0028	0.059	78.17	0.47	0.99
PCEB	PCEB0029	0.099	68.32	2.89	3.20
PCLP	PCLP0125	0.370	71.91	6.51	6.00
PCLP	PCLP0150	0.088	68.97	2.73	3.27
PCLP	PCLP0175	0.552	70.62	1.83	4.66
PCLP	PCLP0200	1.189	67.07	3.99	4.73
PCLP	PCLP0300	0.411	70.99	1.08	2.14
PCLP	PCLP0400	0.054	67.74	0.34	1.07
PCLP	PCLP0500	0.108	57.63	0.50	1.19
PCLP	PCLP0600	0.015	67.92	0.35	0.84
PCLP	PCLP0700	0.039	67.85	0.42	0.94
PCLP	PCLP0800	0.075	73.67	0.42	0.90
PCLP	PCLP0900	0.019	83.80	0.54	0.99
PCLP	PCLP1000	0.027	94.32	0.86	1.68
PCLP	PCLP1100	0.036	74.20	0.42	0.90
PCLP	PCLP1200	0.086	74.93	0.46	0.95
PCLP	PCLP1300	0.139	73.61	0.62	1.17

Poplar Creek Study Area Hydrologic Parameters

Tributary	Sub-basin	Area (sq mi)	Curve Number	Time of concentration (hr)	Storage Coefficient (hr)
PCLP	PCLP2100	0.650	73.70	1.46	4.50
PCLP	PCLP2200	0.040	58.19	0.55	1.23
PCLP	PCLP3100	0.152	70.09	0.62	1.20
PCLP	PCLP4100	0.027	57.99	0.57	1.26
PCLP	PCLP5100	0.374	72.25	1.04	1.68
PCMS	PCMS0001	0.104	69.42	2.27	4.08
PCMS	PCMS0002	0.298	77.03	2.03	4.20
PCMS	PCMS0003	0.498	67.54	7.28	10.53
PCMS	PCMS0004	0.097	64.59	2.72	3.49
PCMS	PCMS0005	0.126	63.43	3.10	5.07
PCMS	PCMS0006	0.206	59.36	3.84	5.67
PCMS	PCMS0007	0.209	58.93	3.85	4.29
PCMS	PCMS0008A	0.021	77.66	1.06	1.56
PCMS	PCMS0008B	0.041	75.58	0.97	1.50
PCMS	PCMS0009	0.689	82.81	3.91	4.68
PCMS	PCMS0010	0.075	79.21	2.83	3.95
PCMS	PCMS0011	0.057	75.26	2.37	2.68
PCMS	PCMS0012A	0.183	80.74	2.19	2.77
PCMS	PCMS0012B	0.357	77.92	3.97	4.59
PCMS	PCMS0013	0.244	83.83	2.36	3.48
PCMS	PCMS0014	0.192	72.69	1.15	1.87
PCMS	PCMS0015	0.342	81.95	2.21	2.96
PCMS	PCMS0016	0.161	80.33	1.45	4.18
PCMS	PCMS0017	0.110	84.08	1.64	3.18
PCMS	PCMS0018	0.668	80.92	5.01	5.42
PCMS	PCMS0019	0.212	81.69	1.67	2.10
PCMS	PCMS0020	0.012	68.49	0.62	2.12
PCMS	PCMS0021	0.293	80.51	2.00	2.88
PCMS	PCMS0022	0.302	79.38	2.30	2.62
PCMS	PCMS0023	0.264	75.61	3.31	6.06
PCMS	PCMS0024	0.276	71.33	5.45	4.94
PCMS	PCMS0125	0.064	78.98	0.41	0.85
PCMS	PCMS0126	0.178	59.87	3.56	4.03
PCMS	PCMS0127	0.178	62.73	3.74	4.03
PCMS	PCMS0128	0.223	66.89	4.54	4.40
PCMS	PCMS0129	0.028	77.05	2.42	2.64
PCMS	PCMS0130	0.207	64.18	4.17	4.27
PCMS	PCMS0131	0.303	62.09	2.33	3.33
PCMS	PCMS0132	0.247	72.57	0.85	1.59
PCMS	PCMS0133	0.189	73.44	0.76	1.35
PCMS	PCMS0134	0.019	58.22	1.32	2.13
PCMS	PCMS0135	0.062	65.33	2.12	2.97
PCMS	PCMS0136	0.364	59.56	5.36	5.55
PCMS	PCMS0137	0.535	74.90	2.14	3.02
PCMS	PCMS0138	1.105	58.02	9.88	9.29
PCMS	PCMS0139	0.675	78.44	1.57	3.49
PCMS	PCMS0140	0.484	80.67	1.48	3.13
PCMS	PCMS0141	0.268	72.19	0.86	2.18
PCMS	PCMS0142	0.367	77.44	1.11	2.25
PCMS	PCMS0143	0.308	68.15	1.84	2.58
PCMS	PCMS0144	0.821	64.60	5.17	6.33
PCMS	PCMS0145	0.589	59.44	7.05	6.42
PCMS	PCMS0146	0.254	65.65	4.80	4.65
PCMS	PCMS0147	0.043	80.11	2.50	3.52

Poplar Creek Study Area Hydrologic Parameters

Tributary	Sub-basin	Area (sq mi)	Curve Number	Time of concentration (hr)	Storage Coefficient (hr)
PCMS	PCMS0148	0.417	60.42	5.88	5.61
PCMS	PCMS0149	0.087	59.72	2.27	2.98
PCMS	PCMS0150	0.460	60.48	4.94	5.98
PCMS	PCMS0151	0.176	63.09	3.74	4.01
PCMS	PCMS0152	0.722	63.59	8.51	7.59
PCMS	PCMS0153	0.062	65.85	1.14	1.80
PCMS	PCMS0154	0.116	67.82	1.04	1.69
PCMS	PCMS0155	0.430	66.22	1.40	2.15
PCMS	PCMS0156	0.229	67.98	0.74	1.39
PCMS	PCMS0157	0.195	76.62	0.75	1.70
PCMS	PCMS0158	0.330	75.69	1.01	1.60
PCMS	PCMS0159	0.106	81.46	0.70	1.43
PCMS	PCMS0160	0.102	61.56	0.45	1.52
PCMS	PCMS0161	0.099	65.52	0.53	1.13
PCMS	PCMS0162	0.068	72.53	0.39	0.86
PCMS	PCMS0163	0.041	51.46	1.02	1.98
PCMS	PCMS0164	1.261	71.36	3.98	6.24
PCMS	PCMS0165	1.064	59.14	4.50	9.56
PCMS	PCMS0166	0.288	58.86	4.62	8.37
PCMS	PCMS0167	0.179	45.15	2.55	4.04
PCMS	PCMS0168	0.387	67.55	2.72	3.64
PCMS	PCMS0169	0.136	71.77	0.58	1.13
PCMS	PCMS0170	0.092	79.32	0.50	0.97
PCMS	PCMS0171	0.117	64.60	1.32	2.13
PCMS	PCMS0172	0.121	48.74	2.25	6.67
PCMS	PCMS0173	0.444	59.56	3.89	4.85
PCMS	PCMS0174	0.025	68.82	2.19	2.64
PCMS	PCMS0175	0.017	50.81	0.64	1.49
PCMS	PCMS0176	0.037	73.30	1.11	2.15
PCRR	PCRR0100	1.201	66.48	3.50	5.27
PCRR	PCRR0200	0.297	77.90	1.17	1.96
PCRR	PCRR0300	0.195	66.34	1.03	1.73
PCRR	PCRR0400	0.048	68.21	0.59	1.18
PCRR	PCRR0500	0.006	77.21	2.43	3.14
PCRR	PCRR0600	0.021	75.37	0.38	0.83
PCRR	PCRR0700	0.021	78.29	0.75	1.25
PCRR	PCRR0800	0.126	74.37	1.40	1.94
PCRR	PCRR0900	0.002	88.83	0.64	1.24
PCRR	PCRR2300	0.292	63.45	3.88	4.65
PCRR	PCRR2400	0.406	67.15	3.57	3.83
PCRR	PCRR2500	0.160	73.95	2.33	2.70
PCSB	PCSB0001	0.975	77.84	1.93	3.75
PCSB	PCSB0002	0.587	72.21	1.37	2.65
PCSB	PCSB0003	0.238	73.69	0.82	1.60
PCSB	PCSB0004	0.076	74.95	0.43	0.95
PCSB	PCSB0005	0.099	78.03	0.52	1.19
PCSB	PCSB0006	0.405	68.97	1.04	2.04
PCSB	PCSB0007	0.114	76.14	0.55	1.12
PCSB	PCSB0008	0.231	69.79	0.84	1.57
PCSB	PCSB0009	0.093	74.92	0.48	1.06
PCSB	PCSB0010	0.403	71.50	1.32	2.24
PCSB	PCSB0011	0.107	78.88	0.55	1.13
PCSB	PCSB0012	0.273	78.94	0.94	1.63
PCSB	PCSB0013	0.052	78.03	0.40	0.85

Poplar Creek Study Area Hydrologic Parameters

Tributary	Sub-basin	Area (sq mi)	Curve Number	Time of concentration (hr)	Storage Coefficient (hr)
PCSB	PCSB0014	0.424	71.23	1.49	2.14
PCSB	PCSB0015	0.163	71.28	0.64	1.64
PCSB	PCSB0016	0.029	88.93	0.52	0.93
PCSB	PCSB0017	0.102	81.83	0.56	1.16
PCSB	PCSB0018	0.327	73.80	1.02	1.64
PCSB	PCSB0019	0.010	83.21	0.44	1.01
PCSB	PCSB0020	0.084	81.02	0.55	1.30
PCSB	PCSB0021	0.550	79.74	2.00	2.48
PCSB	PCSB0022	0.209	69.67	1.98	2.54
PCSB	PCSB0023	0.138	78.39	1.41	1.90
PCSB	PCSB0024	0.089	52.92	1.58	2.58
PCSH	PCSH0100	0.080	71.15	0.44	0.94
PCSH	PCSH0200	0.244	75.54	0.90	1.79
PCSH	PCSH0300	0.265	75.97	0.89	1.67
PCSH	PCSH0350	0.134	74.47	0.63	1.18
PCSH	PCSH0400	0.317	83.05	1.24	1.74
PCSH	PCSH0500	0.089	85.47	0.69	1.66
PCSH	PCSH0600	0.006	85.61	0.42	0.82
PCSH	PCSH0700	0.061	76.84	0.39	0.83
PCSH	PCSH0800	0.293	71.65	0.90	1.53
PCSH	PCSH0900	0.101	70.68	0.55	1.14
PCSH	PCSH1000	0.073	73.51	0.98	1.82
PCSH	PCSH1100	0.169	68.81	0.66	1.30
PCSH	PCSH1200	0.043	65.48	1.83	2.43
PCSH	PCSH2400	0.165	79.78	0.71	1.40
PCSH	PCSH2600	0.091	81.13	0.51	0.98
PCSH	PCSH2800	0.195	82.58	0.80	1.63
PCSH	PCSH2900	0.219	74.30	0.78	1.37
PCSH	PCSH3100	0.397	73.88	1.10	1.96
PCSH	PCSH3500	0.310	76.01	0.98	1.89
PCTA	PCTA0100	0.415	86.46	6.86	6.64
PCTA	PCTA0200	0.149	68.60	3.69	3.94
PCTA	PCTA0300	0.037	88.63	0.43	0.83
PCTA	PCTA0400	0.048	68.12	0.62	1.20
PCTA	PCTA0500	0.015	94.27	0.50	0.88
PCTA	PCTA0600	0.113	89.24	0.82	1.25
PCTA	PCTA0700	0.017	93.03	0.45	0.91
PCTA	PCTA0800	0.069	85.89	0.45	0.94
PCTA	PCTA0900	0.008	73.41	0.37	0.92
PCTA	PCTA1000	0.037	60.59	0.47	1.16
PCTA	PCTA1200	0.287	73.72	2.17	3.27
PCTA	PCTA1500	0.047	88.77	0.43	0.94
PCTA	PCTA2200	0.059	84.25	1.07	1.75
SCMS	SCMS0100	0.547	75.17	1.31	1.63
SCMS	SCMS0200	0.309	77.46	0.68	0.61
SCMS	SCMS0300	0.548	81.54	1.63	2.58
SCMS	SCMS0400	0.167	74.82	0.52	0.72
SCMS	SCMS0500	0.157	81.78	0.97	1.75
SCMS	SCMS0600	0.270	61.27	0.98	1.51
SCMS	SCMS0700	0.087	65.22	0.62	1.05
SCMS	SCMS0800	0.154	67.39	0.57	1.09
SCMS	SCMS0900	0.314	69.01	0.86	0.61
SCMS	SCMS1000	0.057	77.10	0.43	0.71
SCMS	SCMS1100	0.120	74.99	0.58	0.86

Poplar Creek Study Area Hydrologic Parameters

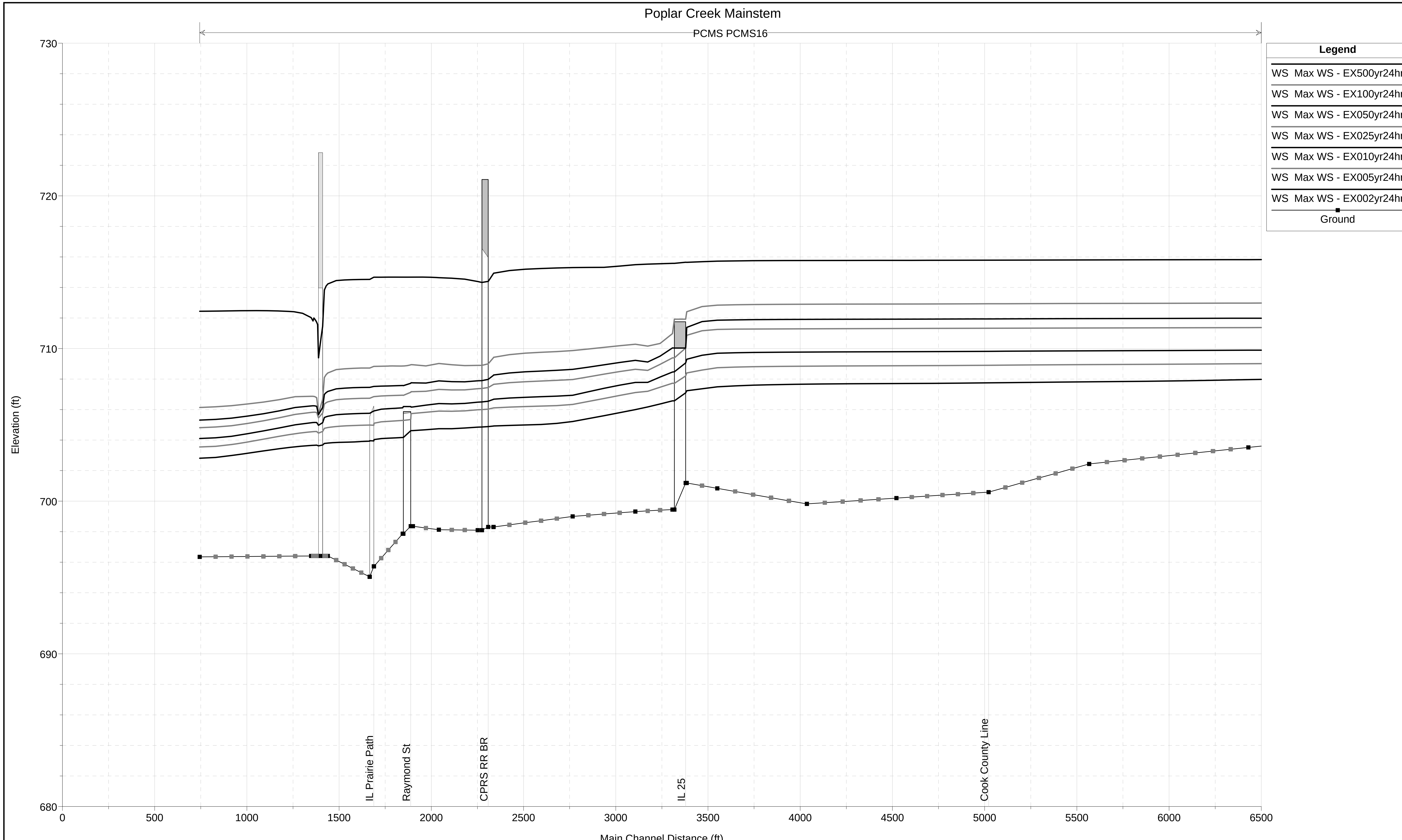
Tributary	Sub-basin	Area (sq mi)	Curve Number	Time of concentration (hr)	Storage Coefficient (hr)
SCMS	SCMS1200	0.161	67.68	0.70	0.68
SCMS	SCMS1300	0.259	82.53	1.33	0.84
SCMS	SCMS1400	0.362	71.47	0.93	0.67
SCMS	SCMS1500	0.133	74.22	0.70	0.62
SCMS	SCMS1600	0.164	76.27	0.68	0.57
SCMS	SCMS1700	0.364	66.76	0.78	0.58
SCMS	SCMS1800	0.067	81.65	0.69	1.52
SCMS	SCMS1900	0.684	76.44	1.30	0.88
SCMS	SCMS2000	0.040	91.73	0.50	1.15
SCMS	SCMS2100	0.098	74.30	0.58	0.65
SCMS	SCMS2200	0.672	76.82	1.21	0.71
SCMS	SCMS2300	0.245	77.95	0.90	0.82
SCMS	SCMS2400	0.077	68.48	0.55	0.50
SCMS	SCMS2500	0.321	70.48	1.24	0.89
SCMS	SCMS2600	0.007	77.25	0.25	0.46
SCMS	SCMS2700	0.879	59.86	1.48	0.73
SCMS	SCMS2800	0.082	79.86	0.64	1.10
SCMS	SCMS2900	0.821	76.25	1.52	1.15
SCMS	SCMS3000	0.175	72.62	0.89	0.74
SCMS	SCMS3100	0.590	69.37	1.30	0.90
SCMS	SCMS3200	0.125	85.56	0.58	1.02
SCMS	SCTA0100	0.208	85.24	0.98	6.47
SCMS	SCTA0200	0.335	83.39	1.36	2.09
SCMS	SCTA0300	0.078	84.93	0.52	0.84
SCMS	SCTA0400	0.021	84.52	0.21	0.24
SCMS	SCTA0500	0.011	87.46	0.20	0.31
SCMS	SCTA0600	0.166	80.17	0.86	0.76
SCMS	SCTA0700	0.431	87.79	0.76	0.53
SCMS	SCTA0750	0.220	81.93	0.82	0.94
SCMS	SCTA0800	0.143	70.20	0.53	0.88
SCMS	SCTA0900	0.022	75.65	0.33	0.54
SCMS	SCTA1000	0.147	72.42	0.68	0.87
SCMS	SCTB0100	0.564	77.48	0.93	0.90
SCMS	SCTB0200	1.043	59.66	1.78	2.17
SCMS	SCTB0300	0.203	66.32	0.95	1.76
SCMS	SCTC0100	0.182	74.37	0.72	1.11
SCMS	SCTC0200	0.677	79.22	1.54	1.16
SCMS	SCTC0300	0.018	82.11	0.34	0.51
SCMS	SCTC0400	0.285	73.22	0.95	1.04
SCMS	SCTD0100	0.733	64.78	1.32	1.07
SCMS	SCTD0200	0.185	69.12	0.74	0.55
SCMS	SCTD0300	0.684	63.70	1.15	0.55
SCMS	SCTD0400	0.287	65.26	1.03	1.34
SCMS	SCTD0500	0.715	61.89	1.24	0.60
SCMS	SCTD0600	0.243	59.28	0.89	0.69
SCMS	SCTD0700	0.064	74.95	0.48	0.45
SCMS	SCTE0100	1.018	83.64	1.59	0.86
SCMS	SCTE0200	0.334	75.90	1.06	0.61
SCMS	SCTF0200	0.013	78.39	0.18	0.24
SCMS	SCTF0300	0.124	76.72	0.53	0.35
SCMS	SCTF0400	0.805	65.90	1.64	0.74
SCMS	SCTF0500	0.371	64.35	0.86	0.48
SCMS	SCOVF100	0.413	52.84	0.92	0.72
WBMS	WBMS0100	0.274	82.34	0.85	5.46

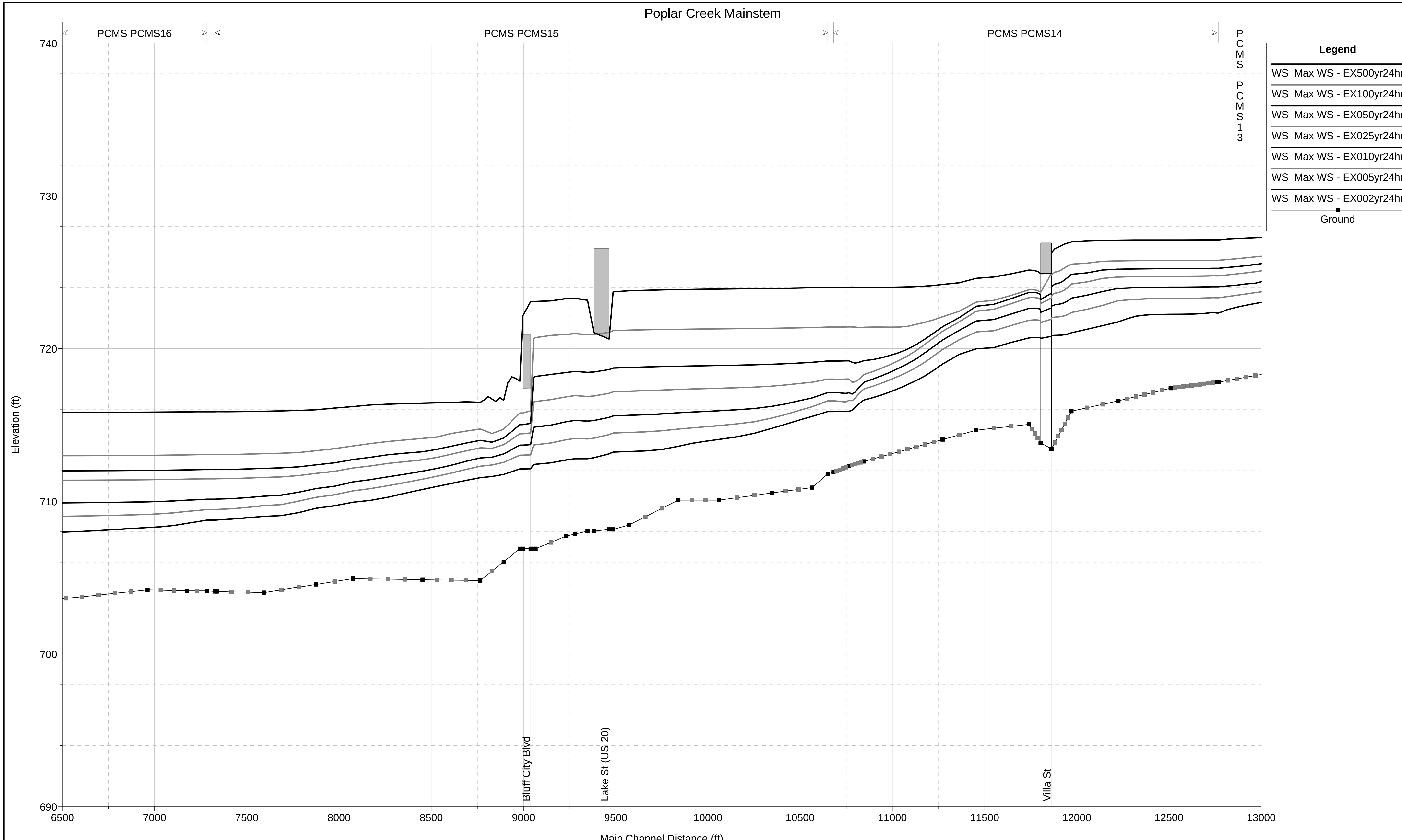
Poplar Creek Study Area Hydrologic Parameters

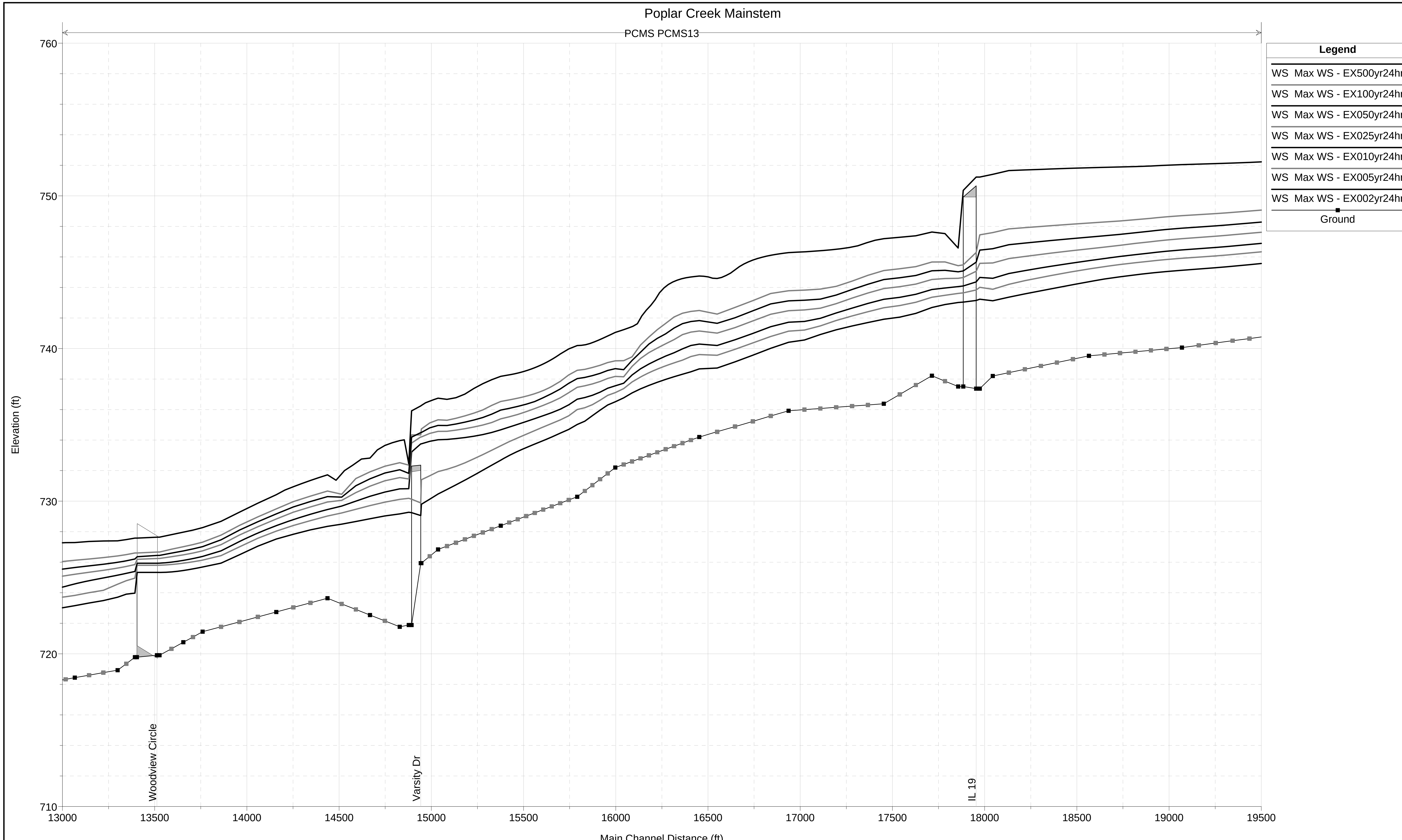
Tributary	Sub-basin	Area (sq mi)	Curve Number	Time of concentration (hr)	Storage Coefficient (hr)
WBMS	WBMS0200	0.101	78.94	0.46	3.01
WBMS	WBMS0300	0.470	74.36	1.04	5.63
WBMS	WBMS0400	0.086	79.18	0.42	2.82
WBMS	WBMS0500	0.057	78.74	0.38	2.99
WBMS	WBMS0600	0.167	78.55	0.64	3.50
WBMS	WBMS0700	0.140	79.76	0.66	4.05
WBMS	WBMS0800	0.508	80.46	1.40	8.92
WBMS	WBMS0850	0.102	81.52	0.48	3.49
WBMS	WBMS0900	0.201	78.91	0.80	4.66
WBMS	WBMS1000	0.038	80.86	0.40	2.49
WBMS	WBMS1100	0.011	70.27	0.59	3.47
WBMS	WBMS1200	0.391	77.24	0.98	6.82
WBMS	WBMS1300	0.091	79.96	0.45	2.73
WBMS	WBMS1400	0.194	79.12	0.67	3.66
WBMS	WBMS1500	0.151	76.14	0.61	3.47
WBMS	WBMS1600	0.060	79.19	0.38	2.50
WBMS	WBMS2200	0.053	79.29	0.34	2.96
WBMS	WBMS2300	0.307	82.78	0.91	4.99
WBMS	WBMS2400	0.062	74.78	0.33	3.48
WBMS	WBMS2500	0.047	76.58	0.33	3.80
WBMS	WBMS2600	0.075	83.03	0.41	4.16
WBMS	WBMS2700	0.069	79.16	0.37	2.53
WBMS	WBMS2800	0.339	83.91	0.98	6.75
WBMS	WBMS2900	0.047	82.42	0.35	2.34
WBMS	WBMS3000	0.012	70.03	0.30	2.54
WBMS	WBMS3050	0.057	94.91	0.57	5.59
WBMS	WBMS3100	0.192	74.09	0.62	3.96
WBMS	WBMS3200	0.114	73.32	0.46	3.42
WBMS	WBMS3300	0.368	79.12	0.97	6.23
WBMS	WBMS3400	0.235	75.53	0.71	4.71
WBMS	WBMS3450	0.143	75.90	2.10	11.60
WBMS	WBMS3500	0.012	86.55	0.50	5.82
WBMS	WBMS3600	0.183	79.40	0.65	3.97
WBMS	WBMS3700	0.031	94.01	0.79	3.49
WBMS	WBMS3800	0.019	84.63	0.44	2.56
WBMS	WBMS3850	0.023	74.48	0.58	6.28
WBMS	WBMS3900	0.183	79.68	0.65	4.27
WBMS	WBMS3950	0.072	74.96	0.57	4.63
WBMS	WBMS4000	0.150	81.49	0.59	4.66
WBMS	WBMS4100	0.066	80.43	1.13	5.04
WBMS	WBTA0100	0.330	81.97	0.94	5.39
WBMS	WBTA0200	0.227	78.88	0.77	4.62
WBMS	WBTA0300	0.173	78.97	0.65	3.93
WBMS	WBTA0400	0.017	79.03	0.35	2.79
WBMS	WBTA0500	0.009	79.56	0.34	2.90
WBTB	WBTB0100	0.497	71.34	1.86	8.83
WBTB	WBTB0200	0.186	78.35	0.65	5.18
WBTB	WBTB0300	0.521	74.57	1.11	7.07
WBTB	WBTB0400	0.454	76.20	1.05	6.81
WBTB	WBTB0500	0.195	78.35	0.83	4.73
WBTB	WBTB0600	0.046	81.01	0.35	2.48
WBTB	WBTB0700	0.148	77.41	0.56	6.31
WBTB	WBTB0800	0.163	80.99	0.62	4.97
WBTB	WBTB0900	0.005	71.33	0.44	3.87

Appendix H

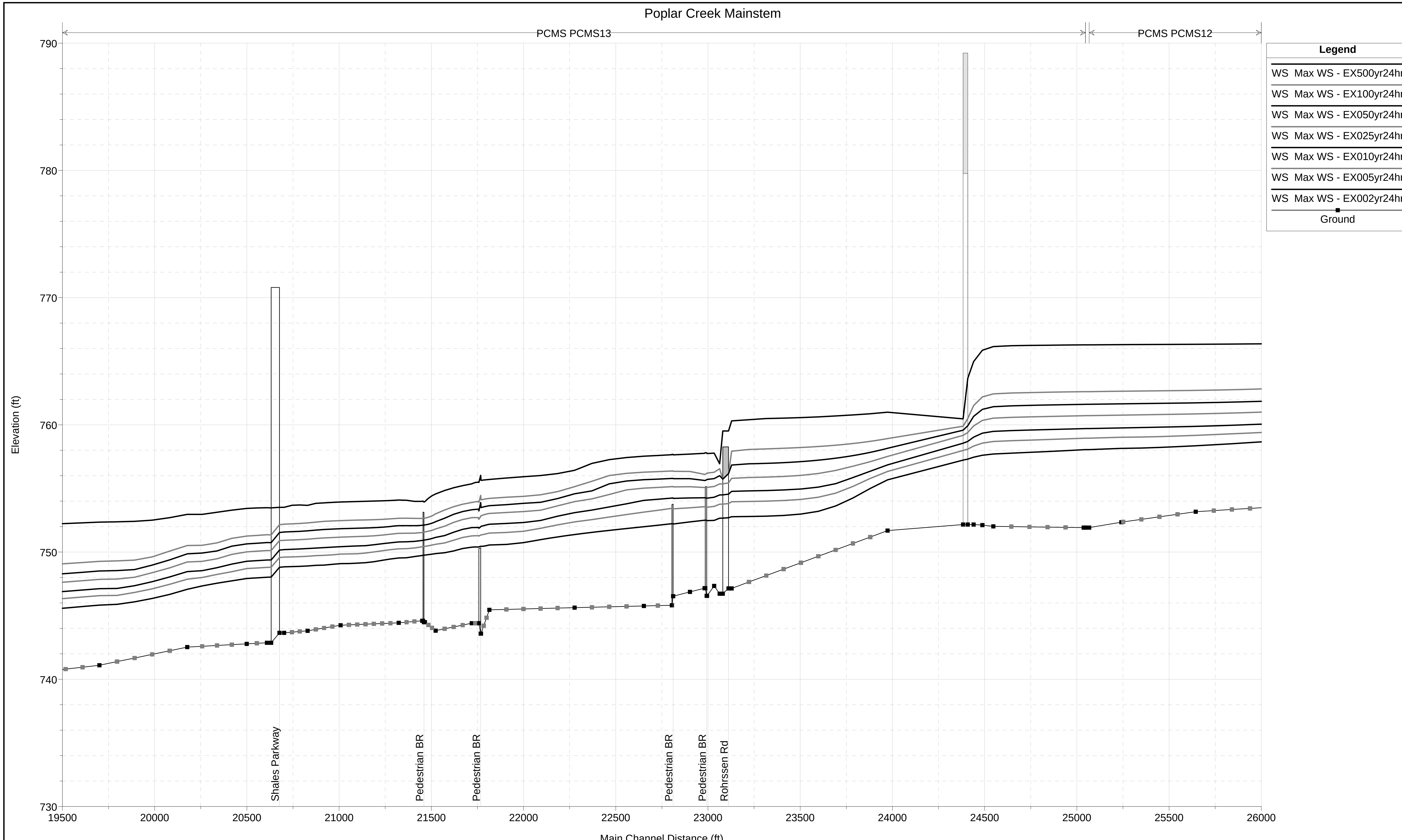
Hydraulic Profiles for Existing Conditions


Poplar Creek Mainstem
PCMS PCMS16
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
730
720
710
700
690
680
IL Prairie Path
Raymond St
CPRS RR BR
IL 25
Cook County Line
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

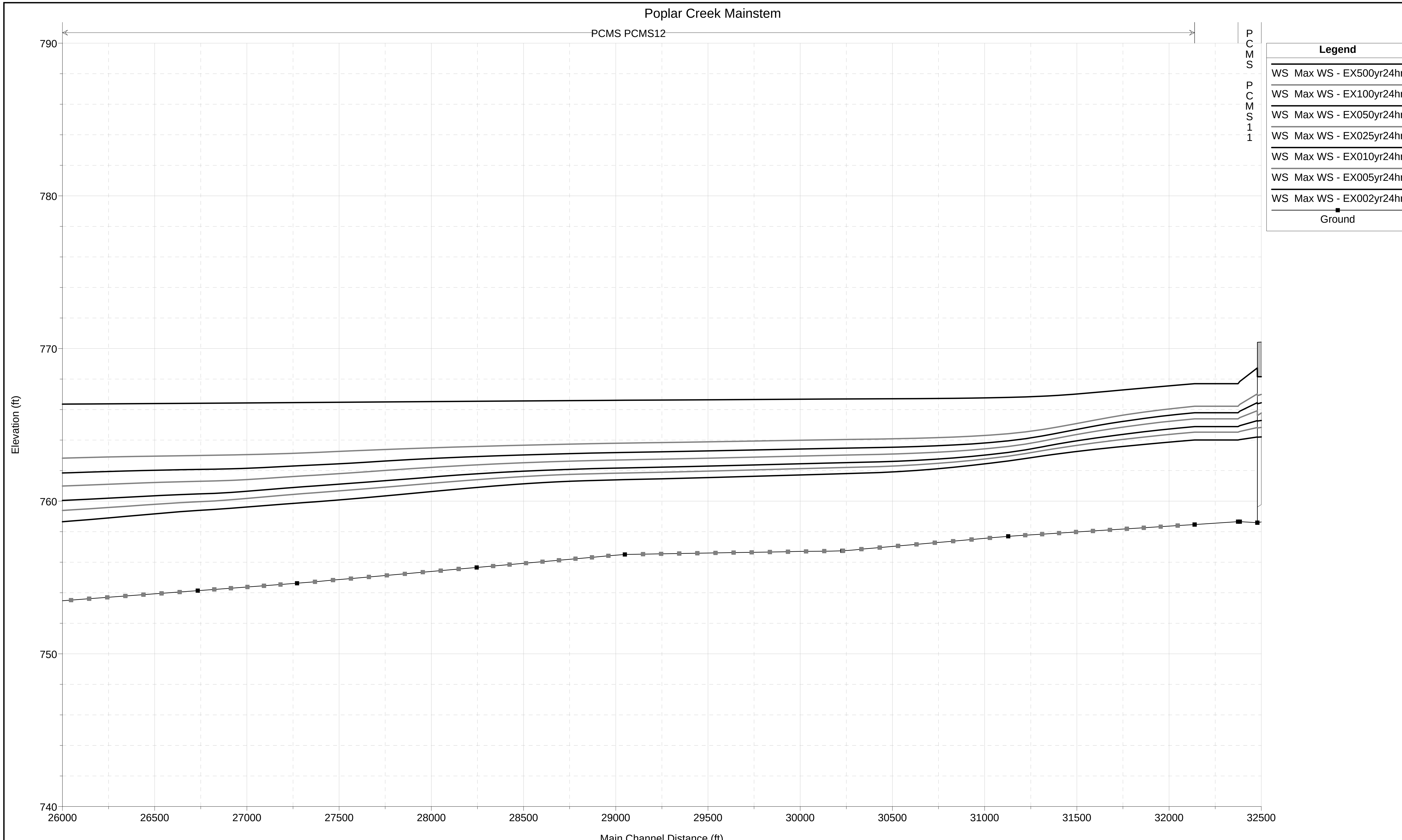

Poplar Creek Mainstem
PCMS PCMS16
PCMS PCMS15
PCMS PCMS14
PCMS
PCMS13
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Bluff City Blvd
Lake St (US 20)
Villa St
Elevation (ft)
740
730
720
710
700
690
Main Channel Distance (ft)
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000



