Mantua Township
Black Brook Flood Study

FINAL

JULY 2023

Choose a building block.

Table of Contents

1.0 Introduction

1.1 Study Background

A one-mile-long section of Mantua Center Rd. between Winchel Rd and SR 82 in Mantua Township is prone to frequent flooding. This section conveys the Black Brook in 8-foot deep ditches along both sides of the road. Flooding along Mantua Center Road has caused, and continues to cause, personal property damage, infrastructure deterioration, and inhibits emergency vehicles from serving residents. In addition, water quality impairments caused by runoff from flooded septic leach fields, agriculture, and a former gravel pit are a concern within the study area. Residents have contended with the effects and costs of damage due to floodwaters for decades. With grant writing assistance from the Chagrin River Watershed Partners (CRWP), this study is funded by an Advanced Assistance award under the Federal Emergency Management Agency (FEMA) DR-4447 Hazard Mitigation Grant Program grant from the Ohio Emergency Management Agency.

The Black Brook Conservancy District was formed in 1942 to drain land for farming and reduce flood risk. In 1879, property owners petitioned the Portage County commissioners to open a road through it to provide access to hundreds of acres of land. As a result, Mantua Center Road was constructed to convey Black Brook.

1.2 Flood Study Objectives

The purpose of this flood study is to identify and evaluate alternatives to mitigating the flood hazards along Mantua Center Road. Results of the flood study will be incorporated into an update to the Black Brook Nine-Element Nonpoint Source Implementation Strategy Plan (NPS-IS) document. The NPS-IS is a watershed action planning tool that summarizes causes and sources of impairment and recommended mitigation. For a project to be eligible for Ohio EPA Section 319 Funding, a proposed project must be described in a U.S. EPA approved NPS-IS. The nine-element nonpoint source implementation strategy plan (NPS-IS) for Black Brook was approved by Ohio EPA on January 3, 2020, and is the first watershed plan for this area.

2.0 Study Area

2.1 Watershed

The study area is located in Mantua Township, Ohio. The drainage area for the study area encompasses approximately 7.8 square miles of the west branch of Black Brook within the Black Brook (HUC 12 - 041100020105) watershed (Figure 1). The Black Brook watershed drains into the Upper Cuyahoga River basin. There is an earthen dam (Black Brook dike) located at the downstream end of the study area watershed. The dam was constructed in the 1960s as part of the LaDue Reservoir project to partially divert water to the reservoir. Upstream of the dike, Black Brook branches off into several segments within the 7.8 square mile watershed. The watershed of the study area is generally bound by State Route 44 to the east, Chamberlain Road to the west, between Pioneer Trail and State Route 82 to the south, and Winchell Road to the north. The watershed is predominately in Portage County with a small portion on the north located in Geauga County.

According to historic 1905/1906 USGS maps, the study area was predominately wetlands and Mantua Center Road has not yet been constructed (Figure 2). The southeast and northwest branches of Black Brook discharge into the wetland. Black Brook becomes a stream again to the northeast. There is minimal development in the watershed. The 1959/1962 USGS maps show Mantua Center Road completed, Black Brook channelized and conveyed in ditches on either side of the road, and numerous homes in the watershed (Figure 3). A gravel pit is located to the west of the study area and is still present today.

Drainage within the basin has been altered over the past century as farmers worked the land and dams were built for water supply. The Black Brook Conservancy District was formed in 1942 to control water within the watershed as farmers continued to work the land. Mantua Center Road was constructed to allow farmers access to additional land. As part of the road construction, Black Brook was directed into roadside ditches along both sides Mantua Center Road.

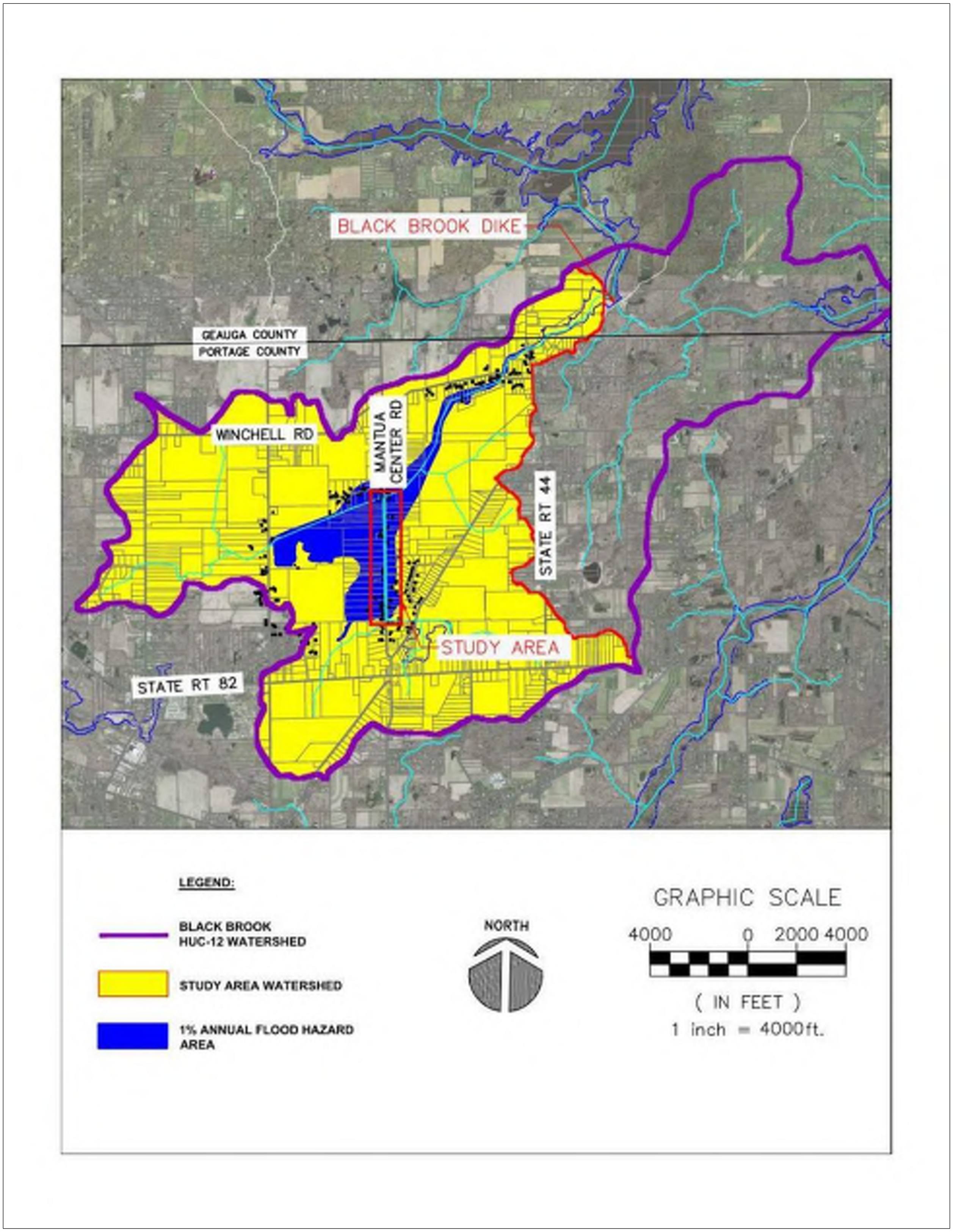


Figure 1 – Watershed of Study Area

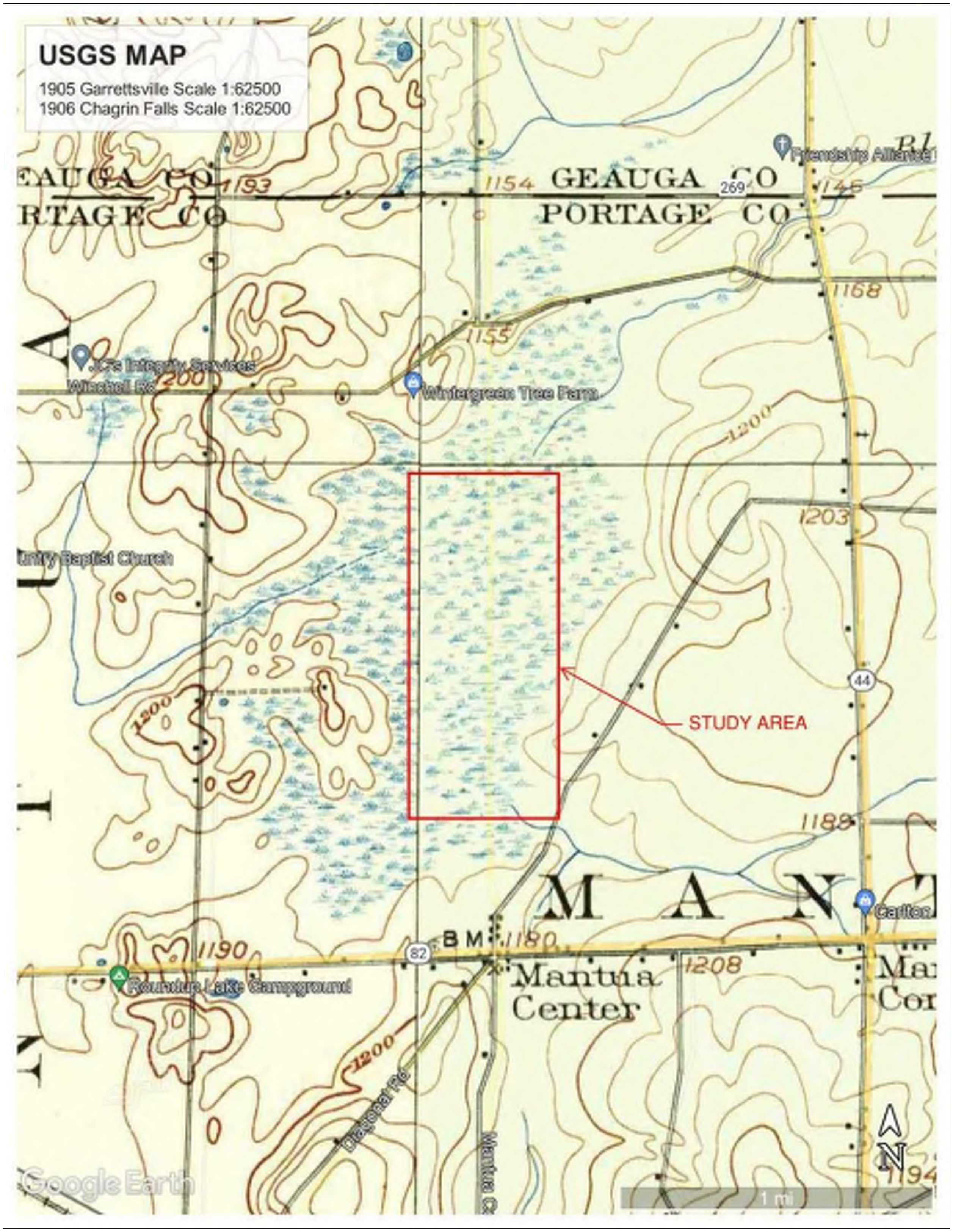


Figure 2 - USGS Map 1905/1906

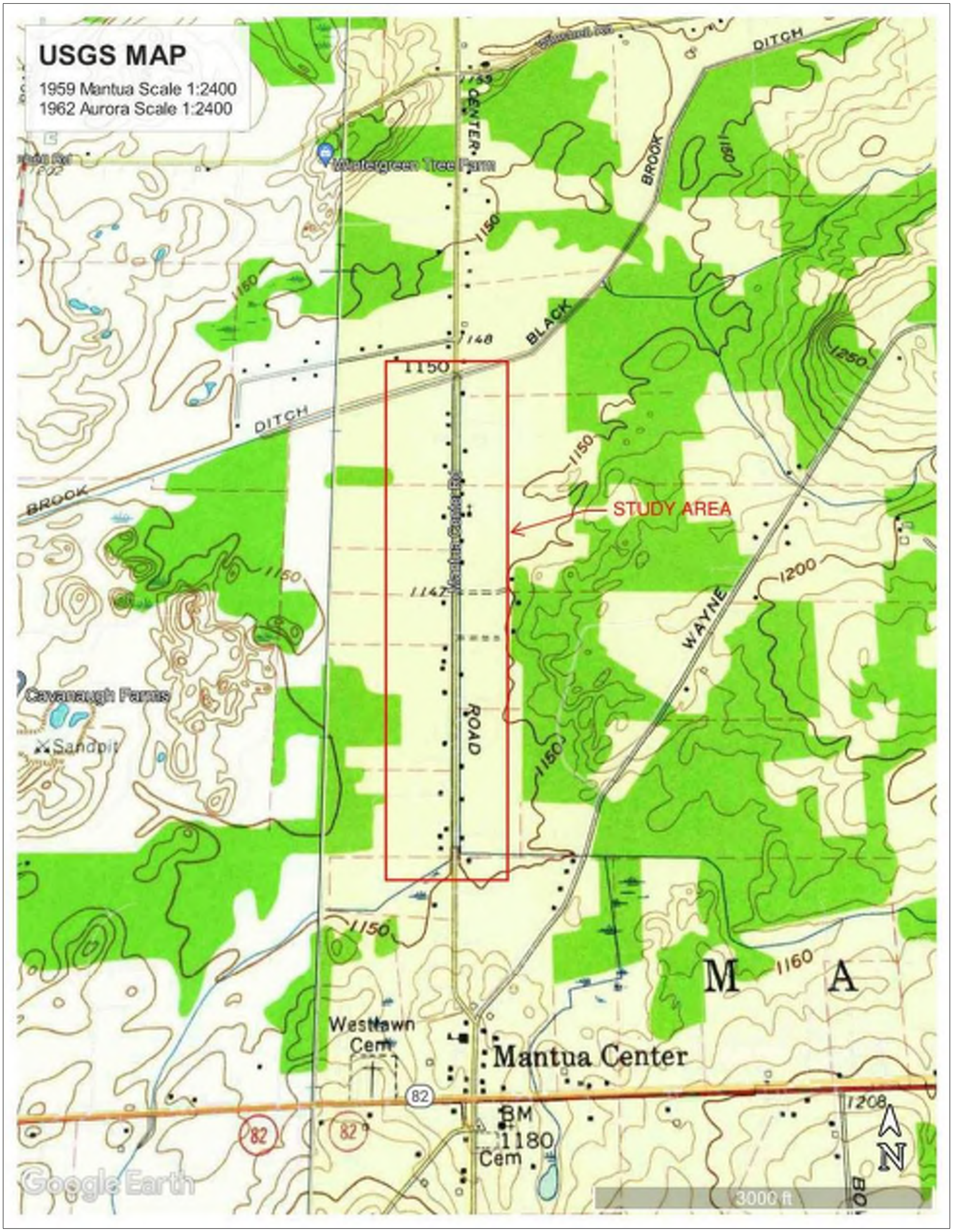


Figure 3 - USGS Map 1959/1962

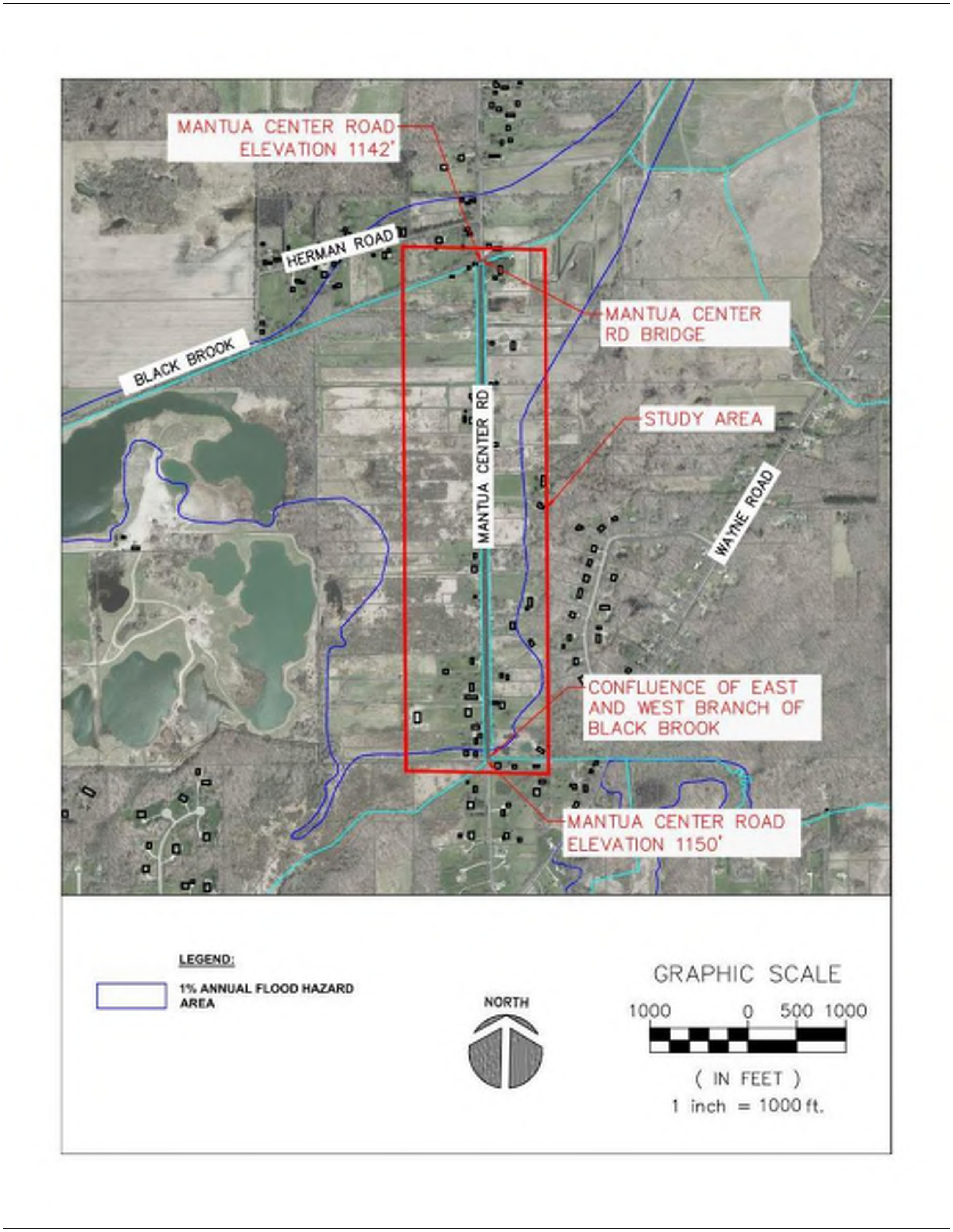


Figure 4 - Study Area

2.2 Topography

The study area is low-lying with only a 0.16% slope from the upstream end to downstream end along the one-mile stretch of Mantua Center Road. The road elevation at the south end of the study area is 1150 feet and the road elevation at the north, at the Mantua Center Road bridge, is 1142 feet. This equates to only eight feet of fall along the length of the road for stormwater runoff. The topography directly east of the study area rises considerably before Wayne Road up to an elevation of 1196 feet. West of the study area, the topography also rises to a maximum elevation of 1206 feet at Frost Road.

2.3 Existing Infrastructure and Condition Assessment

Osborn performed a site visit on August 16^{th}, 2021 to observe existing infrastructure and visually assess the conditions within the study area. The field team observed one road, one bridge, driveway culverts, and utilities along the one-mile segment of Mantua Center Road. A site visit was also conducted on July 17^{th}, 2021 to observe the study area inundated with flood waters.

2.3.1 Mantua Center Road

Mantua Center Road is paved with asphalt in good condition. The road is 24 feet wide with deep ditches running parallel to the road on either side. The ditches convey the southeast and southwest branches of Black Brook (see photographs 2.1 and 2.2). During heavy rain events, Mantua Center Road often overtops with flood water and, at times, becomes impassable. The Mantua Township Road service department maintains the road which includes periodic removal of sediment from the ditches, roadside mowing, filling of potholes, and other maintenance. Frequent flooding along the road causes the road embankments to erode and requires periodic repairs to maintain integrity.

 Photo 2.1 – Mantua Center Road and East Side Ditch	 Photo 2.2 – Mantua Center Road Overtopped with Flood Waters

2.3.2 Mantua Center Road Bridge

The Mantua Center Road bridge is located at the north end of the study area approximately 350 feet south of Herman Road. The bridge conveys the west branch of Black Brook and spans approximately 21 feet (Figure 1). Ditches located on each side of Mantua Center Road which convey the southeast of southwest branches of Black Brook intersect the west branch of Black Brook and drains to the east. The bridge appeared to be well maintained and in good condition (see photographs 2.1 through 2.4).