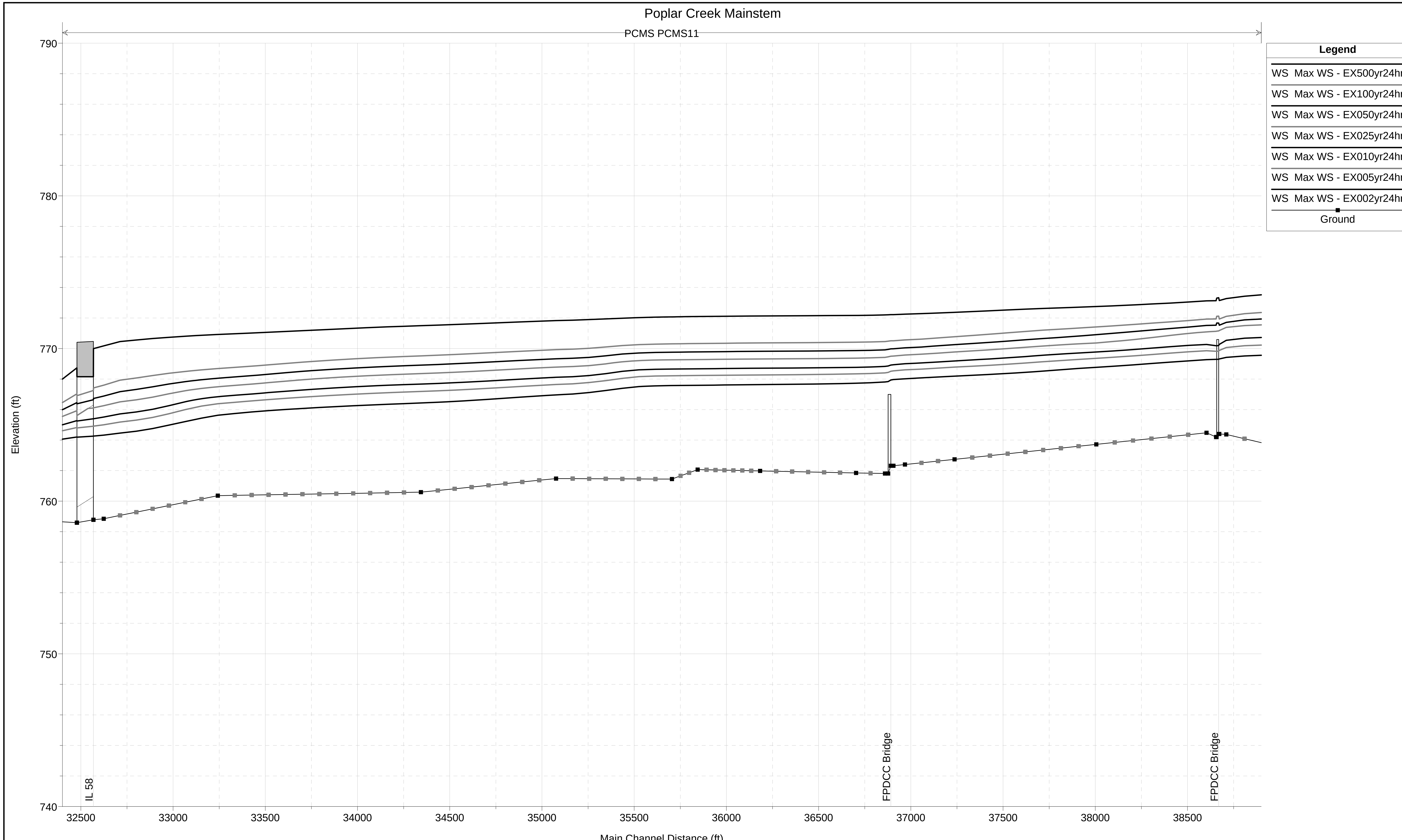
Poplar Creek Mainstem
PCMS PCMS13
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
760
750
740
730
720
710
Woodview Circle
Varsity Dr
IL 19
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
18500
19000
19500
Main Channel Distance (ft)

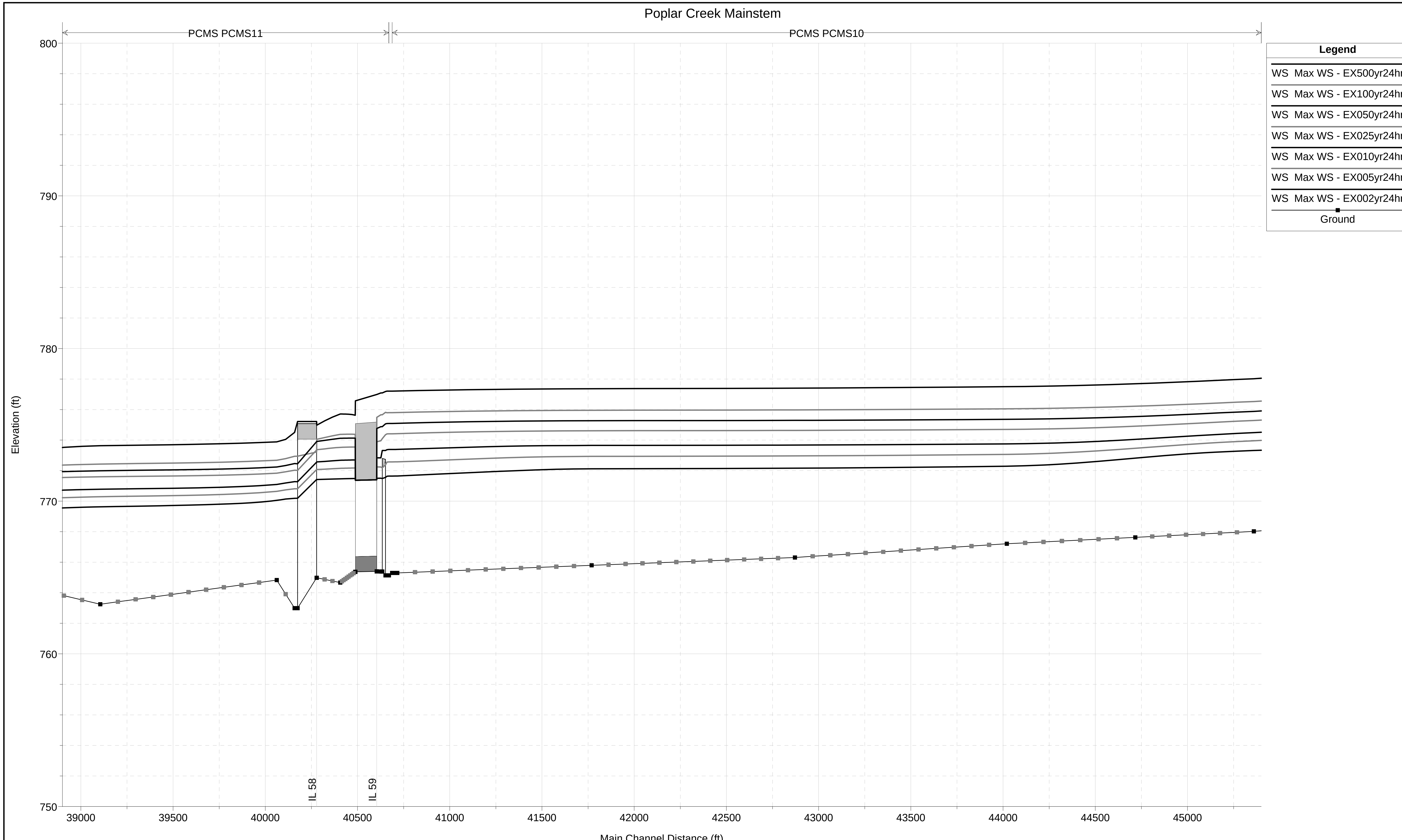


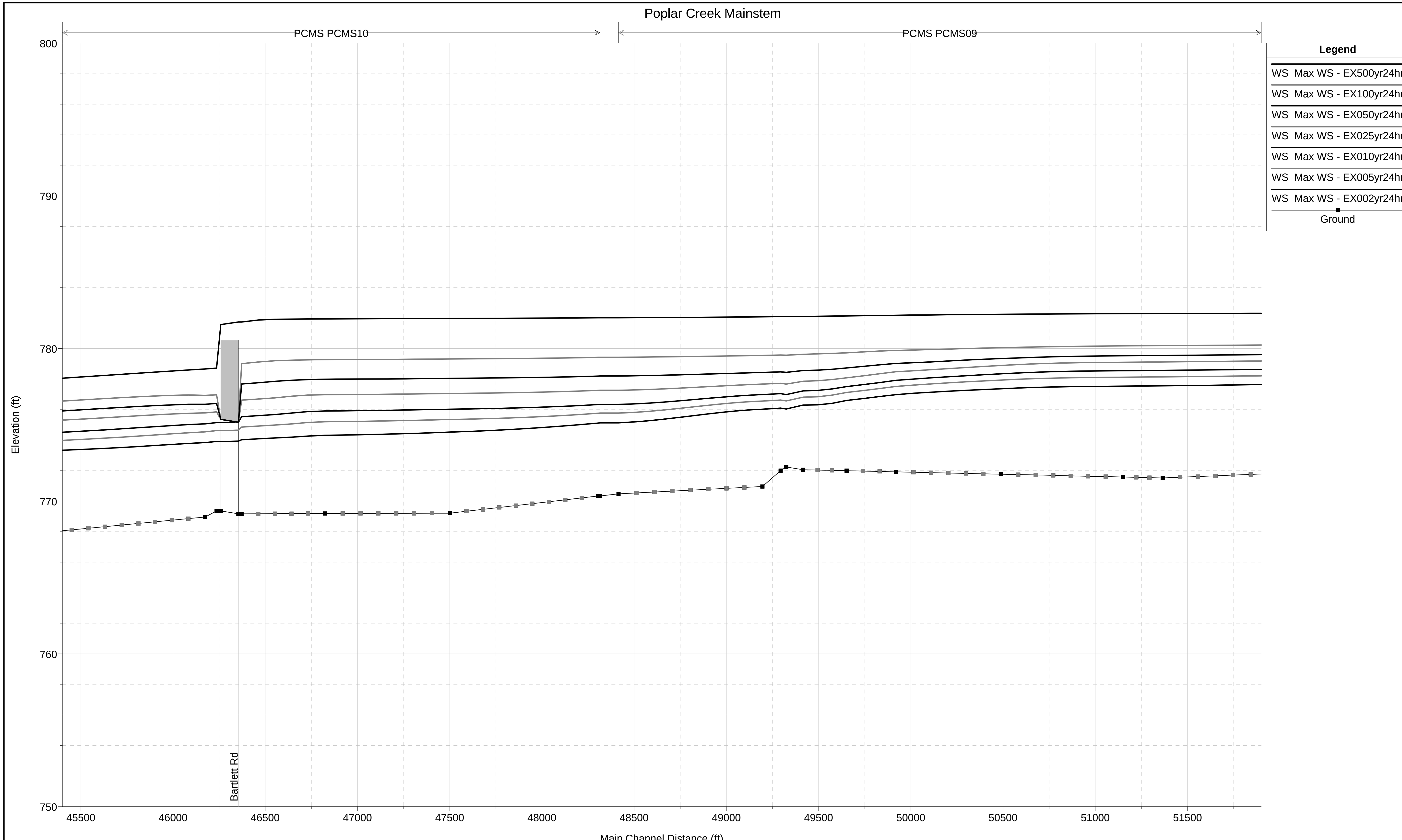
Poplar Creek Mainstem
PCMS PCMS13
PCMS PCMS12
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
790
780
770
760
750
740
730
Shales Parkway
Pedestrian BR
Pedestrian BR
Pedestrian BR
Pedestrian BR
Rohrssen Rd
19500
20000
20500
21000
21500
22000
22500
23000
23500
24000
24500
25000
25500
26000
Main Channel Distance (ft)



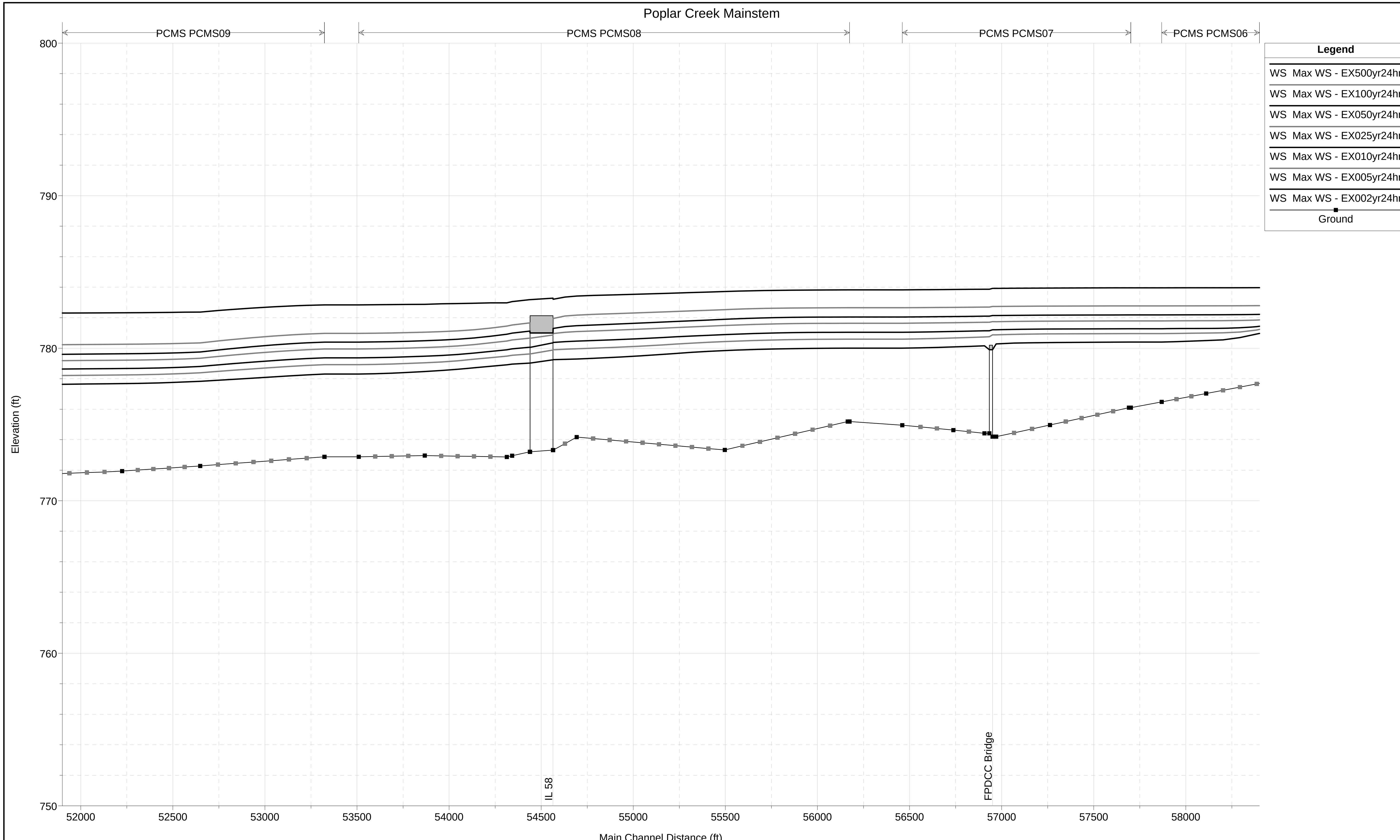
Poplar Creek Mainstem
PCMS PCMS12
PCMS PCMS11
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
790
780
770
760
750
740
26000
26500
27000
27500
28000
28500
29000
29500
30000
30500
31000
31500
32000
32500
Main Channel Distance (ft)

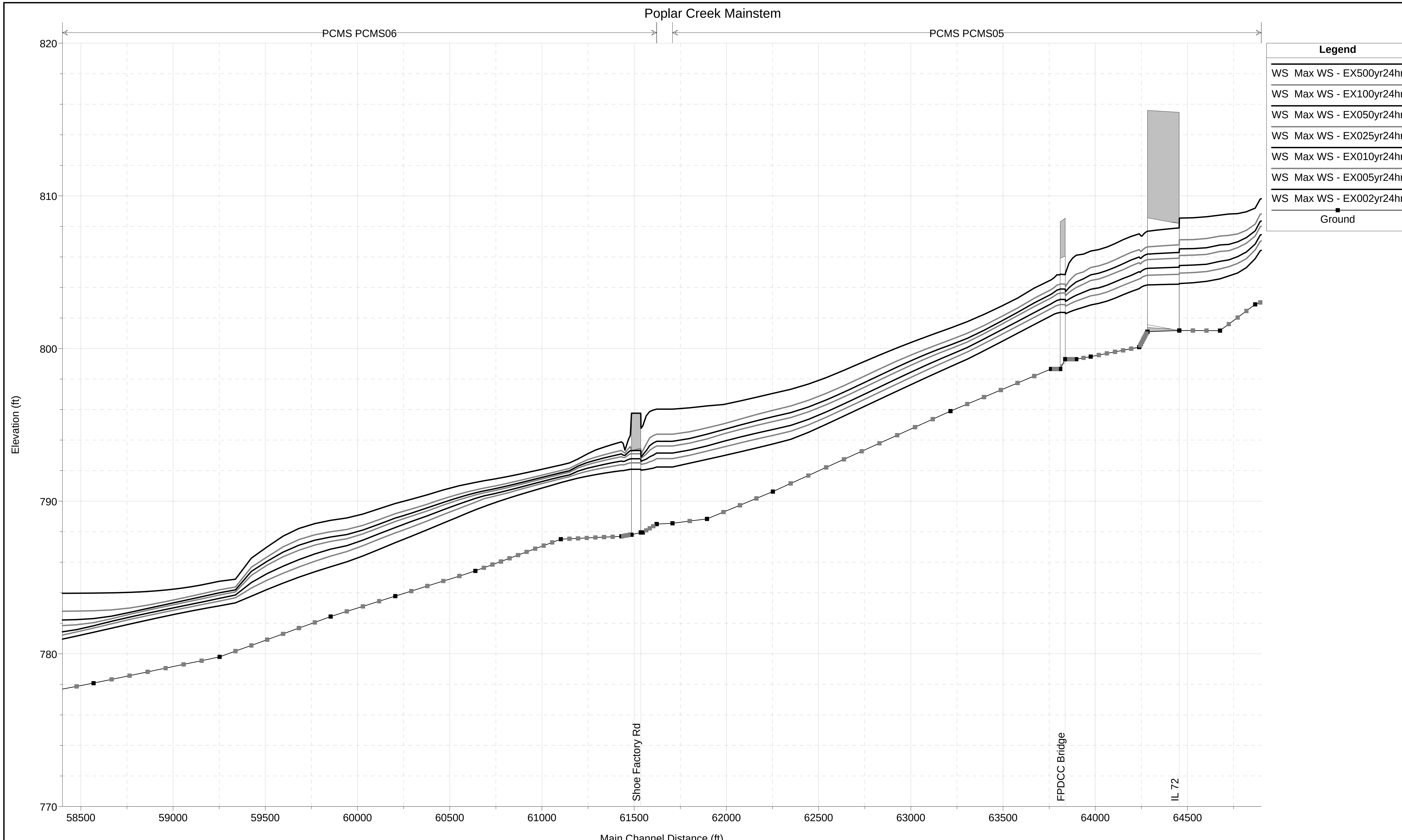

Poplar Creek Mainstem
PCMS PCMS11
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
790
780
770
760
750
740
IL 58
FPDCC Bridge
FPDCC Bridge
32500
33000
33500
34000
34500
35000
35500
36000
36500
37000
37500
38000
38500
Main Channel Distance (ft)


Poplar Creek Mainstem
PCMS PCMS11
PCMS PCMS10
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
750
IL 58
IL 59
39000
39500
40000
40500
41000
41500
42000
42500
43000
43500
44000
44500
45000
Main Channel Distance (ft)

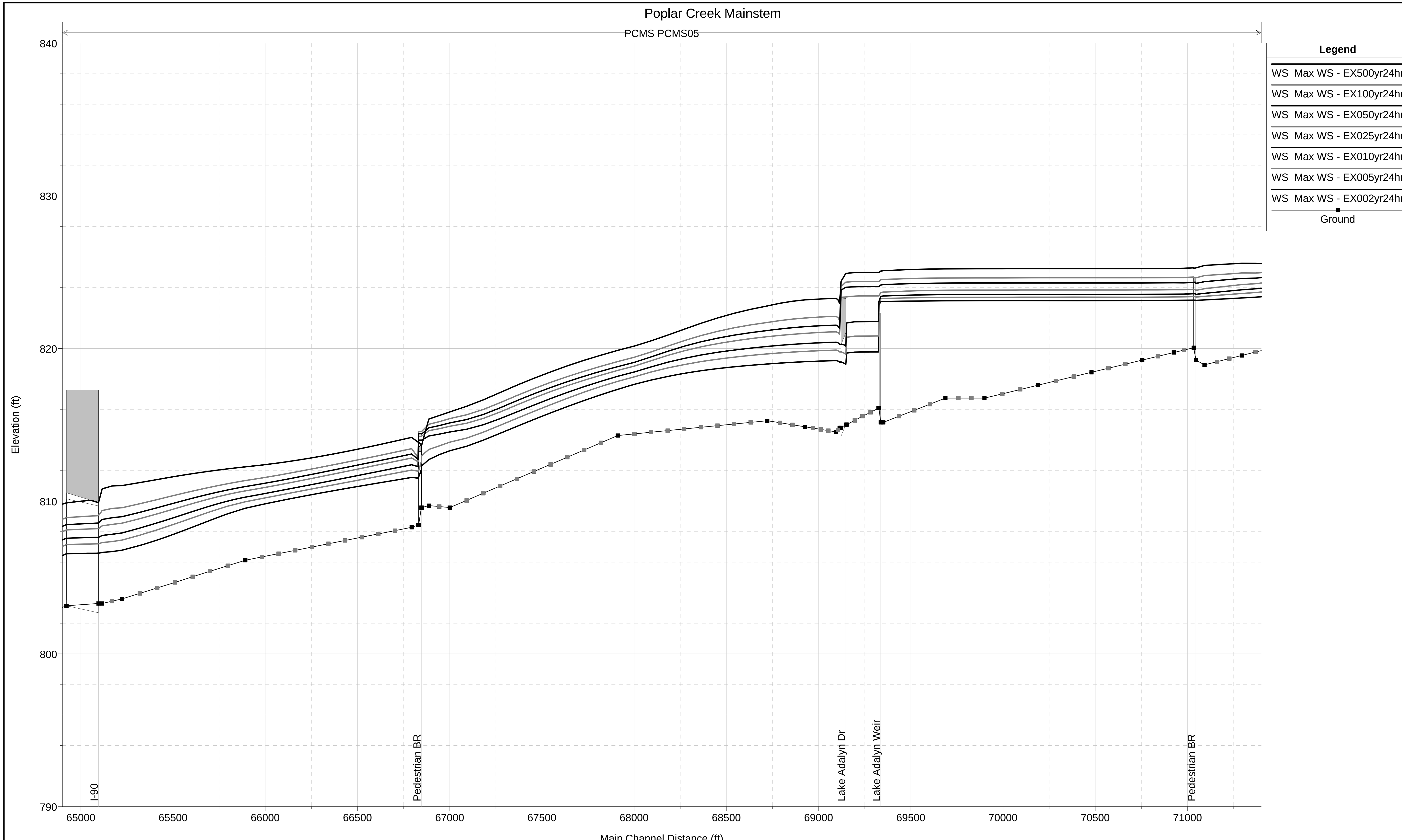


Poplar Creek Mainstem
PCMS PCMS10
PCMS PCMS09
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
750
Bartlett Rd
45500
46000
46500
47000
47500
48000
48500
49000
49500
50000
50500
51000
51500
Main Channel Distance (ft)

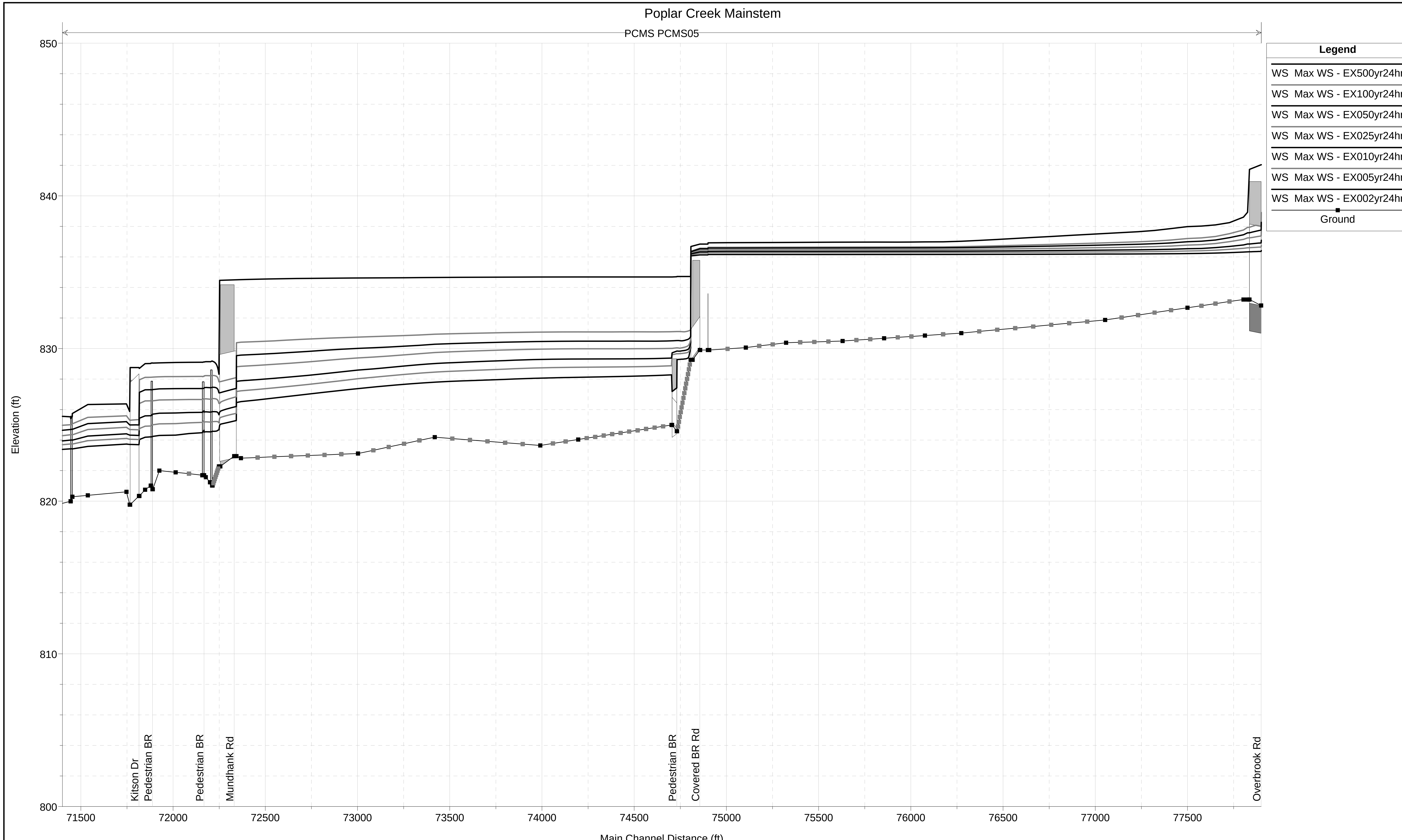

Poplar Creek Mainstem
PCMS PCMS09
PCMS PCMS08
PCMS PCMS07
PCMS PCMS06
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
750
IL 58
FPDCC Bridge
52000
52500
53000
53500
54000
54500
55000
55500
56000
56500
57000
57500
58000
Main Channel Distance (ft)



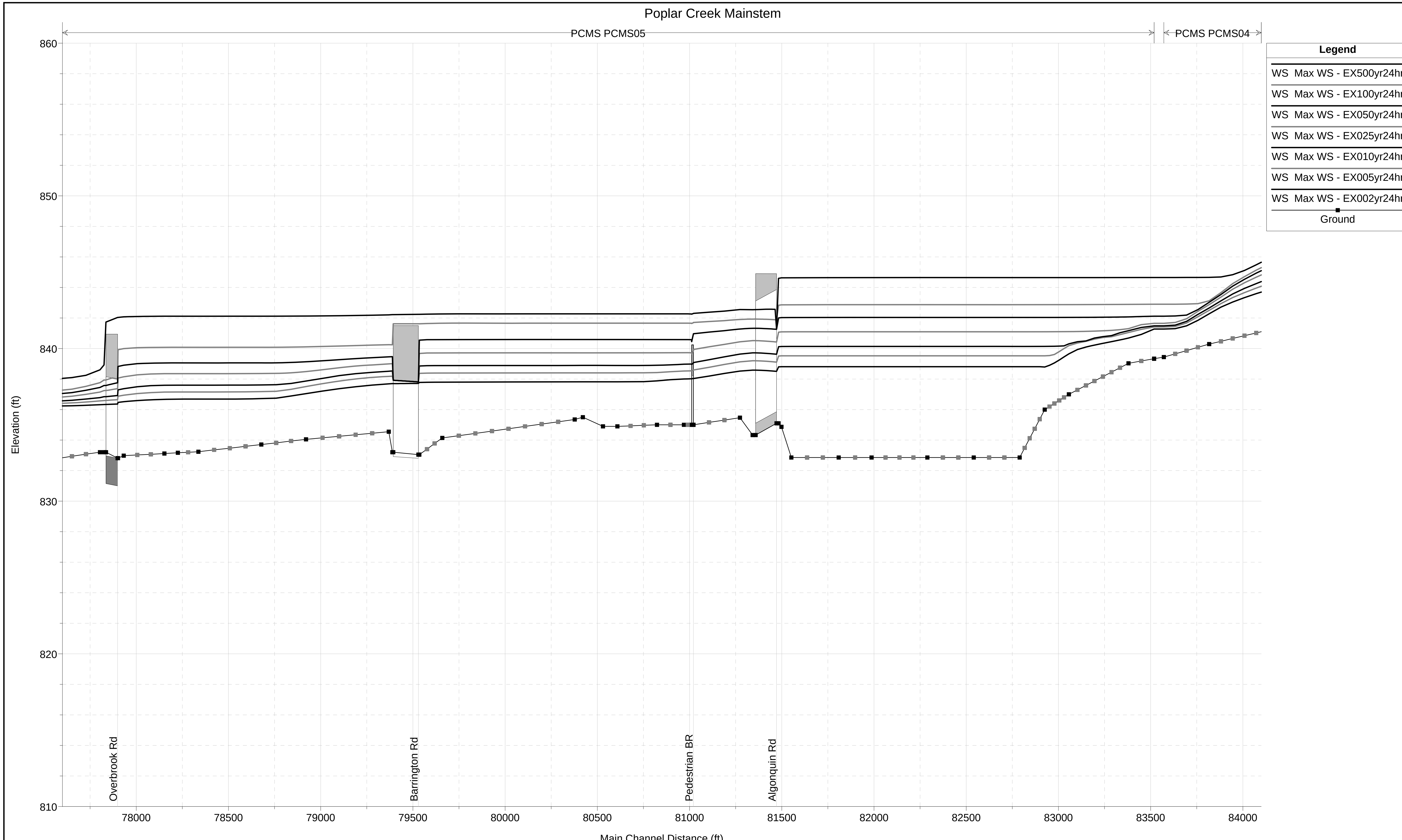
Poplar Creek Mainstem
PCMS PCMS06
PCMS PCMS05
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
820
810
800
790
780
770
Shoe Factory Rd
FPDCC Bridge
IL 72
58500
59000
59500
60000
60500
61000
61500
62000
62500
63000
63500
64000
64500
Main Channel Distance (ft)



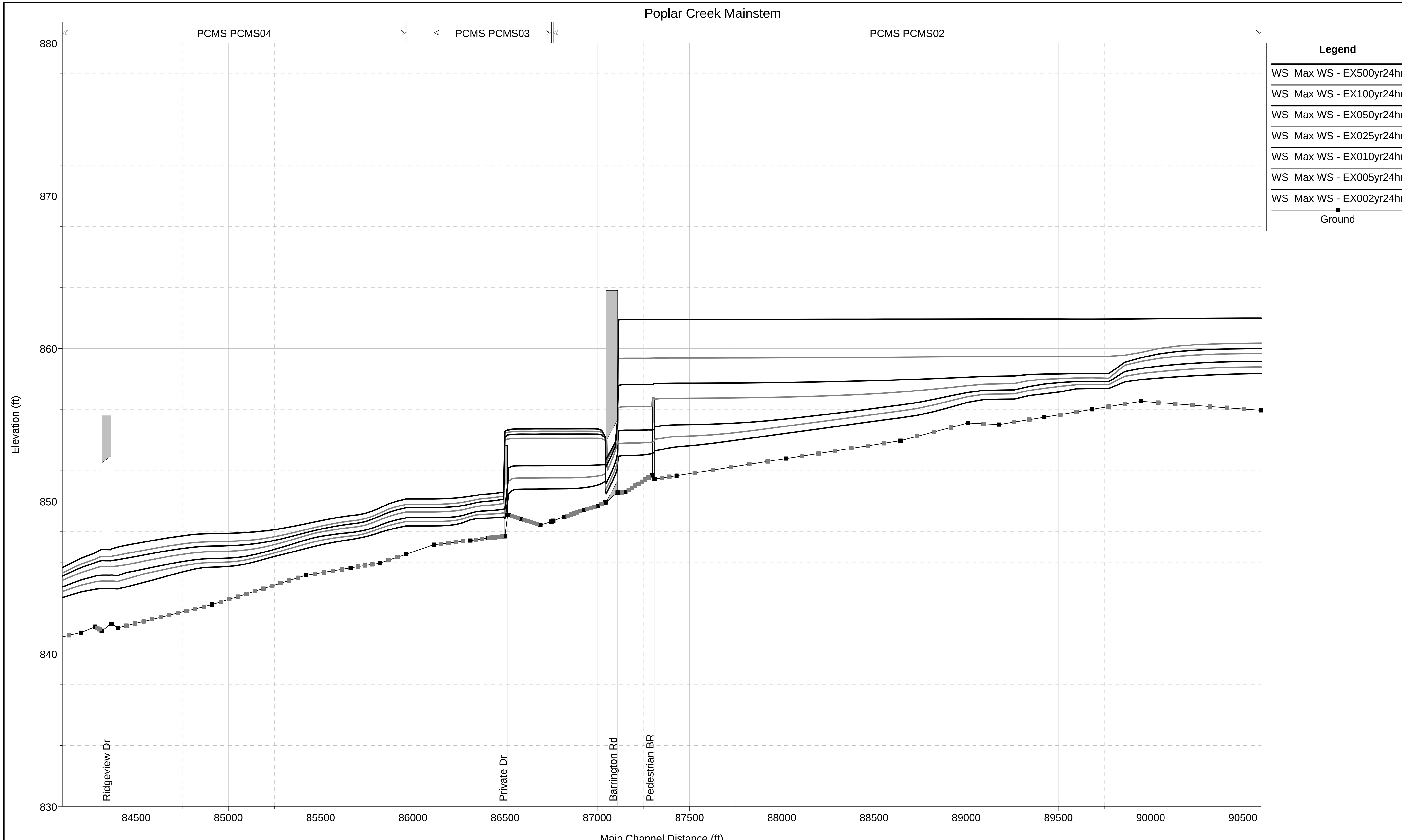
Poplar Creek Mainstem
PCMS PCMS05
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
840
830
820
810
800
790
I-90
Pedestrian BR
Lake Adalyn Dr
Lake Adalyn Weir
Pedestrian BR
65000
65500
66000
66500
67000
67500
68000
68500
69000
69500
70000
70500
71000
Main Channel Distance (ft)

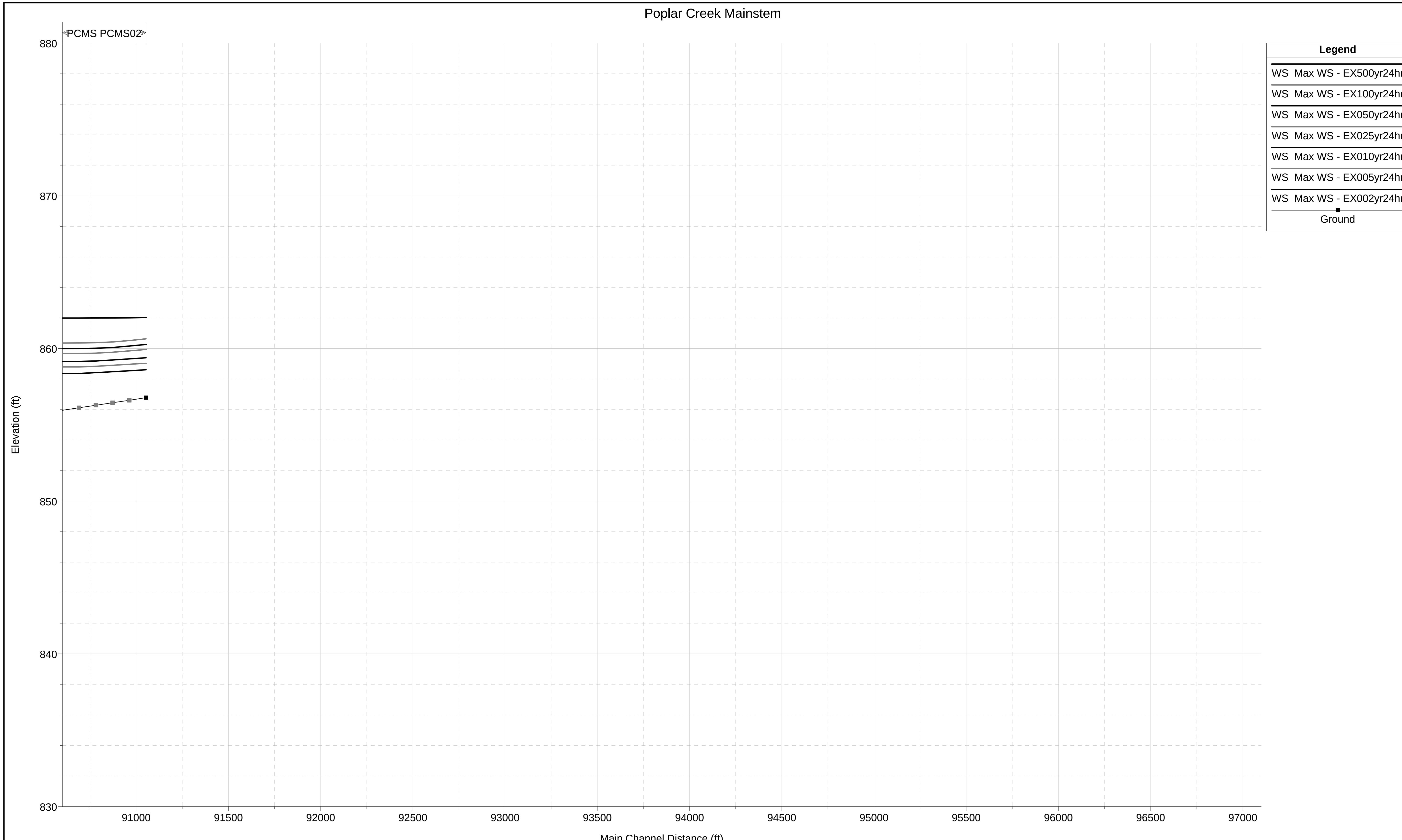


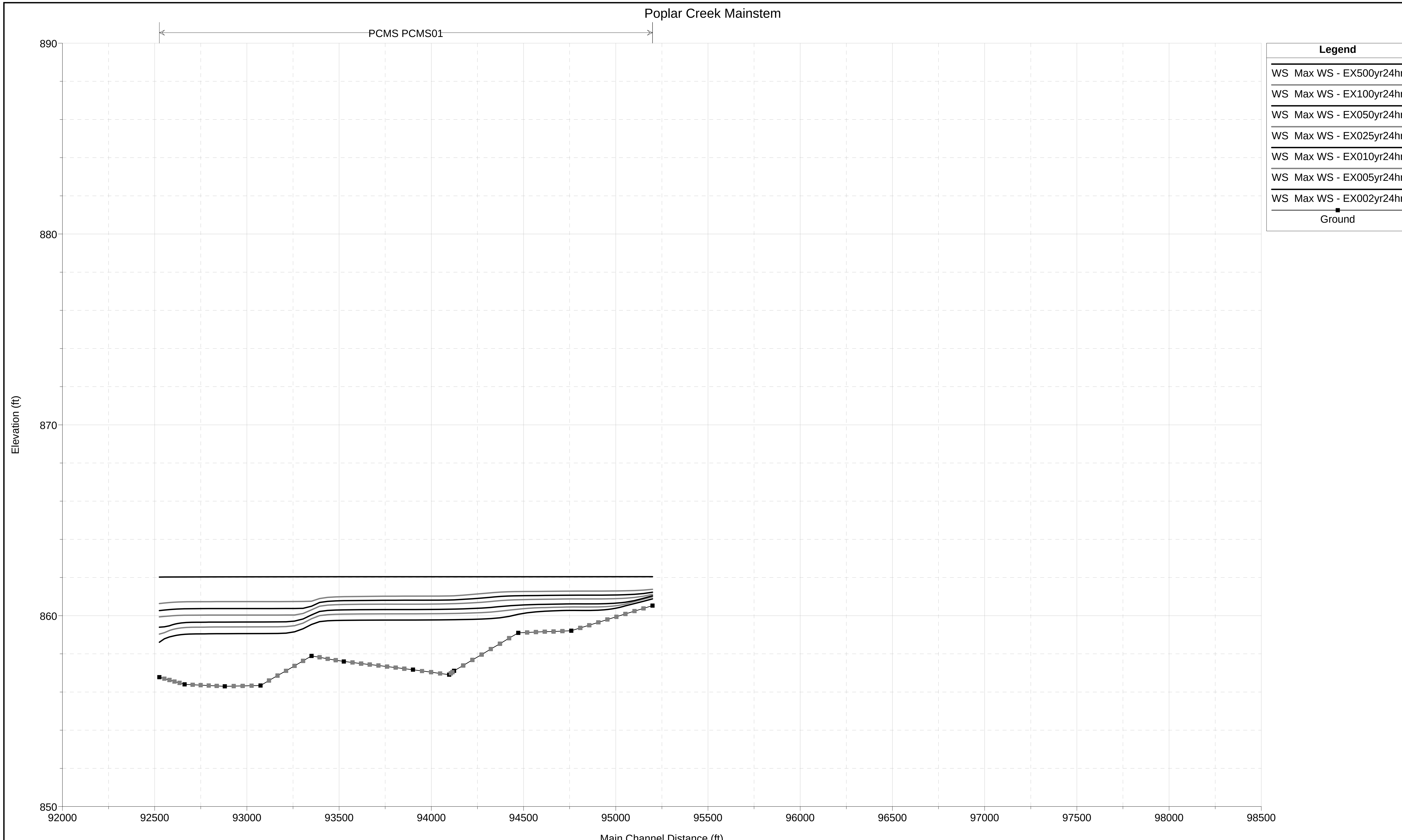
Poplar Creek Mainstem
PCMS PCMS05
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
850
840
830
820
810
800
Kitson Dr
Pedestrian BR
Pedestrian BR
Mundhank Rd
Pedestrian BR
Covered BR Rd
Overbrook Rd
71500
72000
72500
73000
73500
74000
74500
75000
75500
76000
76500
77000
77500
Main Channel Distance (ft)

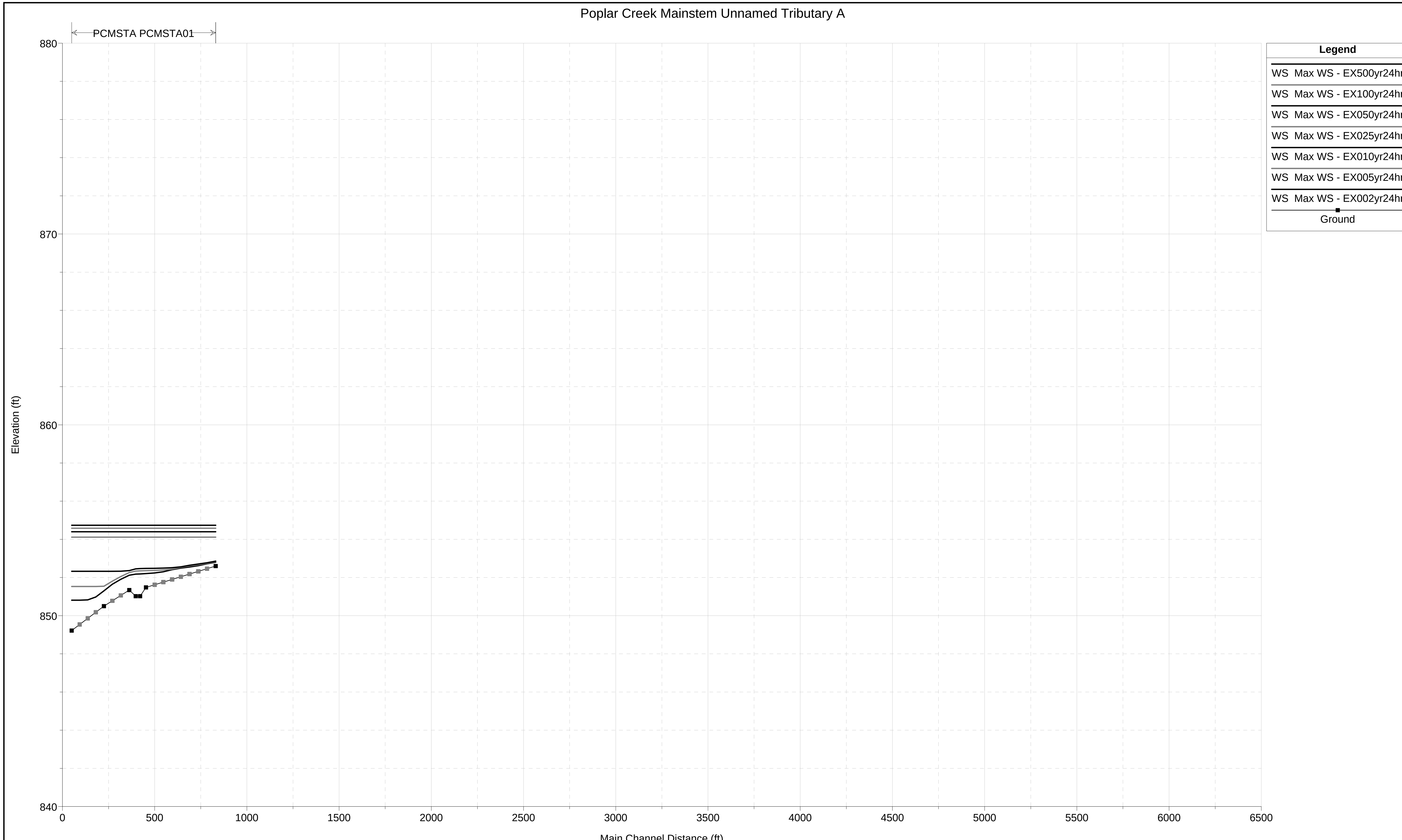


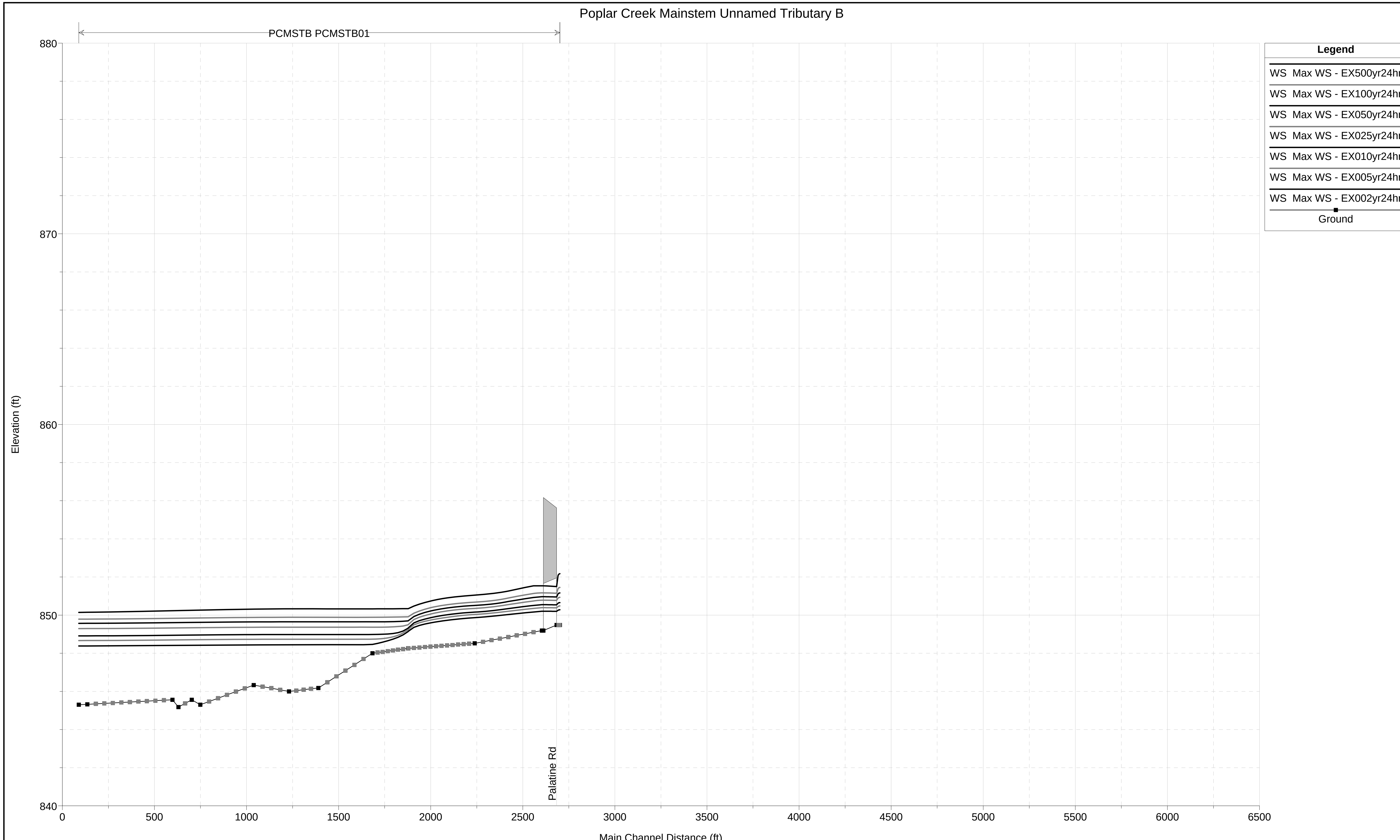
Poplar Creek Mainstem
PCMS PCMS05
PCMS PCMS04
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
860
850
840
830
820
810
Overbrook Rd
Barrington Rd
Pedestrian BR
Algonquin Rd
78000
78500
79000
79500
80000
80500
81000
81500
82000
82500
83000
83500
84000
Main Channel Distance (ft)


Poplar Creek Mainstem
PCMS PCMS04
PCMS PCMS03
PCMS PCMS02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
880
870
860
850
840
830
Ridgeview Dr
Private Dr
Barrington Rd
Pedestrian BR
84500
85000
85500
86000
86500
87000
87500
88000
88500
89000
89500
90000
90500
Main Channel Distance (ft)

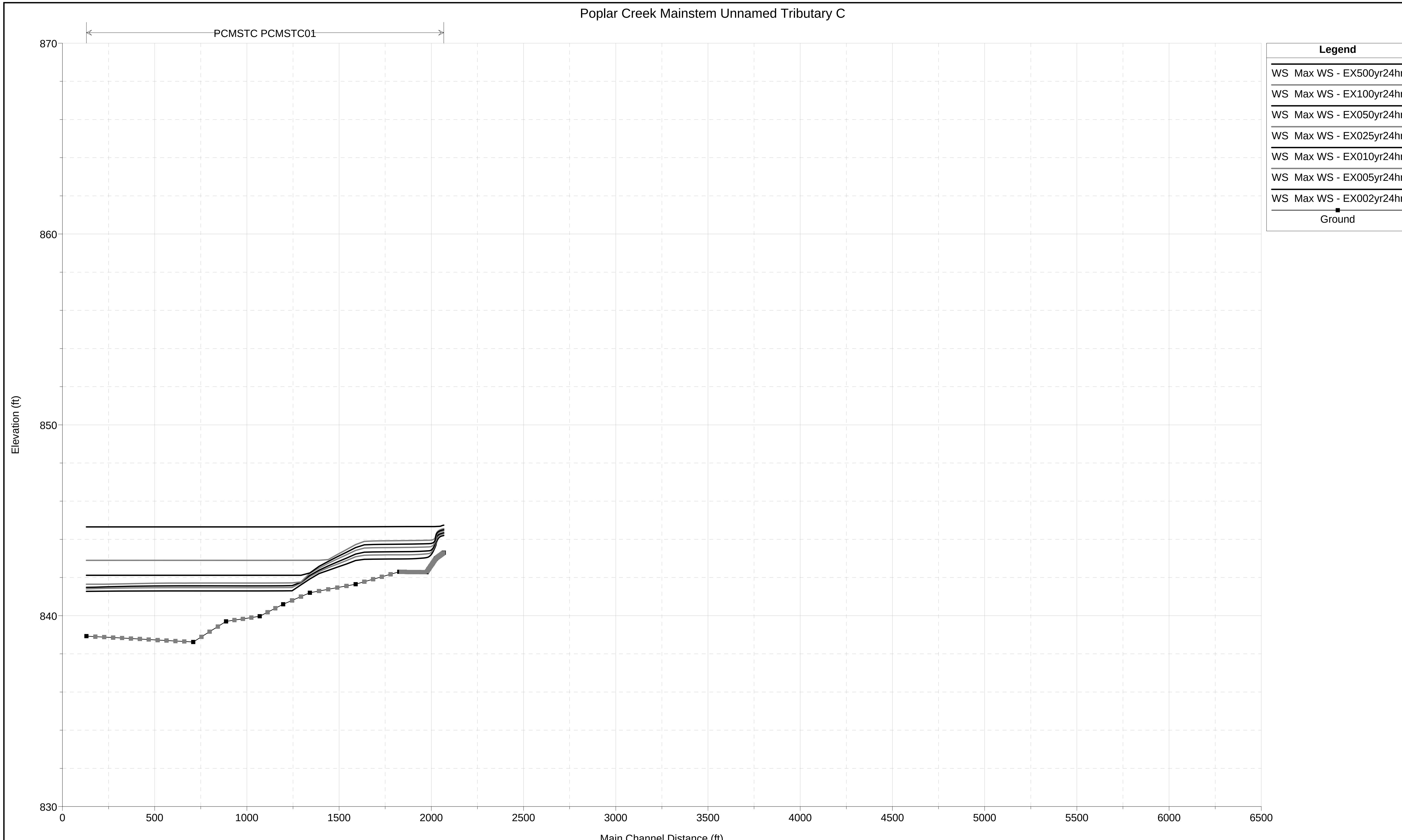

Poplar Creek Mainstem
PCMS PCMS02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
880
870
860
850
840
830
91000
91500
92000
92500
93000
93500
94000
94500
95000
95500
96000
96500
97000
Main Channel Distance (ft)

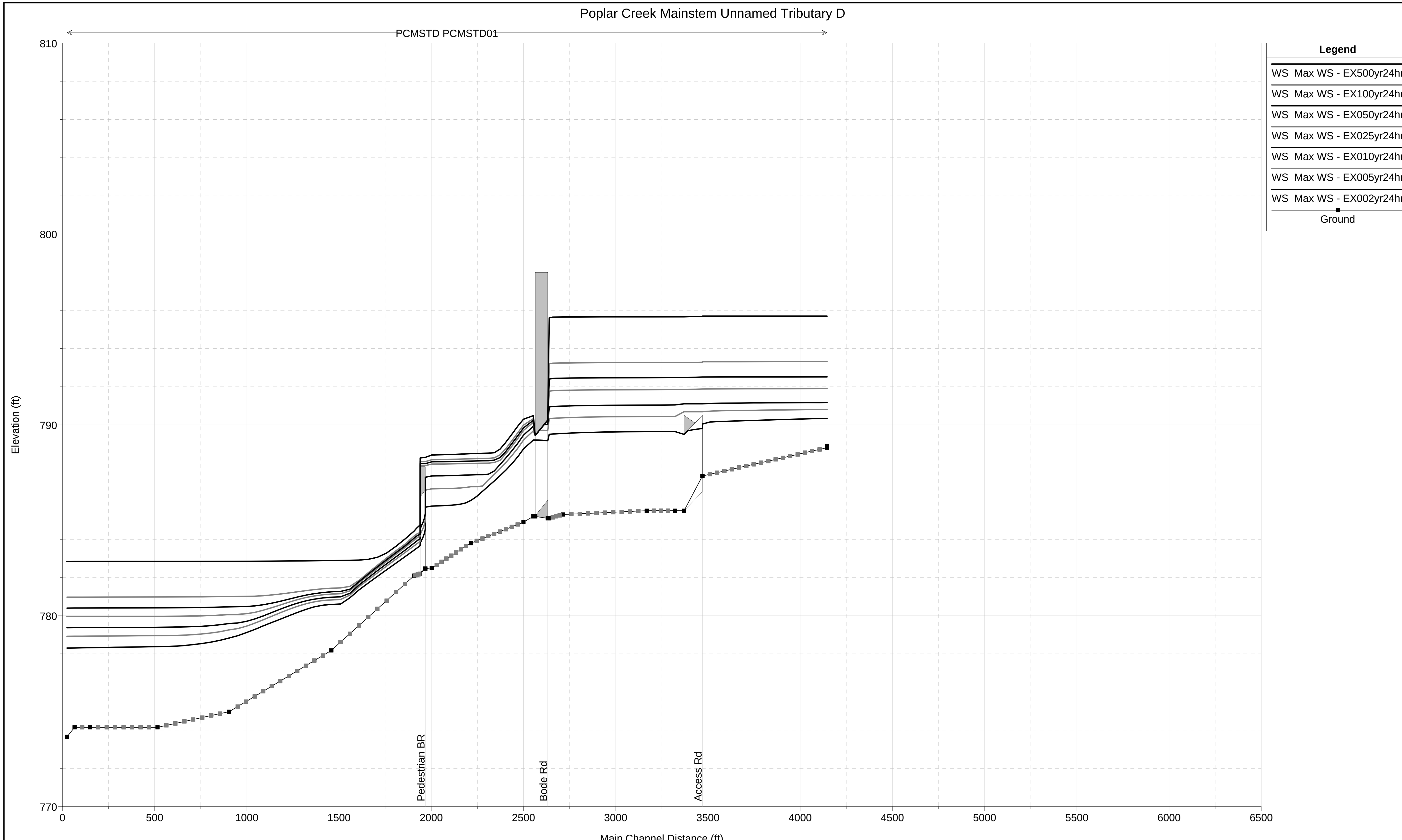

Poplar Creek Mainstem
PCMS PCMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
890
880
870
860
850
92000
92500
93000
93500
94000
94500
95000
95500
96000
96500
97000
97500
98000
98500
Main Channel Distance (ft)

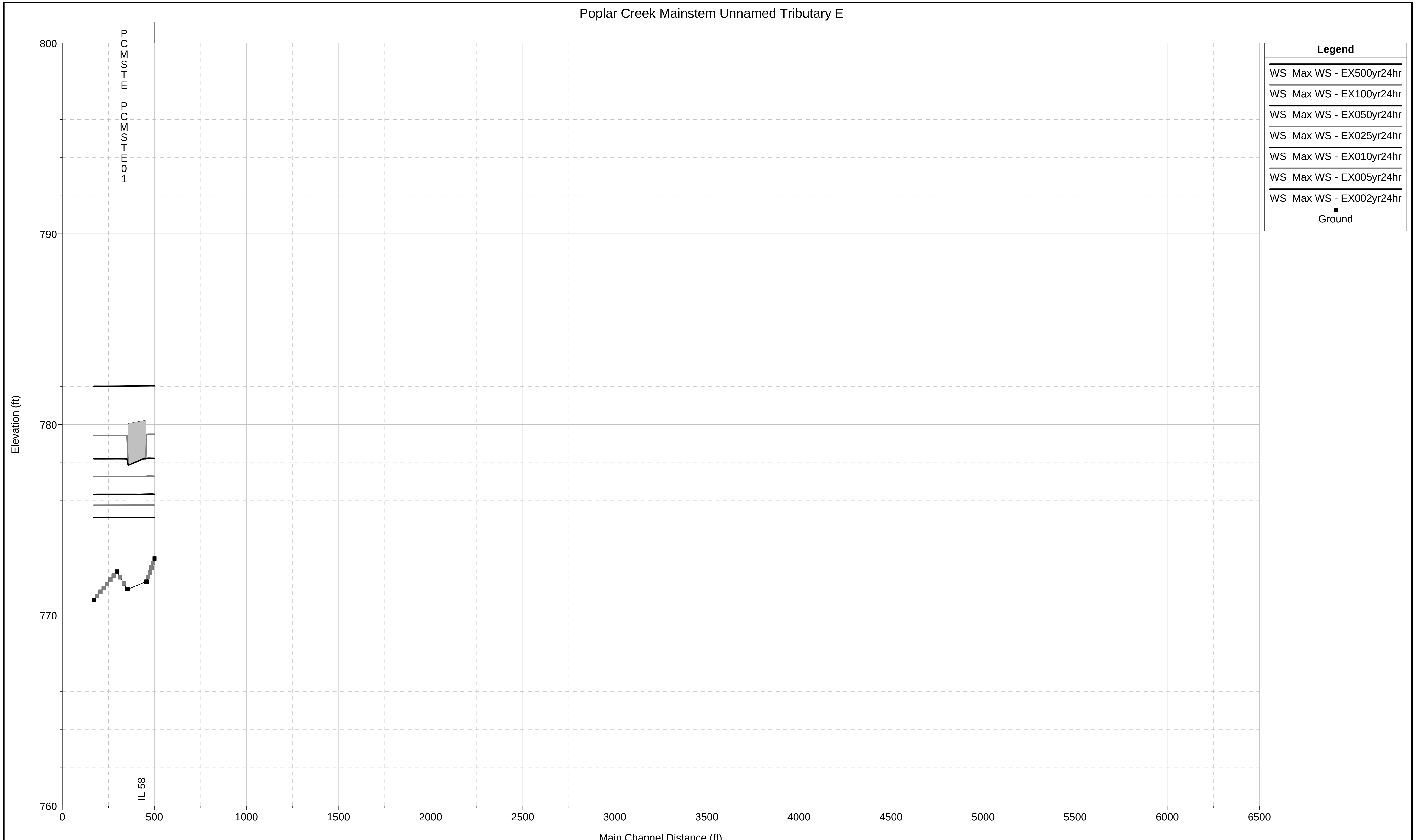

Poplar Creek Mainstem Unnamed Tributary A
PCMSTA PCMSTA01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
880
870
860
850
840
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)



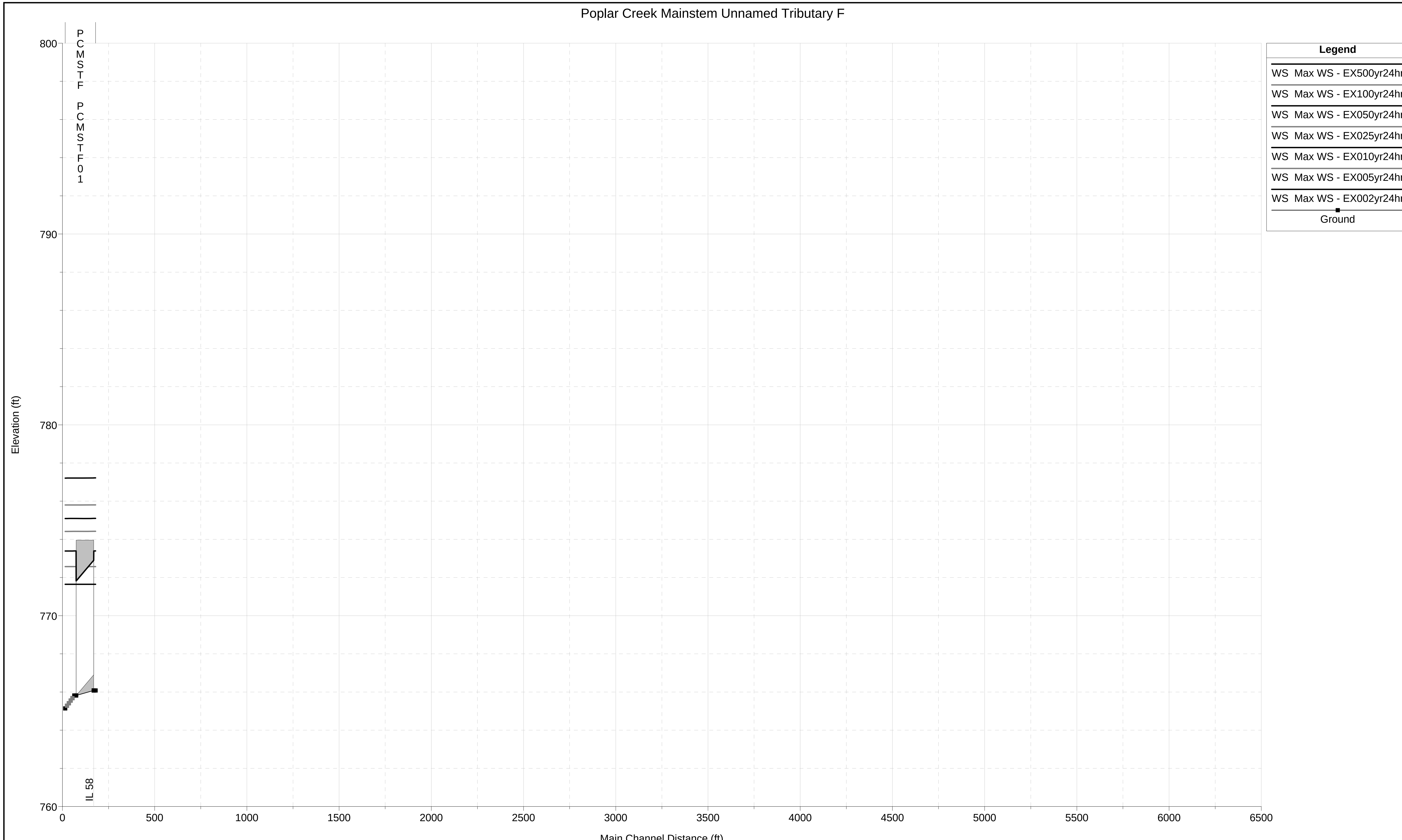
Poplar Creek Mainstem Unnamed Tributary B
PCMSTB PCMSTB01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
880
870
860
850
840
Palatine Rd
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

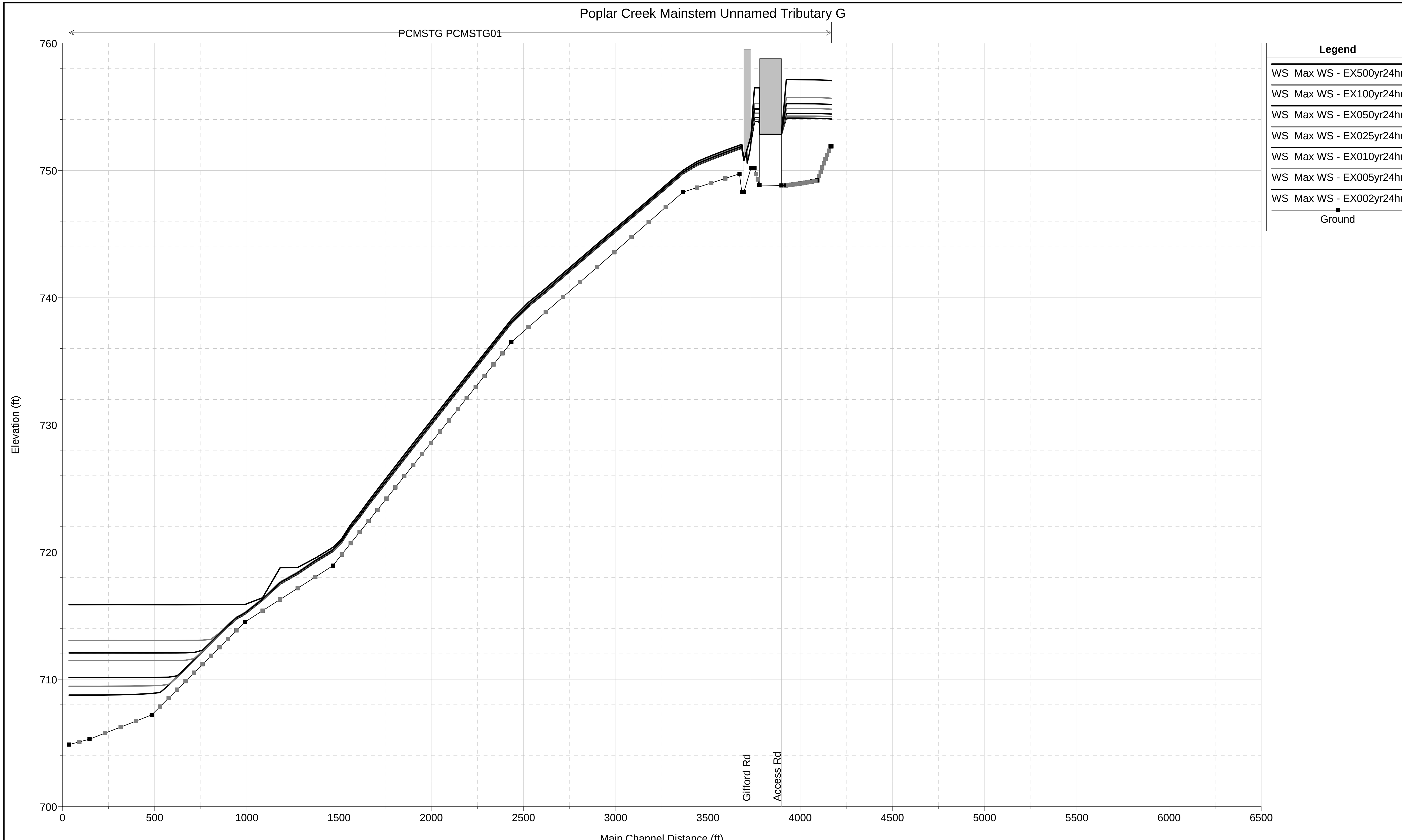

Poplar Creek Mainstem Unnamed Tributary C
PCMSTC PCMSTC01
Elevation (ft)
Main Channel Distance (ft)
870
860
850
840
830
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground


Poplar Creek Mainstem Unnamed Tributary D
PCMSTD PCMSTD01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Pedestrian BR
Bode Rd
Access Rd
Elevation (ft)
810
800
790
780
770
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

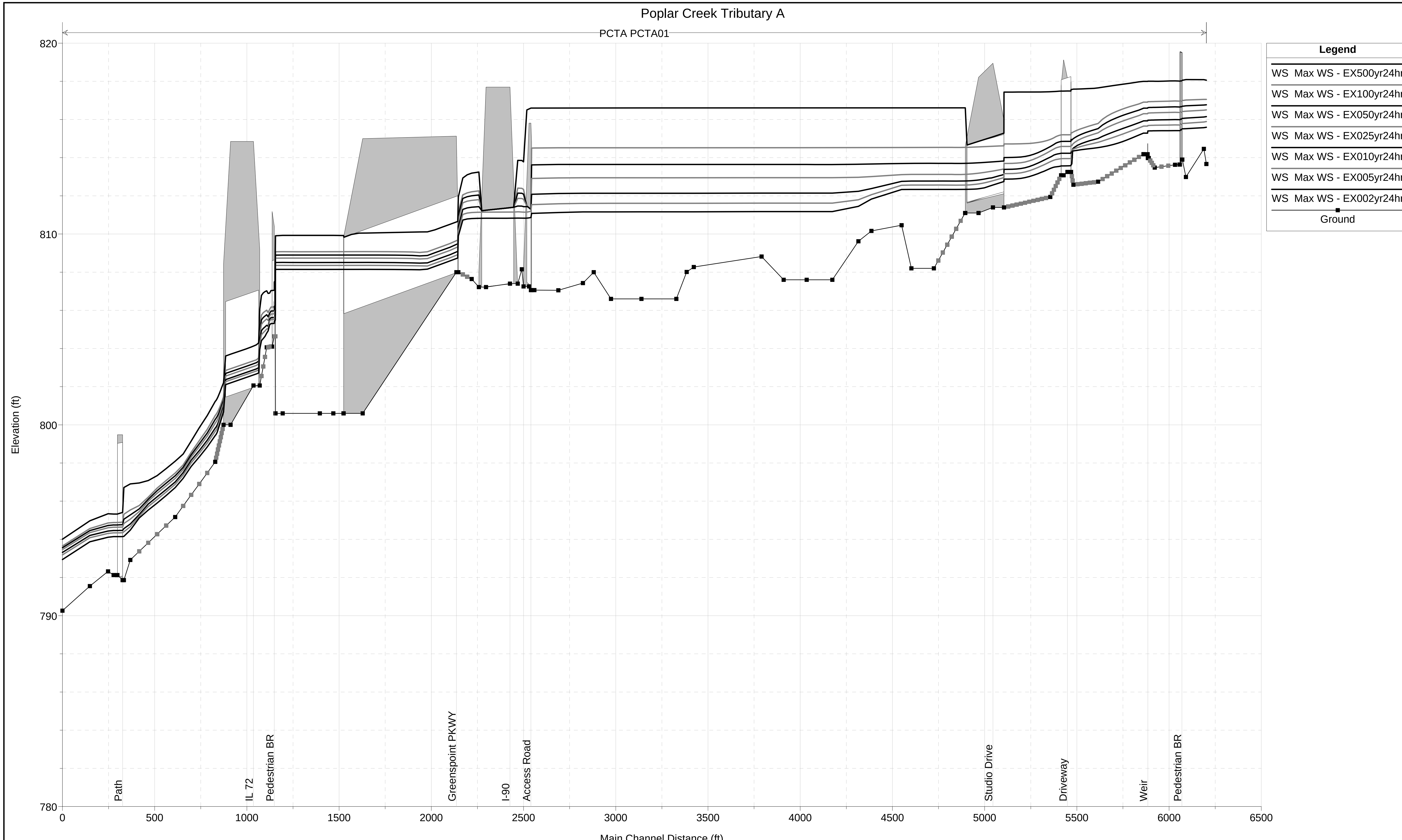


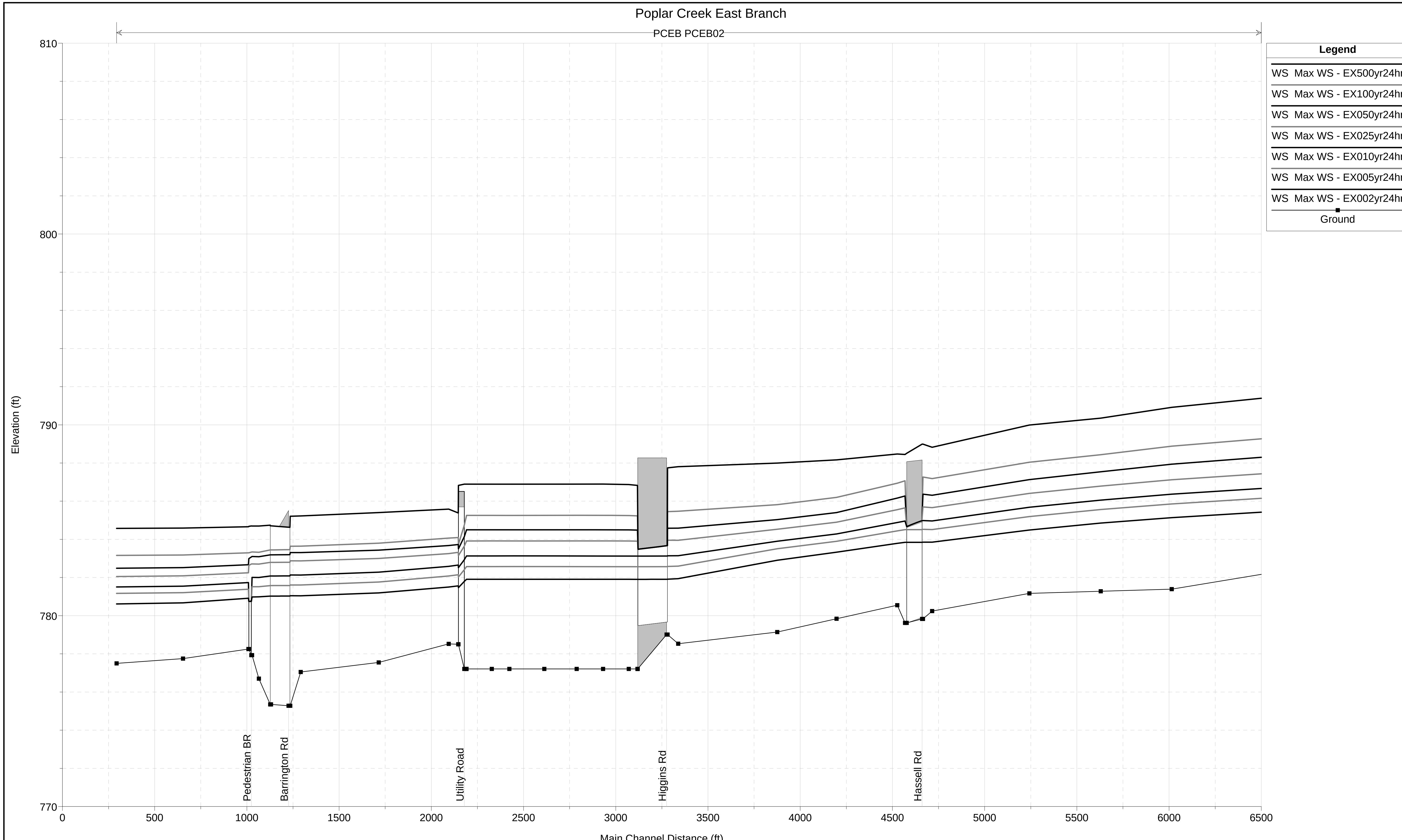
Poplar Creek Mainstem Unnamed Tributary E
PCMSTE
PCMSTE01
IL 58
Elevation (ft)
800
790
780
770
760
Main Channel Distance (ft)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground


Poplar Creek Mainstem Unnamed Tributary F
PCMSTF
PCMSTF01
IL 58
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

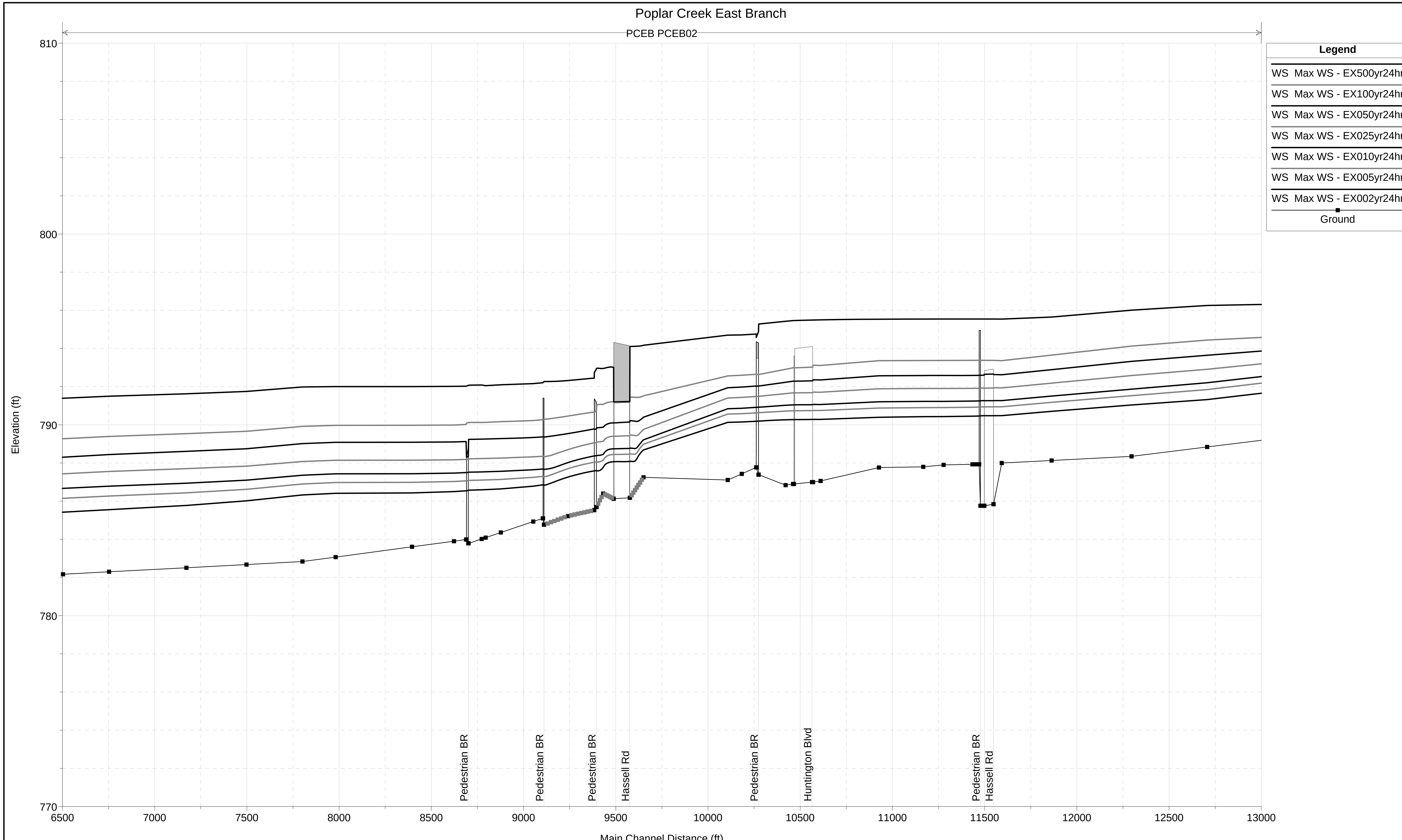


Poplar Creek Mainstem Unnamed Tributary G
PCMSTG PCMSTG01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
760
750
740
730
720
710
700
Gifford Rd
Access Rd
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