 Photo 2.3 – Bridge Abutments	 Photo 2.4 – Bridge Abutment
 Photo 2.5 – Bridge Girder and Decking	 Photo 2.6 – Bridge Guard Rail and West Branch of Black Brook

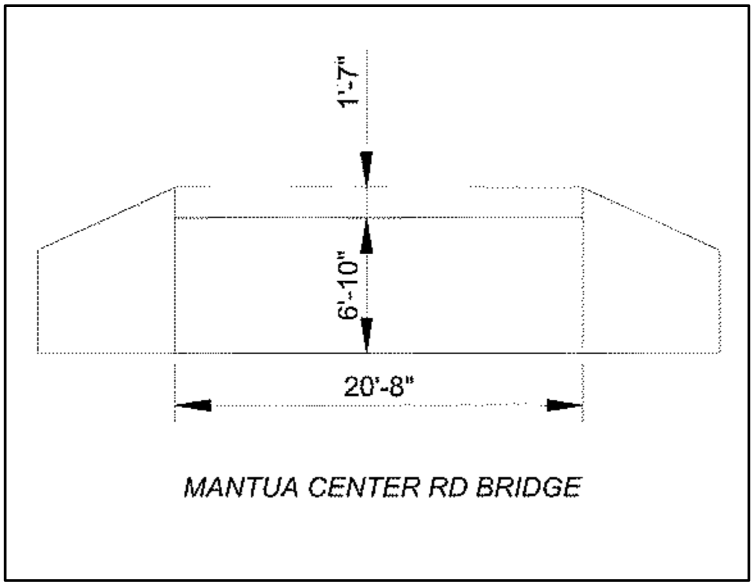


Figure 5 - Mantua Center Rd Bridge Profile

2.3.3 Driveway Culverts

There are 15 driveway culverts on the east side and 14 driveway culverts on the west side of Mantua Center Road along the one-mile stretch within the study area. The culverts are constructed of various materials including concrete, corrugated metal pipes, steel girders, and wood. The culverts are maintained by the homeowners. The conditions of the culverts vary widely. Some are in need of repair or replacement and others are in good condition.

	
Photo 2.7 – Concrete Driveway Culvert	Photo 2.8 – Corrugated Metal Pipe Driveway Culvert

3.0 Stormwater Modeling Methodology

3.1 Model Set-up and Calibration

Hydraulic analysis of the study area was carried out using the HEC-RAS program version 6.2. Model calibration consists of fine tuning of model parameters until the model simulates field conditions to an established degree of accuracy. Fine-tuning of the model entails adjusting the model parameters to obtain the desired output data. The optimal model parameters can be set with manual calibration by changing the parameters little by little until the model output is stable and representative of real-world conditions, to the greatest extent possible. Calibration is important to establish model credibility, create a benchmark, produce a predictive tool, increase knowledge and understanding of the system and its operations, and to discover errors or unknown conditions in the field.

During the calibration process, the following parameters were modified to develop stable, reliable results:

The computation interval option within HEC-RAS can vary from 0.1 second up to one day. Computational intervals for 2D models typically produce stable results at less than one minute time step, however the smaller the time step, the more computations the simulation runs therefore creating a longer simulation time. A balance of model stability and run time was factored into selecting a 15 second computational interval for this model.

The Black Brook Flood Study hydraulic model in this report is a HEC-RAS 2D model with a computational grid mesh based on available GIS data sourced from local government agencies. The 2D grid mesh created during the modeling process can vary in detail based on the modeler's desire for an accurate but speedy model. The smaller the grid, the more computational grid cells the model will calculate. Therefore, the more grid cells the model computes the longer the model run. The calibration process deems to identify a grid size that is as functionally accurate as it can be to real world conditions while running quickly and efficiently. Additionally, supplementary data was added to the 2D grid mesh to better represent some existing stream channel geometry.

Hyfi, working for Chagrin River Watershed Partners through a grant from the Great Lakes Protection Fund, supplied Osborn Engineering stream flow data for two locations along Black Brook; one at Mantua Center Road and the other at Winchell Road. Below is a list of locations, observed data, and time frame.

Mantua Center Road – Elevation – April 28, 2021 through May 28, 2022

Mantua Center Road – Depth – April 28, 2021 through May 28, 2022

Winchell Road – Elevation – December 14, 2020 through May 28, 2022

Winchell Road – Depth – December 14, 2020 through May 28, 2022

The data was utilized to calibrate the model flows through the observed locations and was also used to interpolate an accurate stream base flow to include in the model.

Inflow hydrographs were also calibrated through the modeling process to represent real world land use and soil types as well as accurate time of concentrations for each inflow. The hydrograph data tables were developed in HydroCAD with observed land use and soil data from the USGS Web Soil Survey. Time of concentration paths were developed for each watershed and adjusted to follow observed flow paths, slopes and roughness. These finalized hydrographs were added to HEC-RAS as inflow boundary conditions for each watershed.

Design storms were used to develop hydrographs for use in the HEC-RAS model to predict flood depths for existing conditions, the sensitivity analysis, and alternatives evaluation. The rainfall depths are based on the National Oceanic and Atmospheric Administration's (NOAA) Precipitation Frequency Data Server (PFDS), also known as NOAA Atlas 14. The design storm rainfall depths for each of these recurrence interval events are listed in the table below.

Table 1 - Design Storm Rainfall Depths (NOAA Atlas 14)

RECURRENCE INTERVAL	24-hr RAINFALL DEPTHS (inches)
1-year	2.07
2-year	2.47
5-year	3.07
10-year	3.56
25-year	4.27
50-year	4.87
100-year	5.51

3.2 Data Sources

The digital terrain data used for this hydraulic analysis was obtained from Portage and Geauga Counties and was observed in January 2016 in 2-foot contour intervals and is derived from the Ohio Statewide Imagery Program. The data references elevations to the NAVD 88. Horizontal control is referenced to the NAD83 Ohio State Plane South Zone, US Foot. All hydraulic model results are in NAVD88 and NAD83.

3.2.1 Stream Flow Data

There are no USGS stream gages on Black Brook. However, two water level sensors were installed by hyfi through a Great Lakes Protection Fund grant. One sensor is mounted to the bridge on Mantua Center Rd. where the east and west ditches intersect the Black Brook (41.330057966, -81.245251903). This sensor measures water level data that combines the Black Brook and the west ditch. The second sensor measures water level downstream of the study area and is installed on the Winchell Rd. bridge that conveys Black Brook.

Figure 6 - Flow Sensor on Mantua Center Road Bridge

4.0 Sensitivity Analysis

4.1 Introduction

Several hydraulic model scenarios were developed and evaluated in HEC-RAS to gain an understanding of how the study area performs under various conditions. Each scenario was modeled for the 1-year, 5-year, and 100-year storms. Six locations were selected within the study area to compare the resulting flood depths. A description of these locations is listed below in Table 2.

Table 2 - Locations for Flood Level Comparisons

LOCATION	ADDRESS
1	4002 Herman Road
2	12330 Mantua Center Road
3	Mantua Center Road
4	12100 Mantua Center Road
5	12002 Mantua Center Road
6	11967 Mantua Center Road

The study area was divided into three subwatersheds; the northwest, southwest, and southeast branches of Black Brook as shown on Figure 7. The objective was to determine which of these three branches contributes the most stormwater runoff to flood-prone areas compared to existing conditions. Understanding which branch, if any, contributes more significantly than other subwatersheds could assist with locating flood control improvements in optimal areas.

Results of the first run of the sensitivity analysis showed the southeast subwatershed contributed the most to flooding along Mantua Center Road. Based on this outcome, the southeast subwatershed was further divided into three subwatersheds (areas 1, 2, and 3) to isolate small upstream Black Brook tributaries. Again, the purpose of analyzing these smaller subwatersheds was to identify optimal areas that could be used for flood control. See Appendix A for an output of model results.

A total of nine scenarios were modeled and analyzed as part of the sensitivity analysis as listed in Table 3.

Table 3 - Sensitivity Analysis Scenarios

SCENARIO ID	DESCRIPTION
1	Existing Conditions
2a	Existing Conditions with no Downstream Restrictions
2b	No Flow from Northwest Branch of Black Brook
2c	No Flow from Southwest Branch of Black Brook
2d	No Flow from Southeast Branch of Black Brook
2fa	Reduce Flow from Southeast Branch by 50% - Include Areas 1 and 2 only
2fb	Reduce Flow from Southeast Branch by 50% - Include Areas 1 and 3 only
2g	Reduce Flows from Southwest Branch by 50%
2h	Reduce Flows from Southwest and Southeast Branch by 50%

Scenario 1 – Existing Conditions

The existing conditions model is the baseline for comparison to the other scenarios. The terrain was modified to include field measurements of culverts along SR 82, SR44, Wayne Rd, and Mantua Center Rd.

Scenario 2a – Existing Conditions with no Downstream Restrictions

In this scenario, the terrain in the model was modified to remove downstream restrictions east of the Mantua Center Road bridge. The purpose of running this scenario was to find out if flood waters are backing up into the study area. The results showed the flood levels were almost the same as the existing conditions indicating conditions downstream (e.g. stream geometry) of the study area have little to no effect on flooding.

Scenario 2b – No flow from Northwest Branch of Black Brook

For Scenario 2b, all stream flow from the northwest branch of Black Brook was removed. Results showed a 30 to 100 percent reduction of flood depth in northern part of study area and little to no reduction in flood depth in the southern part of study area.

Scenario 2c – No Flow from Southwest Branch of Black Brook

The results for Scenario 2c are similar to Scenario 2b with the greatest reduction in flood depth in the northern portion of the study area.

Scenario 2d - No Flow from Southeast Branch of Black Brook

Results of the Scenario 2d model showed the greatest amount of flood reduction. However, removing all the water from the southeast subbasin isn't likely to be feasible from a cost perspective. Based on these results, the southeast watershed was further subdivided into three subwatersheds for further study. See Scenarios 2fa and 2fb.

Scenario 2fa - Reduce Flow from Southeast Branch by 50% - Include Subwatersheds 1 and 2 only

As demonstrated in Scenario 2d, runoff from the southeast appears to be contributing the most to the flood levels. Scenario 2fa includes runoff from subwatersheds 1 and 2. Results showed a considerable reduction in flood depths but the reduction wasn't as significant as shown in the results for Scenario 2fb.

Scenario 2fb - Reduce Flow from Southeast Branch by 50% - Includes Subwatersheds 1 and 3 only

This Scenario appears to be the ideal balance between volume of water to be controlled versus results. While the results are not as significant as Scenario 2d, the flood depths are reduced considerably in the three storm events modeled. It is recommended that subwatershed 3 be the focus are to implement stormwater controls.

Scenario 2g – Reduce Flows from Southwest Branch by 50%

Scenario 2g was run as a check to Scenario 2c. Again, results indicated flood reduction in the northern portion of the study area but minimal and even an increase in the southern area.

Scenario 2h – Reduce Flows from Southwest and Southeast Branch by 50%

Scenario 2h was also run as a check and to verify general consistency of the modeling efforts. Results indicated that there may be some benefit to flood water reduction by controlling flows in both the southwest and the southeast branches of Black Brook. While the southeast area is ideal, land may be available in the southwest which could be used for flood control.

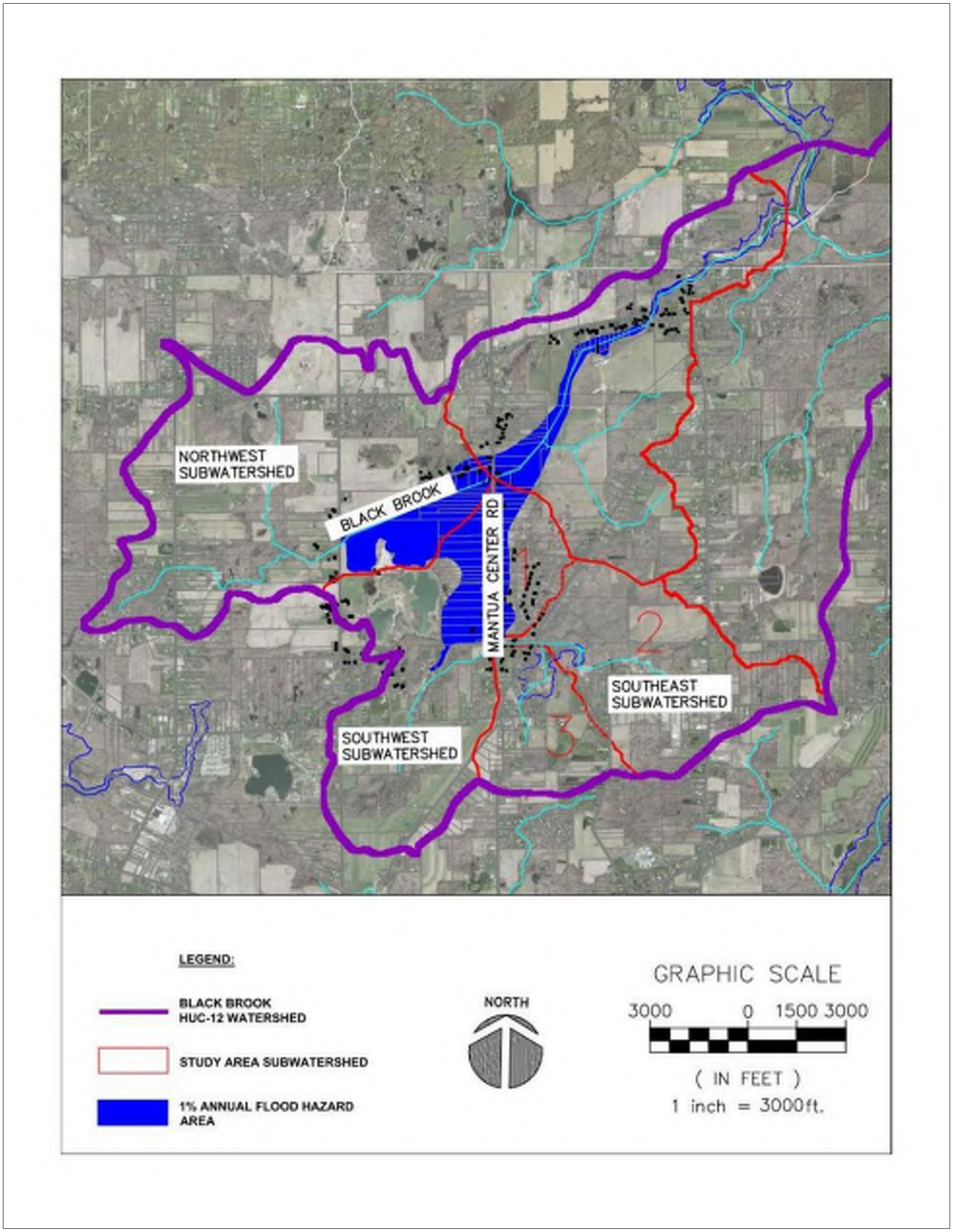


Figure 7 - Study Area Subwatersheds

Table 4 - Results of Sensitivity Analysis

1-YR STORM

LOCATION	SCENARIO																
	1	2a		2b		2c		2d		2fa		2fb		2g		2h	
	Depth	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction
1	0.00	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A
2	0.36	0.36	0%	0.24	33.3%	0.26	27.8%	0.24	33.3%	0.26	27.8%	0.24	33.3%	0.26	27.8%	0.23	36.1%
3	1.85	1.85	0%	1.85	0.0%	1.65	10.8%	1.20	35.1%	1.64	11.4%	1.24	33.0%	1.64	11.4%	0.61	67.0%
4	0.34	0.34	0%	0.34	0.0%	0.25	26.5%	0.24	29.4%	0.25	26.5%	0.24	29.4%	0.25	26.5%	0.16	52.9%
5	0.28	0.29	-4%	0.28	0.0%	0.28	0.0%	0.00	100.0%	0.29	-3.6%	0.14	50.0%	0.29	-3.6%	0.23	17.9%
6	0.12	0.13	-8%	0.13	-8.3%	0.14	-16.7%	0.07	41.7%	0.15	-25.0%	0.07	41.7%	0.15	-25.0%	0.10	16.7%

5-YR STORM

LOCATION	SCENARIO																
	1	2a		2b		2c		2d		2fa		2fb		2g		2h	
	Depth	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction
1	0.00	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A
2	0.68	0.68	0%	0.48	29.4%	0.59	13.2%	0.46	32.4%	0.60	11.8%	0.54	20.6%	0.63	7.4%	0.54	20.6%
3	2.16	2.18	-1%	2.18	-0.9%	2.01	6.9%	0.92	57.4%	2.07	4.2%	1.98	8.3%	2.10	2.8%	1.93	10.6%
4	0.53	0.52	2%	0.54	-1.9%	0.48	9.4%	0.13	75.5%	0.47	11.3%	0.40	24.5%	0.48	9.4%	0.39	26.4%
5	0.37	0.39	-5%	0.39	-5.4%	0.39	-5.4%	0.00	100.0%	0.30	18.9%	0.19	48.6%	0.36	2.7%	0.31	16.2%
6	0.29	0.30	-3%	0.30	-3.4%	0.30	-3.4%	0.07	75.9%	0.18	37.9%	0.10	65.5%	0.30	-3.4%	0.19	34.5%

100-YR STORM

LOCATION	SCENARIO																
	1	2a		2b		2c		2d		2fa		2fb		2g		2h	
	Depth	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction	Depth	% Reduction
1	0.46	0.46	0%	0.00	100.0%	0.00	100.0%	0.00	100.0%	0.00	100.0%	0.00	100.0%	0.00	100.0%	0.00	100.0%
2	2.01	2.01	0%	0.95	52.7%	1.66	17.4%	1.13	43.8%	1.50	25.4%	1.23	38.8%	1.84	8.5%	1.70	15.4%
3	2.53	2.56	-1%	2.56	-1.2%	2.47	2.4%	1.73	31.6%	2.34	7.5%	2.26	10.7%	2.53	0.0%	2.47	2.4%
4	1.00	1.02	-2%	1.02	-2.0%	0.99	1.0%	0.25	75.0%	0.70	30.0%	0.58	42.0%	0.99	1.0%	0.94	6.0%
5	0.66	0.68	-3%	0.68	-3.0%	0.70	-6.1%	0.00	100.0%	0.46	30.3%	0.28	57.6%	0.70	-6.1%	0.70	-6.1%
6	0.58	0.58	0%	0.58	0.0%	0.59	-1.7%	0.09	84.5%	0.38	34.5%	0.14	75.9%	0.59	-1.7%	0.59	-1.7%

5.0 Alternatives Development and Evaluation

5.1 Alternatives Analysis

5.1.1 Infrastructure Improvements

As shown in the modeling efforts, raising Mantua Center Rd and driveways subject to flooding can increase the level of safety along this corridor. While this alternative improves access, it does little to reduce flooding around homes and other structures. A planning level cost estimate was prepared and assumed raising Mantua Center Road by an average of two feet. The cost estimate (Appendix C) also includes building up driveways and installing new culverts.

Planning-Level Cost Estimate: $2.6M

5.1.2 Nature Based Solutions

This study included a considerable amount of effort in evaluating the potential for nature-based solutions such as stream restoration, wetland enhancements and restoration and floodplain improvements to control flood water. A summary report detailing the findings of field work conducted as part of the study is provided in Appendix B.

Planning-Level Cost Estimate: $4.8M

5.1.3 Property Acquisition

Another approach to mitigating flooding at the most impacted homes and properties is to purchase the most flood-prone properties and restore them to natural floodplain storage. There are 49 individual properties within the 100-year flood plain along Mantua Center Road. This number does not include the three parcels owned by the Black Brook Conservancy District. There are various structures on the properties including 23 homes. The homes vary in condition and propensity to flooding. For the purpose of this evaluation, a cost estimate was developed to buy the 49 properties. Acquisition, relocation, and structure demolition costs were included in the estimate (Appendix C).

Planning-Level Cost Estimate: $5M

Appendix A – Wetland and Stream Assessment

Biohabitats
GREAT LAKES BIOREGION
2026 Murray Hill Road, Room 102
Cleveland, OH 44106
216.921.4430
www.biohabitats.com

MEMORANDUM

Date: October 11, 2022

To: Loretta Snider PE, Osborn Engineering
Joe Ferenczy PE, Osborn Engineering

From: Suzanne Hoehne, Biohabitats, Inc.