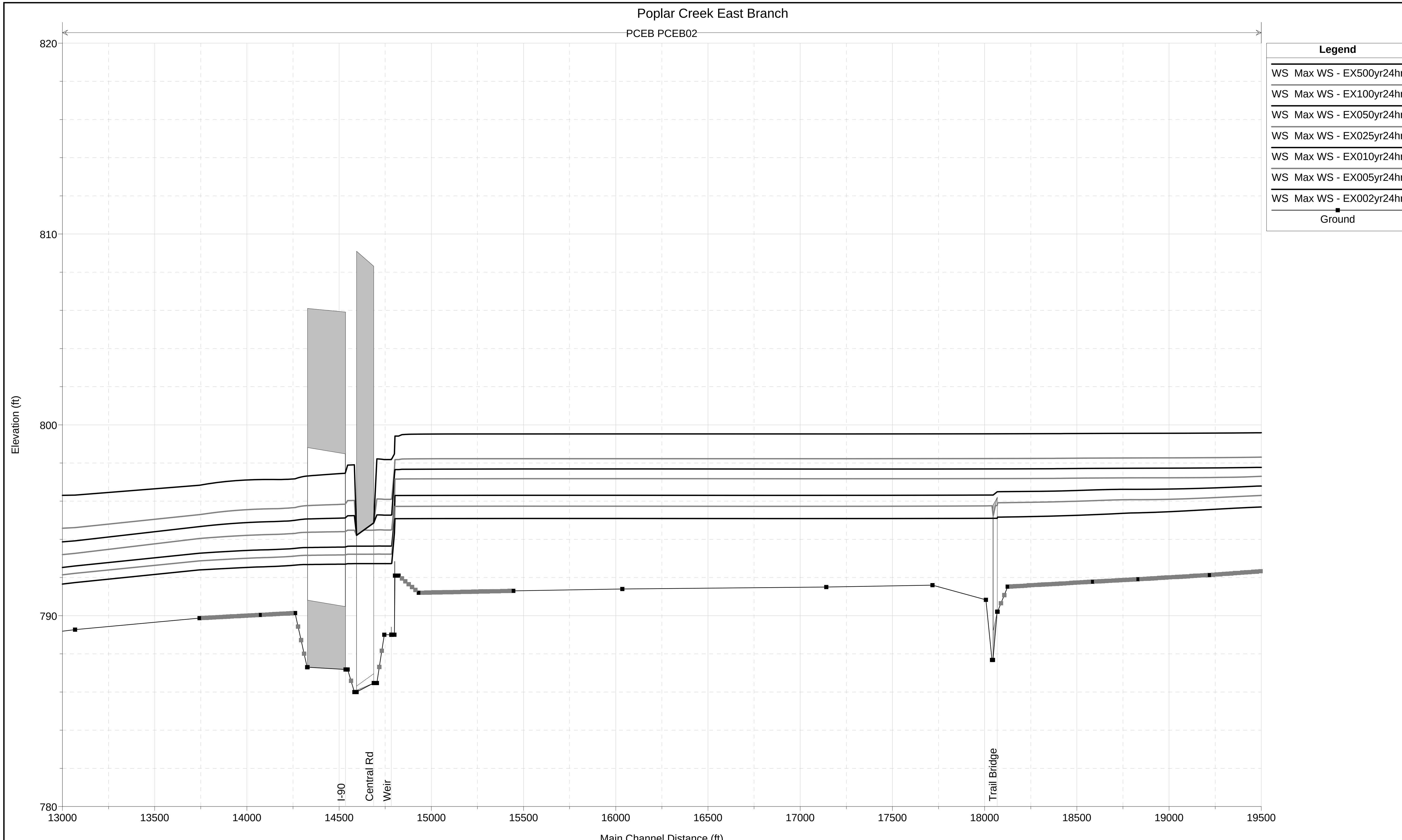

Poplar Creek Tributary A
PCTA PCTA01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
820
810
800
790
780
Main Channel Distance (ft)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Path
IL 72
Pedestrian BR
Greenspoint PKWY
I-90
Access Road
Studio Drive
Driveway
Weir
Pedestrian BR



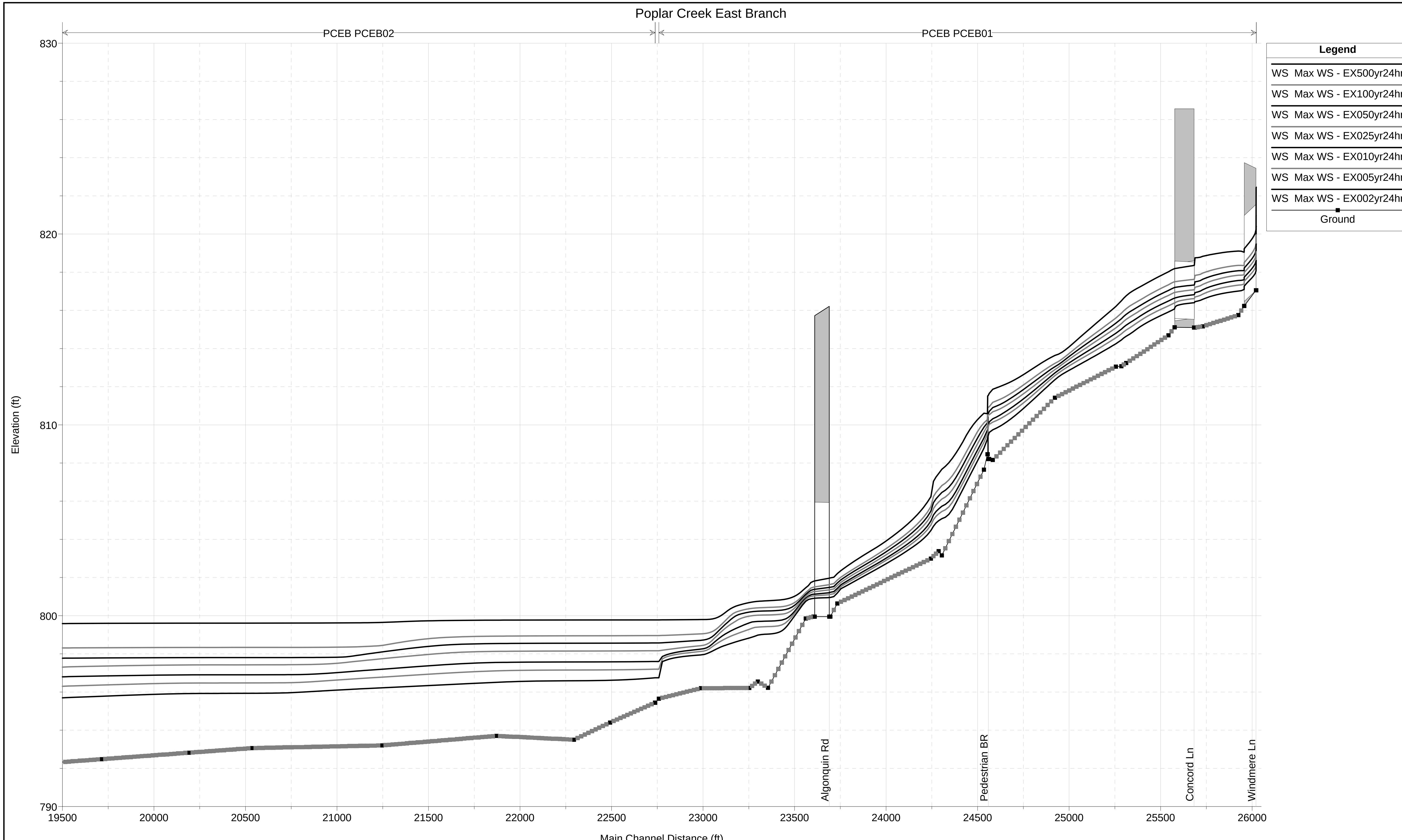
Poplar Creek East Branch
PCEB PCEB02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)
Pedestrian BR
Barrington Rd
Utility Road
Higgins Rd
Hassell Rd

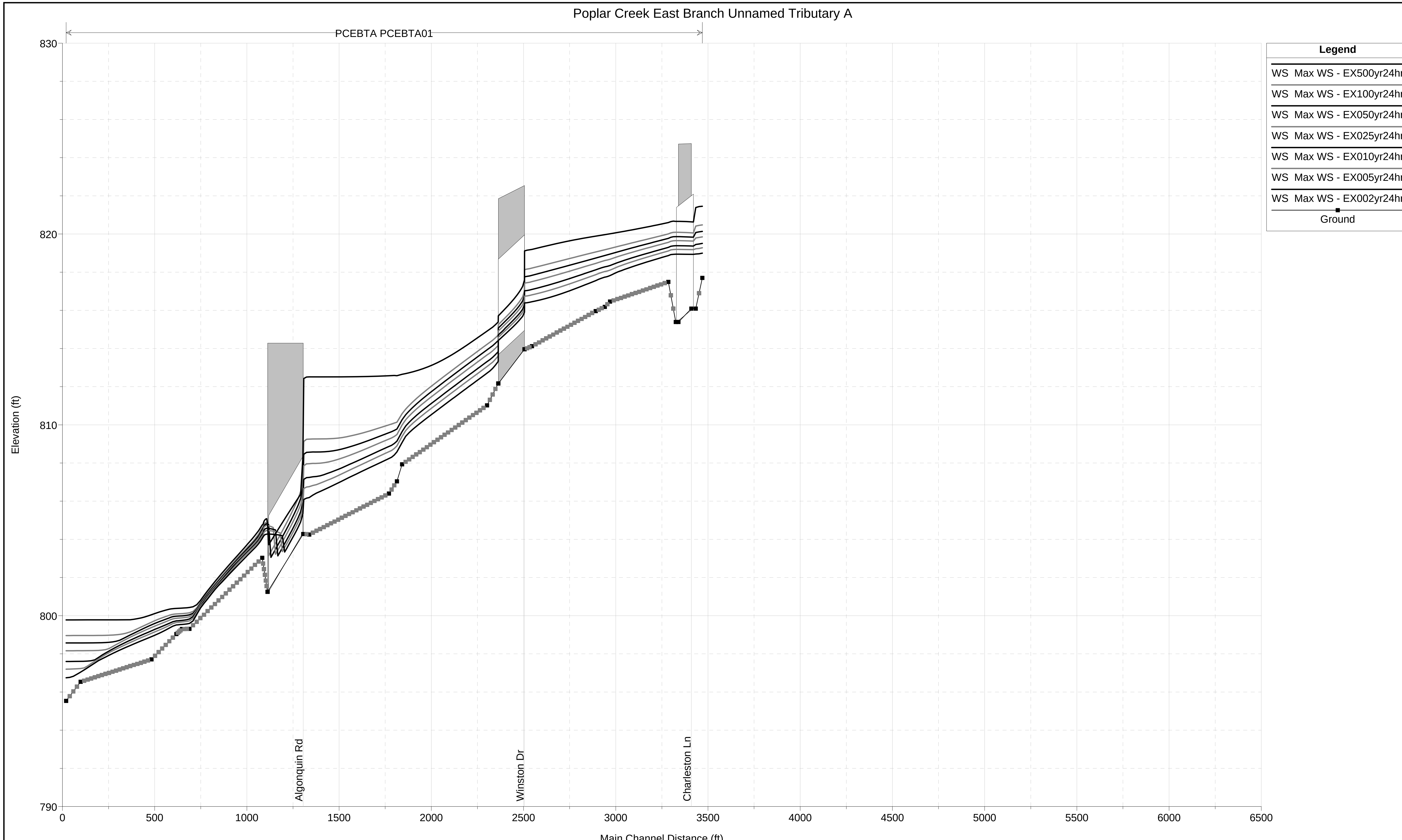


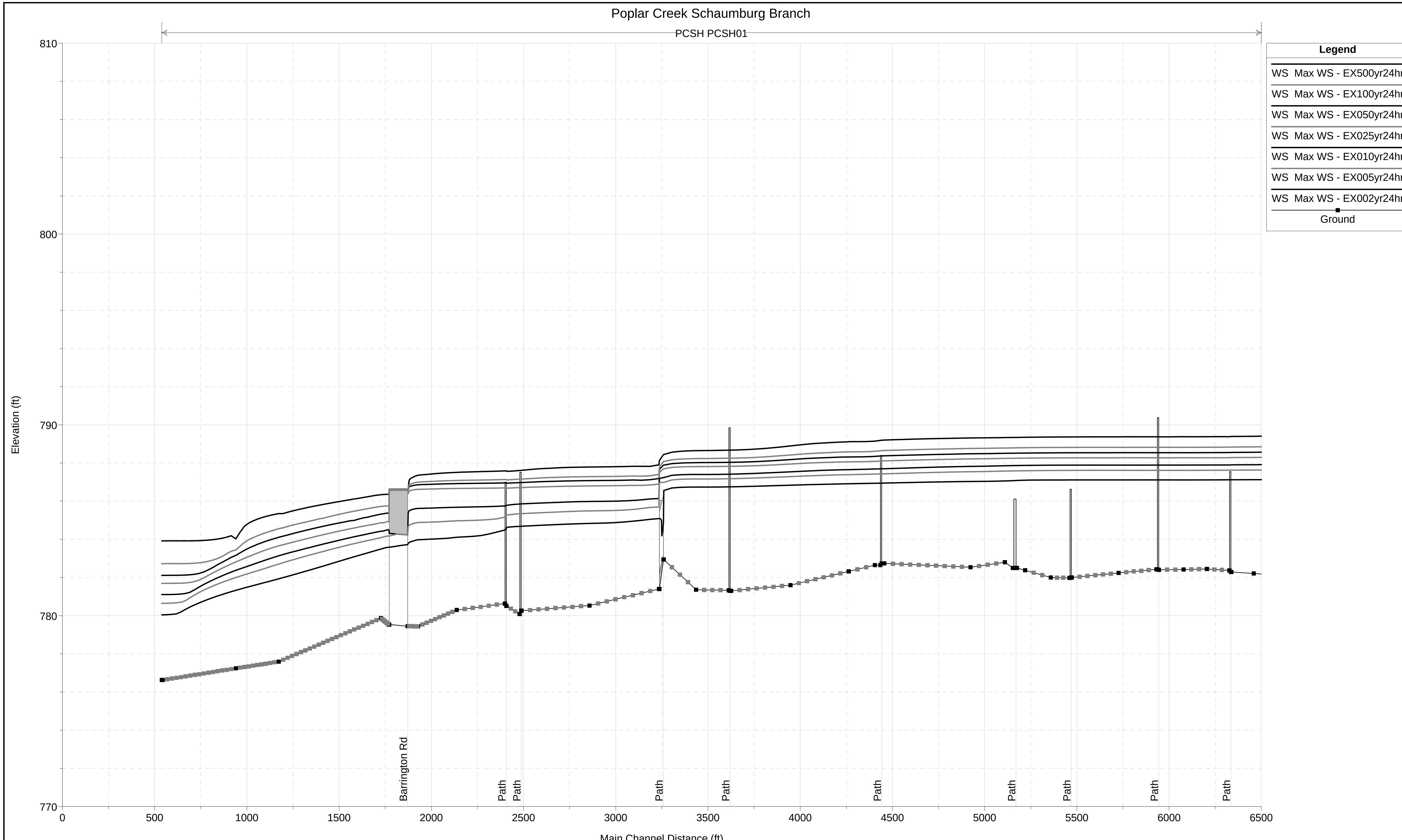
Poplar Creek East Branch
PCEB PCEB02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Pedestrian BR
Pedestrian BR
Pedestrian BR
Hassell Rd
Pedestrian BR
Huntington Blvd
Pedestrian BR
Hassell Rd
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)



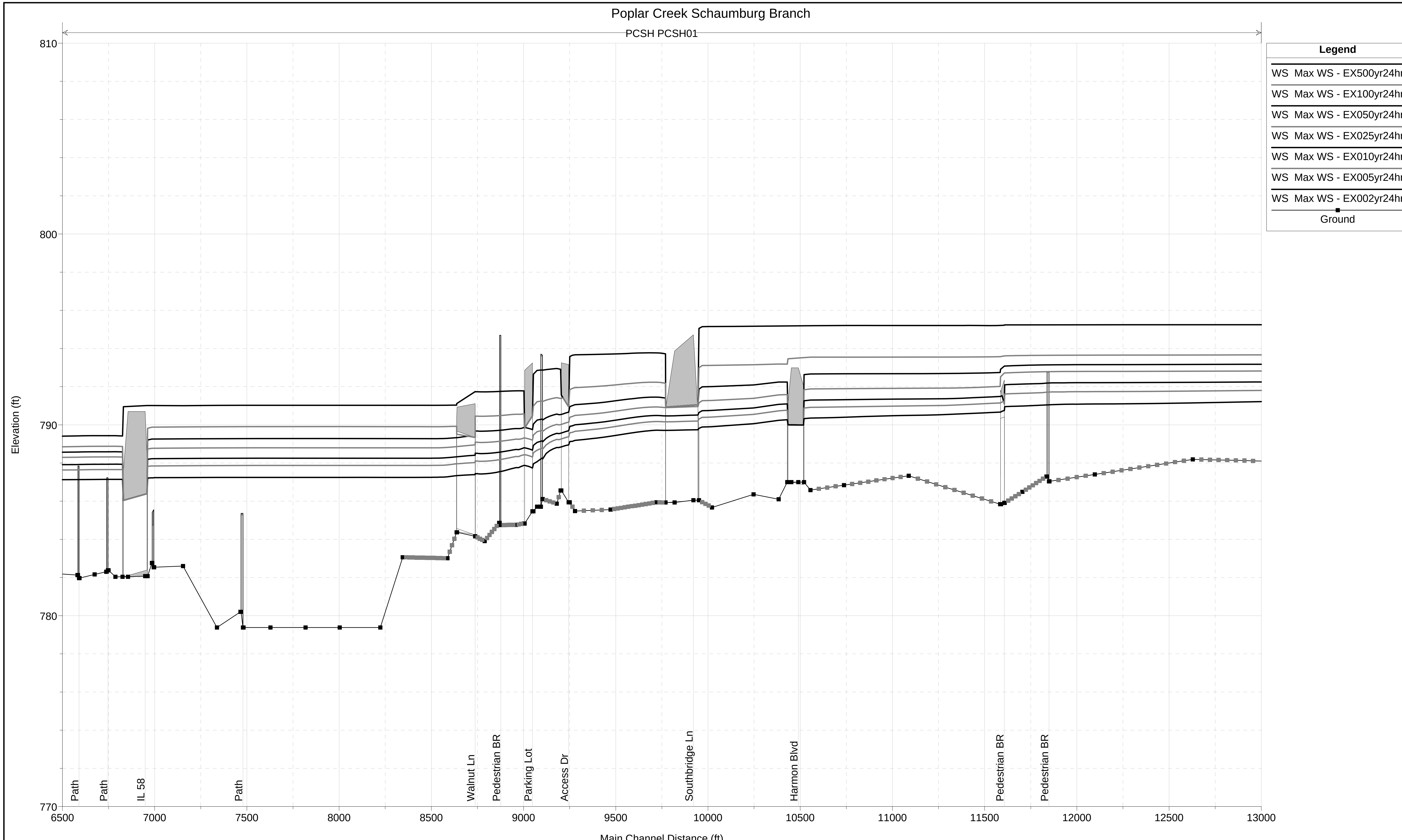
Poplar Creek East Branch
PCEB PCEB02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
820
810
800
790
780
I-90
Central Rd
Weir
Trail Bridge
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
18500
19000
19500
Main Channel Distance (ft)


Poplar Creek East Branch
PCEB PCEB02
PCEB PCEB01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
830
820
810
800
790
Algonquin Rd
Pedestrian BR
Concord Ln
Windmere Ln
19500
20000
20500
21000
21500
22000
22500
23000
23500
24000
24500
25000
25500
26000
Main Channel Distance (ft)

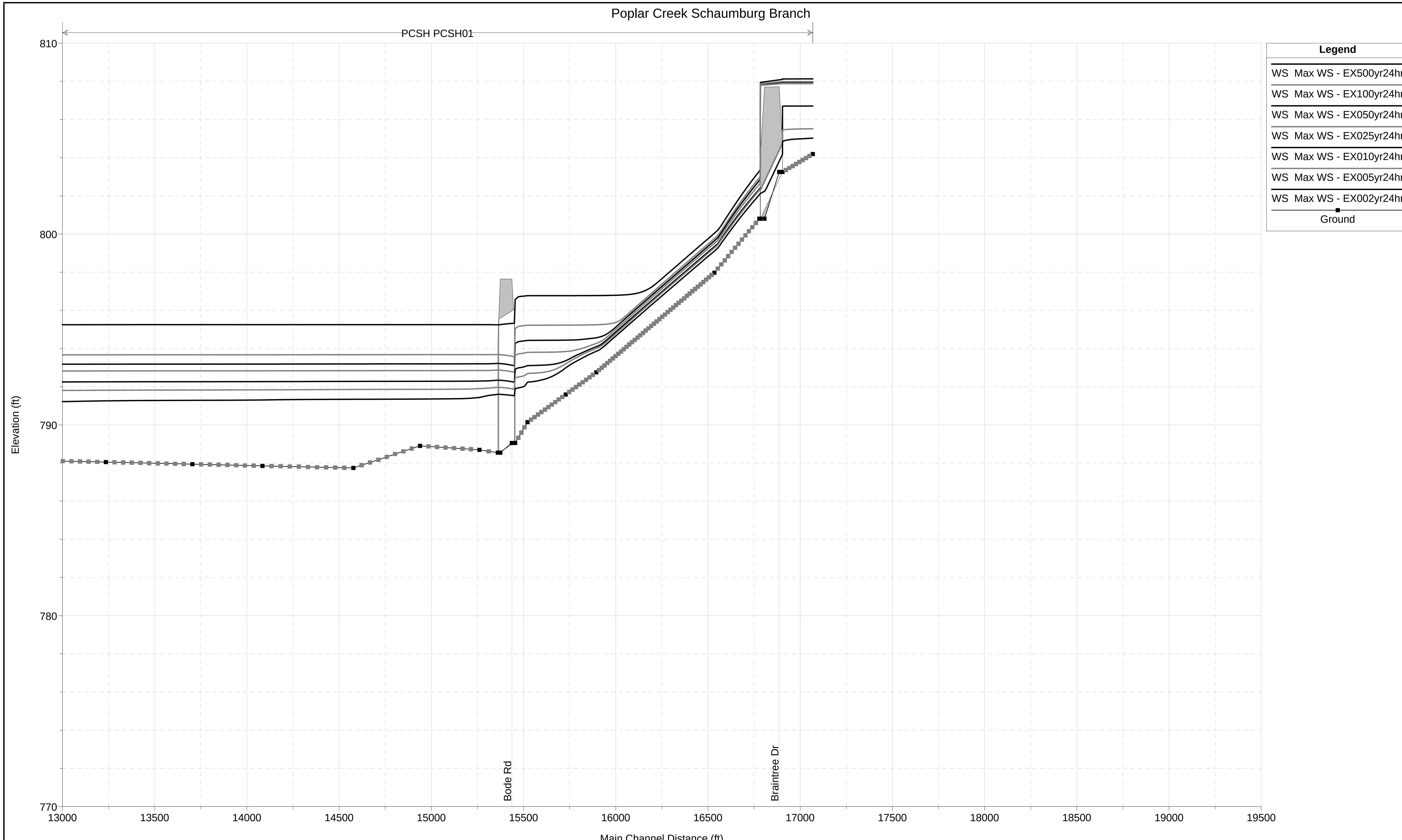

Poplar Creek East Branch Unnamed Tributary A
PCEBTA PCEBTA01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
830
820
810
800
790
Algonquin Rd
Winston Dr
Charleston Ln
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)



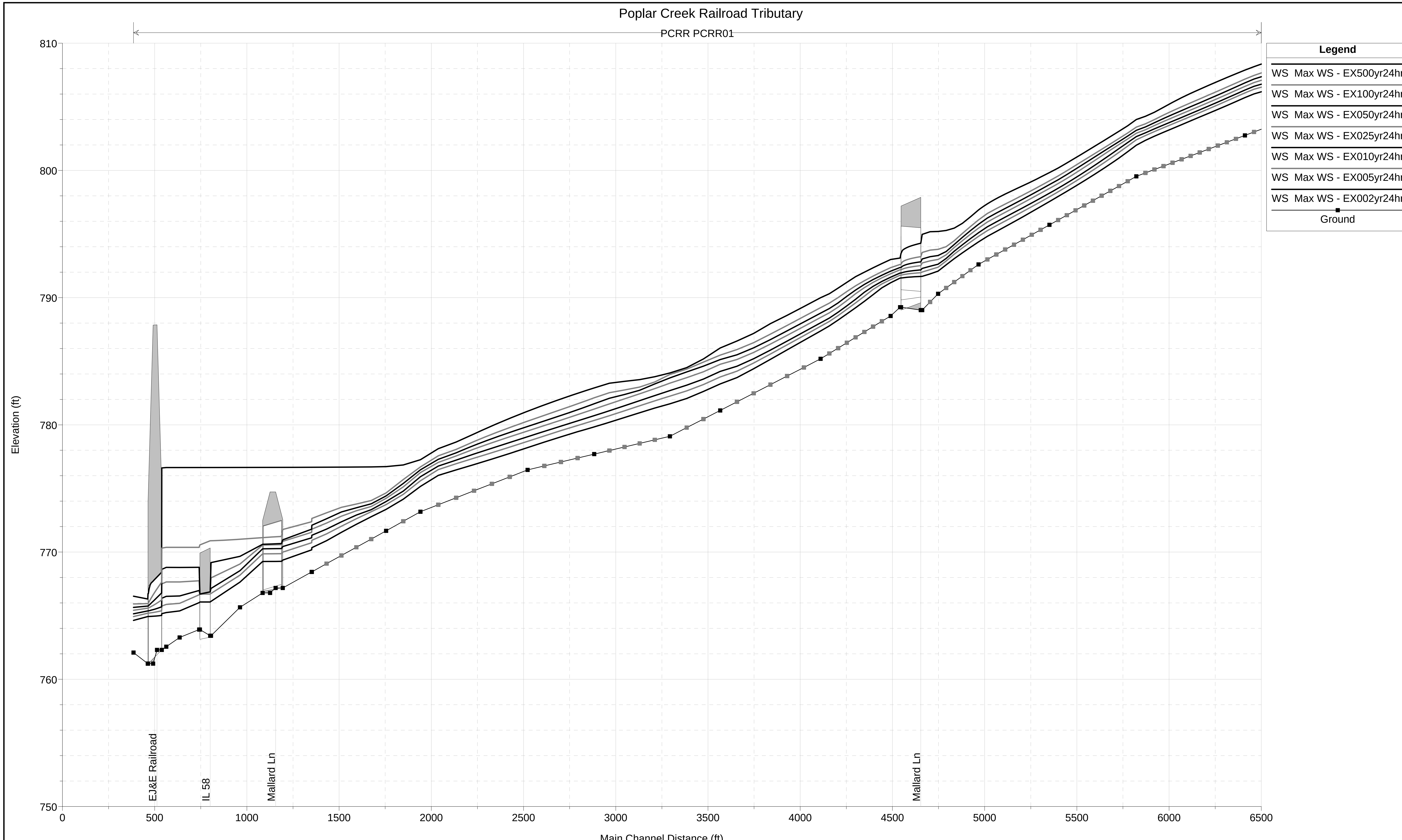
Poplar Creek Schaumburg Branch
PCSH PCSH01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Barrington Rd
Path
Path
Path
Path
Path
Path
Path
Path
Path
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

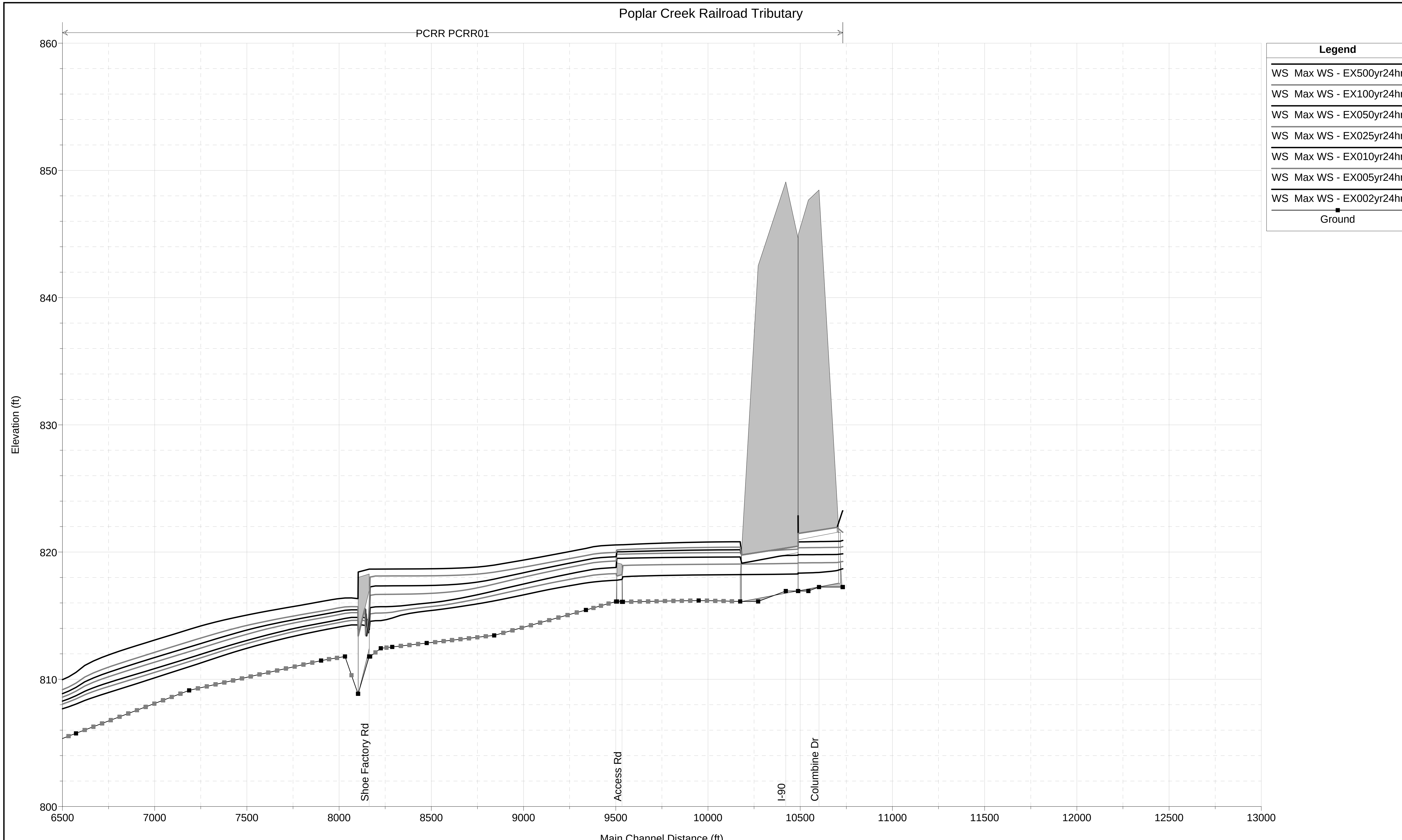


Poplar Creek Schaumburg Branch
PCSH PCSH01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Path
Path
IL 58
Path
Walnut Ln
Pedestrian BR
Parking Lot
Access Dr
Southbridge Ln
Harmon Blvd
Pedestrian BR
Pedestrian BR
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)

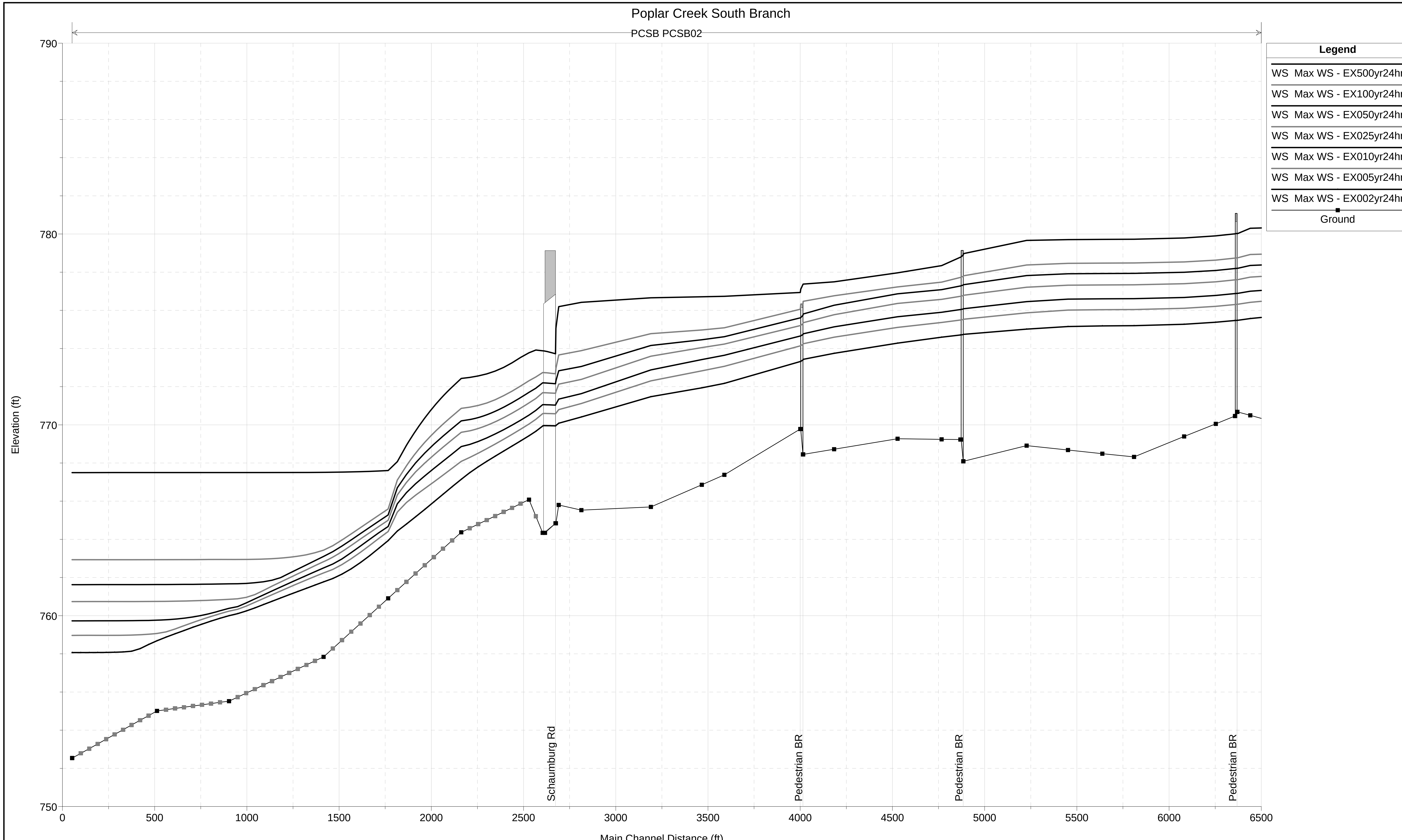


Poplar Creek Schaumburg Branch
PCSH PCSH01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Bode Rd
Braintree Dr
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
18500
19000
19500
Main Channel Distance (ft)

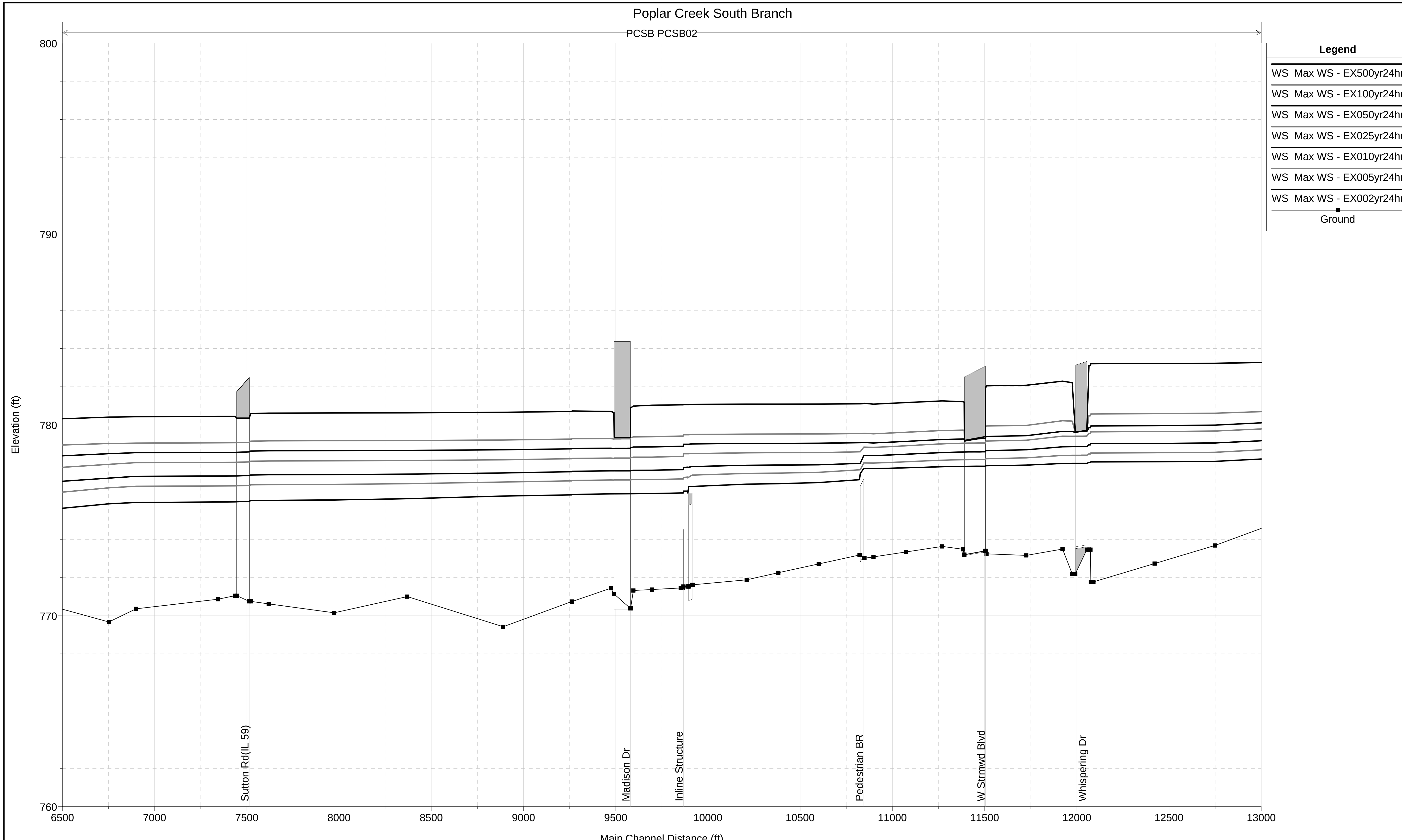

Poplar Creek Railroad Tributary
PCRR PCRR01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
760
750
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)
EJ&E Railroad
IL 58
Mallard Ln
Mallard Ln



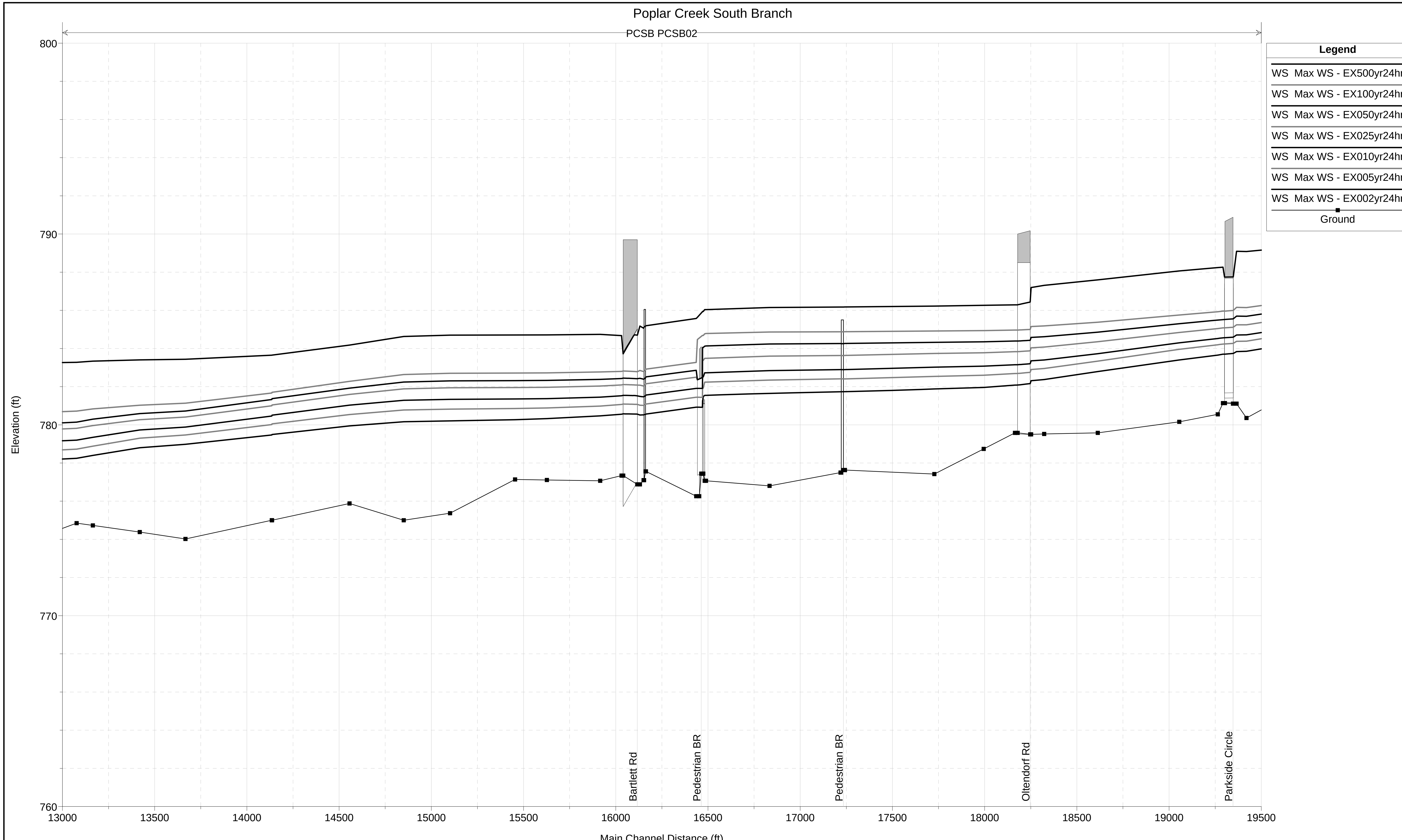
Poplar Creek Railroad Tributary
PCRR PCRR01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
860
850
840
830
820
810
800
Shoe Factory Rd
Access Rd
I-90
Columbine Dr
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)



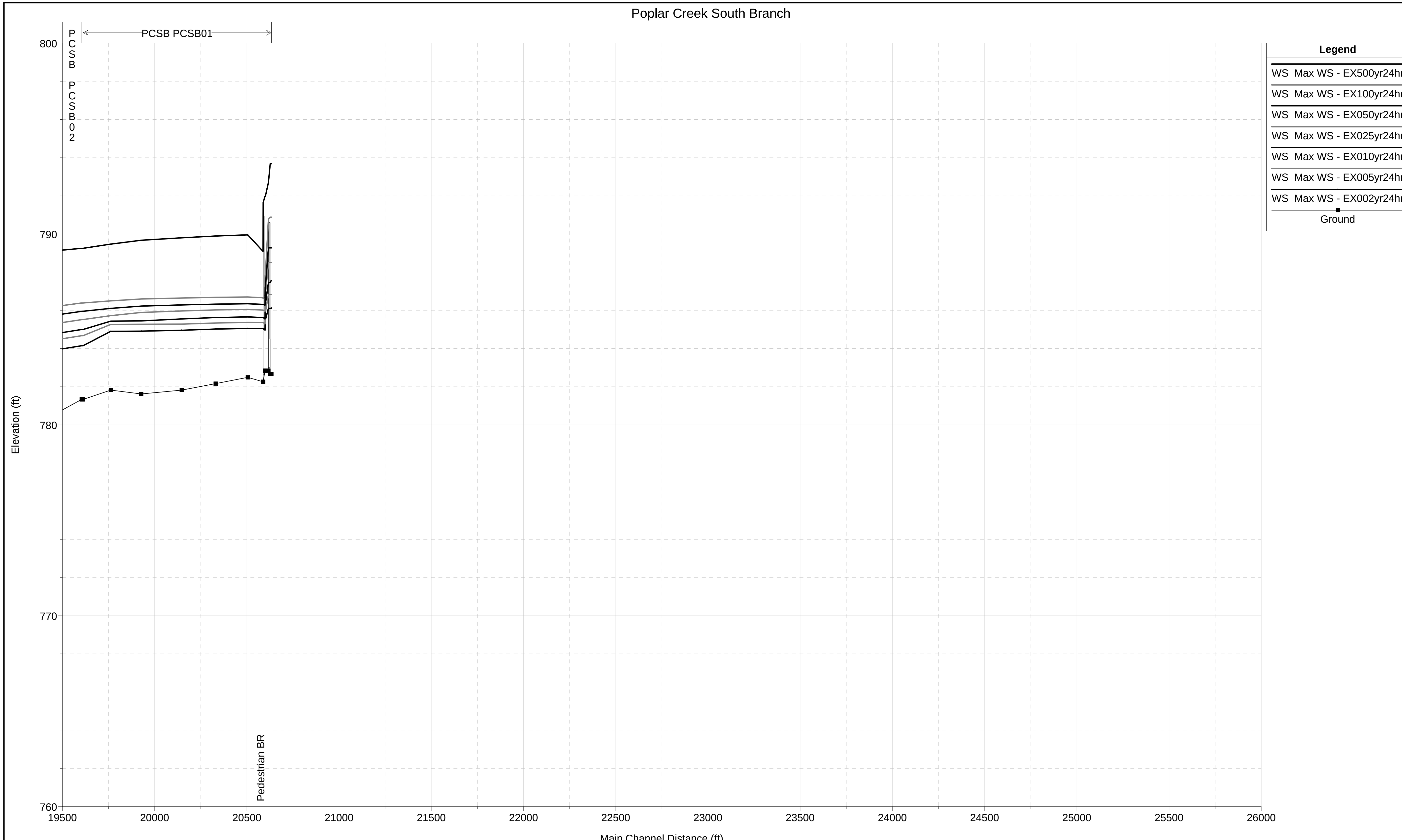
Poplar Creek South Branch
PCSB PCSB02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
790
780
770
760
750
Schaumburg Rd
Pedestrian BR
Pedestrian BR
Pedestrian BR
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

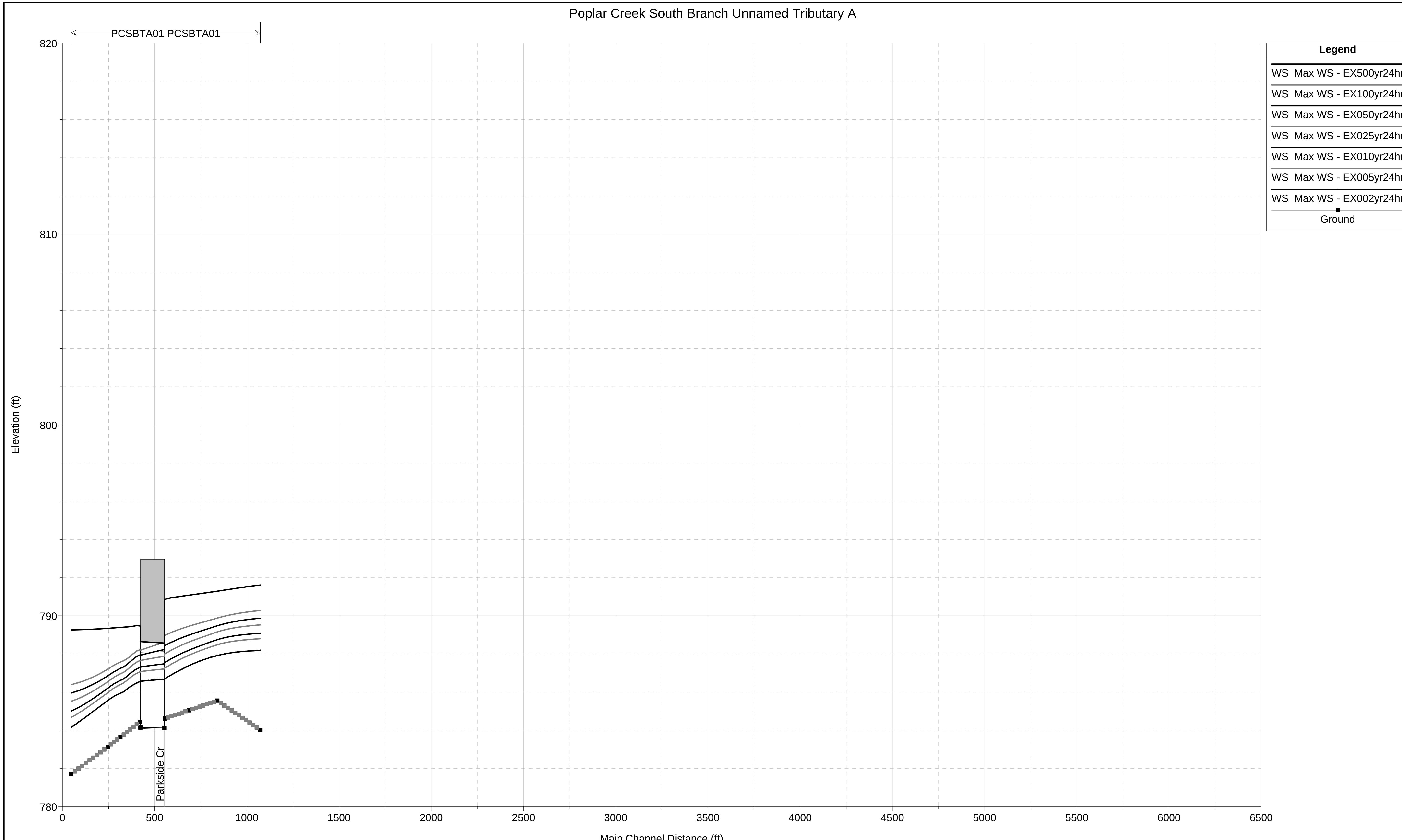


Poplar Creek South Branch
PCSB PCSB02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
Sutton Rd(IL 59)
Madison Dr
Inline Structure
Pedestrian BR
W Strmwd Blvd
Whispering Dr
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)

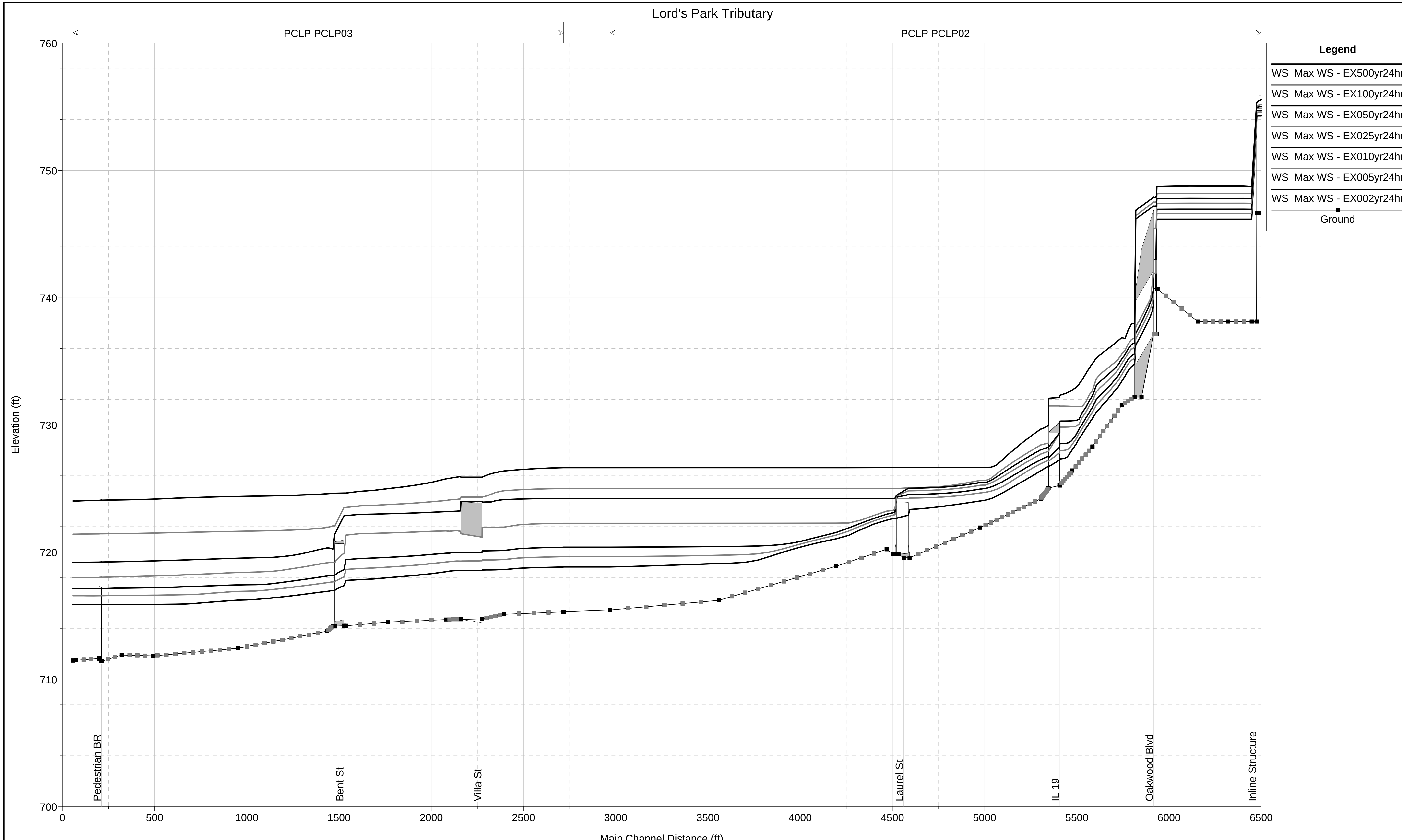


Poplar Creek South Branch
PCSB PCSB02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
Main Channel Distance (ft)
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
18500
19000
19500
Bartlett Rd
Pedestrian BR
Pedestrian BR
Oltendorf Rd
Parkside Circle

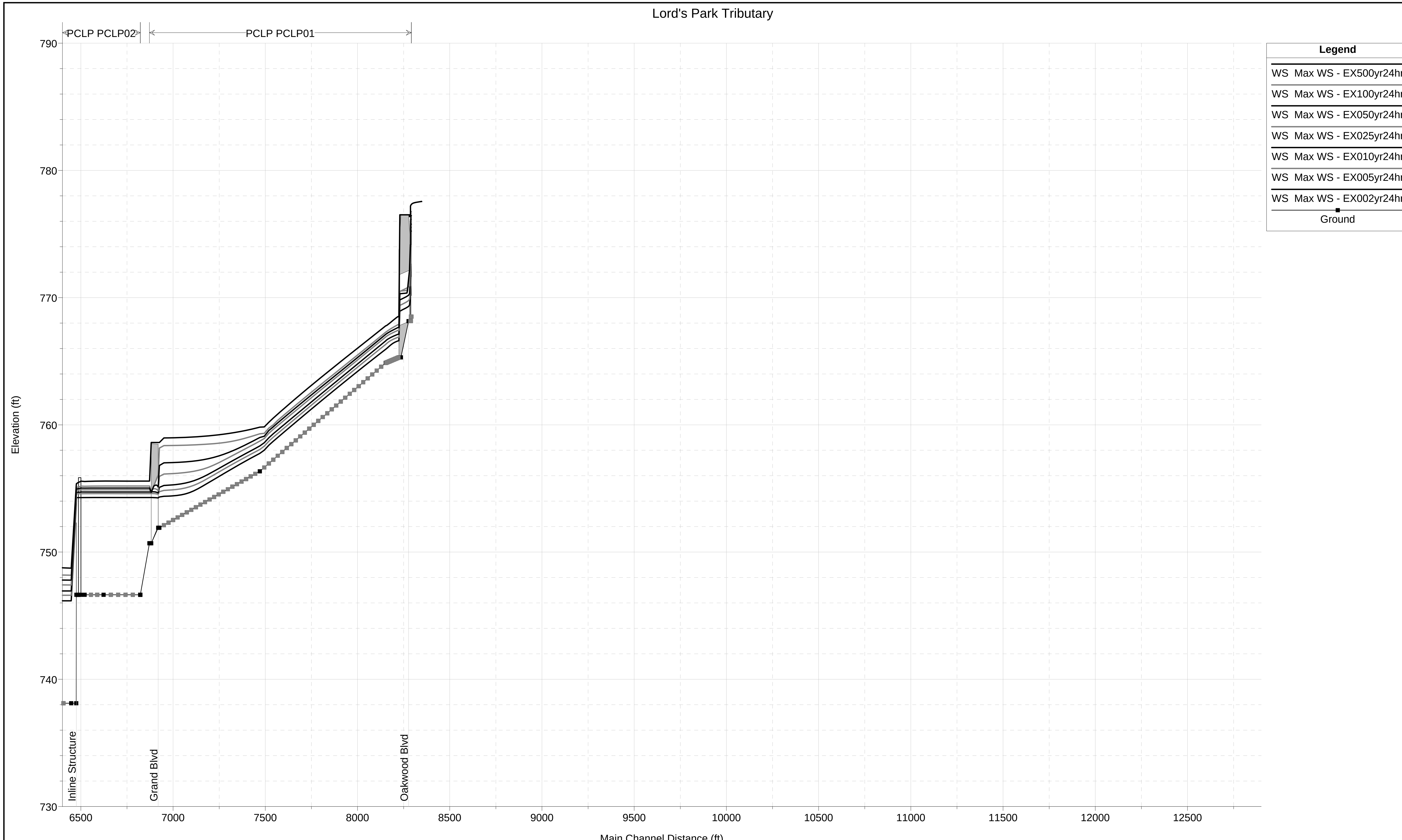

Poplar Creek South Branch
PCSB PCSB01
PCSB
PCSB02
Pedestrian BR
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
19500
20000
20500
21000
21500
22000
22500
23000
23500
24000
24500
25000
25500
26000
Main Channel Distance (ft)



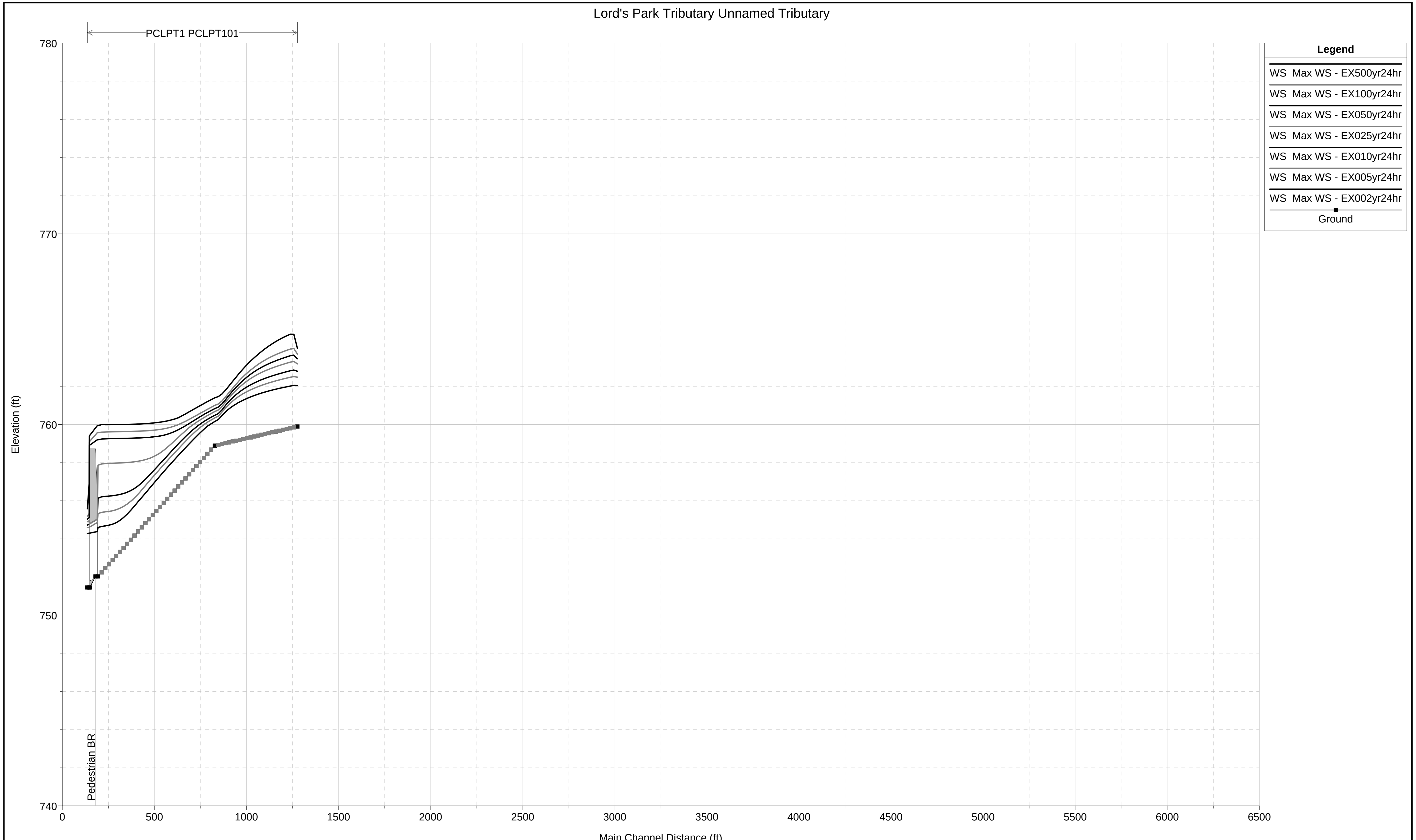
Poplar Creek South Branch Unnamed Tributary A
PCSBTA01 PCSBTA01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
820
810
800
790
780
Parkside Cr
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

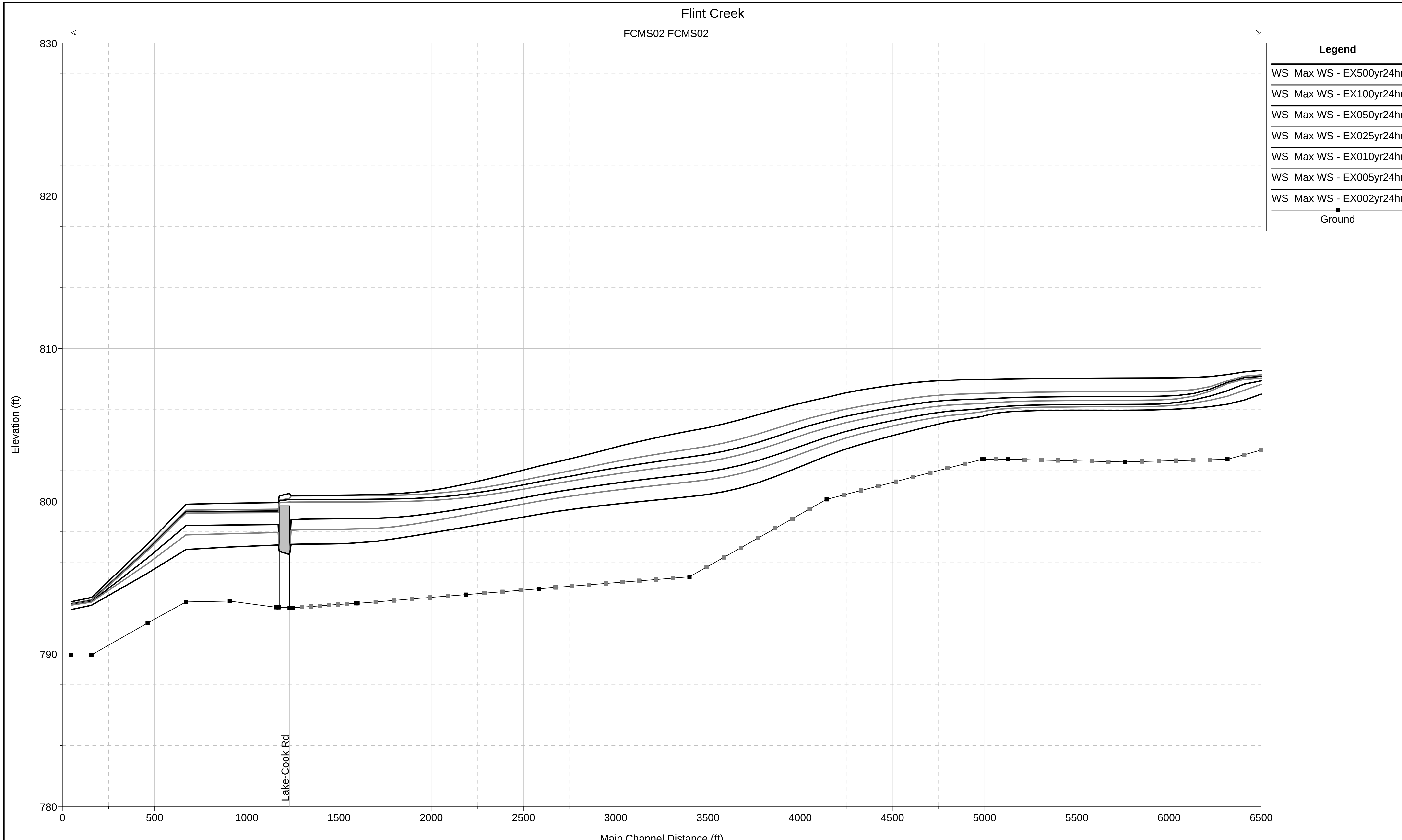


Lord's Park Tributary
PCLP PCLP03
PCLP PCLP02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
760
750
740
730
720
710
700
Pedestrian BR
Bent St
Villa St
Laurel St
IL 19
Oakwood Blvd
Inline Structure
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

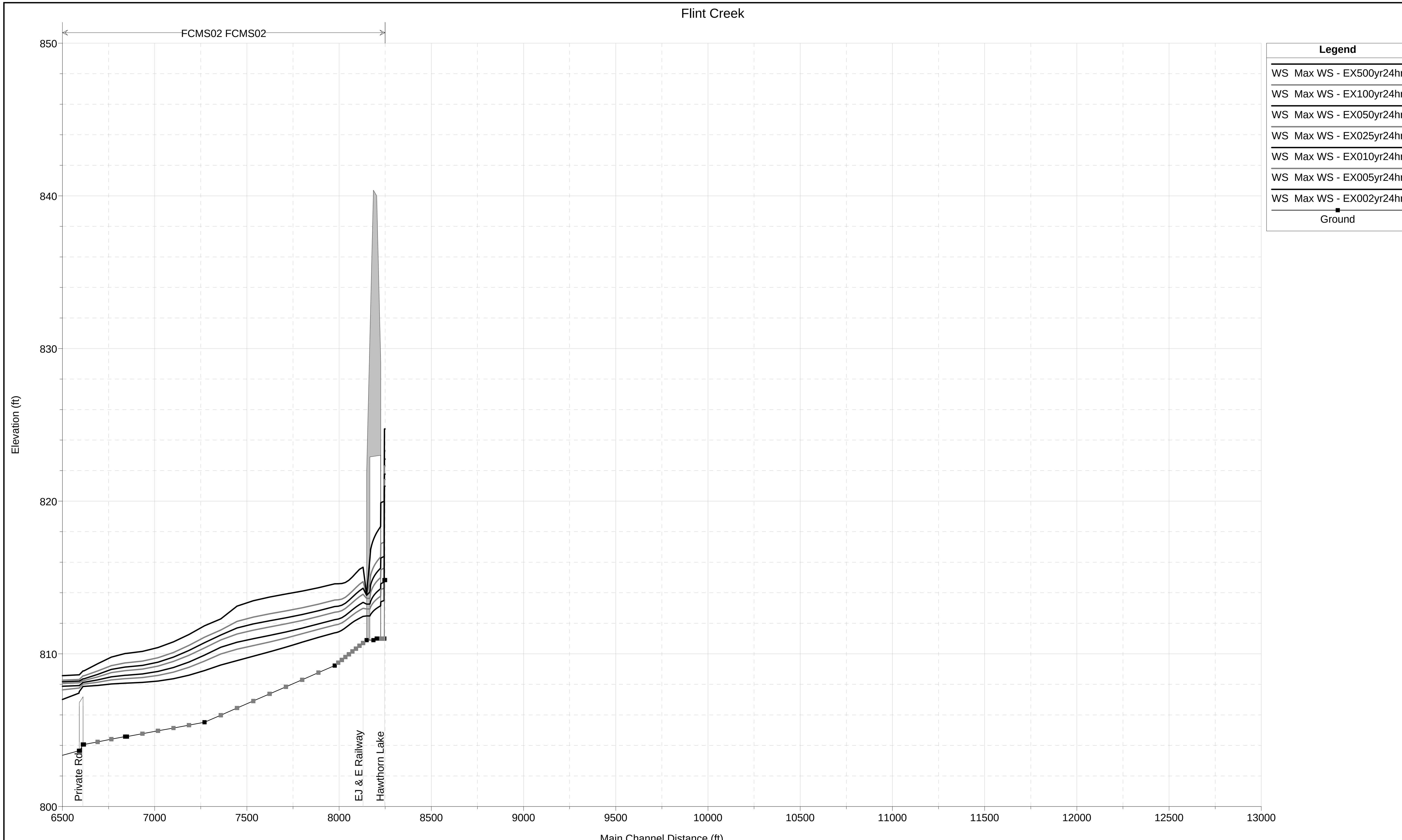


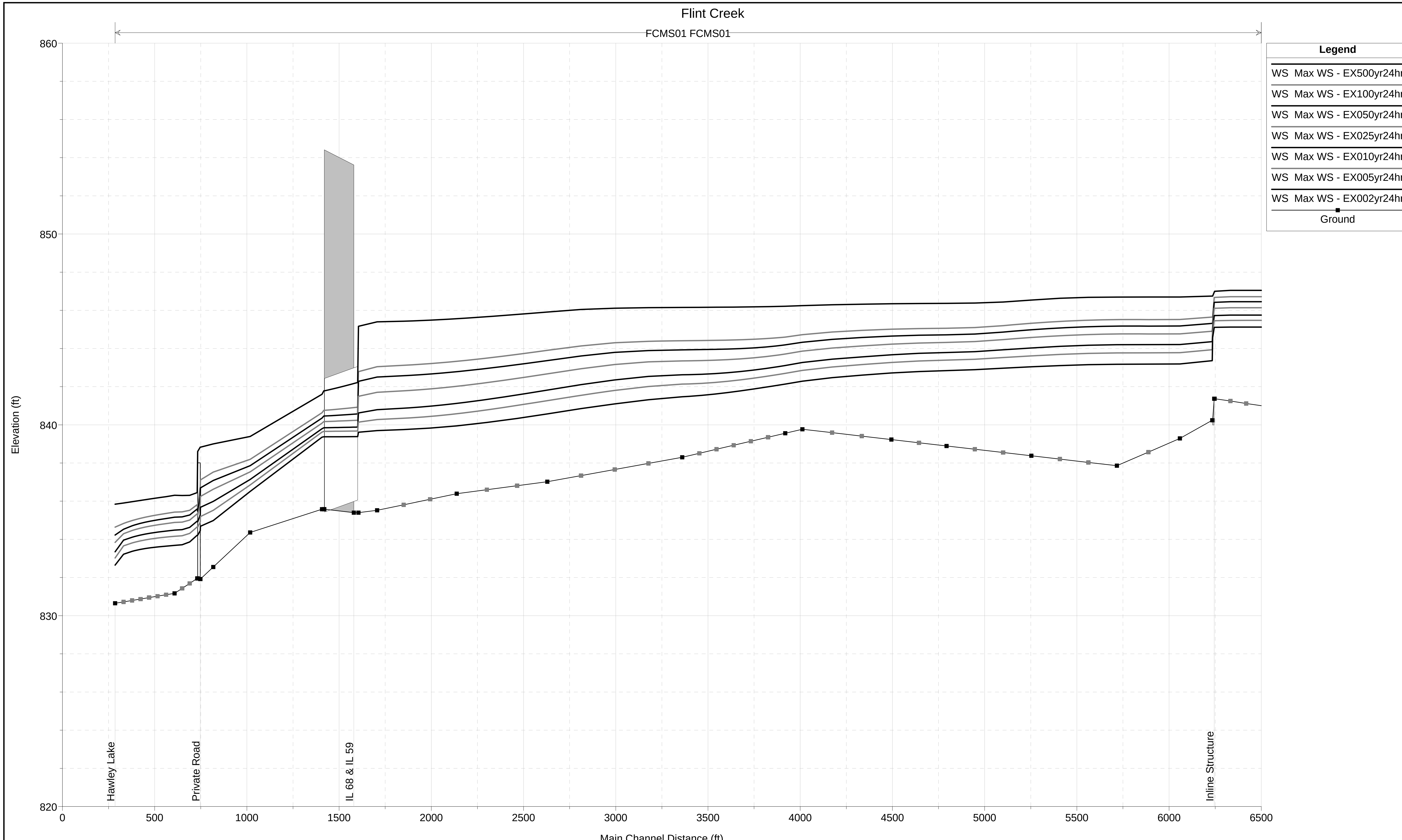
Lord's Park Tributary
PCLP PCLP02
PCLP PCLP01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
790
780
770
760
750
740
730
Inline Structure
Grand Blvd
Oakwood Blvd
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
Main Channel Distance (ft)


Lord's Park Tributary Unnamed Tributary
PCLPT1 PCLPT101
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Pedestrian BR
Elevation (ft)
780
770
760
750
740
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

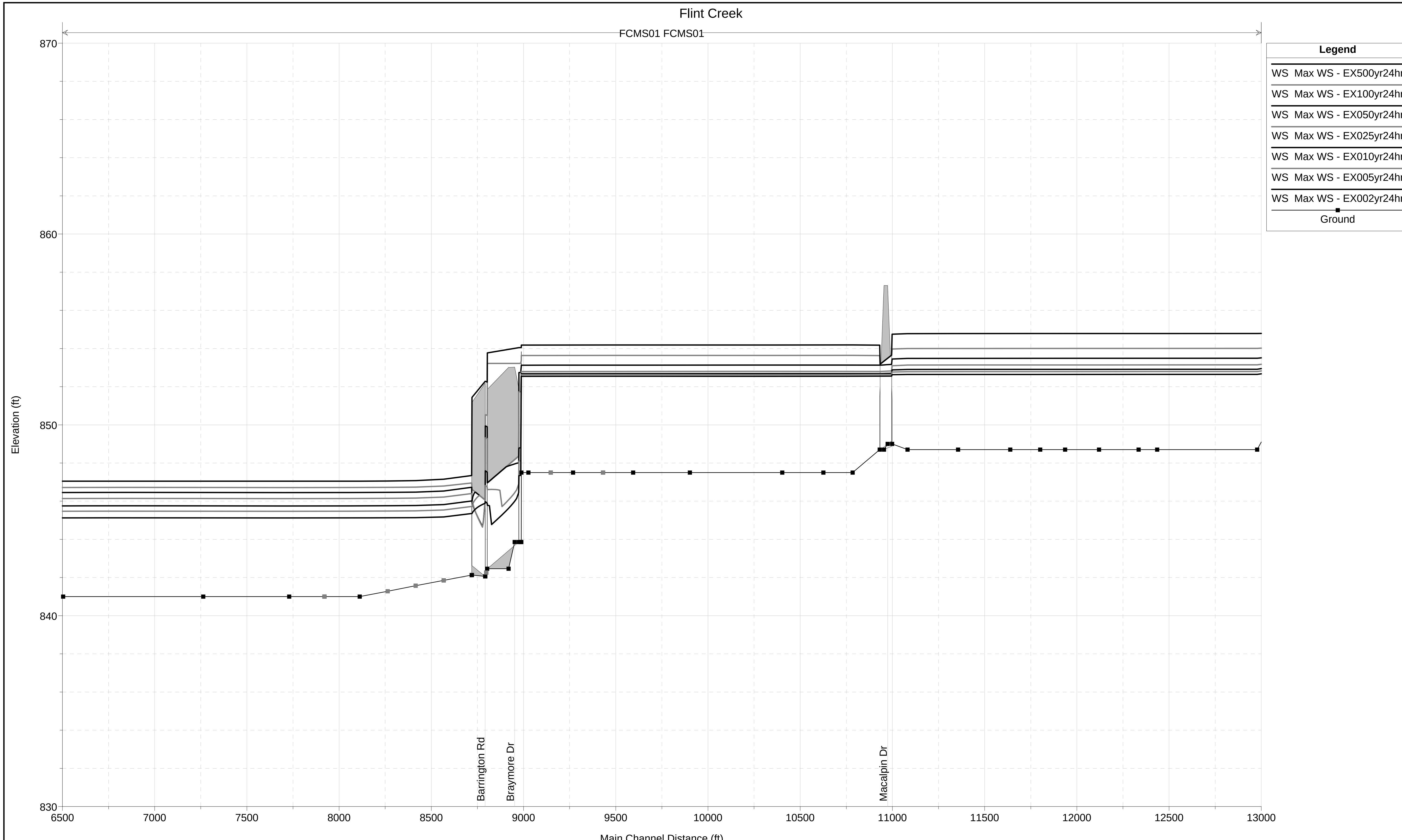


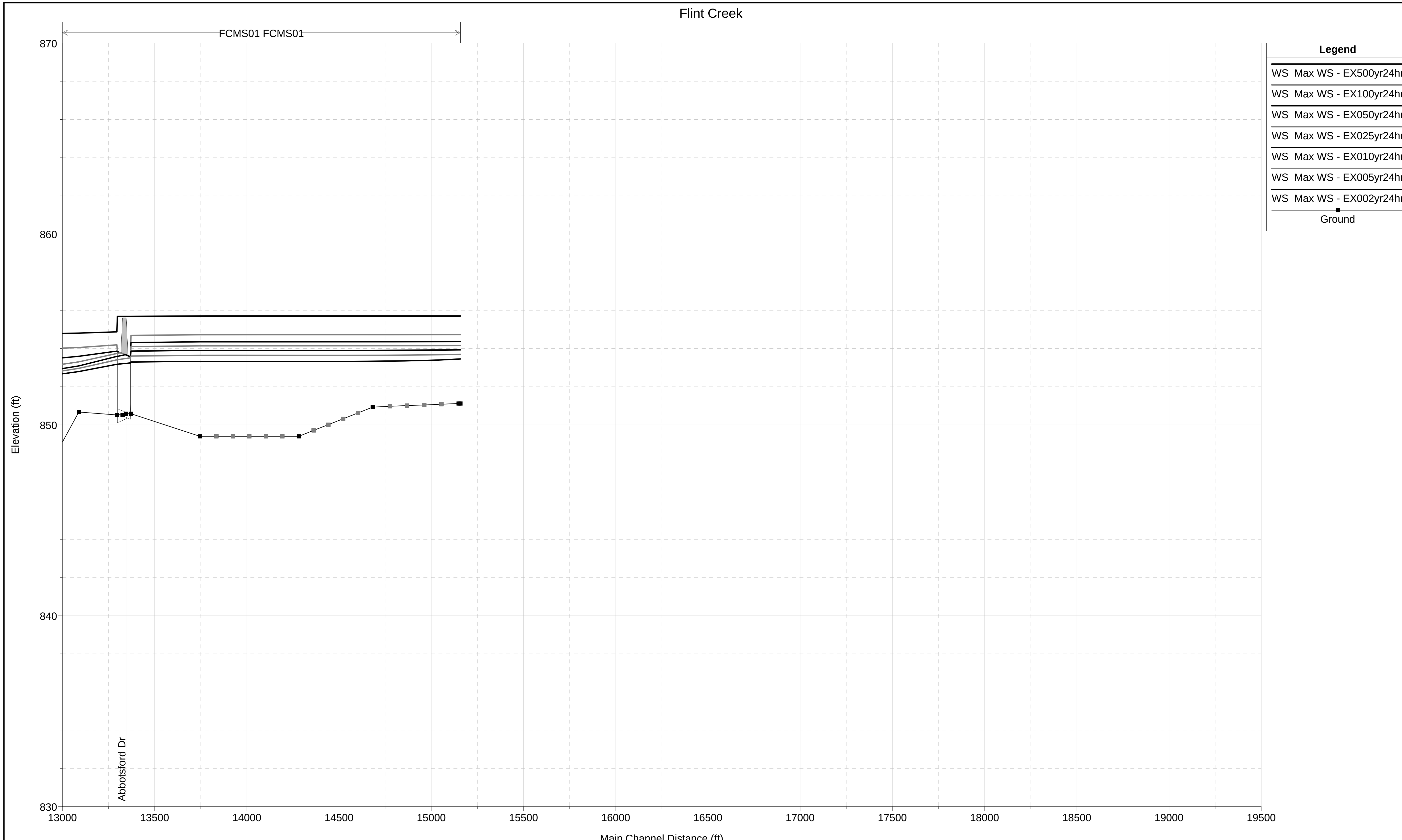
Flint Creek
FCMS02 FCMS02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Lake-Cook Rd
Elevation (ft)
830
820
810
800
790
780
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)