RE: Black Brook Flood Study
Subject: Baseline Assessment-DRAFT

This memorandum summarizes the results of the database review and field activities conducted for the Black Brook Flood Study. The ecological survey/field assessment aims to determine if natural-based opportunities exist to solve flooding problems.

PROJECT LOCATION

The study area is located in Portage County, centered around Mantua Center Road within Mantua Township, bounded approximately by Hwy 44 on the east, Black Brook on the north, Frost Road on the west, and Pioneer Road on the South. The study area (Figure 1) contains a mix of forest, wetlands, and residential and commercial land use.

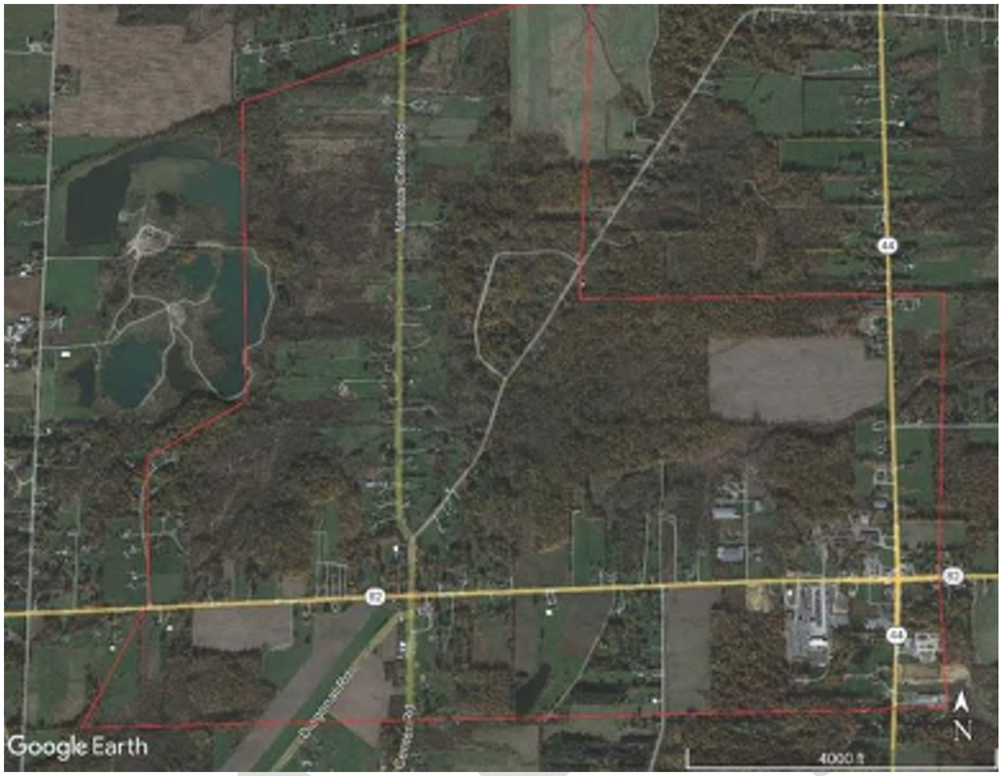


Figure 1. Study area outlined in red

LITERATURE REVIEW

Study area information was obtained from known available resources to support field activities. The literature review was performed before field activities commenced to avoid duplication of past efforts. The review involved collecting GIS data and reviewing other agency resources. Information was obtained from:

- *Ecoregions of Indiana and Ohio* (Woods *et al.* 1998)
- *Web Soil Survey* (USDA NRCS, http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm)
- Aerial photography *circa.* 1952-2019. http://www.historicaerials.com
- *Black Brook NPS-IS* (Chagrin Valley Watershed Partners 2019)
- *Flood Insurance Study of Portage County, OH,* (FEMA 2017)

Ecoregion

The study area is situated within two sub-ecoregions, the Summit Interlobate Area (approximately the Mantua Center Road vicinity) and the Low Lime Drift Plain (on either side of the Summit Interlobate Area) (Woods *et al.* 1998). Both sub-ecoregions are a subset of the Erie/Ontario Drift and Lake Plain ecoregion, which lies between Lake Erie and the Western Allegheny Plateau.

With a rolling landscape comprised of low rounded hills with scattered end moraines and kettles, the Erie/Ontario Drift and Lake Plain ecoregion is comprised of stream networks with lakes and wetlands where the soil is clayey or where streams have been disturbed. Soils in this ecoregion are less fertile than those of other glaciated ecoregions.

Much of the Summit Interlobate Area is different from the other sub-ecoregions within the Low Lime Drift Plain. It's flatter topography leads to more lakes, wetlands, and slow-moving streams. Oak forests within well-drained areas historically dominate it. Currently, the landuse is a mix of woodlands, quarries, low-density residential, and agriculture.

Within the Low Lime Drift Plain sub -ecoregion, the landscape is composed of low rounded hills with scattered end moraines and kettles with less naturally fertile soils. Current land uses are a mix of urban, industrial, and farming, with the uplands composed of woodlands.

Soils

According to the Portage County Soil Survey (2021), the majority of the site is comprised of Canfield silt loam (CdB), Carlisle Muck (Cg), and Wooster Silt Loam (WuB) (Figure 2). The following is a summary of each soil type found in the project area.

<u>Canfield Silt Loam (CdB) – Southern third of the site</u>

Canfield Silt Loam occurs on 2-6% slopes, is found in the uplands, and consists of deep, moderately well-drained soils. A typical profile is brown silt loam (0-89”), firm yellowish and dark yellowish brown silt loam (8-22”), and below that, a firm very compact fragipan is found consisting of fine sandy loam and mottled dark yellowish-brown loam. Within wet periods, a perched water table is found within two feet of the surface. The soil is in hydrologic soil group C/D.

<u>Carlisle Muck (Cg) – Northern portion of the site, especially along Mantua Center Road</u>

Carlisle Muck is a very poorly drained organic soil often found in level or depressional areas in bogs or kettles. It is difficult to drain, and natural drainage might not be available. Soils are subject to subsidence and are in hydrologic soil group A/D. They formed out of muck and peat deposits more than 51 inches thick and the upper 17 inches is black friable muck.

<u>Wooster Silt Loam (WuB) – Lower third of the site</u>

Wooster silt loam is found on 2 to 6 percent slopes and is found on uplands or adjacent to drainage ways. The soil is dark grayish brown silt loam (0-9”), yellowish brown and dark yellowish-brown loam (9-23”), and a very firm and brittle dark yellowish-brown loam fragipan (23-43”). The hydrologic soil group is C.

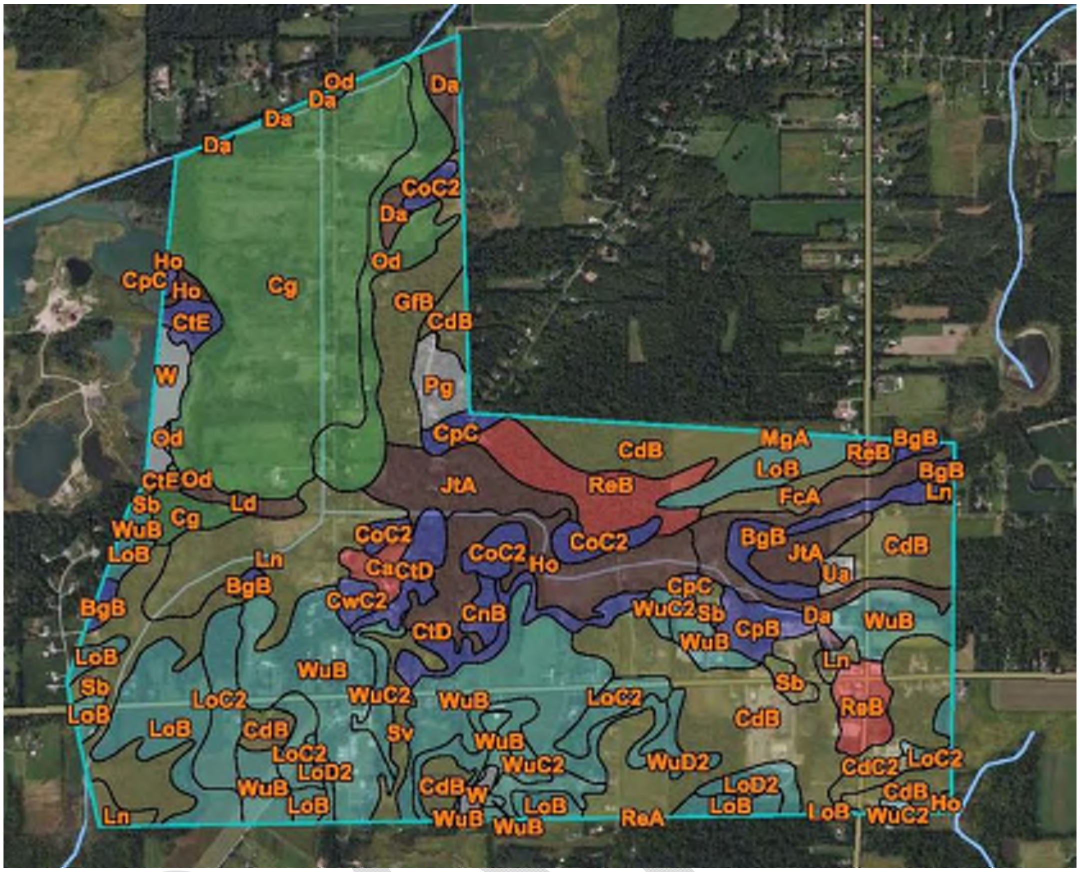


Figure 2. Study Area Soils Map featuring Hydrologic Soil Groups

Database review
Information on the study area was obtained from known available resources to support the various field activities.

Database Review Responses

An endangered species request was initiated with the U.S. Fish and Wildlife Service's Information for Planning and Consultation (IPaC) website to identify rare and endangered species within the project area prematurely. Their review identified rare or endangered species potentially affected by activities in the project area. They include the endangered Indiana Bat (*Myotis sodalist*), threatened Northern Long-eared Bat (*Myotis septentrionalis*), endangered Mitchell's Satyr Butterfly (*Neonympha mitchellii mitchellii*), and the threatened Northern Wild Monkshood (*Aconitum noveboracense*). This location has critical habitat for the Indiana Bat (*Myotis sodalist*), but it is not defined at this time. Investigations would need to be completed prior to initiating nature-based or engineering solutions to define areas of habitat such as where there is exfoliating bark trees and trees over a certain size. There are no existing or proposed state nature preserves, unique ecological sites, geological features, breeding or non-breeding animal concentrations, state parks, state forests, or wildlife areas within the project area. A formal Rare, Threatened and Endangered Species request should be submitted to the USFWS, Division of Ecological Services upon completion of any design plans to avoid impacting any threatened and endangere species (state or federal).

A Natural Heritage Data Request Form was submitted to the Ohio Department of Natural Resources.. The response was that this type of study needs an Environmental Review. An Environmental Review request was submitted on September 21, 2022. A response has not been received as of the date of this technical memo but will be included in Appendix A once received.

Wetland Delineation

The NWI map indicated the presence of numerous wetlands within the study area. Wetland types fall into four categories, freshwater ponds, freshwater emergent, freshwater forest/scrub wetland, and lake (Figure 3). These maps show approximate wetland locations. Site investigation will be necessary prior to design to confirm the presence and/or absence of wetlands and, if present, their boundaries.

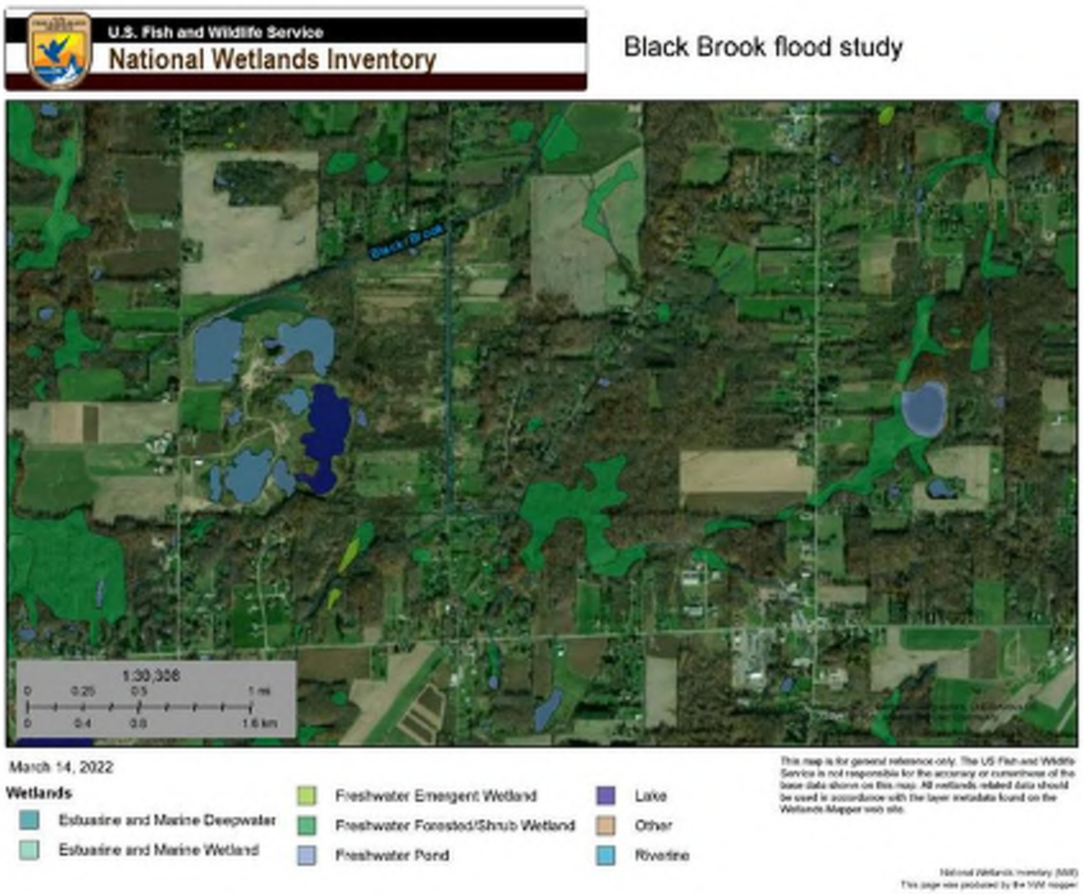


Figure 3. NWI results for project site.

Field Assessment

The field assessment nethods consisted of a remote investigation of aquatic resources, terrestrial resources, wetlands, and endangered species using secondary data, and site visits. The site visits involved examining stream morphology, performing a primary headwater habitat evaluation, identifying vegetation, and identifying opportunities for nature-based solutions to flooding. This fieldwork was performed on March 17-18, 2022, with a follow-up visit on September 13, 2022.

Section Descriptions

The study area was divided into three areas based on the existing stream network. The valley bottom along Mantua Center Road, where the East Tributary and the West Tributary join, was defined as the Mainstem area. The West area is to the southwest and contains the West Tributary. The East area is to the southeast, contains the East Tributary, and stretches just past the Hwy 44 and 82 intersection. Figure 4 shows for the locations of these three areas. Emphasis was placed on the East area, due to the initial modeling efforts by Osborn Engineering indicating that this sub watershed contributes the largest flow contributing to the inundation of the Mainstem area. The fieldwork is further described in subsequent subsections below.

Figure 4. Sections of the Black Brook Study Area

East Section

The upper watershed of the East Tributary contains the village of Mantua Corners and the most developed area of the entire watershed. Historic aerial photos show that much of the watershed has been ditched to facilitate drainage before 1952. Most flow paths through the landscape have been modified, through ditching, channelization, and impoundment. Starting at the upstream end of the watershed near Hwy 44, the East Tributary runs under Hwy 44 in two culverts- a 22” RCP and a 24” CPP. The northern branch has no defined channel and is a long linear wetland mixture of scrub-shrub and emergent wetlands. It is located directly south of the old railroad line location that ran southwest to northeast through Mantua Center. The southern branch is a defined channel that has been channelized and disconnected from its floodplain.

Figure 5. South Branch channelized stream through forest (left) confluence South and North Branch (right)

It flows through various landscapes, including industrial and recently logged mature wet forest. Just before joining the south branch, another channelized tributary enters from the south, draining a portion of the watershed including Mantua Corners. The headwaters of this tributary have been piped and the stormwater from mantua Corners enters into this stream, which is channelized into a straight ditch parallel to businesses. The confluence of the south and north branches is located in an emergent/scrub-shrub wetland approximately 2200 linear feet southeast of the north branch crossing Hwy 44. The East Tributary continues to flow northeast parallel to the old railroad line. A driveway impounds the stream/wetland complex with three – 36” CPP to pass base flow.

Figure 6. Ponded area upstream of driveway embankment (left) and blown out culvert at old railroad line crossing (right)

On both sides of this crossing, there is ponded water. Approximately 900 feet downstream, the tributary takes a northern turn through a break in the railroad embankment. The culvert has blown out at this location, draining an upstream former pond.

The pond has become a mostly emergent wetland dominated by phragmites and reed canary grass with some scrub-shrub wetland mix around the edges. Downstream of the former railroad embankment, the stream enters a forest. The stream has been channelized with the spoils left in a linear mound along the left or right side. Remanent sinuous channels appear through the forest, highlighting historic flow paths.


Figure 7. Entrenched channelized stream in East Section upstream of Wayne Road

A tributary enters from the south approximately 300 feet upstream of Wayne Road. This tributary's flow path is similar to the East Tributary, with an old pond upstream of the railroad crossing that has developed as an emergent wetland dominated by invasive species.

Downstream of Wayne Road, the East Tributary has been channelized and the south side is residential, whereas the north side is a scrub-shrub or forested wetland patches interspersed with residential properties. At Mantua Center Road the East Tributary joins with the West Tributary and becomes the Mainstem. A ditch enters halfway between Wayne and Mantua Center Road from the north, draining the northern properties to the East Tributary.

The above described drainage modifications, likely speed up runoff from the area and may contribute to increased flooding peaks along the Mainstem area.

West Section

The upper watershed of the West Tributary is primarily agricultural in land use. The flow path starts in a large wetland south of HWY 82 and west of Mantua Center and drains northeast toward Mantua Center. Near Hwy 82, the stream has been channelized and impounded on both sides of the highway. Downstream of the impoundment on the north side of the West Tributary enters a large scrub-shrub/emergent wetland complex, surrounded by forested wetlands.

Figure 8. Forested wetland (left) and scrub shrub wetland (right) in West Section

Portions of the north side of the wetland have been ditched, and the West Tributary exits the wetland through ditches both running north and west toward Mantua Center Road and the confluence with the East Tributary. The wetlands and low-lying areas of the site have a very high-water table, indicated by the natural hummocking of the soil and the evidence of frequent ponding on the surface.

Mainstem Section

At the upstream end of the mainstem section, the East Tributary and the West Tributary join by a culvert under Mantua Center Road. The flow travels north parallel to Mantua Center Road in two large ditches adjacent to the road, which connect to Black Brook. Due to prior land use (sod farm), ditches have been excavated perpendicular to the ditches throughout the site, and an additional parallel ditch to the road can be found on the west side of the valley next to the quarry.

Figure 9. Mainstem and side ditch (left) along Mantua Center Road and far west ditch (right)

Within the far west ditch, there is evidence of beaver activity. Much of the valley is fallow and portions of it have been allowed to revert to scrub/shrub wetlands with patches of forest and emergent wetlands. Other portions of the valley are maintained as periodically mown meadows, with a few properties in the far north being used for agriculture. Some of the properties have tile drains that outlet into the Mainstem drainage ditch. Even with all the ditching and the tile drains present, the section has a very high-water table in the spring, with water evident on the surface or within the upper foot of the soil. Within the wetland areas, hummocking is present.

Habitat Types

Emergent wetlands – Emergent wetlands are prevalent throughout the site, concentrated primarily in the East section of the study area. Vegetation found within these areas includes reed canary grass (*Phalaris arundinacea*), Common Reed (*Phragmites australis*), rice cut grass (*Leersia oryzoides*), cattails (*Typha* spp), a variety of sedges (*Carex* spp), white turtlehead (*Chelone glabra*), and jewelweed (*Impatiens capensis*). Depending on the location, water depths can vary from 0-12" deep.

Scrub Shrub Wetlands – These wetlands are the most prevalent type of wetland found within the Mainstem and West areas. Often the soil is hummocked, indicating a high-water table and frequent ponding. The dominant shrub types include a variety of dogwoods *(Cornus* spp) (red osier, rough) and willow (*Salix spp*.) with an understory of herbaceous species including Joe-Pye weed (*Eutrochium purpureum*) and jewelweed.

Forest – The forests historically were very wet along the flow paths and are dominated by red maple (*Acer Rubrum*), elm (*Ulmus americana*), and green ash (*Fraxinus pennsylvanica*) with an understory of sensitive fern (*Onoclea sensibilis*), poison ivy (*Toxicodendron radicans*), multiflora rose (*Rosa multiflora*) and a variety of sedges (*Carex* spp). Further up in the landscape, the upper story of the forest changes to tulip poplar (*Liridendron tulipfera*), sassafras (*Sassafras albidum*), red oak (*Acer rubrum*), and American beech (*Fagus grandifolia*) with an understory of spicebush (*Lindera benzoin*), barberry (*Berberis vulgaris*) and hog-peanut (*Amphicarpaea bracteata*).

Primary Headwater Habitat Evaluation

In-stream habitat within the East section was calculated by using the Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams (OEPA, 2009). This section was divided into five reaches with the HHEI scores ranging from 54 to 66 out of 100 (Appendix B). Four of the reaches would classify the stream as Class III-PHW, which "prevailing flow and temperature conditions of these streams are influenced by groundwater. They exhibit moderately diverse to highly diverse communities of cold water adapted native fauna present year-round…" (OEPA, 2020). The lowest scoring reach which is located just downstream of Hwy 44 near Mantua Corners, classifies as a Class II PHW, which area "normally intermittent, but some may have perennial flow derived from shallow groundwater in which case the ambient stream temperature remains relatively warm during the summer and fluctuates to a greater degree seasonally" (OEPA, 2020) As previously mentioned, the stream suffers from bank erosion and channelization. Most of the riffles are composed of gravel and are frequently mobilized during large storm events. Instream aquatic habitat is lacking with a limited variation in flow regimes (slow-shallow, fast-shallow, fast-deep, slow-deep) with slow shallow being the dominant variety. Bank erosion is likely to increase and the PHW score is likely to decrease as the channel degrades even further.

Natural-based Solutions For Flooding

After evaluation of the study area, the following intervention opportunities could be used to slow and store water on the landscape to reduce or slow flood peaks and provide ecological uplift within the watershed. Historically, the mainstem section of the study area was frequently flooded, as indicated by the type of soils present and the site's natural topography. Flooding will continue to occur, however, these methods may have some effect on the smaller storm events, reducing the frequency of inundation, and minimizing the impact on existing wetlands and forests. Appendix C shows locations of these opportunities.

Floodplain Restoration – Floodplain restoration involves lowering the existing grade down to an elevation where more frequent storm events can access a floodplain, slowing and storing water. The newly graded floodplain would be graded to store smaller storm events on the landscape in depressional areas, allowing it to soak into the ground or be taken up by wetland vegetation. This type of grading is called hummock and hollow grading and mimics old-growth forest landscapes, providing a complex diversity of niche habitats for a variety of species. The floodplain would be planted with a native plant palette, most likely either scrub/shrub or forest in composition.

Wetland Enhancement – Wetland enhancement involves minor interventions into existing wetland complexes, to restore a more natural vegetation palette by removal of invasive species such as phragmites and reed canary grass. Most often these species when found in a wetland dominate the landscape, choking out the natives. To remove these species, excavation can be a method, which would create more storage within the wetland by removing the dense plant and root mass of the invasive species and replacing it with a more open native species palette. Additional areas adjacent to the wetlands could also be excavated and restored as wetlands to provide more storage.

Floodplain Reconnection – Floodplain reconnection involves restoring the stream channel in place, by raising the invert of the channel through the installation of riffles and/or large wood jams. By reconnecting the stream channel to the existing floodplain, the water will spread out more frequently and slow down, changing the timing of when it reaches the downstream sections which can affect the peak discharge size. Through the installation of instream structures, ecological uplift will be realized by improving water quality, increasing instream habitat complexity, rehydrating the floodplain improving, and increasing the acreage of wetlands.

Stream Restoration – Stream restoration is proposed in areas where the stream has been channelized and there is limited floodplain access. These areas are good candidates for a restoration of an integrated stream and wetland complex – which would include restoring a well-connected baseflow channel system where flows can frequently access a floodplain. This type of restoration would increase storage capacity, improve water quality, and create a variety of habitats including wetlands and forests.

Stormwater bmps – Many of the businesses within Mantua Corners drain directly to a stormwater system which then discharges water to the stream. By reducing the flashiness of the runoff directly from developed areas, the peak discharge further downstream can be reduced, eliminating the size or frequency of flooding during rain events. Retrofitting the drainage network with stormwater bmps such as wet swales, bio-retention facilities, stormwater ponds, etc can provide storage, slow the water, and allow it to infiltrate into the soil.

Wetland Restoration – In former wetlands areas (drained or degraded), wetland restoration and enhancement is proposed. The existing grade could be excavated six to 18 inches to provide more storage within the ditch network of the mainstem section of the site and planted with appropriate wetland species for the type of wetland proposed. The depth of excavation would be limited due to the high-water table.

In aggregate, these nature-based interventions have the potential to slow and store water and reduce flood peaks and frequency of inundation for lower runoff events. However, further modeling will be required to assess cost-effectiveness.

References

Chagrin River Watershed Partners. 2020. Nine-Element Nonpoint Source Implementation Strategic Plan. Black Brook (HUC 12) 041100020105. Approved January 3, 2020.

FEMA, 2009. Flood Insurance Study for Portage County, Ohio. Map No. 39133C020055D. August 18, 2009

FEMA, 2020. Building Community Resilience with Nature-Based Solutions: A Guide for Local Communities.

Ohio EPA. 2020. Field Methods for Evaluating Primary Headwater Streams in Ohio. Version 4.1. Ohio EPA Division of Surface Water, Columbus, Ohio. 130 pp.

USDA NRCS. Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

U.S. Fish and Wildlife Service, IPaC, Information for Planning and Consultation: https://ecos.fws.gov/ipac/

U.S. Fish and Wildlife Service, National Wetlands Inventory: https://www.fws.gov/wetlands/data/mapper.html

Woods, A.J., J..M. Omernik, C.S. Brockman, T.D.Gerber, W.D.Hosteter, and S.H. Azevedo. (1998). Ecoregions of Indiana and Ohio

ODNR ENVIRONMENTAL REVIEW REQUEST

APPENDIX A

Biohabitats
GREAT LAKES BIOREGION
2026 Murray Hill Road
Room 102
Cleveland, OH 44106

September 21, 2022

Ohio Department of Natural Resources
Division of Wildlife
Ohio Natural Heritage Program
2045 Morse Rd., Bldg. G-3
Columbus, OH 43229-6693
environmentalreviewrequest@dnr.state.oh.us

To whom it may concern:

We have been contracted by Mantua Township to complete an alternatives study of a tributary of Black Brook to reduce flooding along Mantua Center Road through nature based solutions. The types of solutions being proposed include the following: Property buyouts, wetland and stream restoration, pond restoration, stormwater best management practices within developed areas, etc. As a part of this project, we want to make sure we avoid any sensitive habitat for species of concern within the study area. A natural heritage data request form was submitted, however a response was received that this type of work does not meet the requirements for that type of review and that an Environmental Review was needed. The project is bound by quarries on the west, roughly Wayne Road/Hwy 44 to the east, Black Brook to the north and south of Hwy 82 and is located in Portage County (41.1850,-81.1442).

USGS topographic maps of the Aurora and Mantua Quadrangles with the study area are enclosed, along with a aerial indicating the study area(see Figure 1) and the Natural Heritage Data Request form. I am writing to request data on rare, threatened, and endangered species sited within the project area.

Thank you for your assistance with our project. If you have additional questions regarding our project please contact us at the address or telephone number provided.

Sincerely,
Biohabitats, Inc.

Suzanne Hoehne

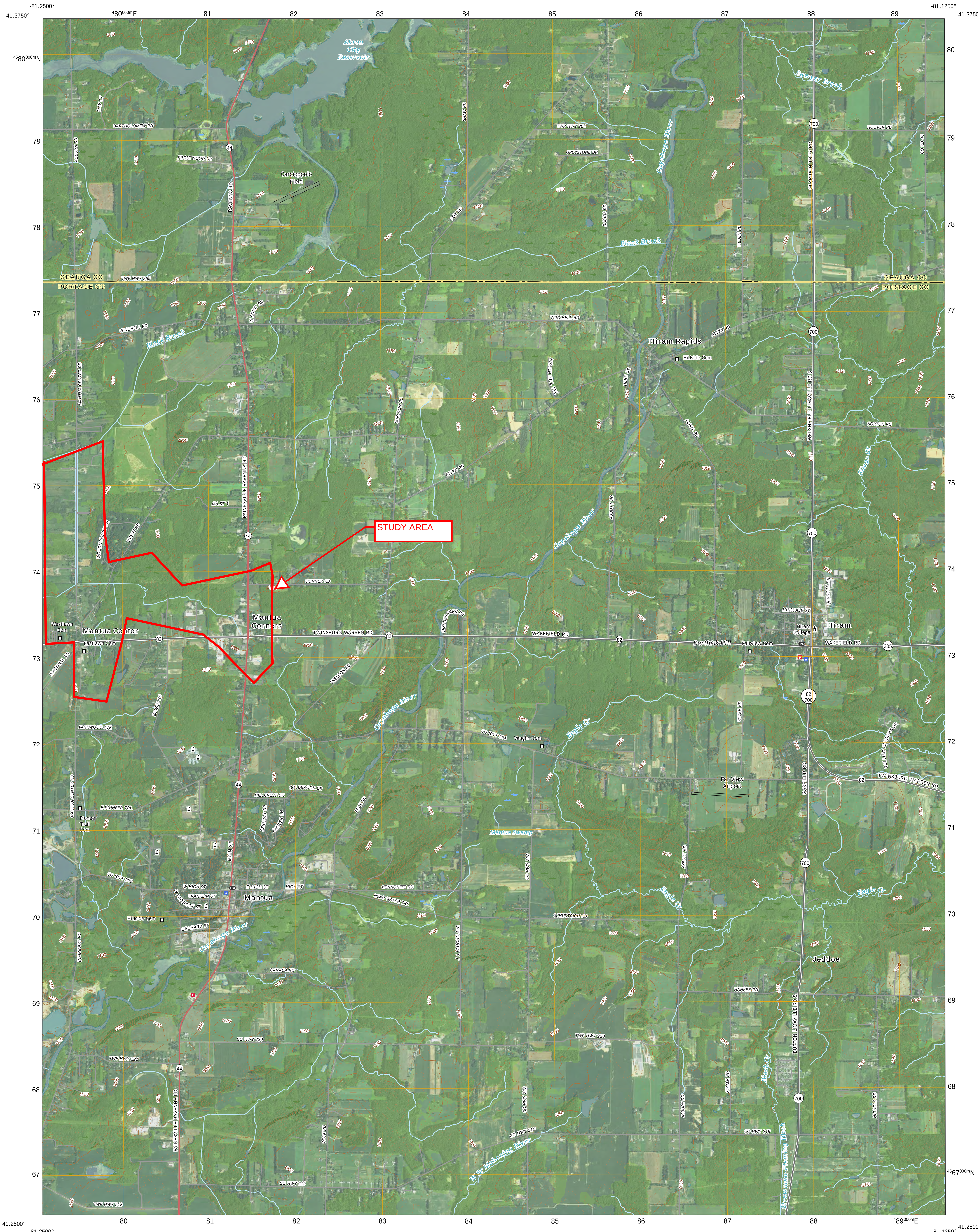
Suzanne Hoehne, CSE
Senior Ecological Designer
shoehne@biohabitats.com
p. 502-650-8880

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

USGS science for a changing world

The National Map US Topo

MANTUA QUADRANGLE
OHIO
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid:Universal Transverse Mercator, Zone 17T
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery....NAIP, July 2015 - October 2015
Roads....U.S. Census Bureau, 2016
Names....GNIS, 1979 - 2019
Hydrography....National Hydrography Dataset, 2004 - 2019
Contours....National Elevation Dataset, 2010
Boundaries....Multiple sources; see metadata file 2017 - 2018
Wetlands....FWS National Wetlands Inventory 2004 - 2007

MN
GN
8°42´
155 MILS
0°7´
2 MILS

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
MF
Grid Zone Designation
17T

SCALE 1:24 000

KILOMETERS
METERS
MILES
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.18

OHIO
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES

1 South Russell
2 Burton
3 Middlefield
4 Aurora
5 Garrettsville
6 Kent
7 Ravenna
8 Windham

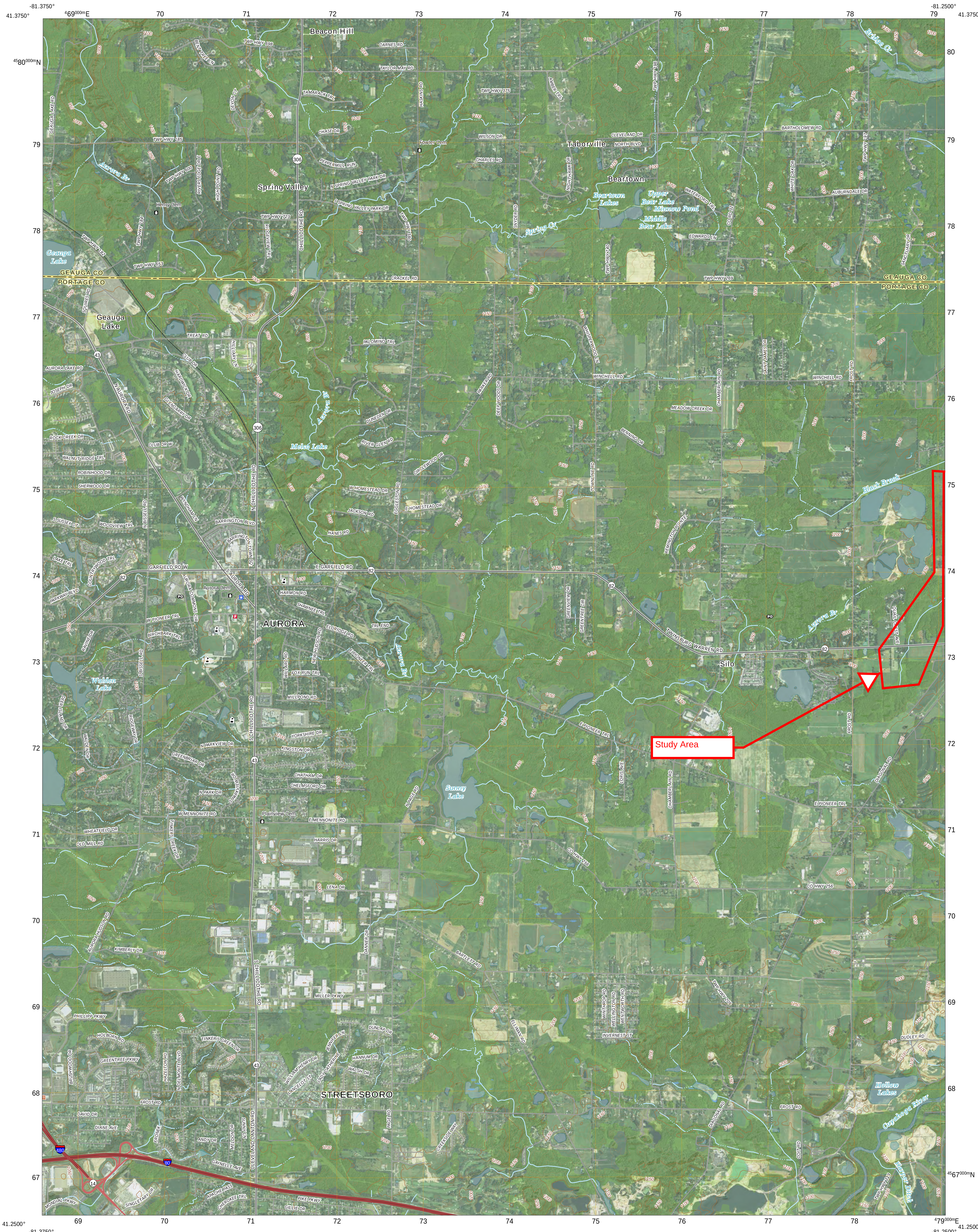
ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

MANTUA, OH
2019

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

AURORA QUADRANGLE
OHIO
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 17T
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery....NAIP, July 2015 - October 2015
Roads....U.S. Census Bureau, 2016
Names....GNIS, 1979 - 2019
Hydrography....National Hydrography Dataset, 2004 - 2019
Contours....National Elevation Dataset, 2010
Boundaries....Multiple sources; see metadata file 2017 - 2018

Wetlands....FWS National Wetlands Inventory 2004 - 2007

MN
GN
8°37´
153 MILS
0°12´
4 MILS

UTM GRID AND 2019 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
MF
Grid Zone Designation
17T

SCALE 1:24 000

KILOMETERS 1 0.5 0 1 2
METERS 1000 500 0 1000 2000
MILES 1 0.5 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.18

OHIO
QUADRANGLE LOCATION

1 Chagrin Falls
2 South Russell
3 Burton
4 Twinsburg
5 Mantua
6 Hudson
7 Kent
8 Ravenna

ADJOINING QUADRANGLES

ROAD CLASSIFICATION

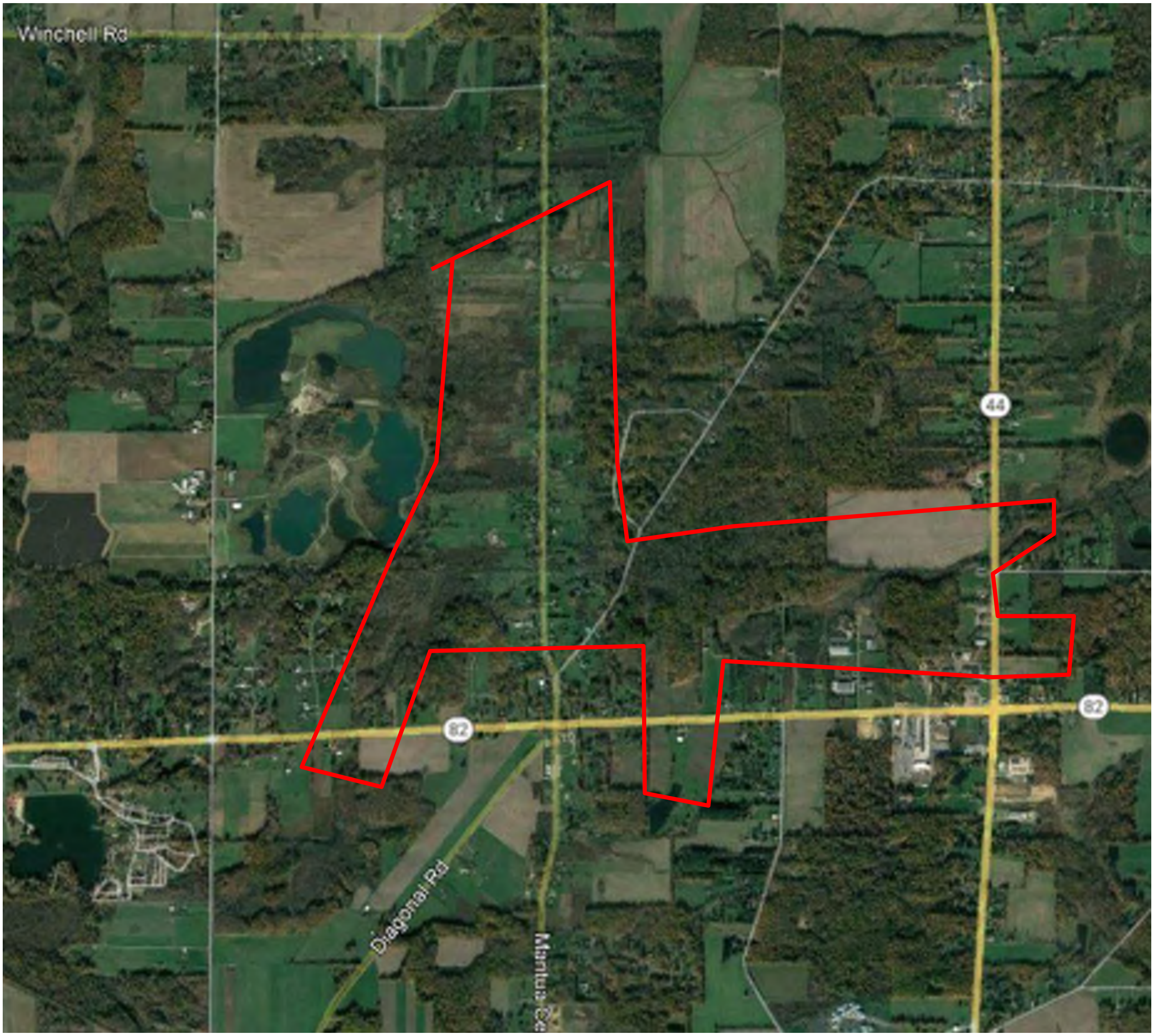
Expressway		Local Connector	
Secondary Hwy		Local Road	
Ramp		4WD	

Interstate Route
US Route
State Route

AURORA, OH
2019

7643016387396
NSN. 7643016387396
NGA REF NO. USGSX24K18777

Figure 1. Approximate Study Area outlined in Red.