Flint Creek
FCMS02 FCMS02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
850
840
830
820
810
800
Private Rd
EJ & E Railway
Hawthorn Lake
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)

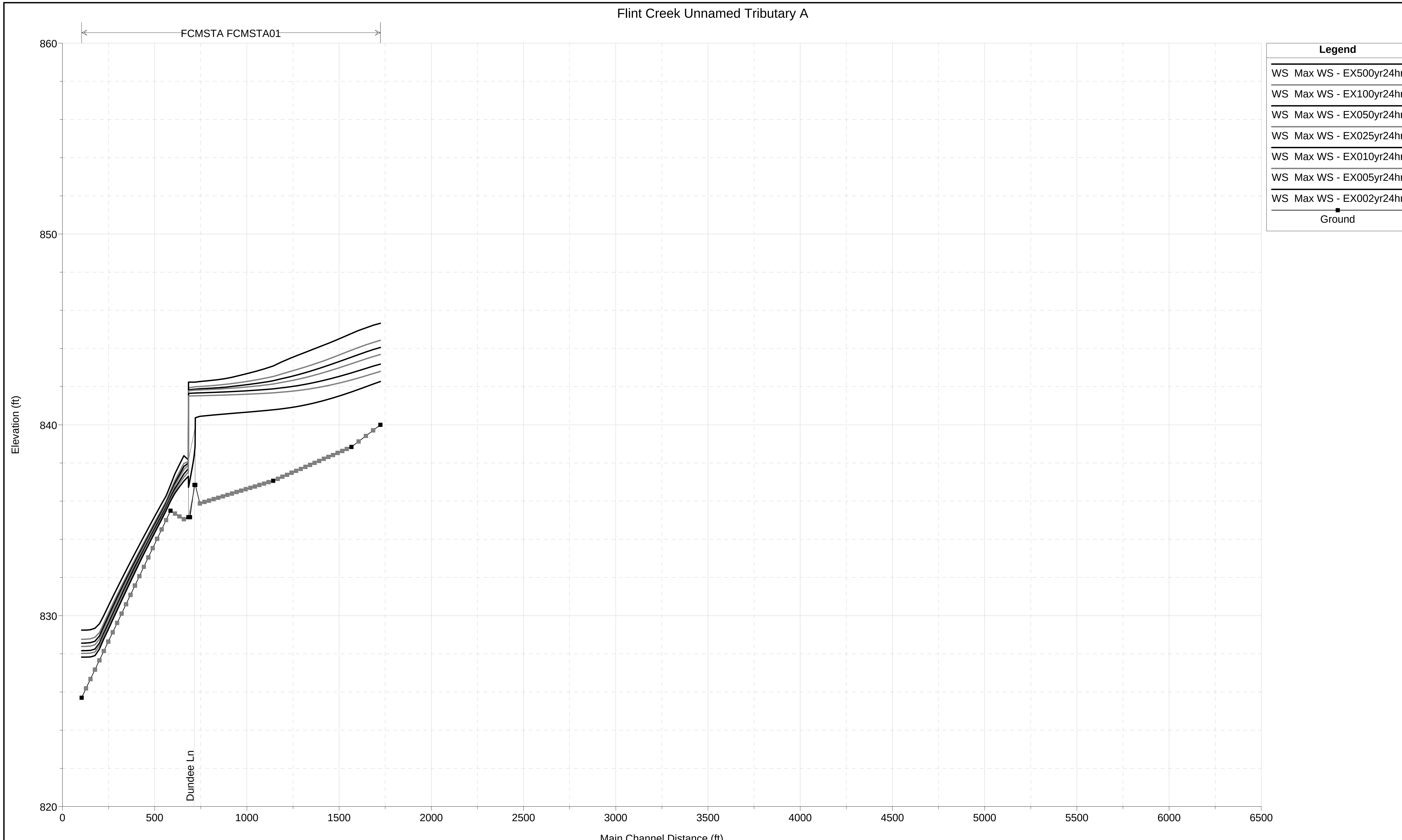


Flint Creek
FCMS01 FCMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
860
850
840
830
820
Hawley Lake
Private Road
IL 68 & IL 59
Inline Structure
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

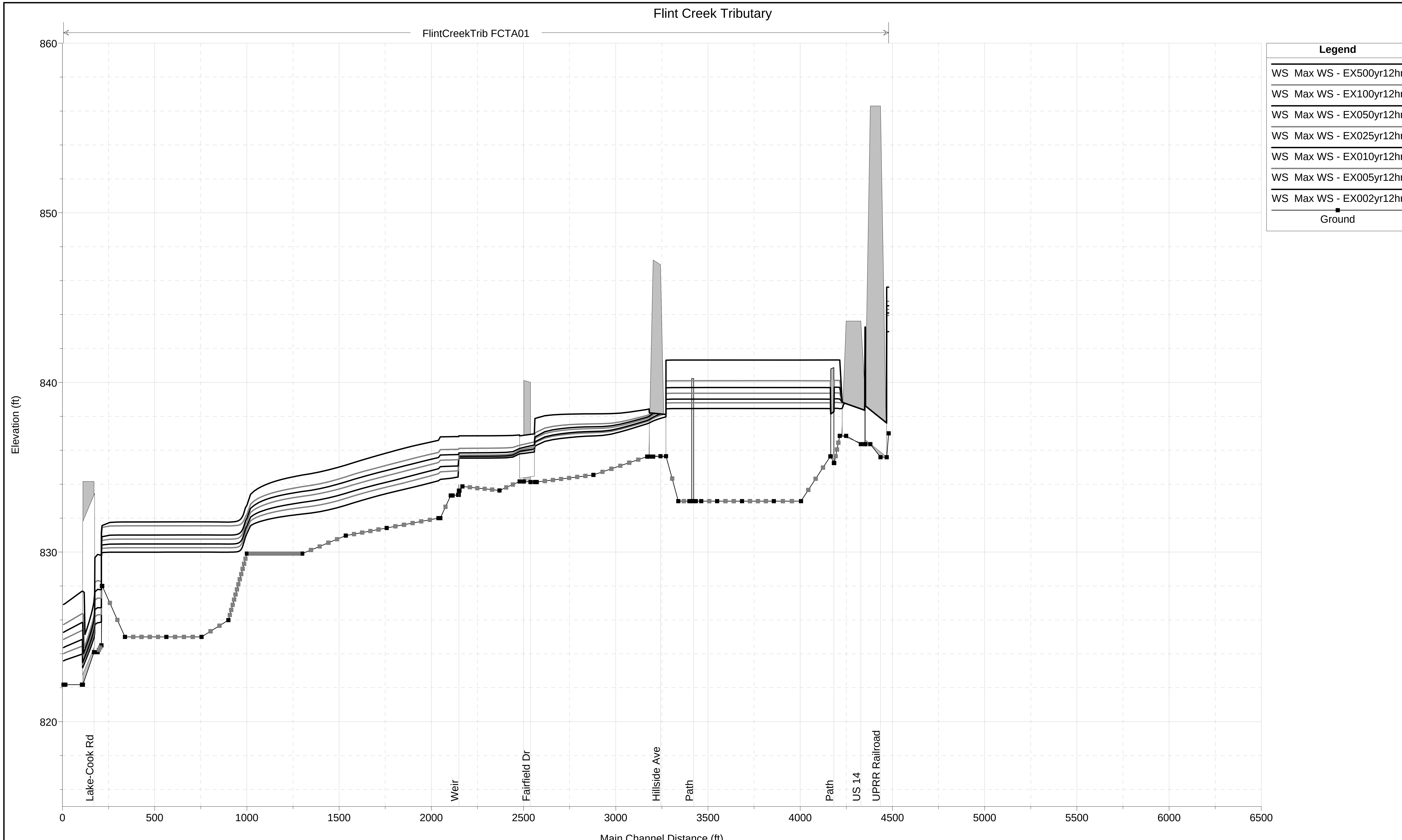

Flint Creek
FCMS01 FCMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
870
860
850
840
830
Barrington Rd
Braymore Dr
Macalpin Dr
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)



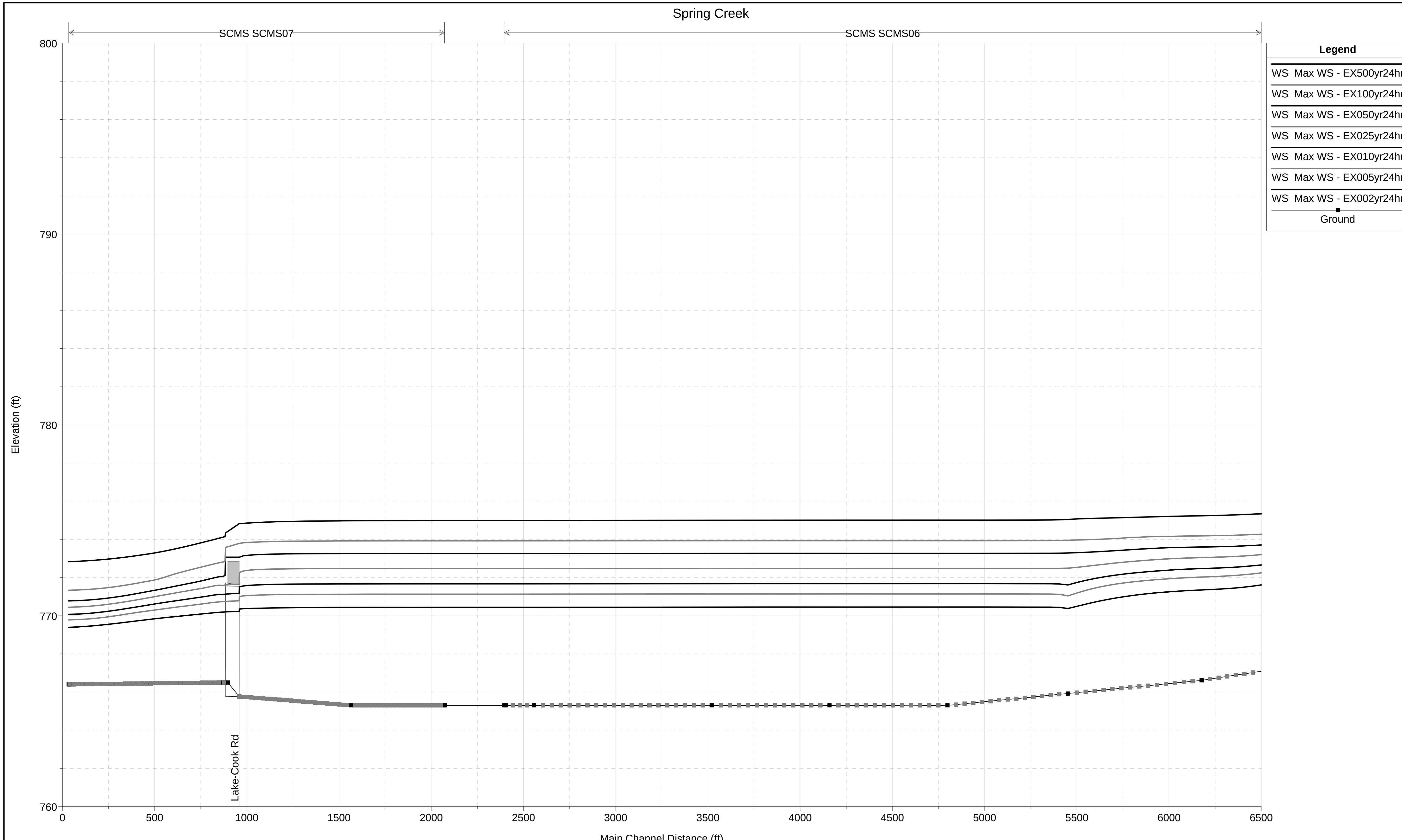
Flint Creek
FCMS01 FCMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
870
860
850
840
830
Abbotsford Dr
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
18500
19000
19500
Main Channel Distance (ft)



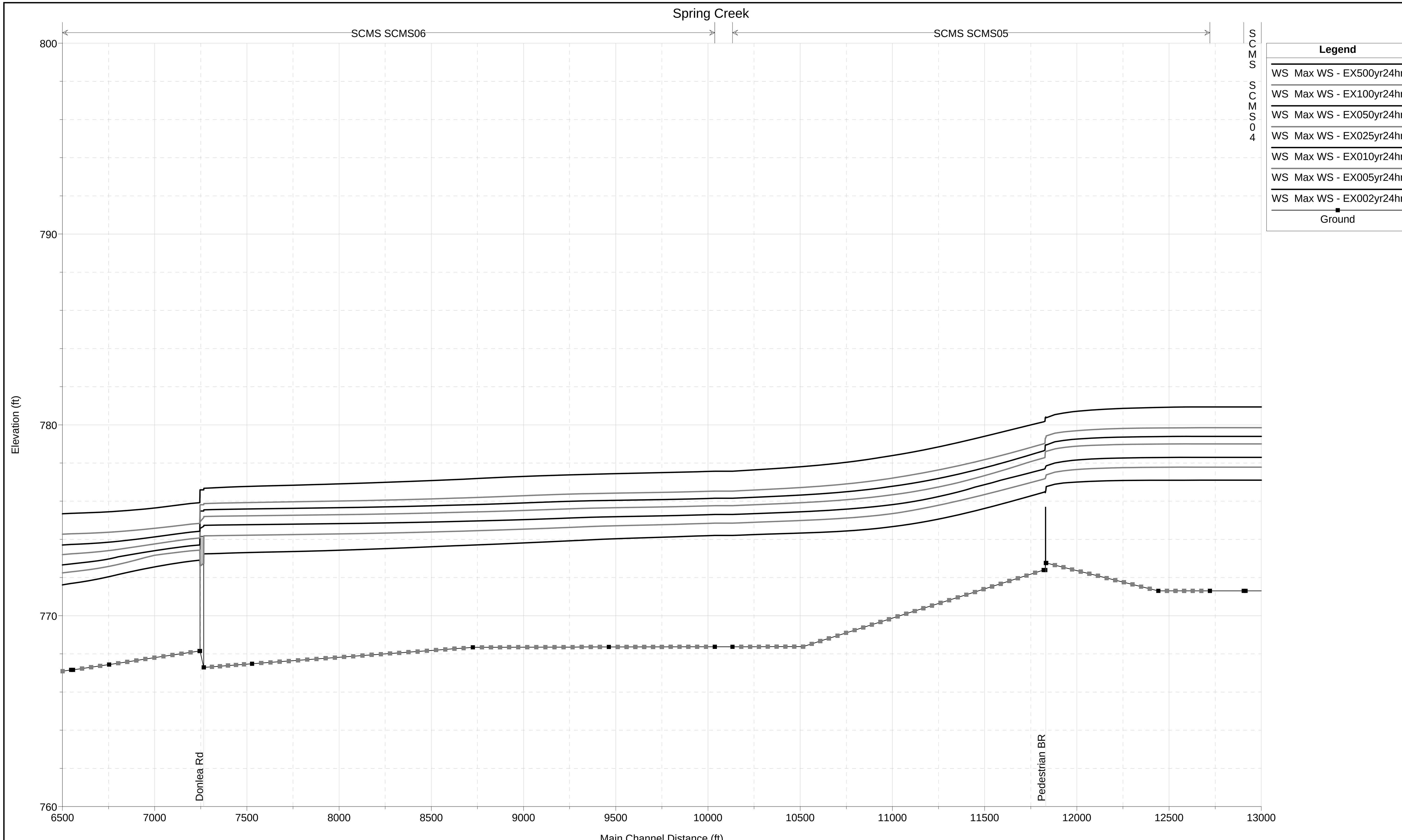
Flint Creek Unnamed Tributary A
FCMSTA FCMSTA01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
860
850
840
830
820
Dundee Ln
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)



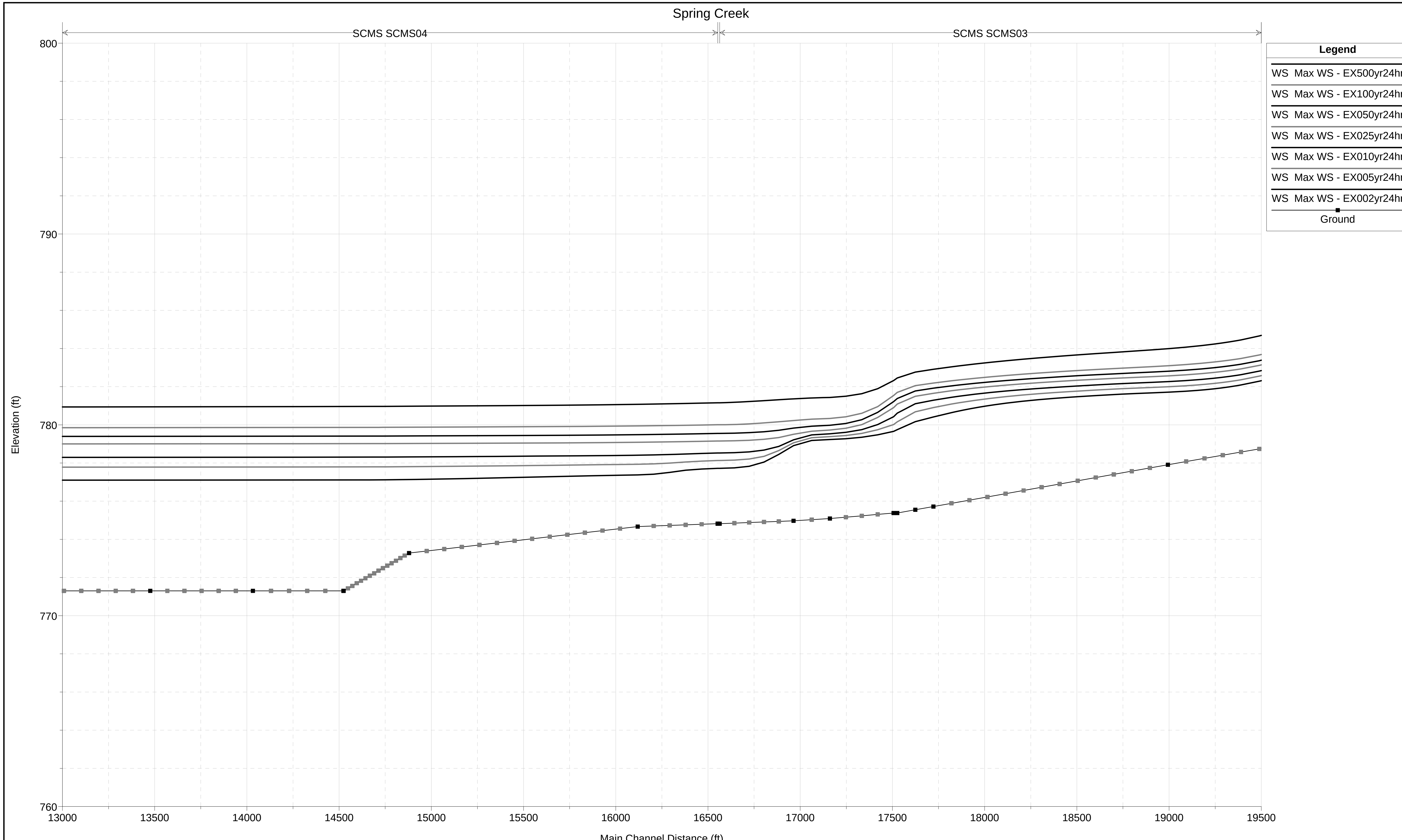
Flint Creek Tributary
FlintCreekTrib FCTA01
Legend
WS Max WS - EX500yr12hr
WS Max WS - EX100yr12hr
WS Max WS - EX050yr12hr
WS Max WS - EX025yr12hr
WS Max WS - EX010yr12hr
WS Max WS - EX005yr12hr
WS Max WS - EX002yr12hr
Ground
Elevation (ft)
860
850
840
830
820
Lake-Cook Rd
Weir
Fairfield Dr
Hillside Ave
Path
Path
US 14
UPRR Railroad
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)



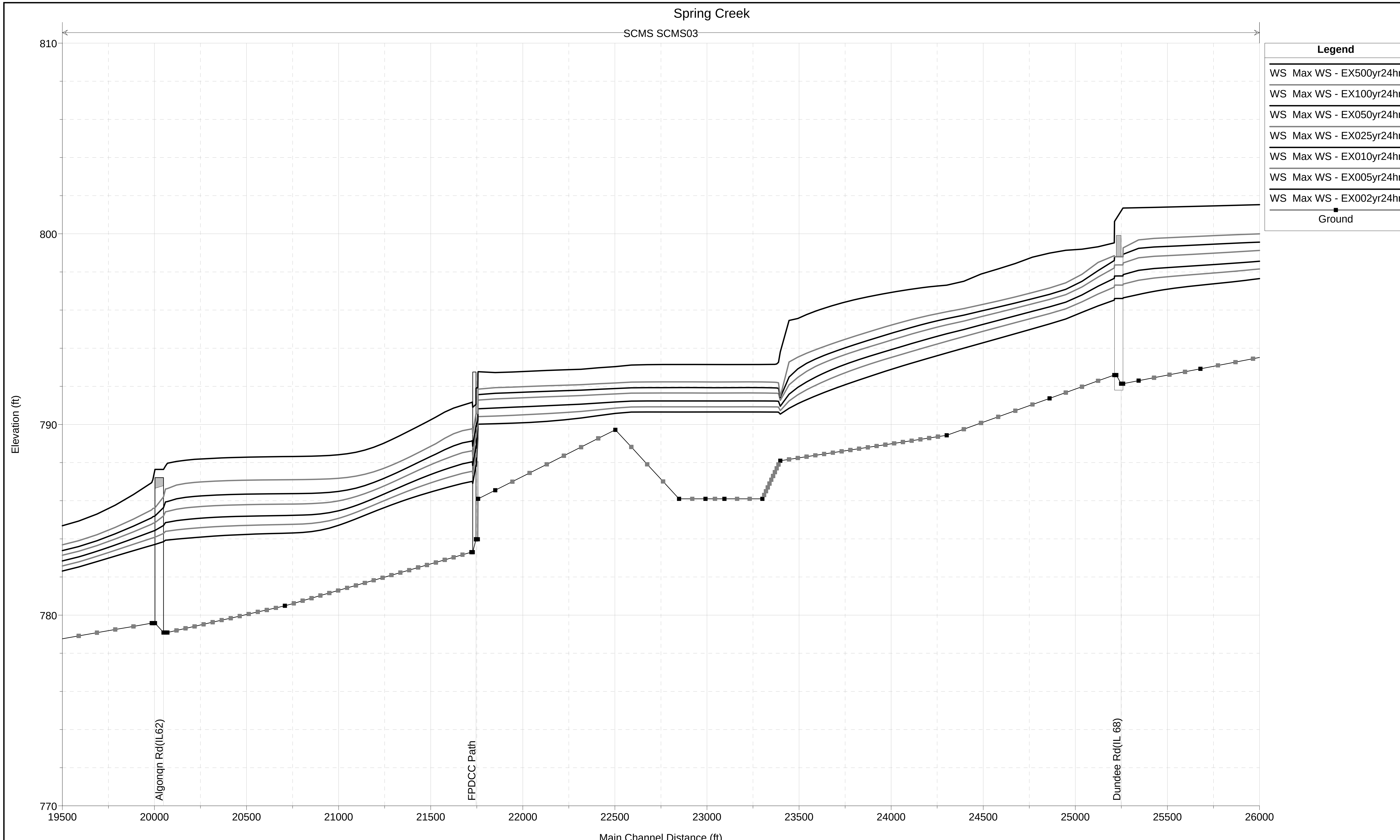
Spring Creek
SCMS SCMS07
SCMS SCMS06
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
Lake-Cook Rd
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

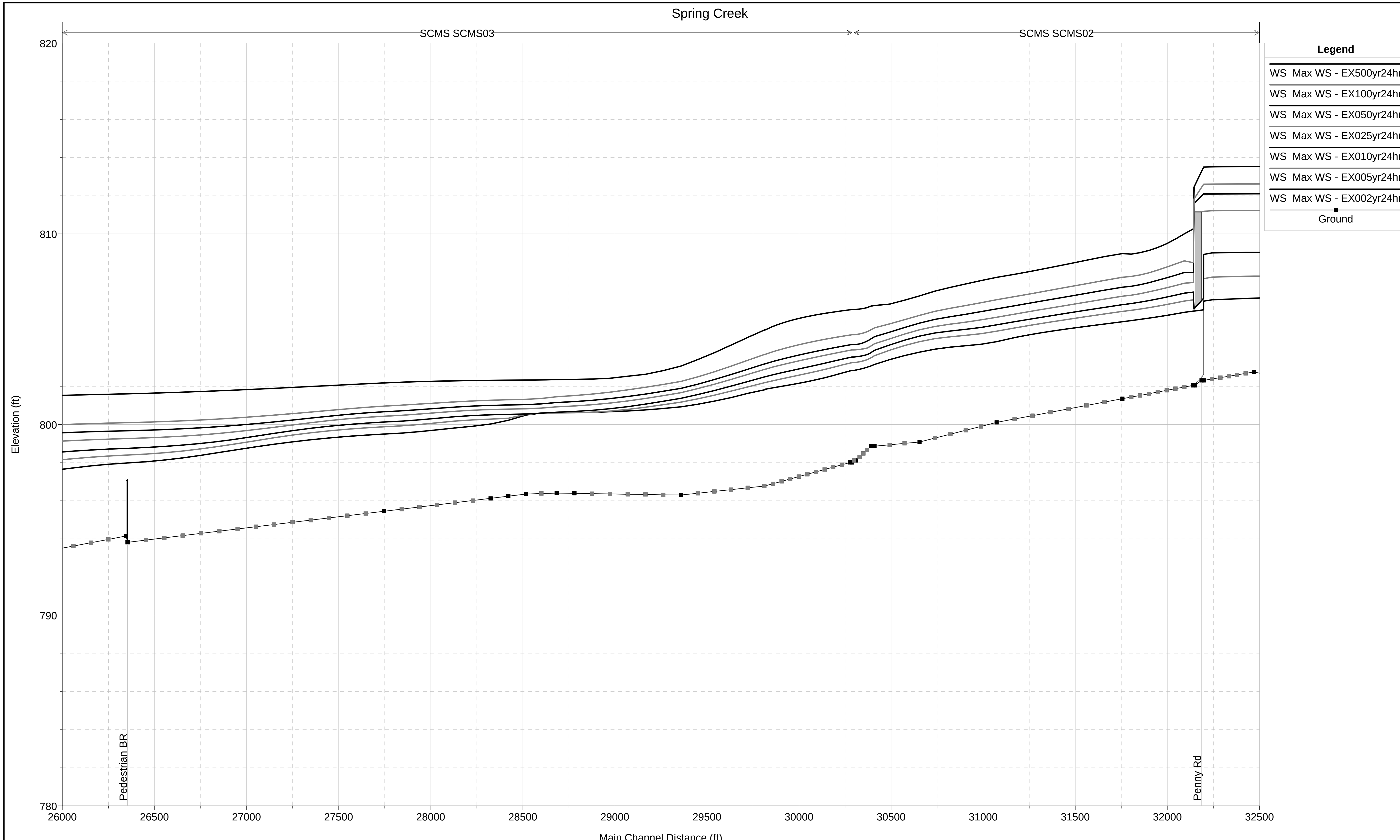


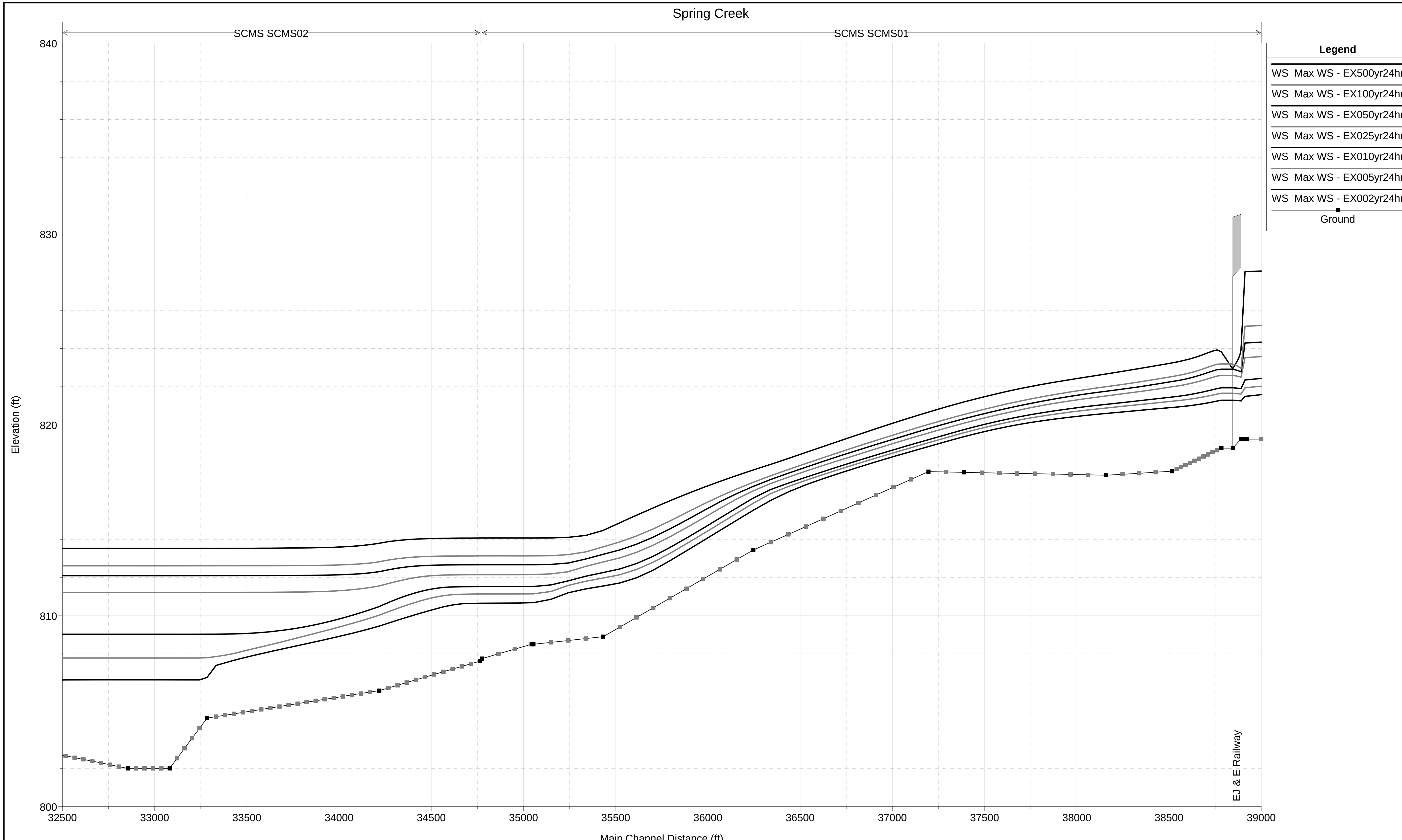
Spring Creek
SCMS SCMS06
SCMS SCMS05
SCMS SCMS04
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
Donlea Rd
Pedestrian BR
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)



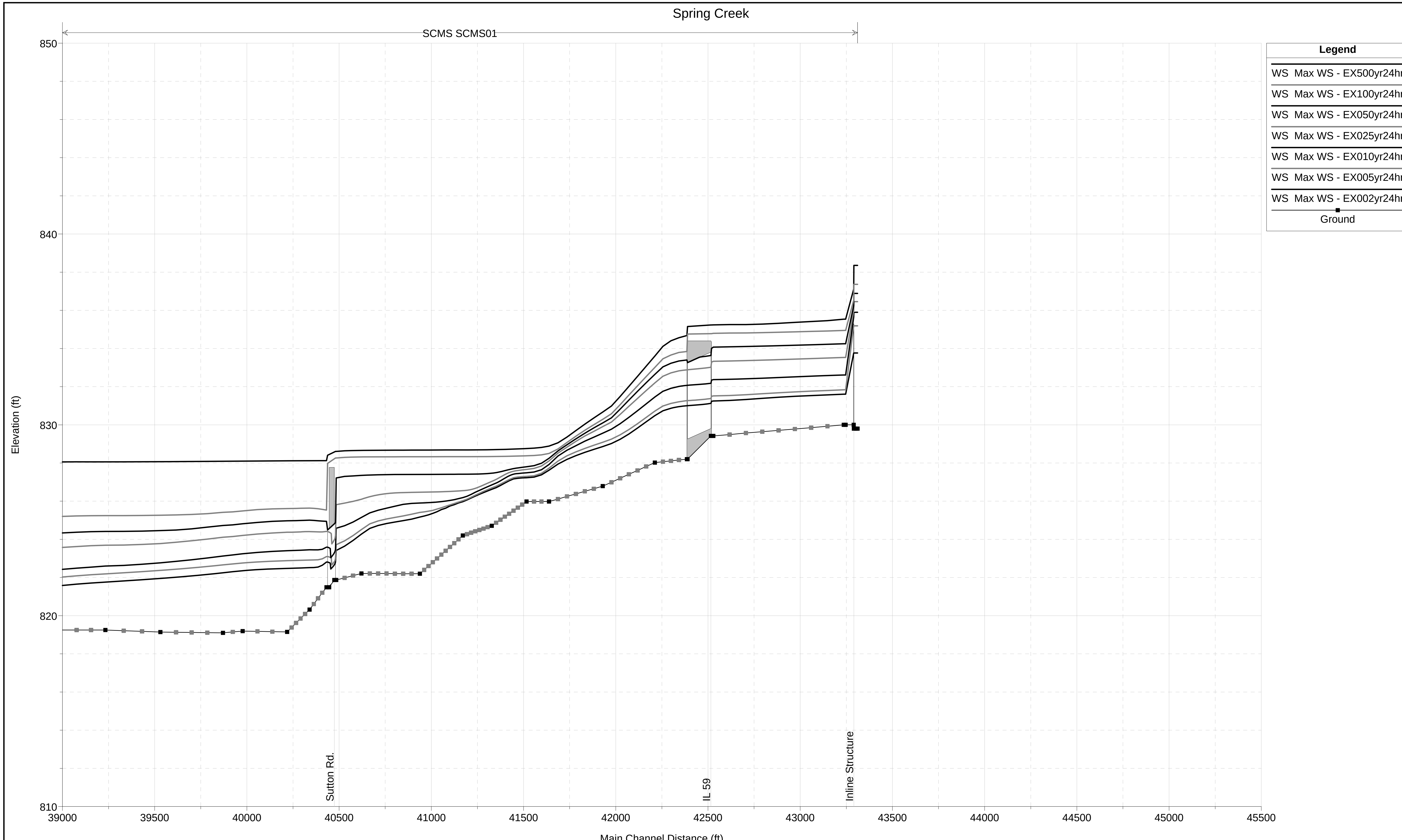
Spring Creek
SCMS SCMS04
SCMS SCMS03
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
18500
19000
19500
Main Channel Distance (ft)

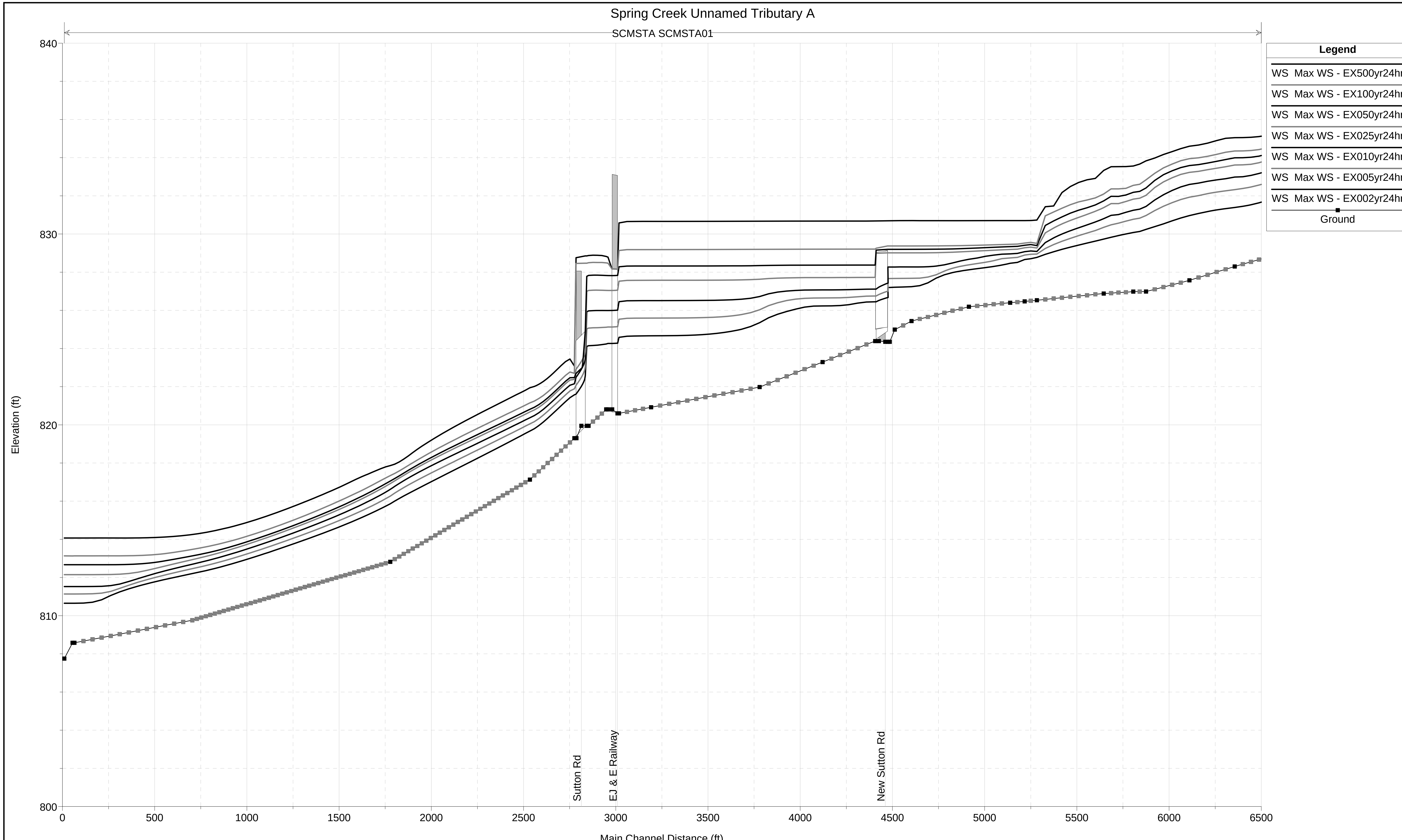

Spring Creek
SCMS SCMS03
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Algonqn Rd(IL62)
FPDCC Path
Dundee Rd(IL 68)
19500
20000
20500
21000
21500
22000
22500
23000
23500
24000
24500
25000
25500
26000
Main Channel Distance (ft)


Spring Creek
SCMS SCMS03
SCMS SCMS02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
820
810
800
790
780
Pedestrian BR
Penny Rd
26000
26500
27000
27500
28000
28500
29000
29500
30000
30500
31000
31500
32000
32500
Main Channel Distance (ft)