DNR 5203 (R1017)

Ohio Department of Natural Resources
DIVISION OF WILDLIFE

NATURAL HERITAGE DATA REQUEST FORM

ODNR Division of Wildlife
Ohio Natural Heritage Program
2045 Morse Rd., Bldg. G-3
Columbus, OH 43229-6693
Email: NHDRequest@dnr.state.oh.us
Phone: 614-265-6818

WHAT KIND OF REVIEW DO I NEED?

ODNR provides two kinds of project reviews, an Ohio Natural Heritage Database (ONHD) data request and an Environmental Review (ER). ONHD data requests will be processed for projects that meet one of the following four criteria:

- consultant prepared reports for ODOT projects
- completion of OEPA's Ohio Rapid Assessment Method for wetlands
- academic research projects
- other non-development or non-construction projects

As applicable to your project, the ONHD will provide records for state and federally listed plants and animals, high quality plant communities, geologic features, breeding animal concentrations, scenic rivers, protected natural areas (managed areas), and significant unprotected natural areas (conservation sites). A one mile radius around the project site will automatically be searched. Because the ONHD contains sensitive information, it is our policy to provide only the data needed to complete your specific project.

If your project does not meet one of these criteria, you will need to submit it for an ER. An ER includes comments on potential impacts to the species and their habitats, and therefore constitutes coordination with ODNR under NEPA, the Fish & Wildlife Coordination Act, the Federal Water Pollution Control Act, and other laws. If your project requires ODNR coordination, please go to http://realestate.ohiodnr.gov/environmental-review for additional information including appropriate contacts. An ONHD search is included as part of the environmental review process.

INSTRUCTIONS:

Please complete all the information on both sides of this form, sign (required) and email it to NHDRequest@dnr.state.oh.us. Please provide a description of the work to be performed at the project site, and a map detailing your project site boundaries. If you request a GIS response, please also submit a shapefile of your project site (unbuffered). Data requests will be completed within approximately 30 days. There is currently no charge to process requests.

Date: 8/25/2022 **Company name:** Biohabitats , Inc.

Name of person response letter should be addressed to:

Mr. ☐ **Ms.** ☐ Suzanne Hoehne

Address: 120 Webster St, Suite 326

City/State/Zip: Louisville, KY 40204

Phone: 502-650-8880

E-mail address: shoehne@biohabitats.com

Project Name: Blackbrook Flood Study

Project Site Address: 11906 Mantua Center Rd, Mantua, OH 44255

Project County: Portage

Project City or Township: Mantua Township

Project site is located on the following USGS 7.5 minute topographic quad(s):

Mantua, OH

Project latitude and longitude: 411850N 811442W

Description of work to be performed at the project site:

A study to determine nature based solutions to flooding within the valley

How do you want your data reported? Both formats provide the same data. The manual search is most appropriate for small scale projects or for those without GIS capabilities. With this option we will send you a letter with a list of records and a map showing their location. If you request a GIS shapefile, we will send you a letter and shapefile of data layers. You will then need to make your own map and list of data for your report. You must have GIS capabilities. If you do not make a selection or if you choose both options, a manual search will be performed (Please choose only one option).

☐ **Printed list and map (manual search)** **OR** ☒ **GIS shapefile (computer search)**

The standard data we search includes state and federally listed plants and animals, high quality plant communities, geologic features, breeding animal concentrations, scenic rivers, managed areas, and conservation sites, including a one mile radius around your project area. List any information in addition to this that you require:

How will the information be used?

Information will be used to inform the study and identify potential locations for sites to install nature based solutions to help reduce downstream flooding

The chief of the Division of Wildlife has determined that the release of the ONHD data you have requested could be detrimental to the conservation of a species or unique natural feature. Pursuant to section 1531.04 of the Ohio Revised Code, this information is not subject to section 149.43 of the Revised Code. By signing below, you certify that the data provided will not be disclosed, published, or distributed beyond the scope of your project.

Signature Suzanne Hoehne **Date:** 8/25/2022

THIS PAGE INTENTIONALLY LEFT BLANK

HHEI FORMS

APPENDIX B

Headwater Habitat Form
HHEI SCORE (SUM OF METRICS 1, 2, 3) **54**

Protection Agency

SITE NAME/LOCATION SE Branch Black Brook 1

SITE NUMBER ______ RIVER BASIN 04110002605 RIVER CODE ______ DRAINAGE AREA (mi²) 0.23

LENGTH OF STREAM REACH (ft) 200 LAT 41.313023 LONG -81.223118 RIVER MILE ______

DATE 9/13/22 SCORER SH, EM, KG COMMENTS ______

NOTE: Complete All Items On This Form - Refer to "Headwater Habitat Evaluation Index Field Manual" for Instructions

STREAM CHANNEL MODIFICATIONS: ☐ NONE / NATURAL CHANNEL ☐ RECOVERED ☒ RECOVERING ☐ RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type present). Check *ONLY* two predominant substrate *TYPE* boxes. (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B

TYPE		PERCENT	TYPE		PERCENT
☐☐	BLDR SLABS [16 pts]		☒☐	SILT [3 pt]	
☐☐	BOULDER (>256 mm) [16 pts]		☐☐	LEAF PACK/WOODY DEBRIS [3 pts]	
☐☐	BEDROCK [16 pts]		☒☐	FINE DETRITUS [3 pts]	
☐☐	COBBLE (65-256 mm) [12 pts]		☐☐	CLAY or HARDPAN [0 pt]	
☐☐	GRAVEL (2-64 mm) [9 pts]		☐☐	MUCK [0 pts]	✓
☐☐	SAND (<2 mm) [6 pts]		☐☐	ARTIFICIAL [3 pts]	

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock 0%

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: (A) 6

TOTAL NUMBER OF SUBSTRATE TYPES: (B) 3

HHEI Metric Points — Substrate Max = 40: **9** (A + B)

2. Maximum Pool Depth (*Measure the maximum pool depth within the 61 meter (200 feet) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes*) (Check *ONLY* one box):

☐ > 30 centimeters [20 pts]
☒ > 22.5 - 30 cm [30 pts]
☐ > 10 - 22.5 cm [25 pts]
☐ 5 cm - 10 cm [15 pts]
☐ < 5 cm [5pts]
☐ NO WATER OR MOIST CHANNEL [0pts]

COMMENTS ______ MAXIMUM POOL DEPTH (centimeters): 25

Pool Depth Max = 30: **30**

3. BANK FULL WIDTH (Measured as the average of 3 - 4 measurements) (Check *ONLY* one box):

☐ > 4.0 meters (> 13') [30 pts]
☐ > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]
☐ > 1.5 m - 3.0 m (> 4' 8" - 9' 7") [20 pts]
☒ > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
☐ ≤ 1.0 m (≤ 3' 3") [5 pts]

COMMENTS ______ AVERAGE BANKFULL WIDTH (meters) 1.35

Bankfull Width Max=30: **15**

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ★NOTE: River Left (L) and Right (R) as looking downstream★

RIPARIAN WIDTH (Per Bank)

L	R	
☐	☐	Wide >10m
☐	☒	Moderate 5-10m
☒	☐	Narrow <5m
☐	☐	None

FLOODPLAIN QUALITY (Most Predominant per Bank)

L	R		L	R	
☐	☒	Mature Forest, Wetland	☐	☐	Conservation Tillage
☐	☐	Immature Forest, Shrub or Old Field	☐	☐	Urban or Industrial
☒	☐	Residential, Park, New Field	☐	☐	Open Pasture, Row Crop
☐	☐	Fenced Pasture	☐	☐	Mining or Construction

COMMENTS ______

FLOW REGIME (*At Time of Evaluation*) (Check *ONLY* one box):

☒ Stream Flowing
☐ Subsurface flow with isolated pools (interstitial)
☐ Moist Channel, isolated pools, no flow (intermittent)
☐ Dry channel, no water (ephemeral)

COMMENTS ______

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

☒ None ☐ 0.5 ☐ 1.0 ☐ 1.5 ☐ 2.0 ☐ 2.5 ☐ 3.0 ☐ >3

STREAM GRADIENT ESTIMATE

☐ Flat (0.5 ft/100 ft) ☒ Flat to Moderate ☐ Moderate (2 ft/100 ft) ☐ Moderate to Severe ☐ Severe (10 ft/100 ft)

QHEI PERFORMED? ☐ Yes ☐ No QHEI Score ________ (If Yes, Attach Completed QHEI form)

DOWNSTREAM DESIGNATED USE(S)

☒ WWH Name: Black Brook Distance from Evaluated Stream ________

☐ CWH Name: ________ Distance from Evaluated Stream ________

☐ EWH Name: ________ Distance from Evaluated Stream ________

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION.

USGS Quadrangle Name: ________ NRCS Soil Map Page: ________ NRCS Soil Map Stream Order: ________

County: Portage Township/City: Mantua Township

MISCELLANEOUS

Base Flow Conditions? (Y/N): ____ Date of last precipitation: ________ Quantity: ________

Photo-documentation Notes: ________

Elevated Turbidity? (Y/N): N Canopy (% open): ________

Were samples collected for water chemistry? (Y/N): N Lab Sample # or ID (attach results): ________

Field Measures: Temp (°C) ____ Dissolved Oxygen (mg/l) ____ pH (S.U.) ____ Conductivity (umhos/cm) ____

Is the sampling reach representative of the stream (Y/N) Y If not, explain: ________

Additional comments/description of pollution impacts: ________

BIOLOGICAL OBSERVATIONS

(Record all observations below)

Fish Observed? (Y/N) Y Species observed (if known): ________

Frogs or Tadpoles Observed? (Y/N) ____ Species observed (if known): ________

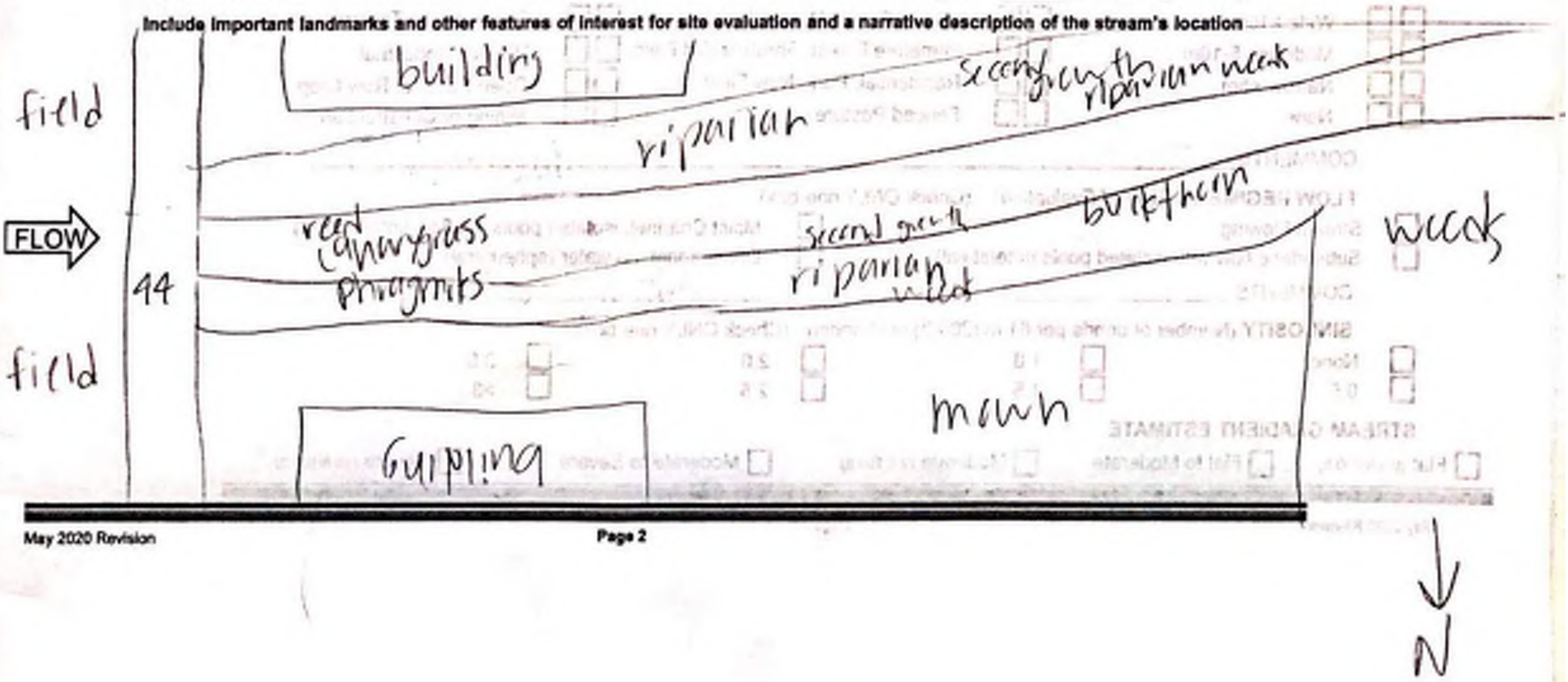
Salamanders Observed? (Y/N) ____ Species observed (if known): ________

Aquatic Macroinvertebrates Observed? (Y/N) ____ Species observed (if known): ________

Comments Regarding Biology: ________

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed)

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location



Protection Agency

Headwater Habitat Form

HHEI SCORE (sum of metrics 1, 2, 3) **65**

SITE NAME/LOCATION: SF Branch Black Creek

SITE NUMBER ______ RIVER BASIN 04110002015 RIVER CODE ______ DRAINAGE AREA (mi²) 0.22

LENGTH OF STREAM REACH (ft) 200 LAT 41.31276 LONG -81.22531 RIVER MILE 2.2

DATE 9/13/22 SCORER SH, FM, KG COMMENTS ______

NOTE: Complete All Items On This Form - Refer to "Headwater Habitat Evaluation Index Field Manual" for Instructions

STREAM CHANNEL MODIFICATIONS: ☐ NONE / NATURAL CHANNEL ☐ RECOVERED ☒ RECOVERING ☐ RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type present). Check *ONLY* two predominant substrate *TYPE* boxes. (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B

TYPE		PERCENT	TYPE		PERCENT
☐☐	BLDR SLABS [16 pts]		☐☐	SILT [3 pt]	✓
☐☐	BOULDER (>256 mm) [16 pts]	✓	☐☐	LEAF PACK/WOODY DEBRIS [3 pts]	
☐☐	BEDROCK [16 pts]		☐☐	FINE DETRITUS [3 pts]	
☐☐	COBBLE (65-256 mm) [12 pts]	✓	☐☐	CLAY or HARDPAN [0 pt]	
☐☒	GRAVEL (2-64 mm) [9 pts]		☐☐	MUCK [0 pts]	
☐☒	SAND (<2 mm) [6 pts]		☐☐	ARTIFICIAL [3 pts]	

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock ______

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: (A) **15**

TOTAL NUMBER OF SUBSTRATE TYPES: (B) **5**

HHEI Metric Points — Substrate Max = 40: **20** (A + B)

2. Maximum Pool Depth (*Measure the maximum pool depth within the 61 meter (200 feet) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes*) (Check *ONLY* one box):

- ☐ > 30 centimeters [20 pts]
- ☐ > 22.5 - 30 cm [30 pts]
- ☒ > 10 - 22.5 cm [25 pts]
- ☐ 5 cm - 10 cm [15 pts]
- ☐ < 5 cm [5pts]
- ☐ NO WATER OR MOIST CHANNEL [0pts]

COMMENTS ______ MAXIMUM POOL DEPTH (centimeters): **16**

Pool Depth Max = 30: **25**

3. BANK FULL WIDTH (Measured as the average of 3 - 4 measurements) (Check *ONLY* one box):

- ☐ > 4.0 meters (> 13') [30 pts]
- ☐ > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]
- ☒ > 1.5 m - 3.0 m (> 4' 8" - 9' 7") [20 pts]
- ☐ > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
- ☐ ≤ 1.0 m (≤ 3' 3") [5 pts]

COMMENTS ______ AVERAGE BANKFULL WIDTH (meters) **2.6**

Bankfull Width Max=30: **20**

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ★NOTE: River Left (L) and Right (R) as looking downstream★

L R	RIPARIAN WIDTH (Per Bank)	L R	FLOODPLAIN QUALITY (Most Predominant per Bank)	L R	
☐☒	Wide >10m	☐☒	Mature Forest, Wetland	☐☐	Conservation Tillage
☒☐	Moderate 5-10m	☒☐	Immature Forest, Shrub or Old Field	☐☐	Urban or Industrial
☐☐	Narrow <5m	☐☐	Residential, Park, New Field	☐☐	Open Pasture, Row Crop
☐☐	None	☐☐	Fenced Pasture	☐☐	Mining or Construction

COMMENTS ______

FLOW REGIME (*At Time of Evaluation*) (Check *ONLY* one box):

- ☒ Stream Flowing
- ☐ Subsurface flow with isolated pools (interstitial)
- ☐ Moist Channel, isolated pools, no flow (intermittent)
- ☐ Dry channel, no water (ephemeral)

COMMENTS ______

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

- ☒ None
- ☐ 0.5
- ☐ 1.0
- ☐ 1.5
- ☐ 2.0
- ☐ 2.5
- ☐ 3.0
- ☐ >3

STREAM GRADIENT ESTIMATE

☐ Flat (0.5 ft/100 ft) ☒ Flat to Moderate ☐ Moderate (2 ft/100 ft) ☐ Moderate to Severe ☐ Severe (10 ft/100 ft)

QHEI PERFORMED? ☐ Yes ☐ No QHEI Score __________ (If Yes, Attach Completed QHEI form)

DOWNSTREAM DESIGNATED USE(S)

☒ WWH Name: Black Brook ______ Distance from Evaluated Stream ______

☐ CWH Name: ______ Distance from Evaluated Stream ______

☐ EWH Name: ______ Distance from Evaluated Stream ______

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION.

USGS Quadrangle Name: ______ NRCS Soil Map Page: ______ NRCS Soil Map Stream Order: ______

County: Portage ______ Township/City: Mantua Township

MISCELLANEOUS

Base Flow Conditions? (Y/N): ______ Date of last precipitation: ______ Quantity: ______

Photo-documentation Notes: ______

Elevated Turbidity? (Y/N): N ______ Canopy (% open): ______

Were samples collected for water chemistry? (Y/N): N ______ Lab Sample # or ID (attach results): ______

Field Measures: Temp (°C) ______ Dissolved Oxygen (mg/l) ______ pH (S.U.) ______ Conductivity (umhos/cm) ______

Is the sampling reach representative of the stream (Y/N) Y ______ If not, explain: ______

______

Additional comments/description of pollution impacts: ______

______

BIOLOGICAL OBSERVATIONS

(Record all observations below)

Fish Observed? (Y/N) Y ______ Species observed (if known): ______

Frogs or Tadpoles Observed? (Y/N) ______ Species observed (if known): ______

Salamanders Observed? (Y/N) ______ Species observed (if known): ______

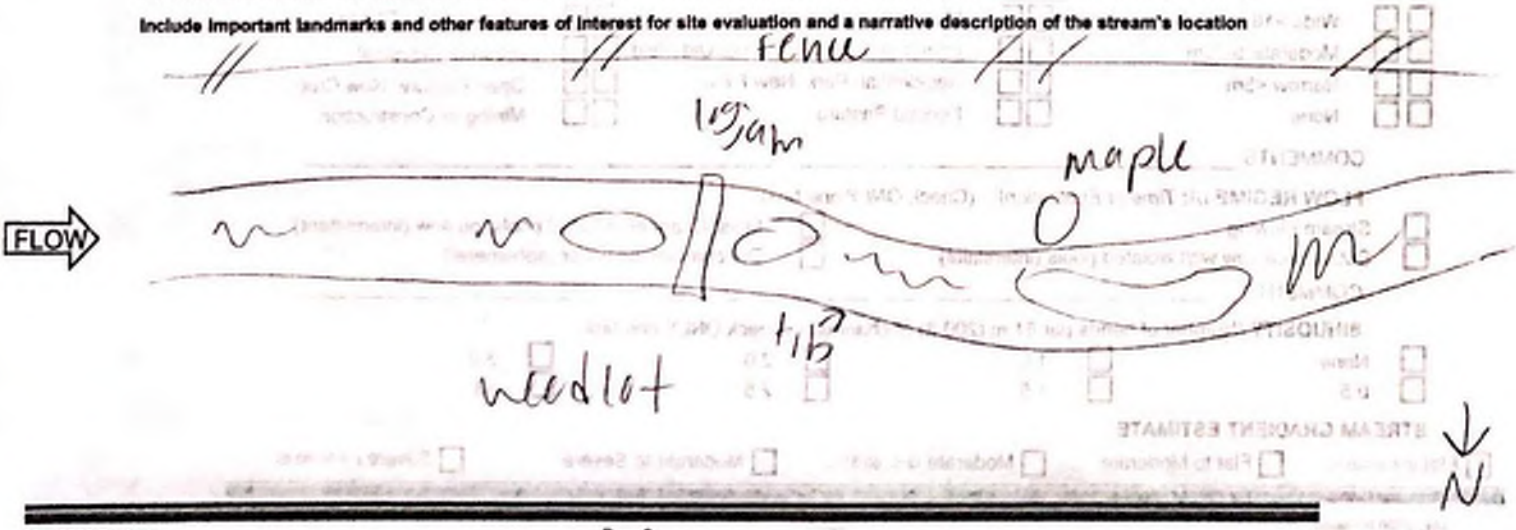
Aquatic Macroinvertebrates Observed? (Y/N) ______ Species observed (if known): ______

Comments Regarding Biology: ______

______

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed)

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location



Headwater Habitat Form
HHEI Score (sum of M1, 2 & 3) 66

Protection Agency

SITE NAME/LOCATION SEW trib
SITE NUMBER ______ RIVER BASIN [illegible] RIVER CODE ______ DRAINAGE AREA (mi²) 0.98
LENGTH OF STREAM REACH (ft) 200 LAT 41.315947 LONG -81.729842 RIVER MILE ______
DATE 9/13/22 SCORER SH, EM, KG COMMENTS ______

NOTE: Complete All Items On This Form - Refer to "Headwater Habitat Evaluation Index Field Manual" for Instructions

STREAM CHANNEL MODIFICATIONS: ☐ NONE / NATURAL CHANNEL ☐ RECOVERED ☒ RECOVERING ☐ RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type present). Check *ONLY* two predominant substrate *TYPE* boxes. (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B

TYPE		PERCENT	TYPE		PERCENT
☐☐	BLDR SLABS [16 pts]	______	☒☐	SILT [3 pt]	______
☒☐	BOULDER (>256 mm) [16 pts]	______	☐☐	LEAF PACK/WOODY DEBRIS [3 pts]	______
☐☐	BEDROCK [16 pts]	______	☐☐	FINE DETRITUS [3 pts]	______
☐☐	COBBLE (65-256 mm) [12 pts]	______	☐☐	CLAY or HARDPAN [0 pt]	______
☐☐	GRAVEL (2-64 mm) [9 pts]	______	☐☐	MUCK [0 pts]	______
☐☐	SAND (<2 mm) [6 pts]	______	☐☐	ARTIFICIAL [3 pts]	______

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock ______

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: (A) 19 **TOTAL NUMBER OF SUBSTRATE TYPES:** (B) 2

HHEI Metric Points — Substrate Max = 40: 21 (A + B)

2. Maximum Pool Depth (*Measure the maximum pool depth within the 61 meter (200 feet) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes*) (Check *ONLY* one box):

☐ > 30 centimeters [20 pts]
☐ > 22.5 - 30 cm [30 pts]
☒ > 10 - 22.5 cm [25 pts]
☐ 5 cm - 10 cm [15 pts]
☐ < 5 cm [5pts]
☐ NO WATER OR MOIST CHANNEL [0pts]

COMMENTS ______ **MAXIMUM POOL DEPTH (centimeters):** 14

Pool Depth Max = 30: 25

3. BANK FULL WIDTH (Measured as the average of 3 - 4 measurements) (Check *ONLY* one box):

☐ > 4.0 meters (> 13') [30 pts]
☐ > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]
☒ > 1.5 m - 3.0 m (> 4' 8" - 9' 7") [20 pts]
☐ > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
☐ ≤ 1.0 m (≤ 3' 3") [5 pts]

COMMENTS straightened ditch dikes along both sides **AVERAGE BANKFULL WIDTH (meters)** 2.5

Bankfull Width Max=30: 20

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ★NOTE: River Left (L) and Right (R) as looking downstream★

RIPARIAN WIDTH (Per Bank)

L	R	
☒	☒	Wide >10m
☐	☐	Moderate 5-10m
☐	☐	Narrow <5m
☐	☐	None

FLOODPLAIN QUALITY (Most Predominant per Bank)

L	R		L	R	
☒	☒	Mature Forest, Wetland	☐	☐	Conservation Tillage
☐	☐	Immature Forest, Shrub or Old Field	☐	☐	Urban or Industrial
☐	☐	Residential, Park, New Field	☐	☐	Open Pasture, Row Crop
☐	☐	Fenced Pasture	☐	☐	Mining or Construction

COMMENTS ______

FLOW REGIME (*At Time of Evaluation*) (Check *ONLY* one box):

☒ Stream Flowing
☐ Subsurface flow with isolated pools (interstitial)
☐ Moist Channel, isolated pools, no flow (intermittent)
☐ Dry channel, no water (ephemeral)

COMMENTS ______

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

☒ None ☐ 0.5 ☐ 1.0 ☐ 1.5 ☐ 2.0 ☐ 2.5 ☐ 3.0 ☐ >3

STREAM GRADIENT ESTIMATE

☐ Flat (0.5 ft/100 ft) ☐ Flat to Moderate ☐ Moderate (2 ft/100 ft) ☐ Moderate to Severe ☐ Severe (10 ft/100 ft)

QHEI PERFORMED? ☐ Yes ☐ No QHEI Score __________ (If Yes, Attach Completed QHEI form)

DOWNSTREAM DESIGNATED USE(S)

☒ WWH Name: Black Brook   Distance from Evaluated Stream ______

☐ CWH Name: ______   Distance from Evaluated Stream ______

☐ EWH Name: ______   Distance from Evaluated Stream ______

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION.

USGS Quadrangle Name: ______ NRCS Soil Map Page: ______ NRCS Soil Map Stream Order: ______

County: Portage   Township/City: Mantua Township

MISCELLANEOUS

Base Flow Conditions? (Y/N): ______ Date of last precipitation: ______ Quantity: ______

Photo-documentation Notes: ______

Elevated Turbidity? (Y/N): N   Canopy (% open): ______

Were samples collected for water chemistry? (Y/N): ______ Lab Sample # or ID (attach results): ______

Field Measures: Temp (°C) ______ Dissolved Oxygen (mg/l) ______ pH (S.U.) ______ Conductivity (umhos/cm) ______

Is the sampling reach representative of the stream (Y/N) Y If not, explain: ______

Additional comments/description of pollution impacts: ______

BIOLOGICAL OBSERVATIONS

(Record all observations below)

Fish Observed? (Y/N) Y   Species observed (if known): ______

Frogs or Tadpoles Observed? (Y/N) ______ Species observed (if known): ______

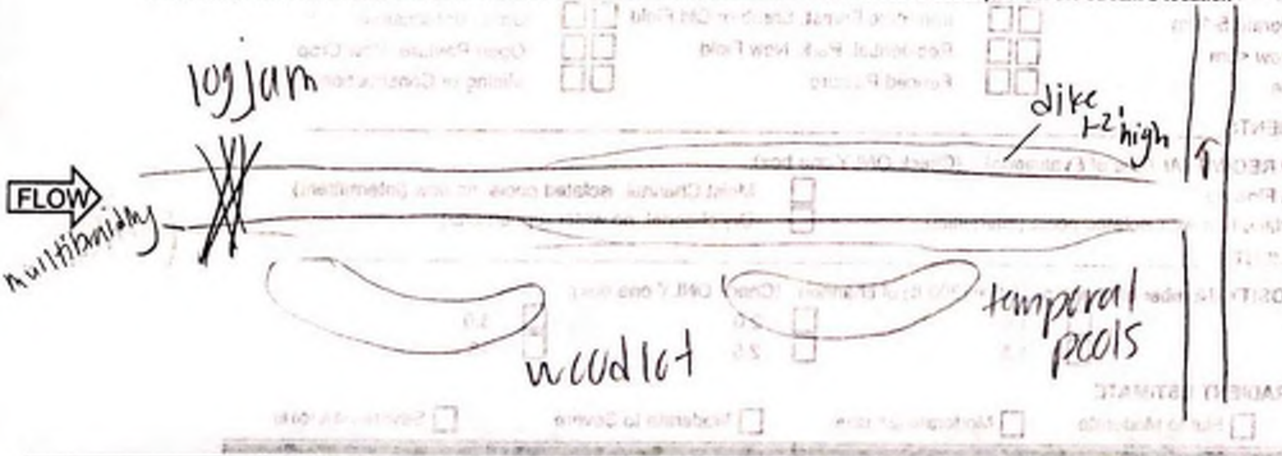
Salamanders Observed? (Y/N) ______ Species observed (if known): ______

Aquatic Macroinvertebrates Observed? (Y/N) ______ Species observed (if known): ______

Comments Regarding Biology: ______

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed)

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location



Headwater Habitat Form

HHEI SCORE (sum of metrics 1, 2, 3): 62

SITE NAME/LOCATION Black Brook Scadpoint East Branch

SITE NUMBER ________ RIVER BASIN 04110002015 RIVER CODE ________ DRAINAGE AREA (mi²) 0.96

LENGTH OF STREAM REACH (ft) 200 LAT 41.216413 LONG -81.237175 RIVER MILE ________

DATE 9/13/22 SCORER SH, EM, KG COMMENTS ________

NOTE: Complete All Items On This Form - Refer to "Headwater Habitat Evaluation Index Field Manual" for Instructions

STREAM CHANNEL MODIFICATIONS: ☐ NONE / NATURAL CHANNEL ☐ RECOVERED ☒ RECOVERING ☐ RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type present). Check *ONLY* two predominant substrate *TYPE* boxes. (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B

TYPE			PERCENT	TYPE			PERCENT
☐	☐	BLDR SLABS [16 pts]		☐	☒	SILT [3 pt]	
☐	☐	BOULDER (>256 mm) [16 pts]	✓	☐	☐	LEAF PACK/WOODY DEBRIS [3 pts]	✓
☐	☐	BEDROCK [16 pts]		☐	☐	FINE DETRITUS [3 pts]	
☐	☐	COBBLE (65-256 mm) [12 pts]	✓	☐	☐	CLAY or HARDPAN [0 pt]	
☒	☐	GRAVEL (2-64 mm) [9 pts]		☐	☐	MUCK [0 pts]	
☐	☐	SAND (<2 mm) [6 pts]		☐	☐	ARTIFICIAL [3 pts]	

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock ________

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: (A) 12 TOTAL NUMBER OF SUBSTRATE TYPES: (B) 5

HHEI Metric Points — Substrate Max = 40: **17** (A + B)

2. Maximum Pool Depth (*Measure the maximum pool depth within the 61 meter (200 feet) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes*) (Check *ONLY* one box):

- ☐ > 30 centimeters [20 pts]
- ☐ > 22.5 - 30 cm [30 pts]
- ☒ > 10 - 22.5 cm [25 pts]
- ☐ 5 cm - 10 cm [15 pts]
- ☐ < 5 cm [5pts]
- ☐ NO WATER OR MOIST CHANNEL [0pts]

COMMENTS ________ MAXIMUM POOL DEPTH (centimeters): 11

Pool Depth Max = 30: **25**

3. BANK FULL WIDTH (Measured as the average of 3 - 4 measurements) (Check *ONLY* one box):

- ☐ > 4.0 meters (> 13') [30 pts]
- ☐ > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]
- ☒ > 1.5 m - 3.0 m (> 4' 8" - 9' 7") [20 pts]
- ☐ > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
- ☐ ≤ 1.0 m (≤ 3' 3") [5 pts]

COMMENTS ________ AVERAGE BANKFULL WIDTH (meters) 7ft

Bankfull Width Max=30: **20**

This Information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ★NOTE: River Left (L) and Right (R) as looking downstream★

RIPARIAN WIDTH (Per Bank)

L	R	
☒	☒	Wide >10m
☐	☐	Moderate 5-10m
☐	☐	Narrow <5m
☐	☐	None

FLOODPLAIN QUALITY (Most Predominant per Bank)

L	R		L	R	
☒	☒	Mature Forest, Wetland	☐	☐	Conservation Tillage
☐	☐	Immature Forest, Shrub or Old Field	☐	☐	Urban or Industrial
☐	☐	Residential, Park, New Field	☐	☐	Open Pasture, Row Crop
☐	☐	Fenced Pasture	☐	☐	Mining or Construction

COMMENTS ________

FLOW REGIME (*At Time of Evaluation*) (Check *ONLY* one box):

- ☒ Stream Flowing
- ☐ Subsurface flow with isolated pools (interstitial)
- ☐ Moist Channel, isolated pools, no flow (intermittent)
- ☐ Dry channel, no water (ephemeral)

COMMENTS ________

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

- ☐ None
- ☐ 0.5
- ☐ 1.0
- ☐ 1.5
- ☒ 2.0
- ☐ 2.5
- ☐ 3.0
- ☐ >3

STREAM GRADIENT ESTIMATE

☒ Flat (0.5 ft/100 ft) ☐ Flat to Moderate ☐ Moderate (2 ft/100 ft) ☐ Moderate to Severe ☐ Severe (10 ft/100 ft)

QHEI PERFORMED? ☐ Yes ☐ No QHEI Score __________ (If Yes, Attach Completed QHEI form)

DOWNSTREAM DESIGNATED USE(S)

☒ WWH Name: Black Brook Distance from Evaluated Stream ________

☐ CWH Name: ________ Distance from Evaluated Stream ________

☐ EWH Name: ________ Distance from Evaluated Stream ________

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION.

USGS Quadrangle Name: ________ NRCS Soil Map Page: ________ NRCS Soil Map Stream Order: ________

County: Portage Township/City: Mantua Township

MISCELLANEOUS

Base Flow Conditions? (Y/N): ________ Date of last precipitation: ________ Quantity: ________

Photo-documentation Notes: ________

Elevated Turbidity? (Y/N): N Canopy (% open): ________

Were samples collected for water chemistry? (Y/N): N Lab Sample # or ID (attach results): ________

Field Measures: Temp (°C) ________ Dissolved Oxygen (mg/l) ________ pH (S.U.) ________ Conductivity (umhos/cm) ________

Is the sampling reach representative of the stream (Y/N) Y If not, explain: ________

Additional comments/description of pollution impacts: ________

BIOLOGICAL OBSERVATIONS

(Record all observations below)

Fish Observed? (Y/N) ________ Species observed (if known): ________

Frogs or Tadpoles Observed? (Y/N) ________ Species observed (if known): ________

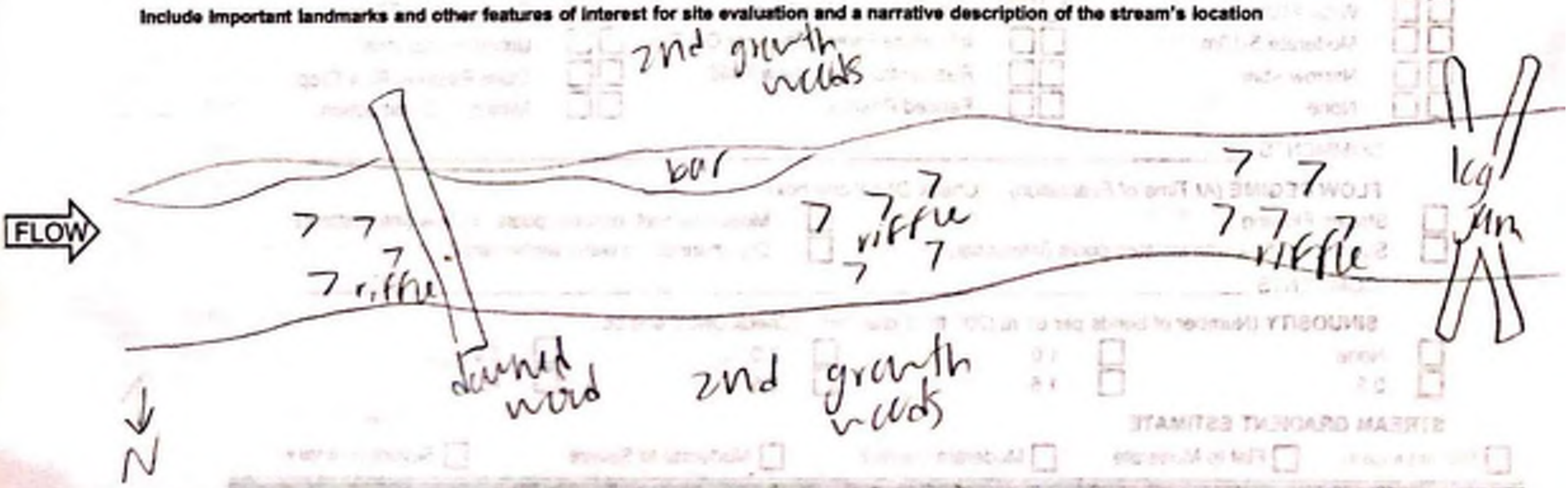
Salamanders Observed? (Y/N) ________ Species observed (if known): ________

Aquatic Macroinvertebrates Observed? (Y/N) ________ Species observed (if known): ________

Comments Regarding Biology: ________

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed)

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location



Headwater Habitat Form

HHEI SCORE (Sum of Metrics 1, 2, 3): 59

SITE NAME/LOCATION Black Brook SW East DS

SITE NUMBER ______ RIVER BASIN [illegible] RIVER CODE ______ DRAINAGE AREA (mi²) 0.82

LENGTH OF STREAM REACH (ft) 200 LAT 41.31516 LONG -81.231560 RIVER MILE ______

DATE 9/13/22 SCORER SH, EM, KG COMMENTS ______

NOTE: Complete All Items On This Form - Refer to "Headwater Habitat Evaluation Index Field Manual" for Instructions

STREAM CHANNEL MODIFICATIONS: ☐ NONE / NATURAL CHANNEL ☐ RECOVERED ☒ RECOVERING ☐ RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type present). Check *ONLY* two predominant substrate *TYPE* boxes. (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B

TYPE		PERCENT	TYPE		PERCENT
☐☐	BLDR SLABS [16 pts]		☒☐	SILT [3 pt]	
☐☐	BOULDER (>256 mm) [16 pts]		☐☐	LEAF PACK/WOODY DEBRIS [3 pts]	
☐☐	BEDROCK [16 pts]		☐☐	FINE DETRITUS [3 pts]	
☐☐	COBBLE (65-256 mm) [12 pts]		☐☐	CLAY or HARDPAN [0 pt]	
☒☐	GRAVEL (2-64 mm) [9 pts]		☐☐	MUCK [0 pts]	
☐☐	SAND (<2 mm) [6 pts]		☐☐	ARTIFICIAL [3 pts]	

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock ______

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: (A) 12 **TOTAL NUMBER OF SUBSTRATE TYPES:** (B) 2

HHEI Metric Points — Substrate Max = 40: **14** (A + B)

2. Maximum Pool Depth (*Measure the maximum pool depth within the 61 meter (200 feet) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes*) (Check *ONLY* one box):

- ☐ > 30 centimeters [20 pts]
- ☐ > 22.5 - 30 cm [30 pts]
- ☒ > 10 - 22.5 cm [25 pts]
- ☐ 5 cm - 10 cm [15 pts]
- ☐ < 5 cm [5pts]
- ☐ NO WATER OR MOIST CHANNEL [0pts]

COMMENTS ______ **MAXIMUM POOL DEPTH (centimeters):** 17

Pool Depth Max = 30: **25**

3. BANK FULL WIDTH (Measured as the average of 3 - 4 measurements) (Check *ONLY* one box):

- ☐ > 4.0 meters (> 13') [30 pts]
- ☐ > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]
- ☒ > 1.5 m - 3.0 m (> 4' 8" - 9' 7") [20 pts]
- ☐ > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
- ☐ ≤ 1.0 m (≤ 3' 3") [5 pts]

COMMENTS ______ **AVERAGE BANKFULL WIDTH (meters)** 2.9

Bankfull Width Max=30: **20**

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ★NOTE: River Left (L) and Right (R) as looking downstream★

RIPARIAN WIDTH (Per Bank)

L	R	
☒	☒	Wide >10m
☐	☐	Moderate 5-10m
☐	☐	Narrow <5m
☐	☐	None

FLOODPLAIN QUALITY (Most Predominant per Bank)

L	R		L	R	
☒	☒	Mature Forest, Wetland	☐	☐	Conservation Tillage
☐	☐	Immature Forest, Shrub or Old Field	☐	☐	Urban or Industrial
☐	☐	Residential, Park, New Field	☐	☐	Open Pasture, Row Crop
☐	☐	Fenced Pasture	☐	☐	Mining or Construction

COMMENTS ______

FLOW REGIME *(At Time of Evaluation)* (Check *ONLY* one box):

- ☒ Stream Flowing
- ☐ Subsurface flow with isolated pools (interstitial)
- ☐ Moist Channel, isolated pools, no flow (intermittent)
- ☐ Dry channel, no water (ephemeral)

COMMENTS ______

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

- ☒ None
- ☐ 0.5
- ☐ 1.0
- ☐ 1.5
- ☐ 2.0
- ☐ 2.5
- ☐ 3.0
- ☐ >3

STREAM GRADIENT ESTIMATE

☐ Flat (0.5 ft/100 ft) ☒ Flat to Moderate ☐ Moderate (2 ft/100 ft) ☐ Moderate to Severe ☐ Severe (10 ft/100 ft)

QHEI PERFORMED? ☐ Yes ☐ No QHEI Score __________ (If Yes, Attach Completed QHEI form)

DOWNSTREAM DESIGNATED USE(S)

☒ WWH Name: Black Brook Distance from Evaluated Stream __________

☐ CWH Name: __________ Distance from Evaluated Stream __________

☐ EWH Name: __________ Distance from Evaluated Stream __________

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION.