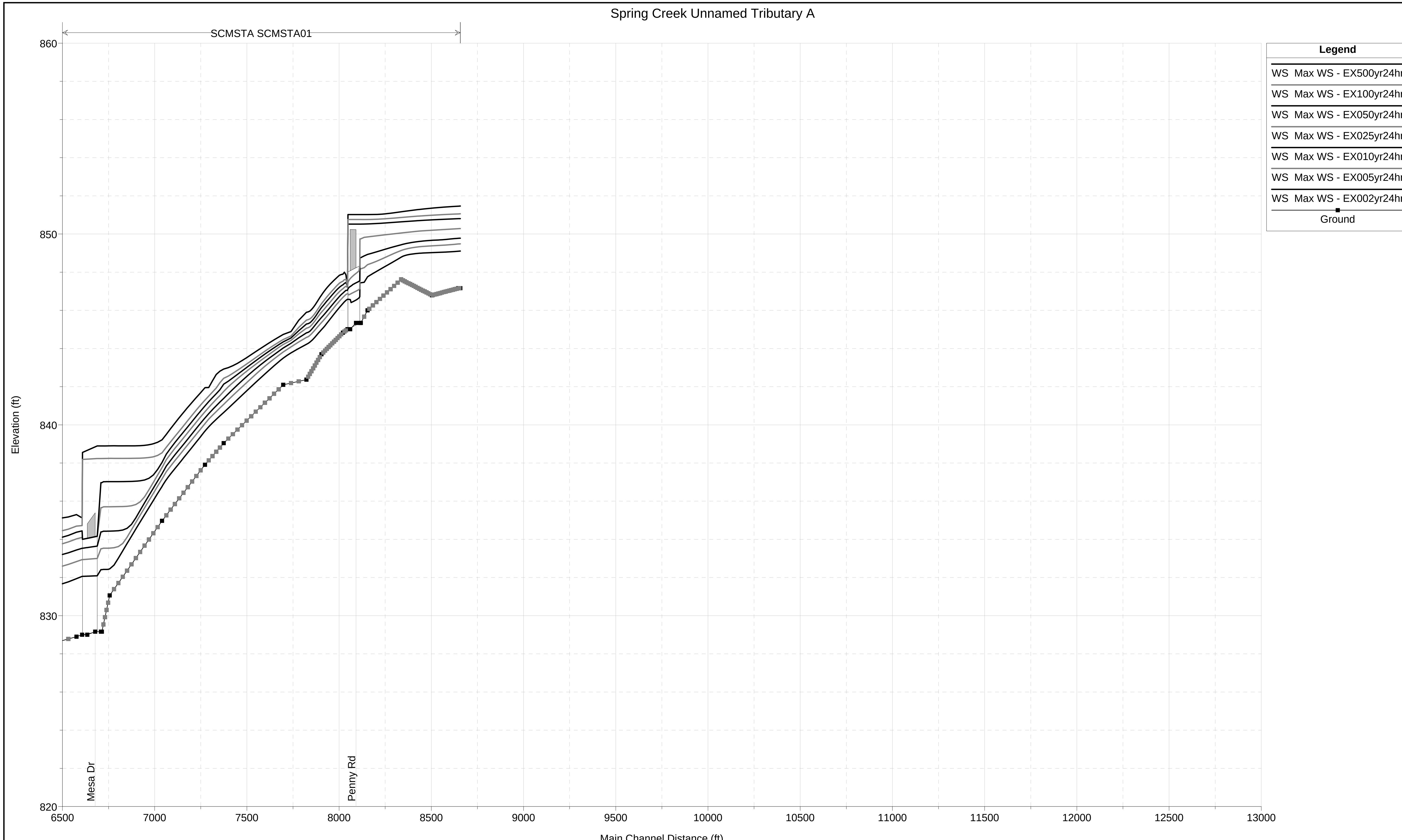


Spring Creek
SCMS SCMS02
SCMS SCMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
840
830
820
810
800
32500
33000
33500
34000
34500
35000
35500
36000
36500
37000
37500
38000
38500
39000
Main Channel Distance (ft)
EJ & E Railway

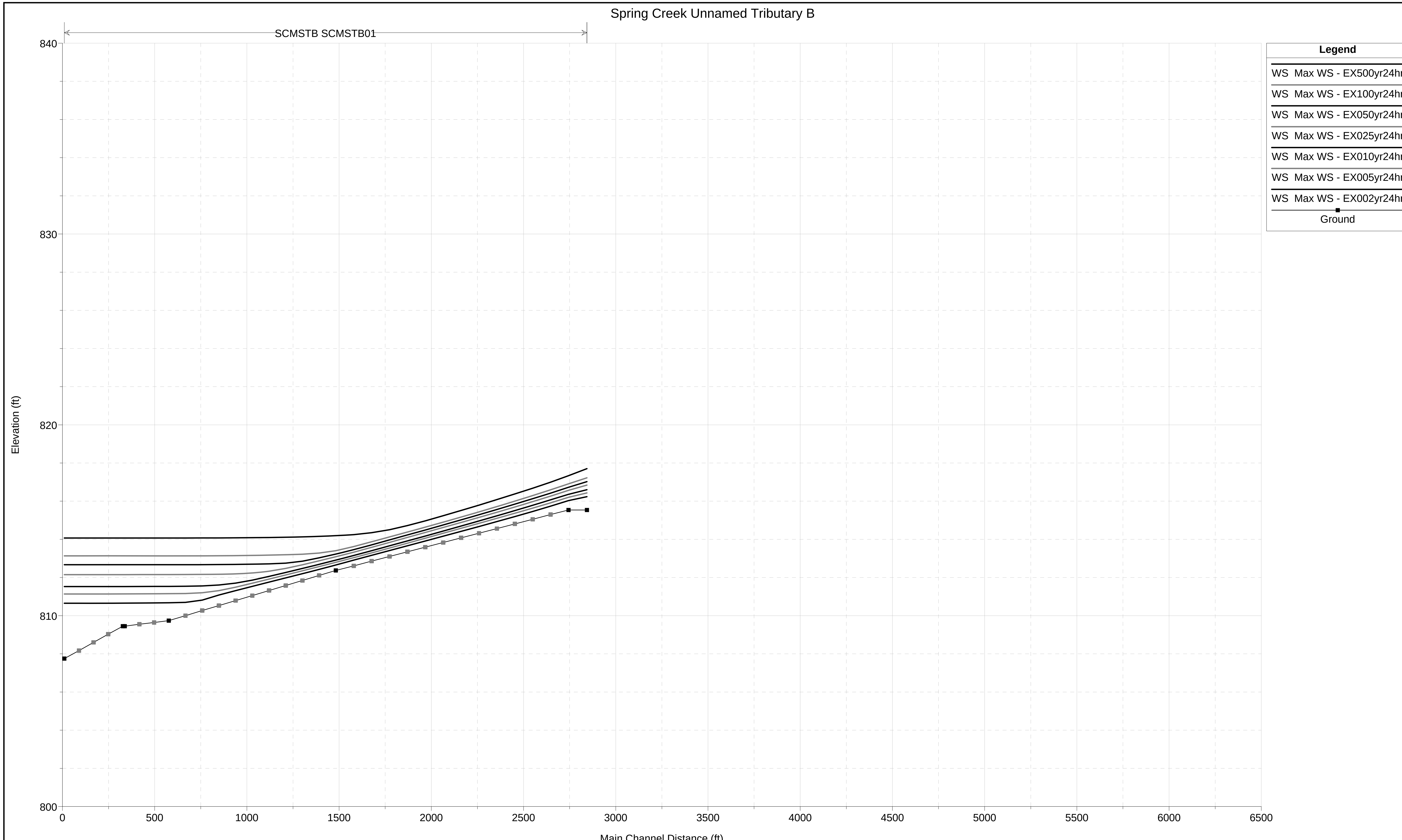

Spring Creek
SCMS SCMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
850
840
830
820
810
Sutton Rd.
IL 59
Inline Structure
39000
39500
40000
40500
41000
41500
42000
42500
43000
43500
44000
44500
45000
45500
Main Channel Distance (ft)

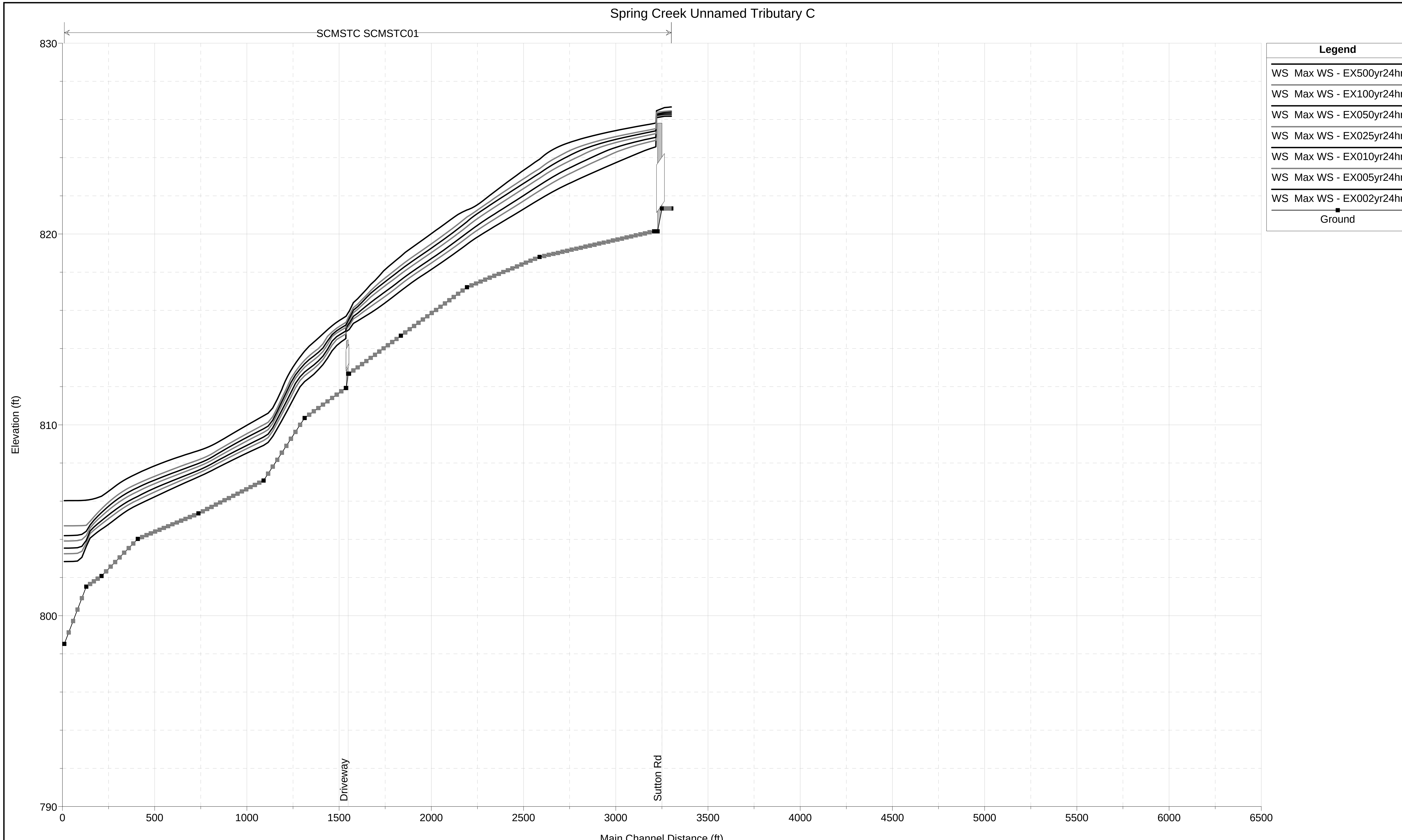


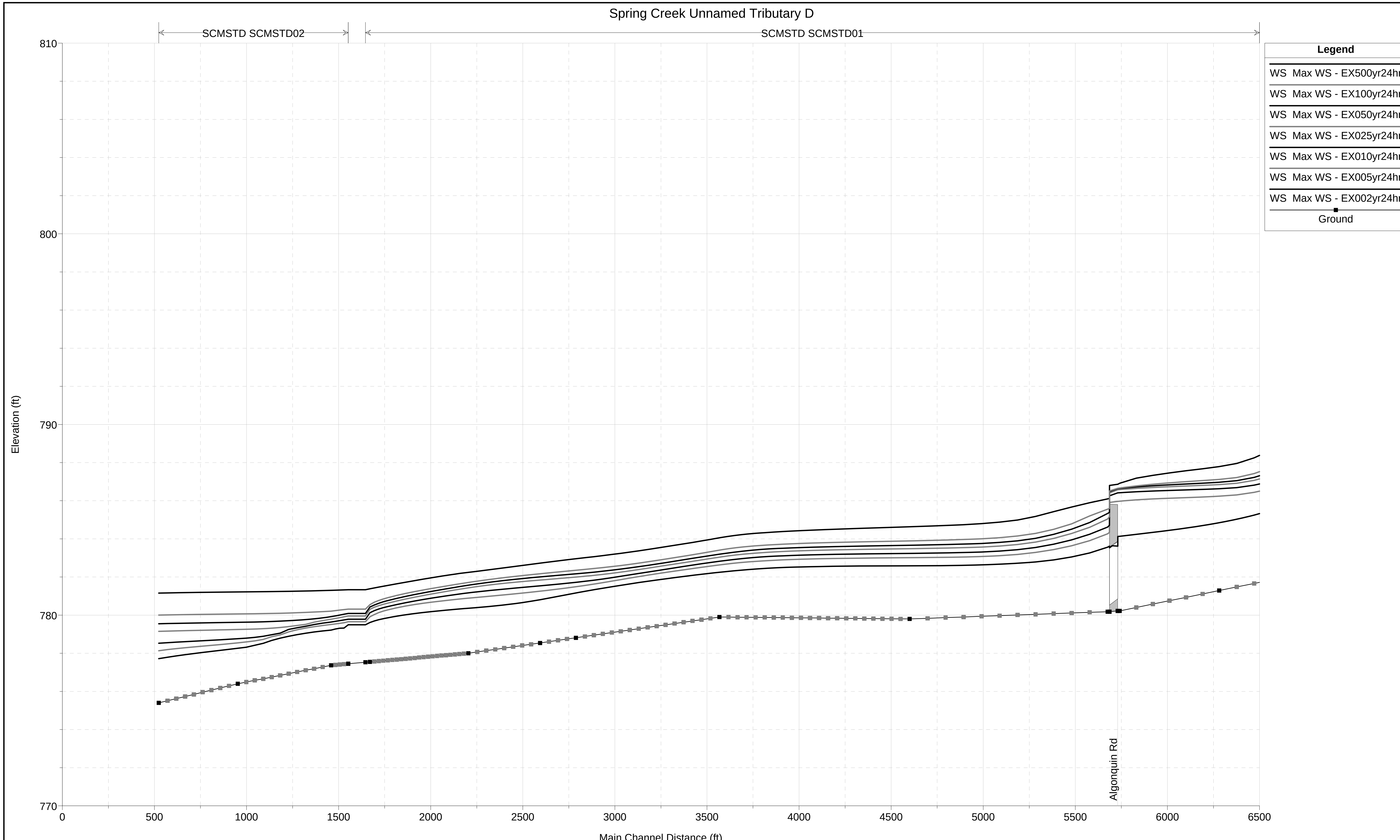
Spring Creek Unnamed Tributary A
SCMSTA SCMSTA01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
840
830
820
810
800
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)
Sutton Rd
EJ & E Railway
New Sutton Rd



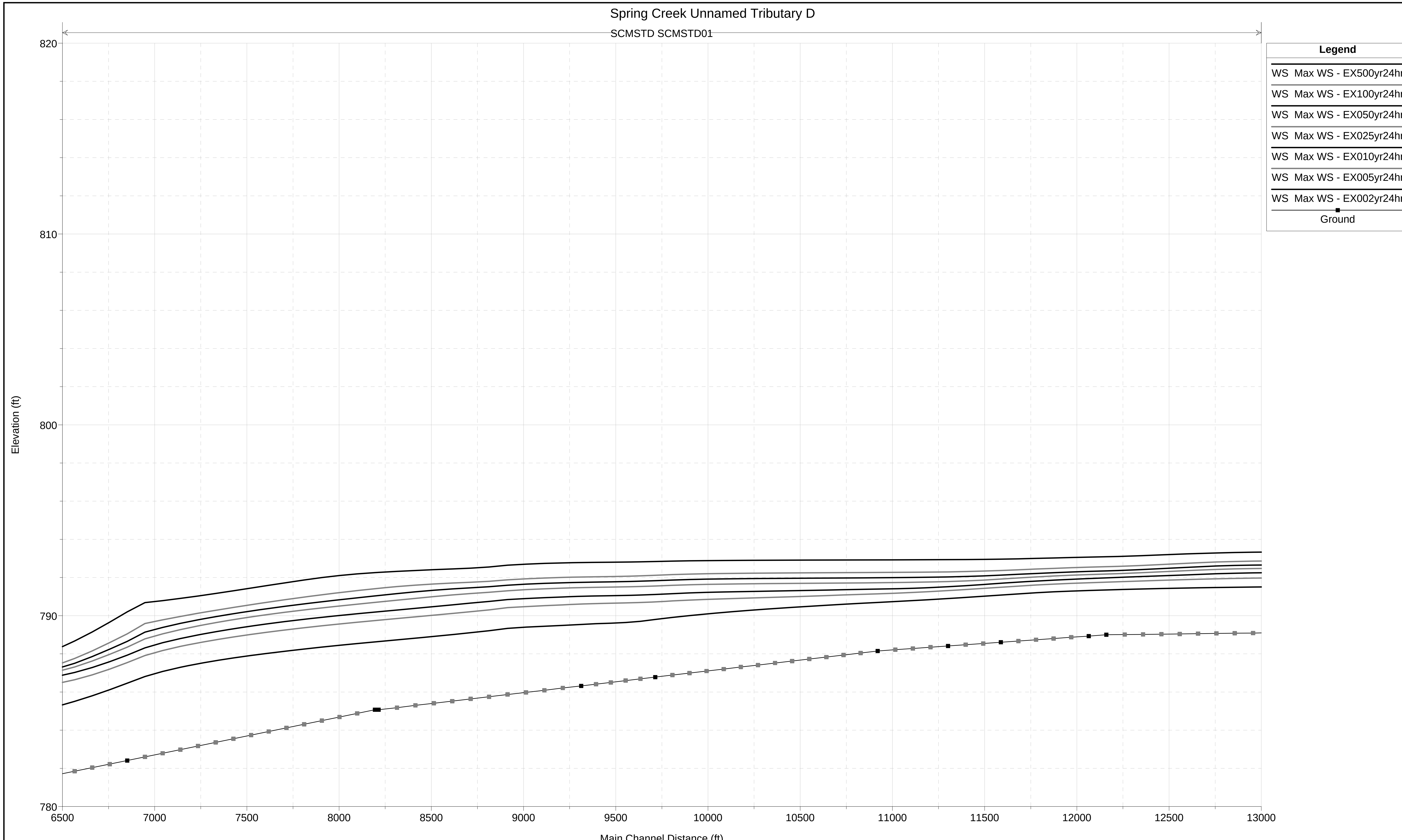
Spring Creek Unnamed Tributary A
SCMSTA SCMSTA01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
860
850
840
830
820
Mesa Dr
Penny Rd
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)


Spring Creek Unnamed Tributary B
SCMSTB SCMSTB01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
840
830
820
810
800
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

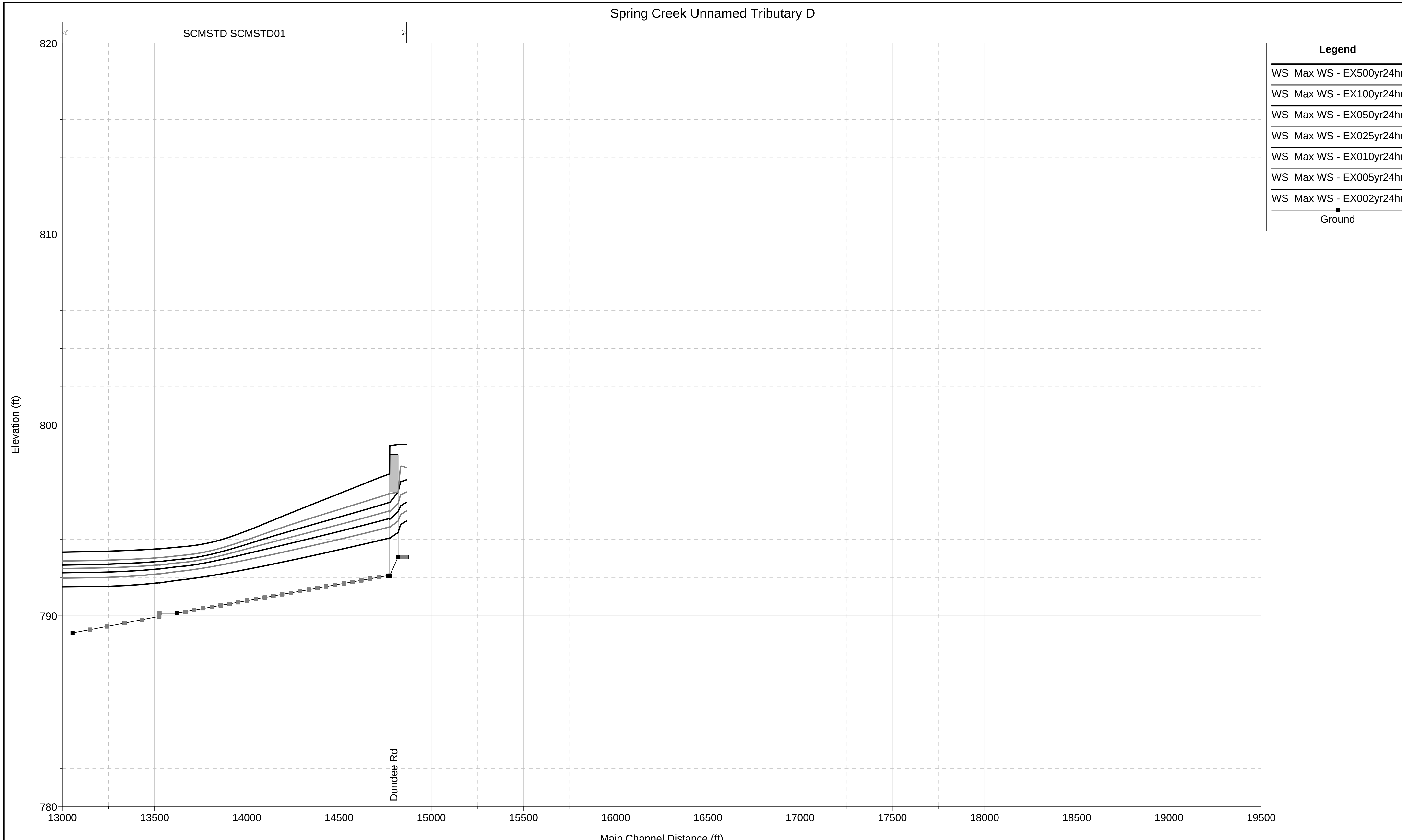

Spring Creek Unnamed Tributary C
SCMSTC SCMSTC01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
830
820
810
800
790
Driveway
Sutton Rd
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)



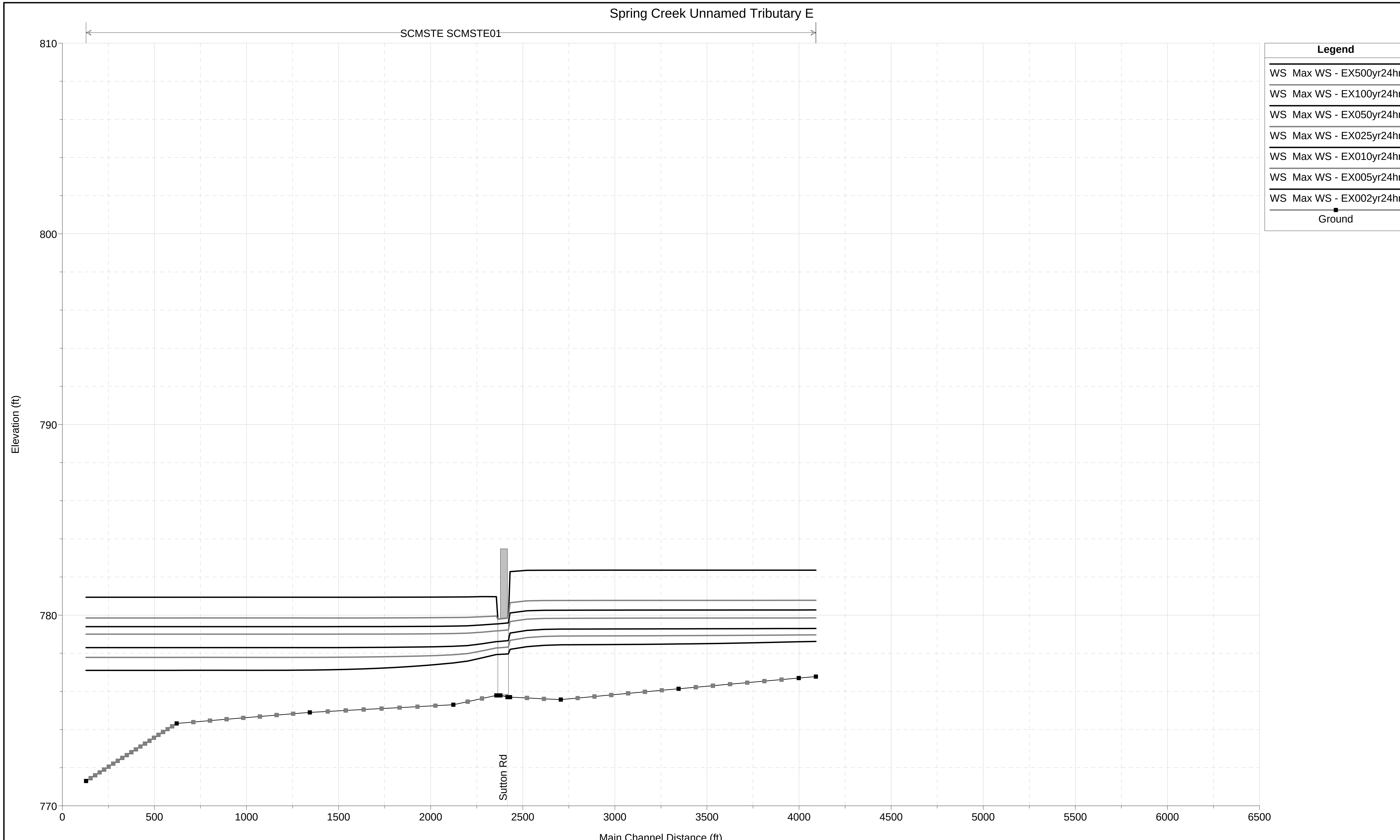
Spring Creek Unnamed Tributary D
SCMSTD SCMSTD02
SCMSTD SCMSTD01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Algonquin Rd
Elevation (ft)
810
800
790
780
770
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

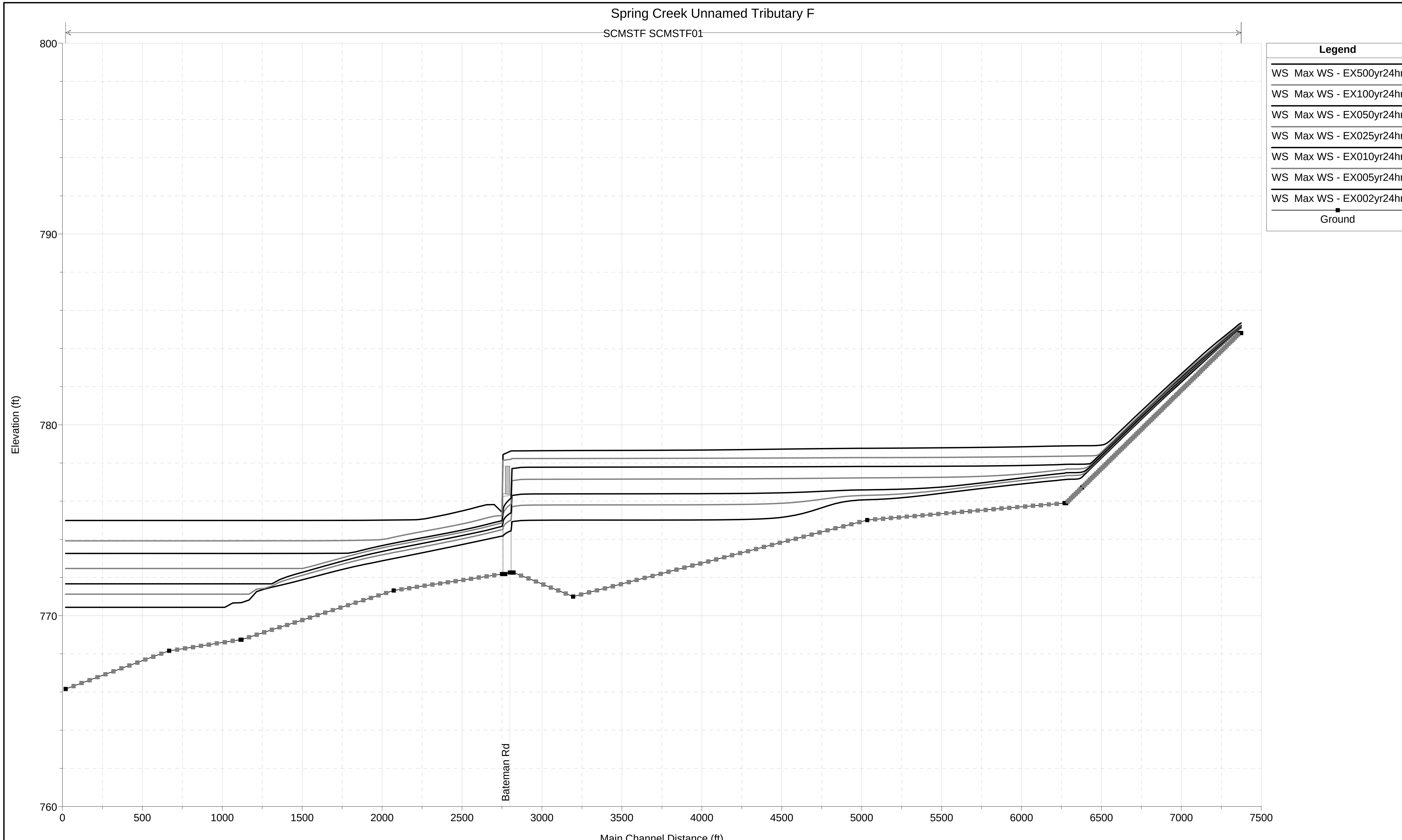


Spring Creek Unnamed Tributary D
SCMSTD SCMSTD01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
820
810
800
790
780
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)

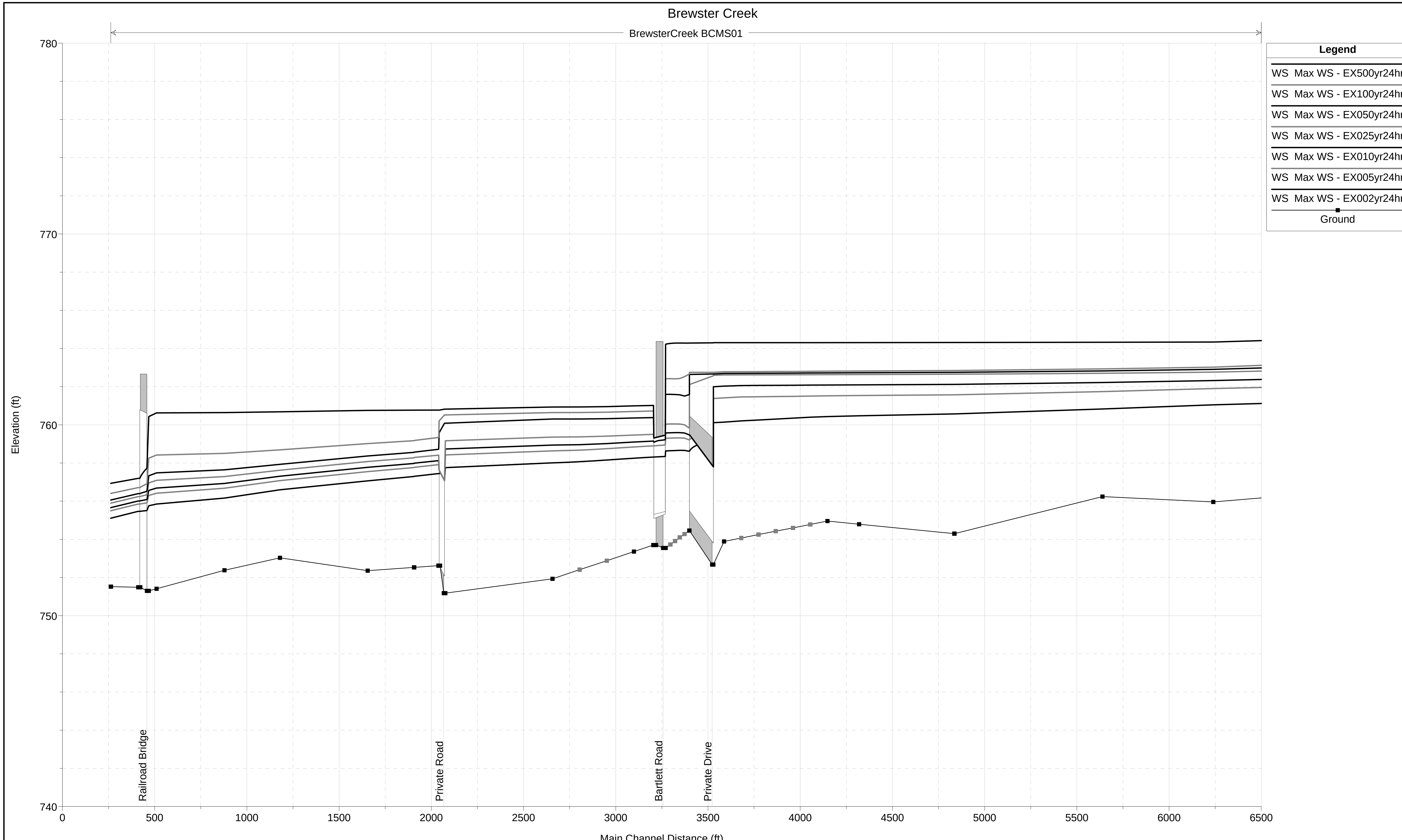


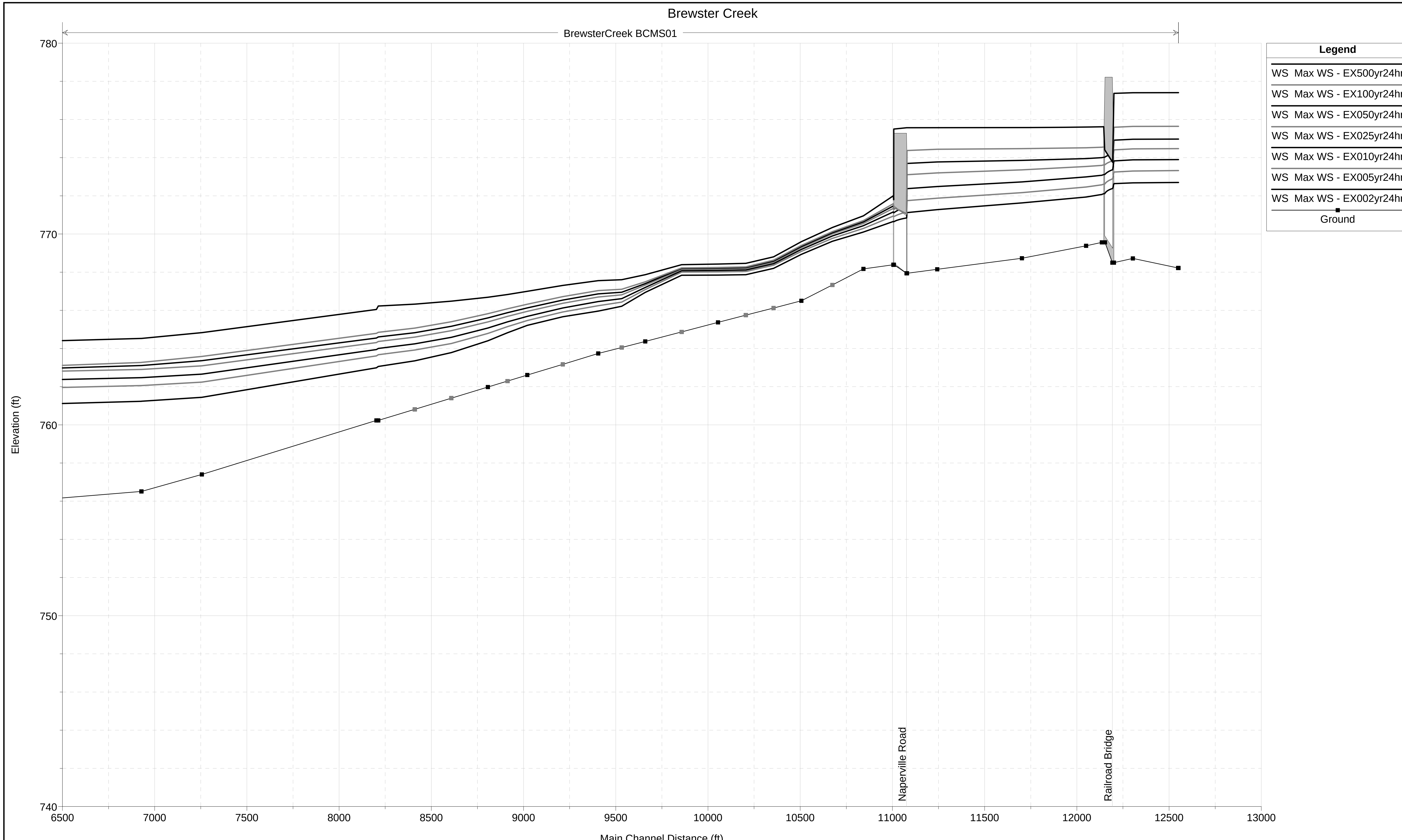
Spring Creek Unnamed Tributary D
SCMSTD SCMSTD01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Dundee Rd
Elevation (ft)
820
810
800
790
780
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
18500
19000
19500
Main Channel Distance (ft)

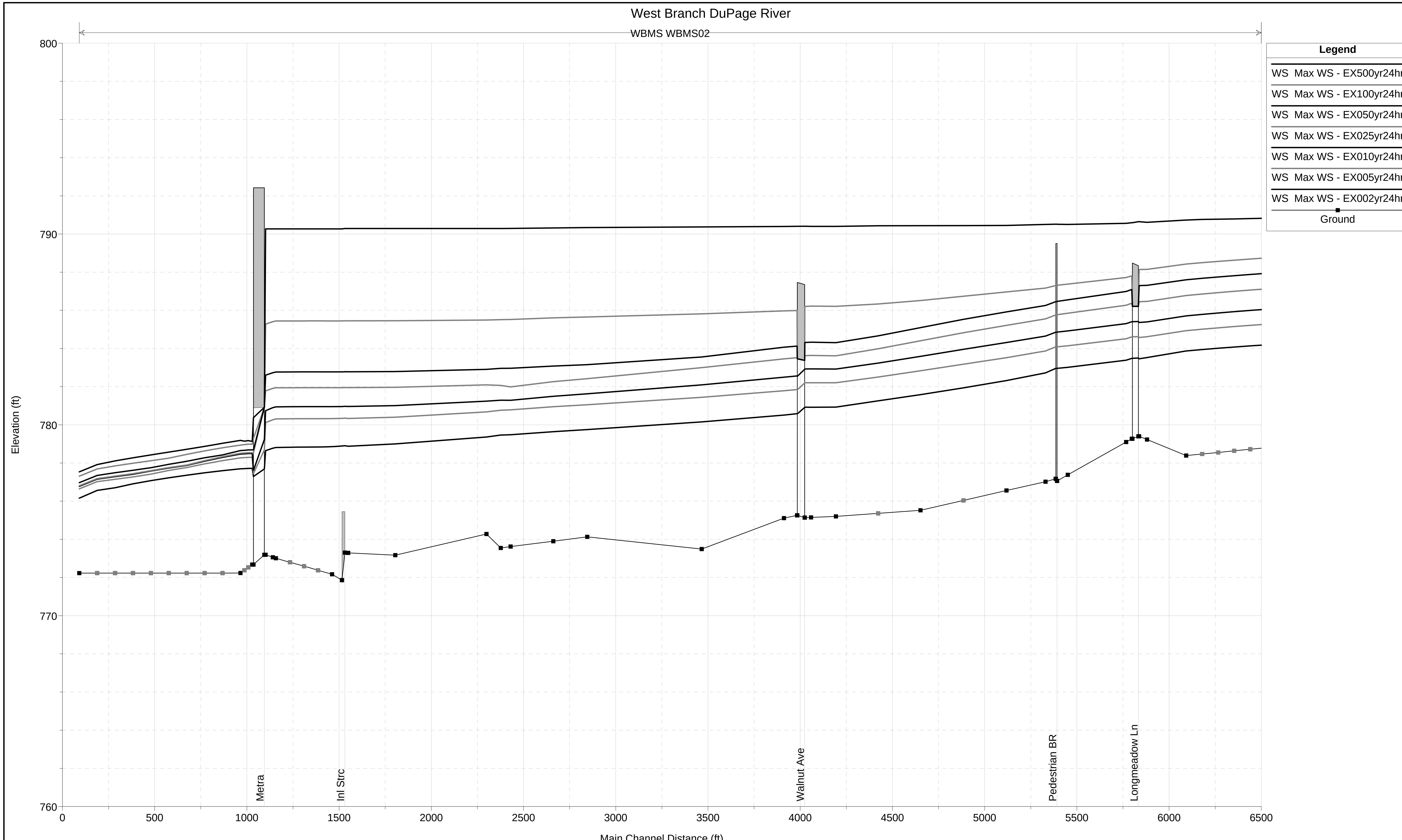

Spring Creek Unnamed Tributary E
SCMSTE SCMSTE01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Sutton Rd
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)