USGS Quadrangle Name: __________ NRCS Soil Map Page: ______ NRCS Soil Map Stream Order: ______

County: Portage Township/City: Mantua Township

MISCELLANEOUS

Base Flow Conditions? (Y/N): ______ Date of last precipitation: __________ Quantity: __________

Photo-documentation Notes: __________

Elevated Turbidity? (Y/N): N Canopy (% open): __________

Were samples collected for water chemistry? (Y/N): N Lab Sample # or ID (attach results): __________

Field Measures: Temp (°C) ______ Dissolved Oxygen (mg/l) ______ pH (S.U.) ______ Conductivity (umhos/cm) ______

Is the sampling reach representative of the stream (Y/N) Y If not, explain: __________

Additional comments/description of pollution impacts: __________

BIOLOGICAL OBSERVATIONS

(Record all observations below)

Fish Observed? (Y/N) ______ Species observed (if known): __________

Frogs or Tadpoles Observed? (Y/N) ______ Species observed (if known): __________

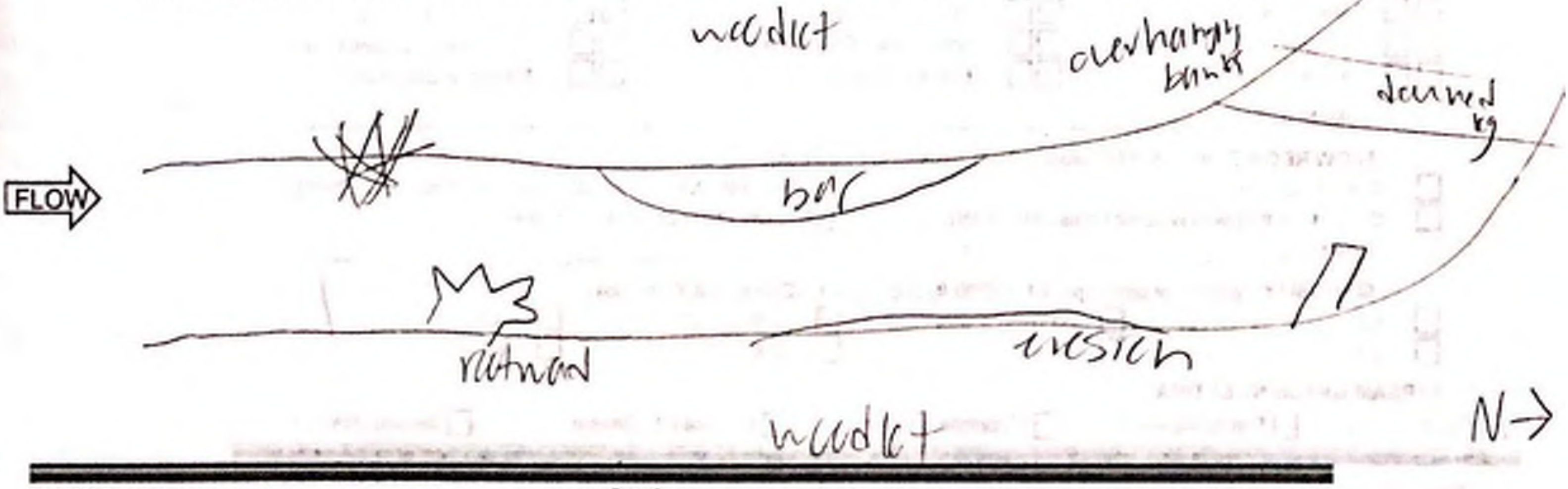
Salamanders Observed? (Y/N) ______ Species observed (if known): __________

Aquatic Macroinvertebrates Observed? (Y/N) ______ Species observed (if known): __________

Comments Regarding Biology: __________

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed)

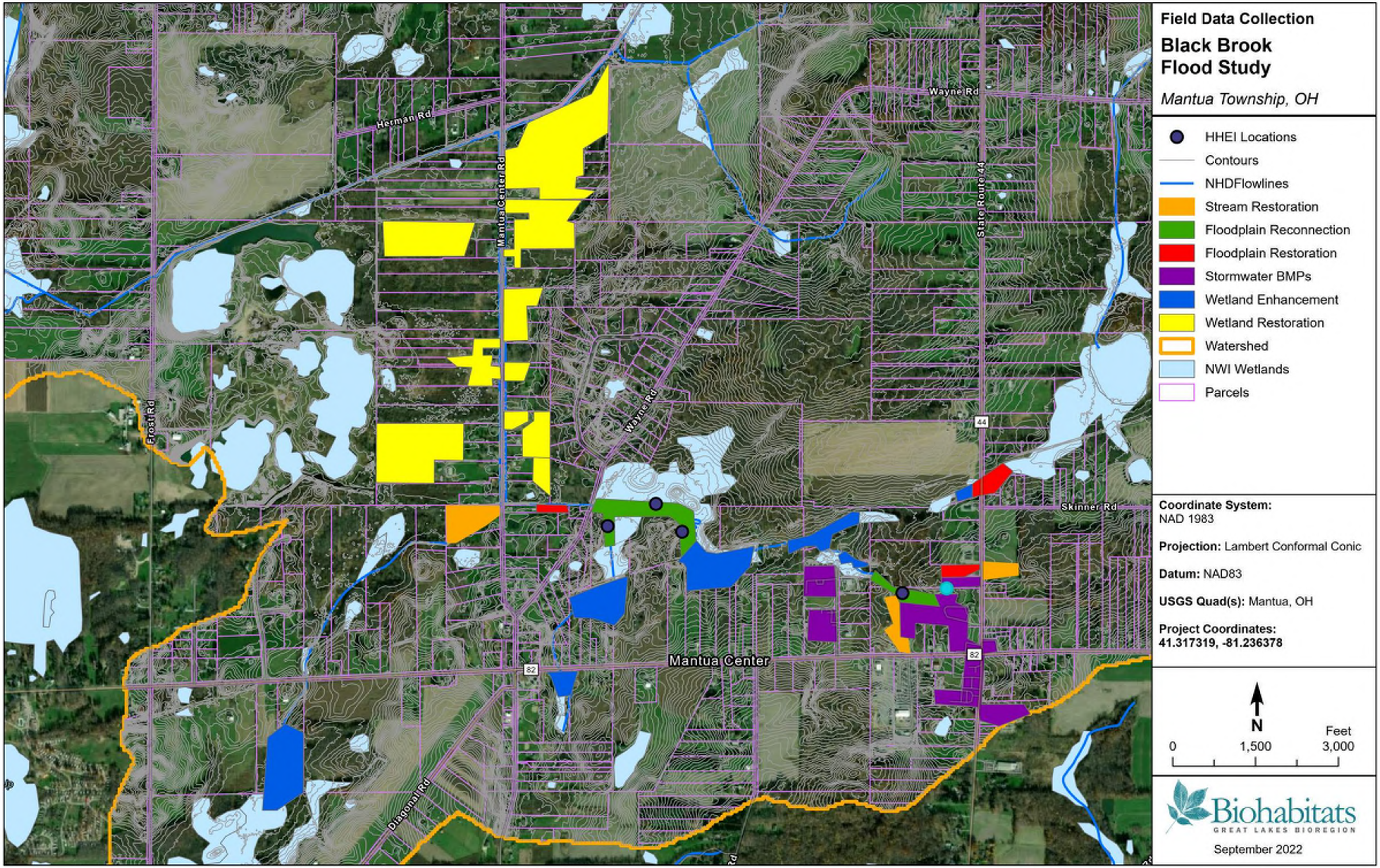
Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location



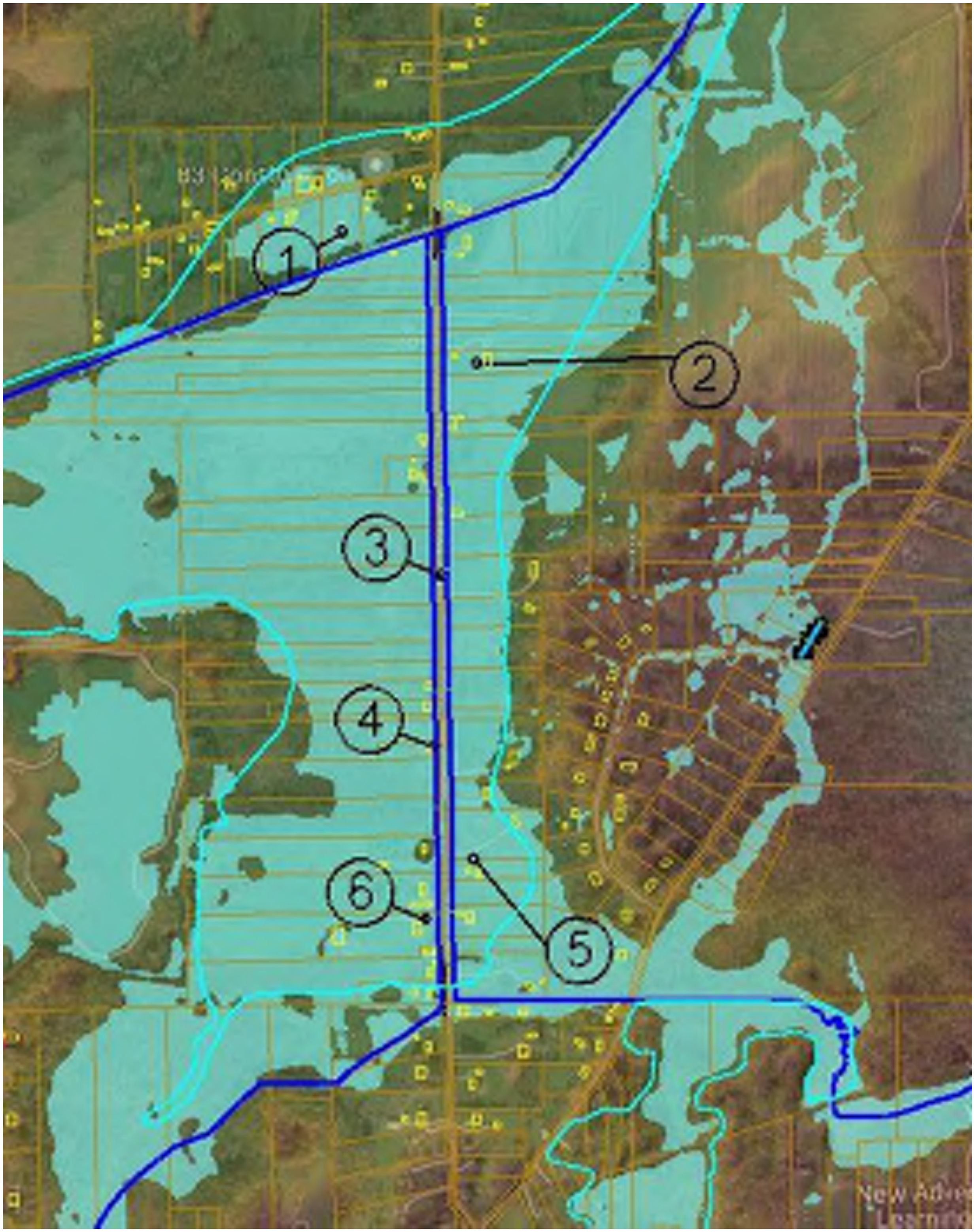
THIS PAGE INTENTIONALLY LEFT BLANK

NATURAL SOLUTIONS TO FLOODING OPPORTUNITIES

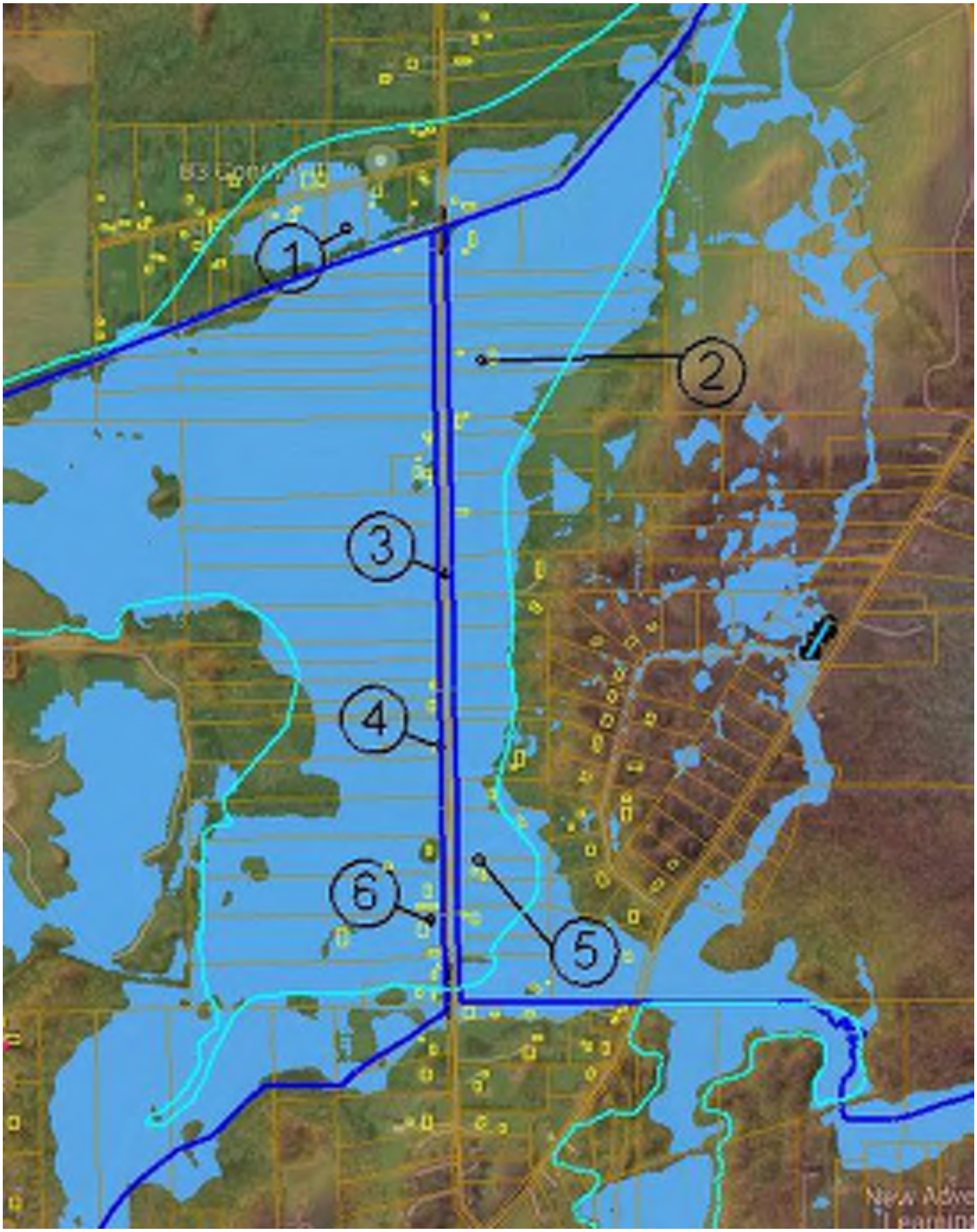
APPENDIX C


Field Data Collection
Black Brook
Flood Study
Mantua Township, OH
HHEI Locations
Contours
NHDFlowlines
Stream Restoration
Floodplain Reconnection
Floodplain Restoration
Stormwater BMPs
Wetland Enhancement
Wetland Restoration
Watershed
NWI Wetlands
Parcels
Coordinate System: NAD 1983
Projection: Lambert Conformal Conic
Datum: NAD83
USGS Quad(s): Mantua, OH
Project Coordinates: 41.317319, -81.236378
N
Feet
0
1,500
3,000
Biohabitats
GREAT LAKES BIOREGION
September 2022
Herman Rd
Mantua Center Rd
Wayne Rd
State Route 44
Frost Rd
Skinner Rd
Mantua Center
Diagonal Rd
44
82