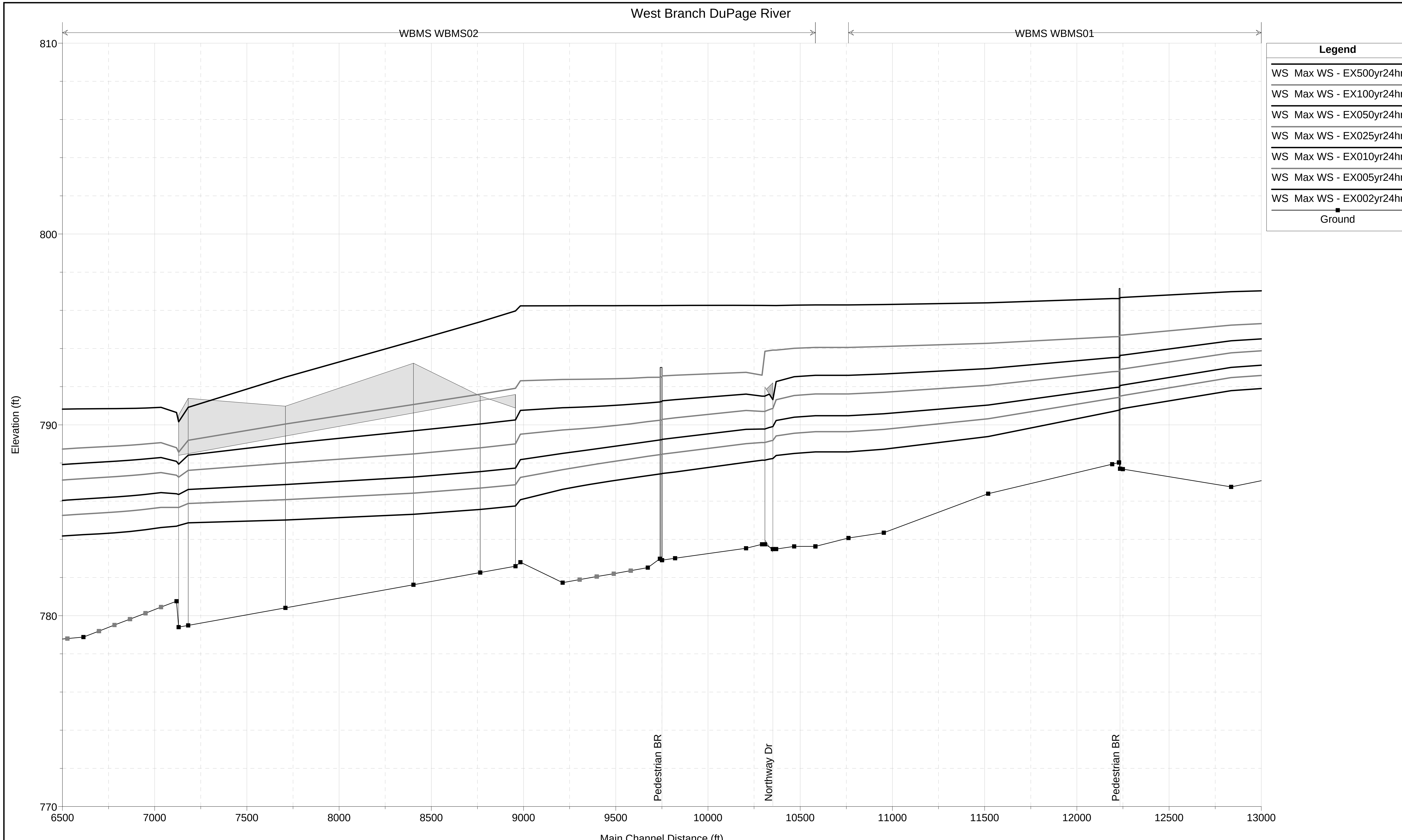
Spring Creek Unnamed Tributary F
SCMSTF SCMSTF01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
Main Channel Distance (ft)
Bateman Rd


Brewster Creek
BrewsterCreek BCMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
780
770
760
750
740
Railroad Bridge
Private Road
Bartlett Road
Private Drive
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

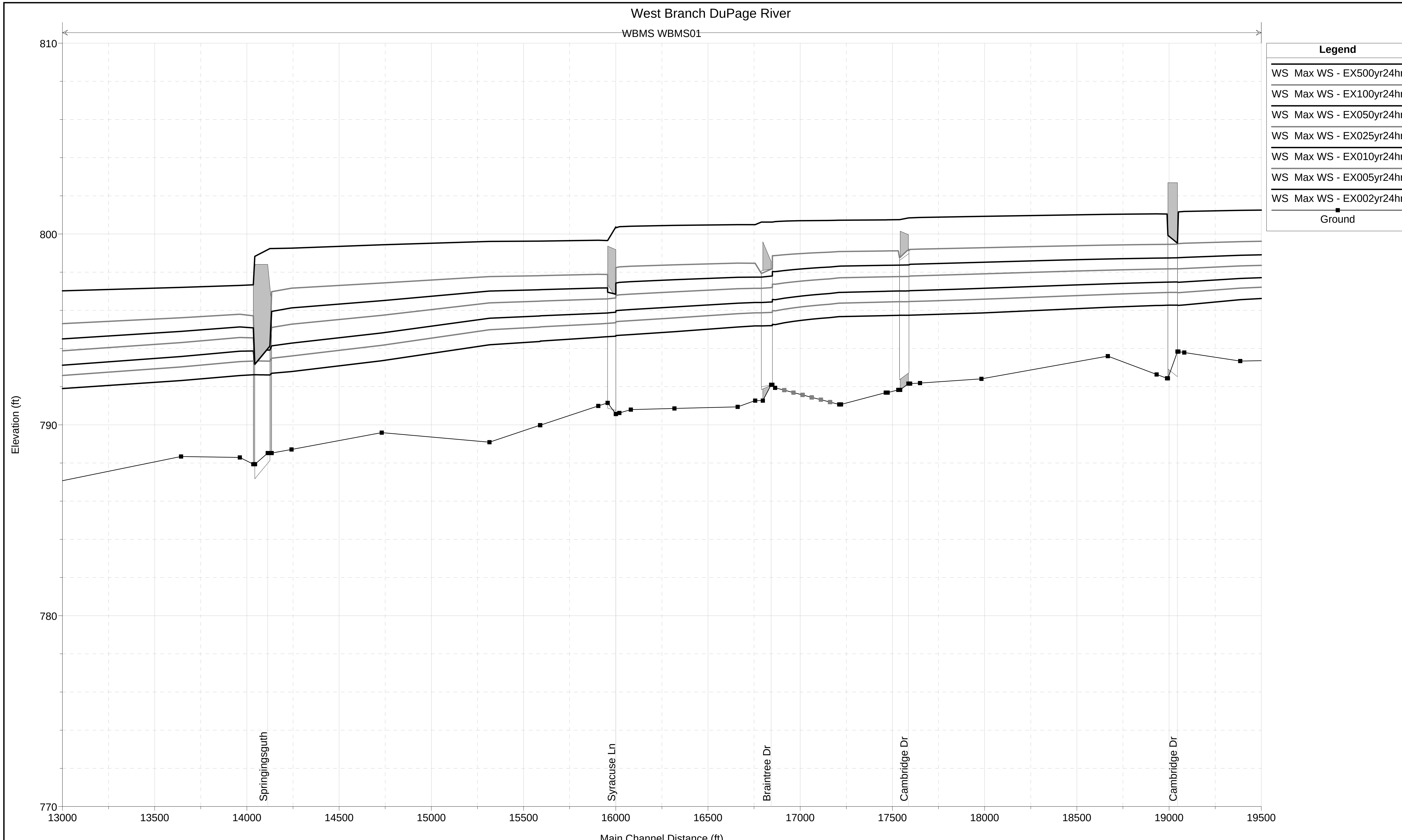

Brewster Creek
BrewsterCreek BCMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Naperville Road
Railroad Bridge
Elevation (ft)
780
770
760
750
740
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)



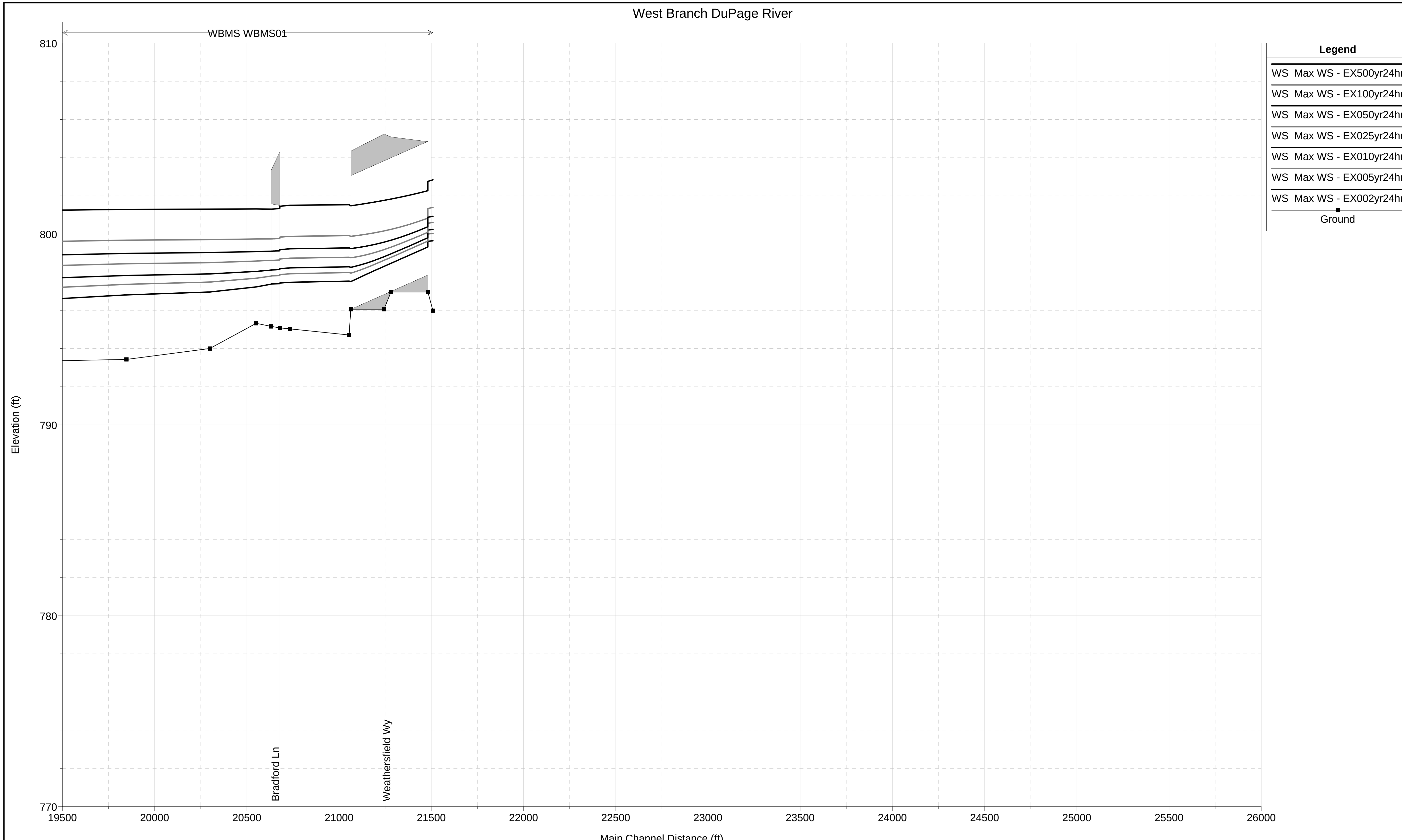
West Branch DuPage River
WBMS WBMS02
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
800
790
780
770
760
Metra
Inl Strc
Walnut Ave
Pedestrian BR
Longmeadow Ln
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)



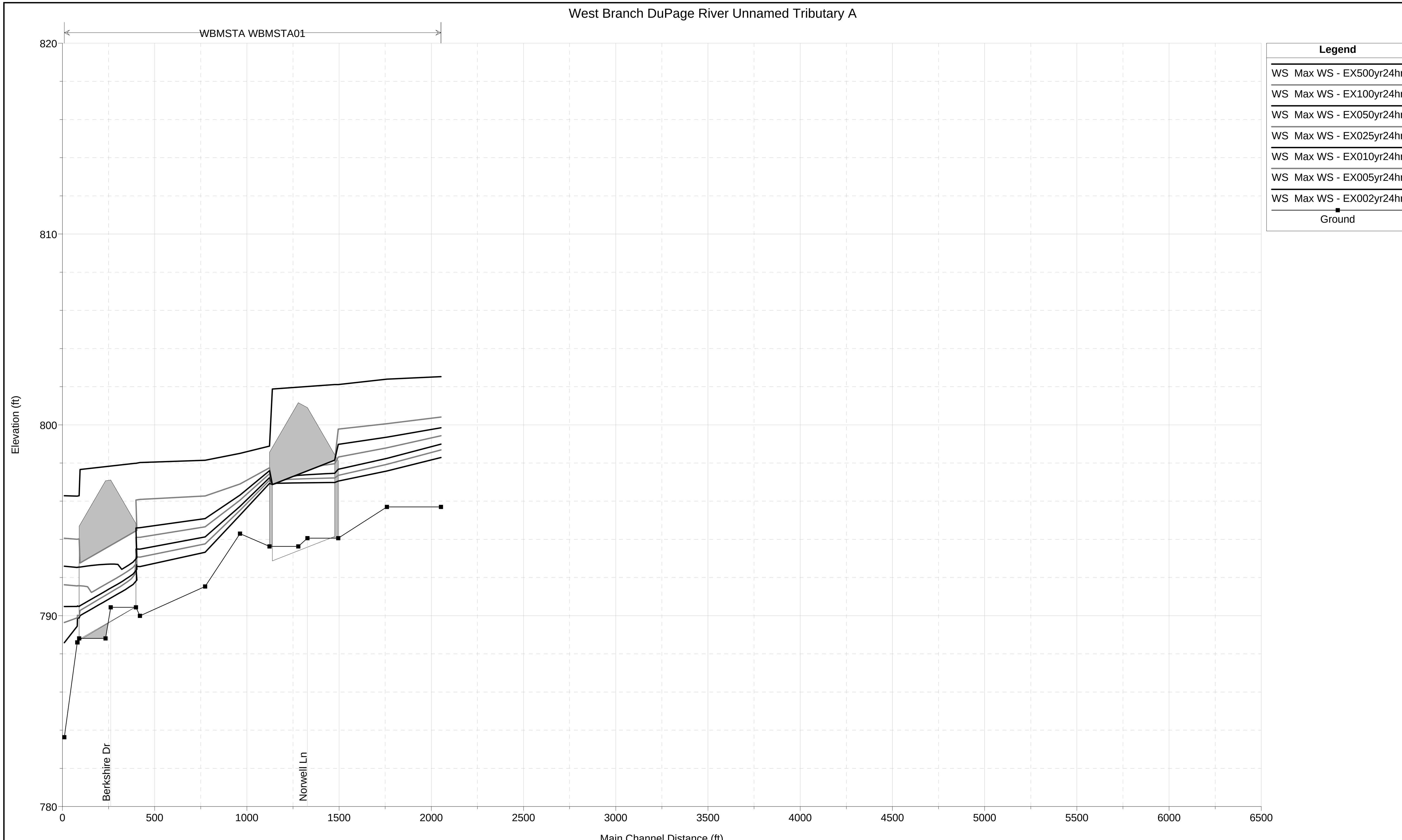
West Branch DuPage River
WBMS WBMS02
WBMS WBMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Pedestrian BR
Northway Dr
Pedestrian BR
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
13000
Main Channel Distance (ft)



West Branch DuPage River
WBMS WBMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Springingsguth
Syracuse Ln
Braintree Dr
Cambridge Dr
Cambridge Dr
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
18500
19000
19500
Main Channel Distance (ft)



West Branch DuPage River
WBMS WBMS01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
810
800
790
780
770
Bradford Ln
Weathersfield Wy
19500
20000
20500
21000
21500
22000
22500
23000
23500
24000
24500
25000
25500
26000
Main Channel Distance (ft)


West Branch DuPage River Unnamed Tributary A
WBMSTA WBMSTA01
Legend
WS Max WS - EX500yr24hr
WS Max WS - EX100yr24hr
WS Max WS - EX050yr24hr
WS Max WS - EX025yr24hr
WS Max WS - EX010yr24hr
WS Max WS - EX005yr24hr
WS Max WS - EX002yr24hr
Ground
Elevation (ft)
820
810
800
790
780
Berkshire Dr
Norwell Ln
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
Main Channel Distance (ft)

Appendix I
Project Cost Estimates

Metropolitan Water Reclamation District of Greater Chicago
Poplar Creek Watershed Detailed Watershed Plan

Alternative Name PCMS-2

Problem Description Structure flooding on Poplar Creek and Lord's Park Tributary.

Strategy Construct new levee, improve channel for 1,700 feet, replace structures.

District Minimum Criteria for Funding: Met

Recommended Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Embankment construction, grading and restoration: Additional fill	yd3	10000	$13.88	$138,800.00	$0	$0	Levee construction assuming 6 ft height, 8 ft top width, 3:1 side slopes, and a length of 1700 feet.
Embankment construction, grading and restoration: Compaction of fill	yd3	10000	$5.34	$53,400.00	$0	$0	
Embankment construction, grading and restoration: Material hauled from offsite	yd3	10000	$10.68	$106,800.00	$0	$0	
Channel treatment: Material to be hauled offsite	yd3	8200	$11.75	$96,350.00	$0	$0	Assumed 130 ft2 per foot, length equals 1700 feet (8185 yd3).
Channel treatment: Soil stabilization and vegetative cover	yd2	9000	$13.88	$124,920.00	$116,174	$29,912	
Pump Station: 10ac-ft per day interior drainage	each	3	$800,000.00	$2,400,000.00	$2,231,963	$0	
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	850	$148.47	$126,199.50	$117,364	$0	Access Road. Assume 1-lane so do half of distance.
Channel treatment: Excavation	yd3	2100	$10.68	$22,428.00	$0	$0	
Channel treatment: Material to be hauled offsite	yd3	2100	$11.75	$24,675.00	$0	$0	
Bridge: Bridge COnstruction (Medium Complexity)	SF	8550	$300.00	$2,565,000.00	$2,385,411	$0	$200-$400 per SF - Assume 300 for piers and dealing with water.
Channel treatment: Soil stabilization and vegetative cover	yd2	500	$13.88	$6,940.00	$6,454	$1,662	
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	600	$148.47	$89,082.00	$82,845	$0	Re-paving for the bridge (assume double width).
Channel treatment: Excavation	yd3	64000	$10.68	$683,520.00	$0	$0	
Channel treatment: Material to be hauled offsite	yd3	64000	$11.75	$752,000.00	$0	$0	
Channel treatment: Soil stabilization and vegetative cover	yd2	48000	$13.88	$666,240.00	$619,593	$159,533	
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	350	$148.47	$51,964.50	$48,326	$0	Pave new road for Kirk Ave., Kramer St., and Getty St.
Bridge: Bridge COnstruction (Medium Complexity)	SF	5719	$300.00	$1,715,700.00	$1,595,575	$0	$200-$400 per SF-Assume 300 for piers and dealing with water.
Channel treatment: Excavation	yd3	2000	$10.68	$21,360.00	$0	$0	
Channel treatment: Material to be hauled offsite	yd3	2000	$11.75	$23,500.00	$0	$0	
Channel treatment: Soil stabilization and vegetative cover	yd2	650	$13.88	$9,022.00	$8,390	$2,160	
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	150	$148.47	$22,270.50	$20,711	$0	Re-pave for new bridge.

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Alternative Name PCMS-2

Problem Description Structure flooding on Poplar Creek and Lord's Park Tributary.

Strategy Construct new levee, improve channel for 1,700 feet, replace structures.

District Minimum Criteria for Funding: Met

Recommended Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Channel treatment: Excavation	yd3	500	$10.68	$5,340.00	$0	$0	Excavate additional channel.
Channel treatment: Material to be hauled offsite	yd3	500	$11.75	$5,875.00	$0	$0	Excavate additional channel.
Embankment construction, grading and restoration: Material hauled from offsite	yd3	10000	$10.68	$106,800.00	$0	$0	Raise the IL 25 roadway.
Embankment construction, grading and restoration: Additional fill	yd3	10000	$13.88	$138,800.00	$0	$0	Raise the IL 25 roadway.
Embankment construction, grading and restoration: Compaction of fill	yd3	10000	$5.34	$53,400.00	$0	$0	Raise the IL 25 roadway.
Bridge: Bridge Contruction (High Complexity)	SF	5185	$400.00	2,074,000.00	$1,928,788	$0	$200-$400 per SF - Assume 400 for piers and dealing with water.
Channel treatment: Soil stabilization and vegetative cover	yd2	3000	$13.88	$41,640.00	$38,725	$9,971	
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	1000	$148.47	$148,470.00	$138,075	$0	Re-paving for the bridge (assume that this will raise the bridge deck too).
Channel treatment: Excavation	yd3	1000	$10.68	$10,680.00	$0	$0	Excavate additional channel.
Channel treatment: Material to be hauled offsite	yd3	1000	$11.75	$11,750.00	$0	$0	Excavate additional channel.
Bridge: Railroad Bridge Construction	sf	2231	$1,305.00	2,911,455.00	$2,707,609	$0	97-ft by 23-ft bridge deck.
Channel treatment: Soil stabilization and vegetative cover	yd2	425	$13.88	$5,899.00	$5,486	$1,413	
Concrete: Cast in place	yd3	52	$250.00	$13,000.00	$0	$0	Headwall & Wingwalls.
Pipe under Pavement (City): Box Culvert (72 sf to 144 sf)	lf	153	$2,500.00	$382,500.00	$355,719	$0	3- 12ft x 6ft box culverts.
Channel treatment: Soil stabilization and vegetative cover	yd2	85	$13.88	$1,179.80	$1,097	$283	
Channel treatment: Material to be hauled offsite	yd3	200	$11.75	$2,350.00	$0	$0	
Channel treatment: Excavation	yd3	200	$10.68	$2,136.00	$0	$0	
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	50	$148.47	$7,423.50	$6,904	$0	
Buyout: Property *	dollar	4830191	$1.00	4,830,191.49	$0	$0	
Bridge: Bridge Demolition-Concrete Removal	cf	10000	$25.00	$250,000.00	$0	$0	
Bridge: Bridge Demolition-Concrete Removal	cf	16000	$25.00	$400,000.00	$0	$0	
Bridge: Bridge Demolition-Concrete Removal	cf	8100	$25.00	$202,500.00	$0	$0	
Bridge: Bridge Demolition-Concrete Removal	cf	18000	$25.00	$450,000.00	$0	$0	

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Alternative Name	PCMS-2
Problem Description	Structure flooding on Poplar Creek and Lord's Park Tributary.
Strategy	Construct new levee, improve channel for 1,700 feet, replace structures.
District Minimum Criteria for Funding:	Met
Recommended	Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)							
Subtotal (direct costs)				**$16,925,370**	**$12,415,208**	**$204,934**	
Utility Relocation			4 %	$677,015			
Mobilization \ General Conditions			5%	$846,268			
Subtotal with Percent Allowances				**$18,448,653**			
Contingency			30%	$5,534,596			
Profit			5%	$1,199,162			
Probable Construction Cost Estimate				**$25,182,411**			
Design Engineering, Geotechnical, and Construction Management			10%	$2,518,241			
Property Acquisition Cost:				$4,830,191			
Total Conceptual Cost Estimate				**$45,150,986**			

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Alternative Name PCMS-3

Problem Description Bank erosion on the Poplar Creek Mainstem south bank on Villa Avenue.

Strategy Stabilize 400' of bank with structural stabilization.

District Minimum Criteria for Funding: Met

Recommended Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Channel treatment: Reinforced one sided concrete wall	yd3	415	$587.35	$243,750.25	$226,684	$58,367	Assume a 2x9 wall with a 5x2 toe. Re-bar not included in estimate. 400 foot length per discussion.
Channel treatment: Excavation	yd3	78	$10.68	$833.04	$0	$0	See backup calcs.
Channel treatment: Compaction	yd3	58	$7.48	$433.84	$0	$0	75% of excavation can be used as fill.
Channel treatment: Additional fill	yd3	101	$13.88	$1,401.88	$0	$0	
Channel treatment: Soil stabilization and vegetative cover	yd2	693	$13.88	$9,618.84	$8,945	$2,303	Calculated the distance from top of gabions to backyard grade (15.6). (15.6 x 400/9).
Embankment construction, grading and restoration: Material hauled from offsite	yd3	19	$10.68	$202.92	$0	$0	

* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)

		Base Cost	Maint. Cost	Replacement Cost
Subtotal (direct costs)		**$256,241**	**$235,629**	**$60,670**
Utility Relocation	4 %	$10,250		
Mobilization \ General Conditions	5%	$12,812		
Subtotal with Percent Allowances		**$279,302**		
Contingency	30%	$83,791		
Profit	5%	$18,155		
Probable Construction Cost Estimate		**$381,248**		
Design Engineering, Geotechnical, and Construction Management	10%	$38,125		
Property Acquisition Cost:		$0		
Total Conceptual Cost Estimate		**$715,672**		

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Alternative Name PCMS-4

Problem Description Bank erosion on the Poplar Creek Mainstem south bank, just north of Thorndale Dr.

Strategy Stabilize 400' with structural stabilization.

District Minimum Criteria for Funding: Met

Recommended Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Channel treatment: Reinforced one sided concrete wall	yd3	415	$587.35	$243,750.25	$226,684	$58,367	Assume a 2x9 wall with a 5x2 toe. Re-bar not included in estimate. 400 foot length per discussion.
Channel treatment: Material to be hauled offsite	yd3	237	$11.75	$2,784.75	$0	$0	See backup calcs.
Channel treatment: Compaction	yd3	178	$7.48	$1,331.44	$0	$0	75% of excavation can be used as fill.
Channel treatment: Additional fill	yd3	414	$13.88	$5,746.32	$0	$0	592-147.
Channel treatment: Soil stabilization and vegetative cover	yd2	1129	$13.88	$15,670.52	$14,573	$3,752	Calculated the distance from top of gabions to backyard grade (25.4). (25.4 x 400/9).
Channel treatment: Material to be hauled offsite	yd3	59	$11.75	$693.25	$0	$0	

* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)

Subtotal (direct costs)		**$269,977**	**$241,257**	**$62,119**
Utility Relocation	4 %	$10,799		
Mobilization \ General Conditions	5%	$13,499		
Subtotal with Percent Allowances		**$294,274**		
Contingency	30%	$88,282		
Profit	5%	$19,128		
Probable Construction Cost Estimate		**$401,685**		
Design Engineering, Geotechnical, and Construction Management	10%	$40,168		
Property Acquisition Cost:		$0		
Total Conceptual Cost Estimate		**$745,229**		

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Metropolitan Water Reclamation District of Greater Chicago
Poplar Creek Watershed Detailed Watershed Plan

Alternative Name PCMS-5

Problem Description Bank erosion on the Poplar Creek Mainstem west bank, next to Campus Drive.

Strategy Stabilize 450 feet of bank with structural stabilization.

District Minimum Criteria for Funding: Met

Recommended Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Channel treatment: Reinforced one sided concrete wall	yd3	467	$587.35	$274,292.45	$255,088	$65,680	Assume a 2x9 wall with a 5x2 toe. Re-bar not included in estimate. 450 foot length per discussion.
Channel treatment: Excavation	yd3	2667	$10.68	$28,483.56	$0	$0	See backup calcs.
Channel treatment: Compaction	yd3	200	$7.48	$1,496.00	$0	$0	75% of excavation can be used as fill.
Channel treatment: Additional fill	yd3	200	$13.88	$2,776.00	$0	$0	
Channel treatment: Soil stabilization and vegetative cover	yd2	1270	$13.88	$17,627.60	$16,393	$4,221	Calculated the distance from top of gabions to backyard grade (25.4). Then 6 feet were added to for what was needed for grow areas for the gabion (30.7x450/9).
Channel treatment: Material to be hauled offsite	yd3	67	$11.75	$787.25	$0	$0	

* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)

Subtotal (direct costs)		**$325,463**	**$271,481**	**$69,901**
Utility Relocation	4 %	$13,019		
Mobilization \ General Conditions	5%	$16,273		
Subtotal with Percent Allowances		**$354,755**		
Contingency	30%	$106,426		
Profit	5%	$23,059		
Probable Construction Cost Estimate		**$484,240**		
Design Engineering, Geotechnical, and Construction Management	10%	$48,424		
Property Acquisition Cost:		$0		
Total Conceptual Cost Estimate		**$874,046**		

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Alternative Name	PCSH-1
Problem Description	Barrington Road overtopped in the 50- and 100-year events.
Strategy	Reconstruct Barrington Road culvert to eliminate road overtopping.
District Minimum Criteria for Funding:	Met
Recommended	Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Excavation, Structural (deep heavy soil & clay): Structural Excavation (12"-18" deep)	yd3	490	$169.80	$83,202.00	$77,377	$0	Structural excavation for new bridge. Includes removal of existing culvert.
Channel treatment: Material to be hauled offsite	yd3	490	$11.75	$5,757.50	$0	$0	
Bridge: Bridge Contruction (High Complexity)	SF	2800	$400.00	$1,120,000.00	$1,041,583	$0	28-ft wide bridge opening, 6-ft high bridge opening, 100-ft length.
Concrete: Cast in place	yd3	125	$250.00	$31,250.00	$0	$0	Vertical Headwall/Wingwalls
Channel treatment: Soil stabilization and vegetative cover	yd2	500	$13.88	$6,940.00	$6,454	$1,662	
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	300	$148.47	$44,541.00	$41,422	$0	4 lane road - assume 150 ft x 2 for the quantity.

* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)

Subtotal (direct costs)		**$1,291,691**	**$1,166,836**	**$1,662**
Utility Relocation	4 %	$51,668		
Mobilization \ General Conditions	5%	$64,585		
Subtotal with Percent Allowances		**$1,407,943**		
Contingency	30%	$422,383		
Profit	5%	$91,516		
Probable Construction Cost Estimate		**$1,921,842**		
Design Engineering, Geotechnical, and Construction Management	10%	$192,184		
Property Acquisition Cost:		$0		
Total Conceptual Cost Estimate		**$3,282,524**		

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Alternative Name	PCRR-1
Problem Description	Golf Road (IL 58) overtopped in the 100-year event.
Strategy	Increase culvert size under EJ&E Railroad to eliminate the backwater responsible for this problem.
District Minimum Criteria for Funding:	Met
Recommended	Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Channel treatment: Excavation	yd3	100	$10.68	$1,068.00	$0	$0	
Channel treatment: Material to be hauled offsite	yd3	1500	$11.75	$17,625.00	$0	$0	
Excavation, Structural (deep heavy soil & clay): Structural Excavation (12"-18" deep)	yd3	1500	$169.80	$254,700.00	$236,867	$0	Structural Excavation for the open-cut construction.
Channel treatment: Sheet piling	yd2	450	$303.28	$136,476.00	$0	$32,680	Stabilize open cut construction.
Embankment construction, grading and restoration: Additional fill	yd3	1200	$13.88	$16,656.00	$0	$0	Backfill over pipe.
Embankment construction, grading and restoration: Compaction of fill	yd3	1200	$5.34	$6,408.00	$0	$0	Backfill over pipe.
Embankment construction, grading and restoration: Material hauled from offsite	yd3	1200	$10.68	$12,816.00	$0	$0	Backfill over pipe.
Pipe under Pavement (City): Box Culvert (72 sf to 144 sf)	lf	72	$2,500.00	$180,000.00	$167,397	$0	12x6 box culvert - 72 ft long
Concrete: Cast in place	yd3	38	$250.00	$9,500.00	$0	$0	12x6 box culvert headwalls/wingwalls
Channel treatment: Soil stabilization and vegetative cover	yd2	250	$13.88	$3,470.00	$3,227	$831	

* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)

Subtotal (direct costs)		**$638,719**	**$407,491**	**$33,511**
Utility Relocation	4 %	$25,549		
Mobilization \ General Conditions	5%	$31,936		
Subtotal with Percent Allowances		**$696,204**		
Contingency	30%	$208,861		
Profit	5%	$45,253		
Probable Construction Cost Estimate		**$950,318**		
Design Engineering, Geotechnical, and Construction Management	10%	$95,032		
Property Acquisition Cost:		$0		
Total Conceptual Cost Estimate		**$1,486,352**		

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Metropolitan Water Reclamation District of Greater Chicago
Poplar Creek Watershed Detailed Watershed Plan

Alternative Name SCTD-1

Problem Description IL 62 is overtopped in the 5-, 10-, 25-, 50-, and 100-year events.

Strategy Reconstruct culverts and raise the roadway elevation.

District Minimum Criteria for Funding: Met

Recommended Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Excavation, Structural (deep heavy soil & clay): Structural Excavation (12"-18" deep)	yd3	375	$169.80	$63,675.00	$59,217	$0	
Channel treatment: Material to be hauled offsite	yd3	300	$11.75	$3,525.00	$0	$0	
Pipe under Pavement (City): Box Culvert (72 sf to 144 sf)	lf	90	$2,500.00	$225,000.00	$209,247	$0	Double 12x6 box culverts, 45 feet length.
Channel treatment: Soil stabilization and vegetative cover	yd2	4000	$13.88	$55,520.00	$51,633	$13,294	
Embankment construction, grading and restoration: Additional fill	yd3	6000	$13.88	$83,280.00	$0	$0	Raising IL 62.
Embankment construction, grading and restoration: Compaction of fill	yd3	6000	$5.34	$32,040.00	$0	$0	Raising IL 62.
Embankment construction, grading and restoration: Material hauled from offsite	yd3	6000	$10.68	$64,080.00	$0	$0	Raising IL 62.
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	1200	$148.47	$178,164.00	$165,690	$0	

* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)

Subtotal (direct costs)		**$705,284**	**$485,786**	**$13,294**
Utility Relocation	4 %	$28,211		
Mobilization \ General Conditions	5%	$35,264		
Subtotal with Percent Allowances		**$768,760**		
Contingency	30%	$230,628		
Profit	5%	$49,969		
Probable Construction Cost Estimate		**$1,049,357**		
Design Engineering, Geotechnical, and Construction Management	10%	$104,936		
Property Acquisition Cost:		$0		
Total Conceptual Cost Estimate		**$1,653,372**		

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Metropolitan Water Reclamation District of Greater Chicago
Poplar Creek Watershed Detailed Watershed Plan

Alternative Name BCMS-1

Problem Description Structure damage at commercial building and mobile homes.

Strategy Reconstruct the Bartlett Road culvert and the private driveway culvert. Provide 55 Ac-ft detention storage.

District Minimum Criteria for Funding: Met

Recommended Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Channel treatment: Excavation	yd3	108900	$10.68	$1,163,052.00	$0	$0	Excavate storage area.
Channel treatment: Material to be hauled offsite	yd3	108900	$11.75	$1,279,575.00	$0	$0	Storage area material.
Channel treatment: Soil stabilization and vegetative cover	yd2	34350	$13.88	$476,778.00	$443,396	$114,166	Storage area.
Channel treatment: Dumped riprap	yd3	90	$67.28	$6,055.20	$5,631	$1,450	Storage area overflow.
Pipe in earth (city): 36 inches or less	lf	80	$216.78	$17,342.40	$16,128	$0	Storage area outlet.
Outlet structures (Headwall): 36 inches or less	each	2	$2,600.34	$5,200.68	$4,837	$0	Storage area outlet.
Concrete: Cast in place	yd3	36	$250.00	$9,000.00	$0	$0	10 x 6 Box Culvert - 130 feet long (Private Drive).
Pipe under pavement (city): Box culvert (51 to 60 ft2)	lf	130	$661.03	$85,933.90	$79,917	$0	10 x 6 Box Culvert - 130 feet long (Private Drive).
Pipe under pavement (city): 90 to 96 inches / box culvert (39 to 50 ft2)	lf	124	$608.70	$75,478.80	$70,194	$0	2 - 6x8 box culverts - 62 feet long (Bartlett Rd)
Concrete: Cast in place	yd3	40	$250.00	$10,000.00	$0	$0	2 - 6x8 box culverts - 62 feet long(Bartlett Rd)
Buyout: Property *	dollar	188195	$1.00	$188,195.29	$0	$0	

* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)

		Base Cost	Maint. Cost	Replacement Cost
Subtotal (direct costs)		**$3,128,416**	**$620,104**	**$115,616**
Utility Relocation	4 %	$125,137		
Mobilization \ General Conditions	5%	$156,421		
Subtotal with Percent Allowances		**$3,409,973**		
Contingency	30%	$1,022,992		
Profit	5%	$221,648		
Probable Construction Cost Estimate		**$4,654,614**		
Design Engineering, Geotechnical, and Construction Management	10%	$465,461		
Property Acquisition Cost:		$188,195		
Total Conceptual Cost Estimate		**$6,043,990**		

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Metropolitan Water Reclamation District of Greater Chicago
Poplar Creek Watershed Detailed Watershed Plan

Alternative Name WBMS-3

Problem Description Structure flooding on Cornell Lane.

Strategy Improve 6,300' of channel and replace two crossings.

District Minimum Criteria for Funding: Met

Recommended Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
Channel treatment: Excavation	yd3	19800	$10.68	$211,464.00	$0	$0	Channel excavation
Channel treatment: Material to be hauled offsite	yd3	19800	$11.75	$232,650.00	$0	$0	Channel excavation
Channel treatment: Soil stabilization and vegetative cover	yd2	41740	$13.88	$579,351.20	$538,788	$138,727	Channel excavation
Channel treatment: Excavation	yd3	24000	$10.68	$256,320.00	$0	$0	Comp-storage area
Channel treatment: Material to be hauled offsite	yd3	24000	$11.75	$282,000.00	$0	$0	Comp-storage area
Channel treatment: Soil stabilization and vegetative cover	yd2	11111	$13.88	$154,220.68	$143,423	$36,929	Comp-storage area
Bridge: Bridge Demolition-Concrete Removal	cf	950	$25.00	$23,750.00	$0	$0	Remove pedestrian bridge
Concrete: Cast in place	yd3	43	$250.00	$10,750.00	$0	$0	Syracuse Ln headwall/ wingwall
Pipe under Pavement (City): Box Culvert (72 sf to 144 sf)	lf	45	$2,500.00	$112,500.00	$104,623	$0	Syracuse Ln 10x7 Box culvert
Channel treatment: Soil stabilization and vegetative cover	yd2	85	$13.88	$1,179.80	$1,097	$283	Syracuse Ln
Channel treatment: Material to be hauled offsite	yd3	85	$11.75	$998.75	$0	$0	Syracuse Ln
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	50	$148.47	$7,423.50	$6,904	$0	Syracuse Ln
Concrete: Cast in place	yd3	43	$250.00	$10,750.00	$0	$0	Braintree headwall/ wingwall
Pipe under Pavement (City): Box Culvert (72 sf to 144 sf)	lf	60	$2,500.00	$150,000.00	$139,498	$0	Braintree 10x7 Box culvert
Channel treatment: Soil stabilization and vegetative cover	yd2	85	$13.88	$1,179.80	$1,097	$283	Braintree
Channel treatment: Material to be hauled offsite	yd3	115	$11.75	$1,351.25	$0	$0	Braintree
Paving: Asphalt Pavement Installation (24 ft wide, 2 ft C&G, 1 ft Excavation	lf	50	$148.47	$7,423.50	$6,904	$0	Braintree

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding

Alternative Name	WBMS-3
Problem Description	Structure flooding on Cornell Lane.
Strategy	Improve 6,300' of channel and replace two crossings.
District Minimum Criteria for Funding:	Met
Recommended	Yes

	Unit	Quantity	Unit Cost	Base Cost	Maint. Cost	Replacement Cost	Notes/Issues
* Indicates item excluded from subtotal (e.g. land acquisition, buyouts)							
Subtotal (direct costs)				**$2,043,312**	**$942,333**	**$176,222**	
Utility Relocation			4 %	$81,733			
Mobilization \ General Conditions			5%	$102,166			
Subtotal with Percent Allowances				**$2,227,211**			
Contingency			30%	$668,163			
Profit			5%	$144,769			
Probable Construction Cost Estimate				**$3,040,142**			
Design Engineering, Geotechnical, and Construction Management			10%	$304,014			
Property Acquisition Cost:				$0			
Total Conceptual Cost Estimate				**$4,462,712**			

Additional Comments

Note: Small differences between the base cost and the reported product of quantity and unit cost due to rounding