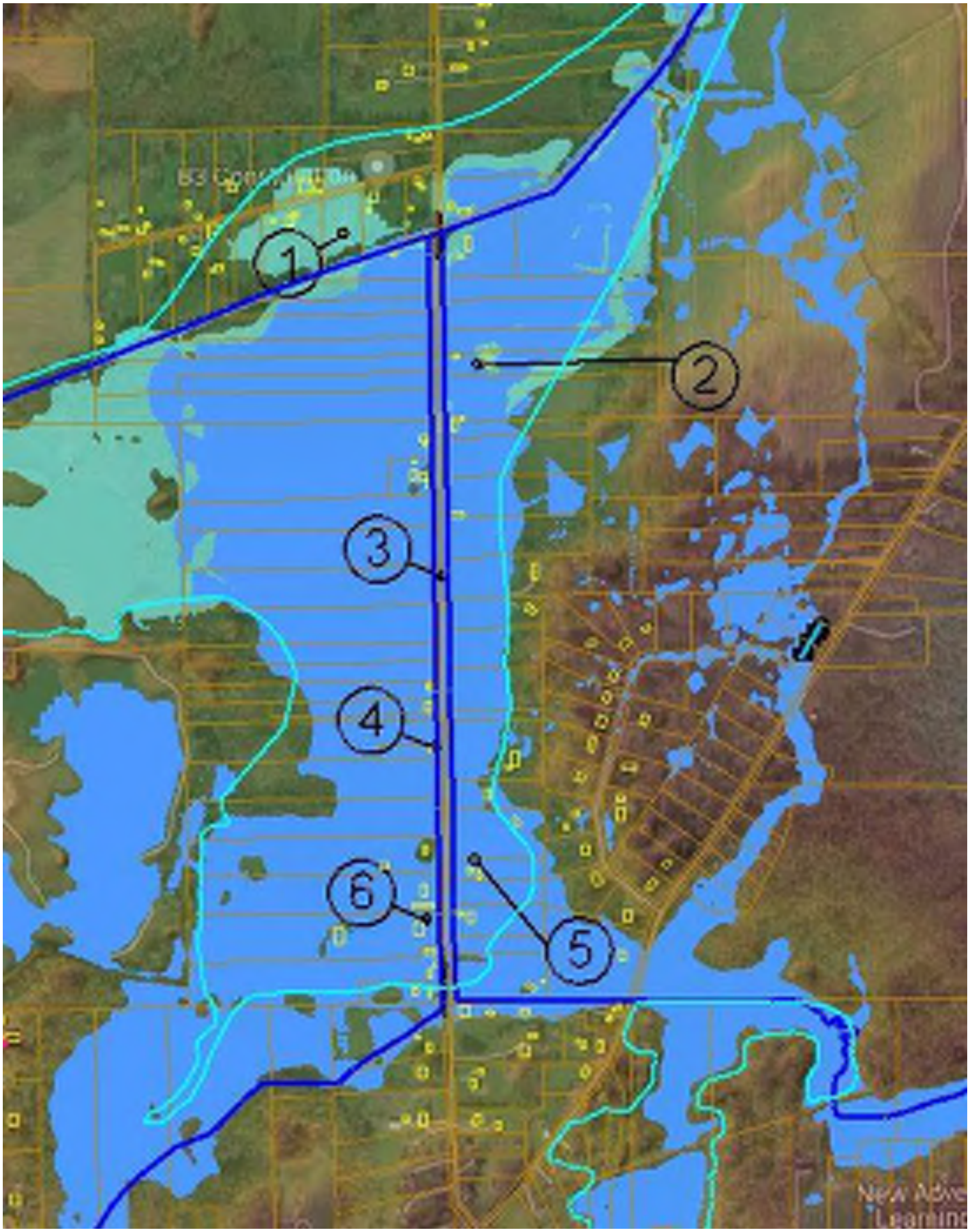
Appendix B – HEC RAS Model Output



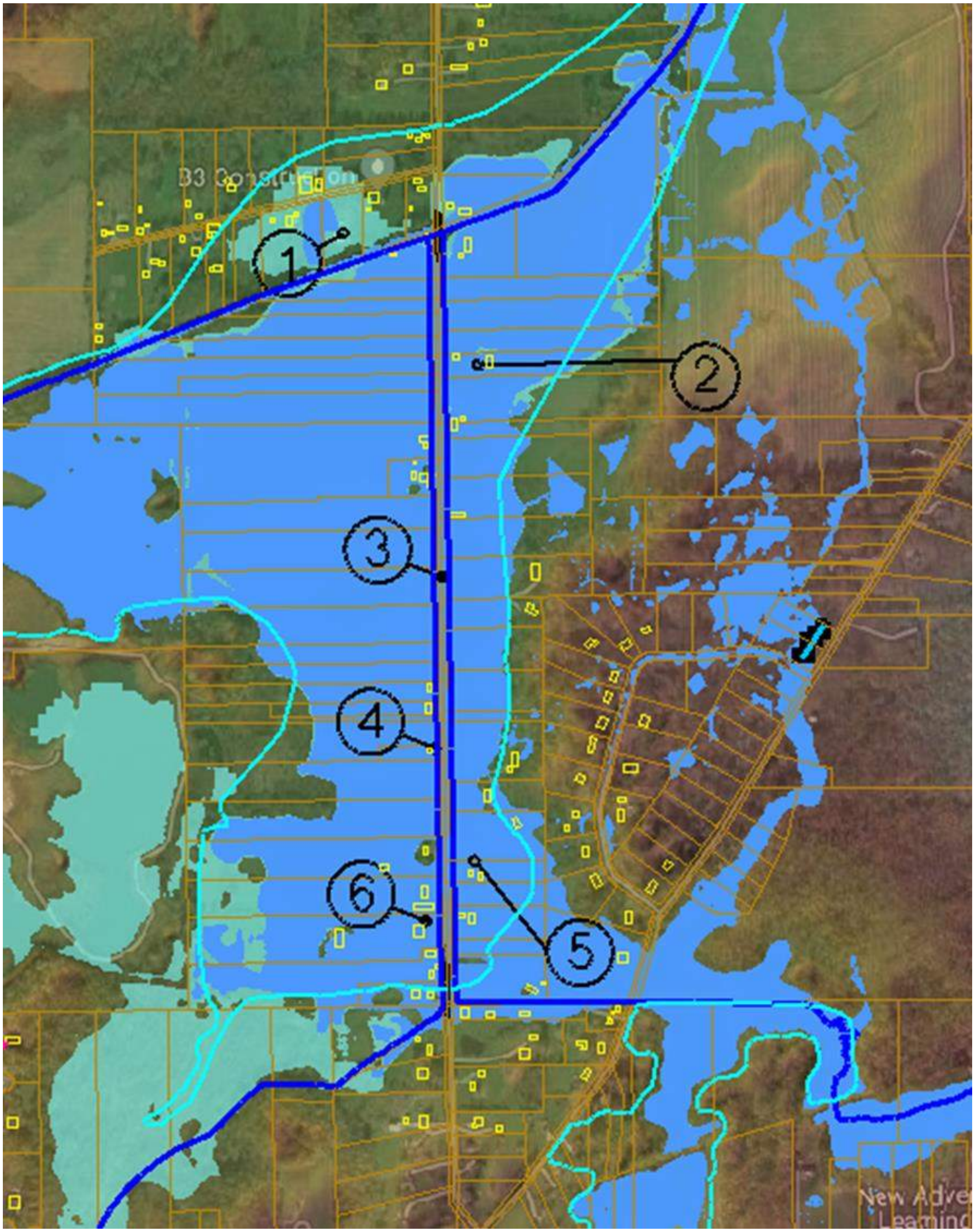
100-year - Existing Conditions



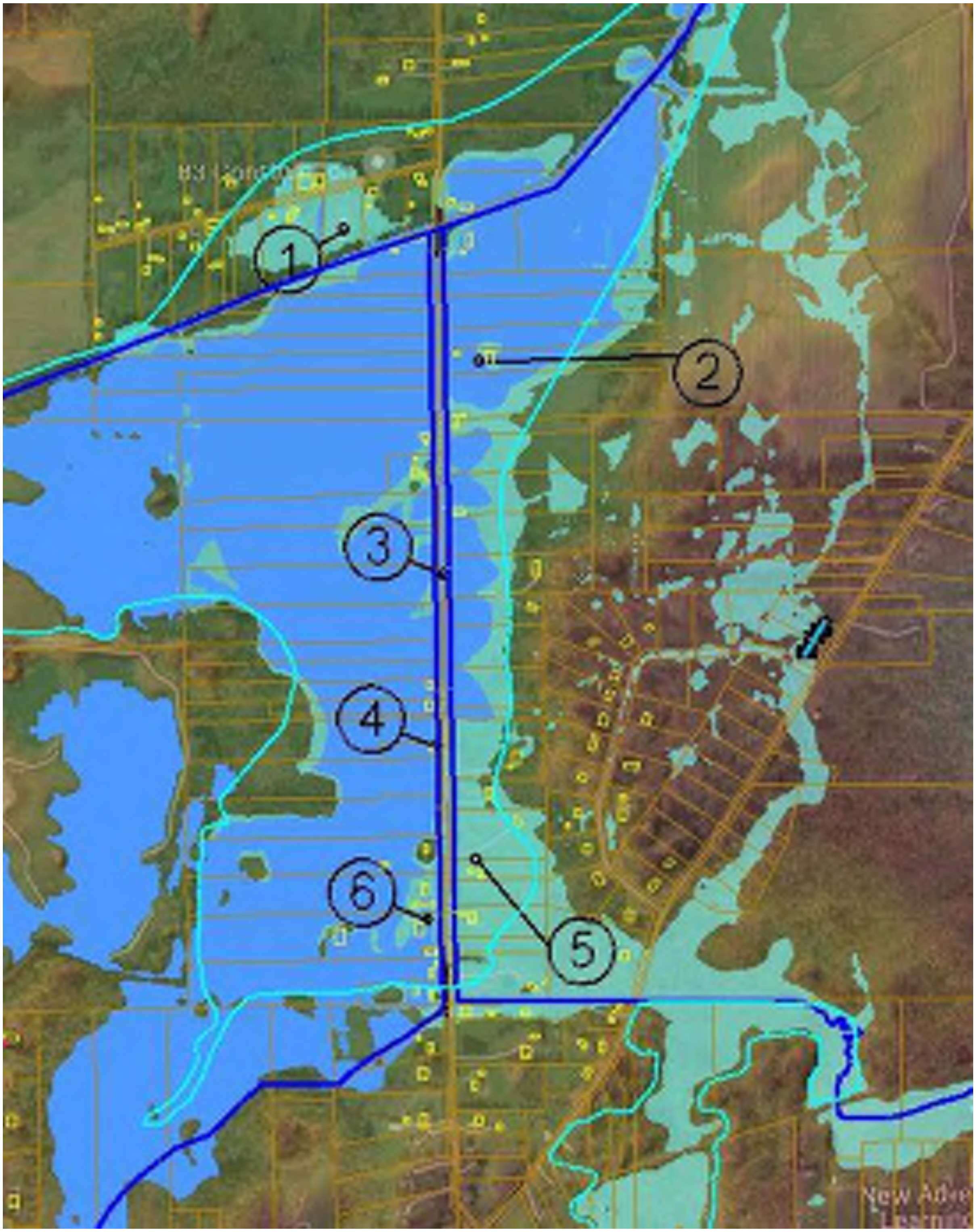
100-year - Existing Conditions and 2a



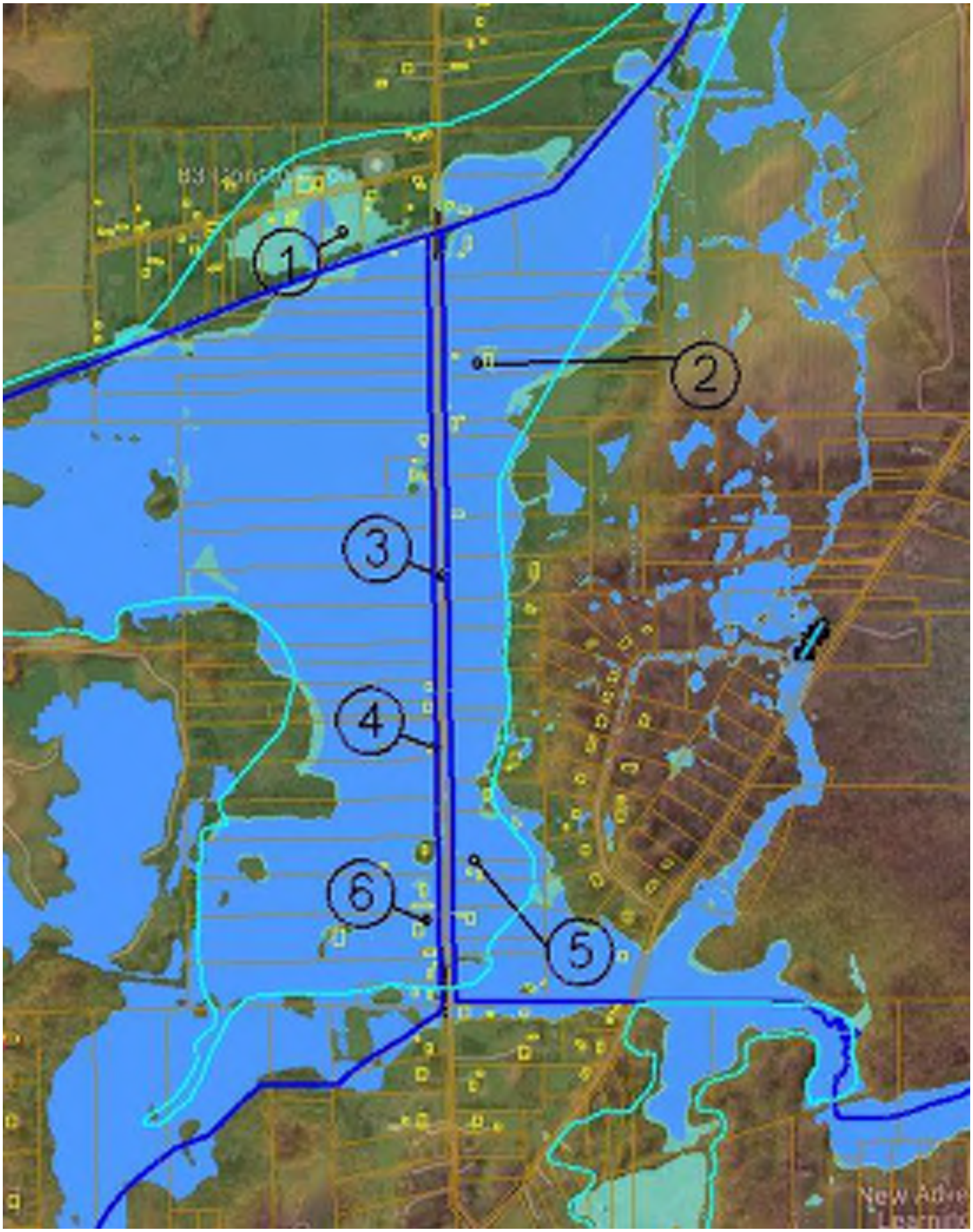
100-year - Existing Conditions and 2b



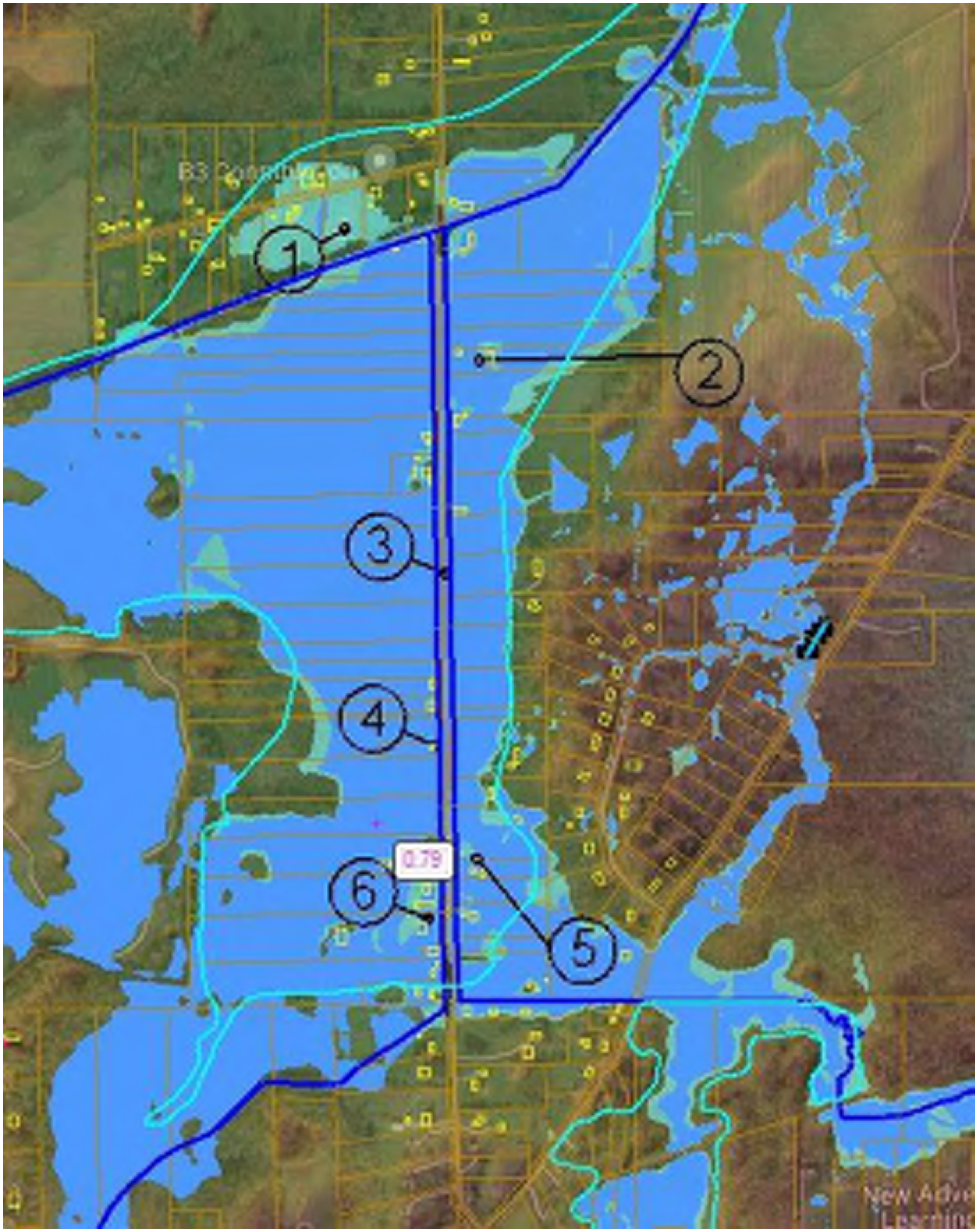
100-year - Existing Conditions and 2c



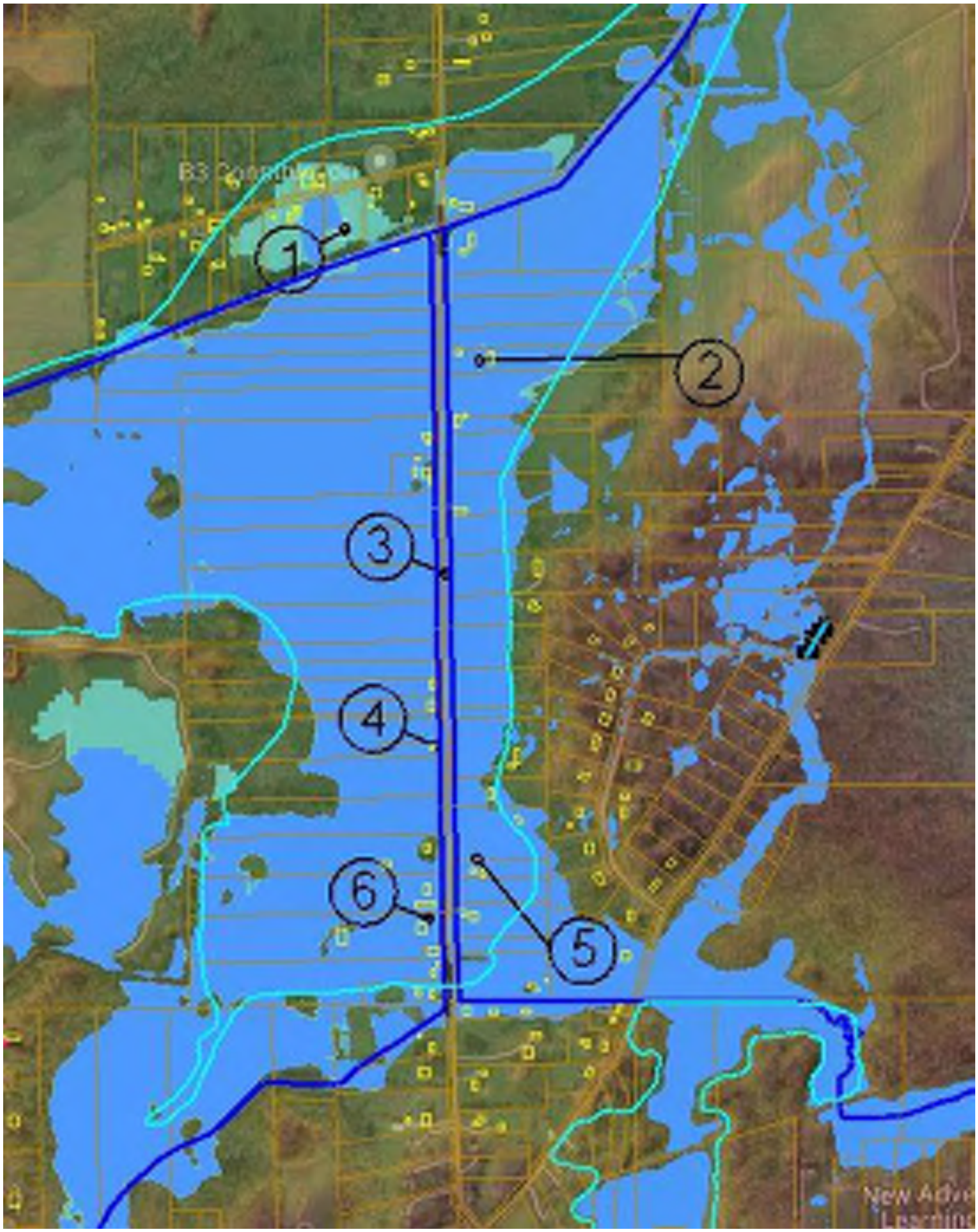
100-year - Existing Conditions and 2d



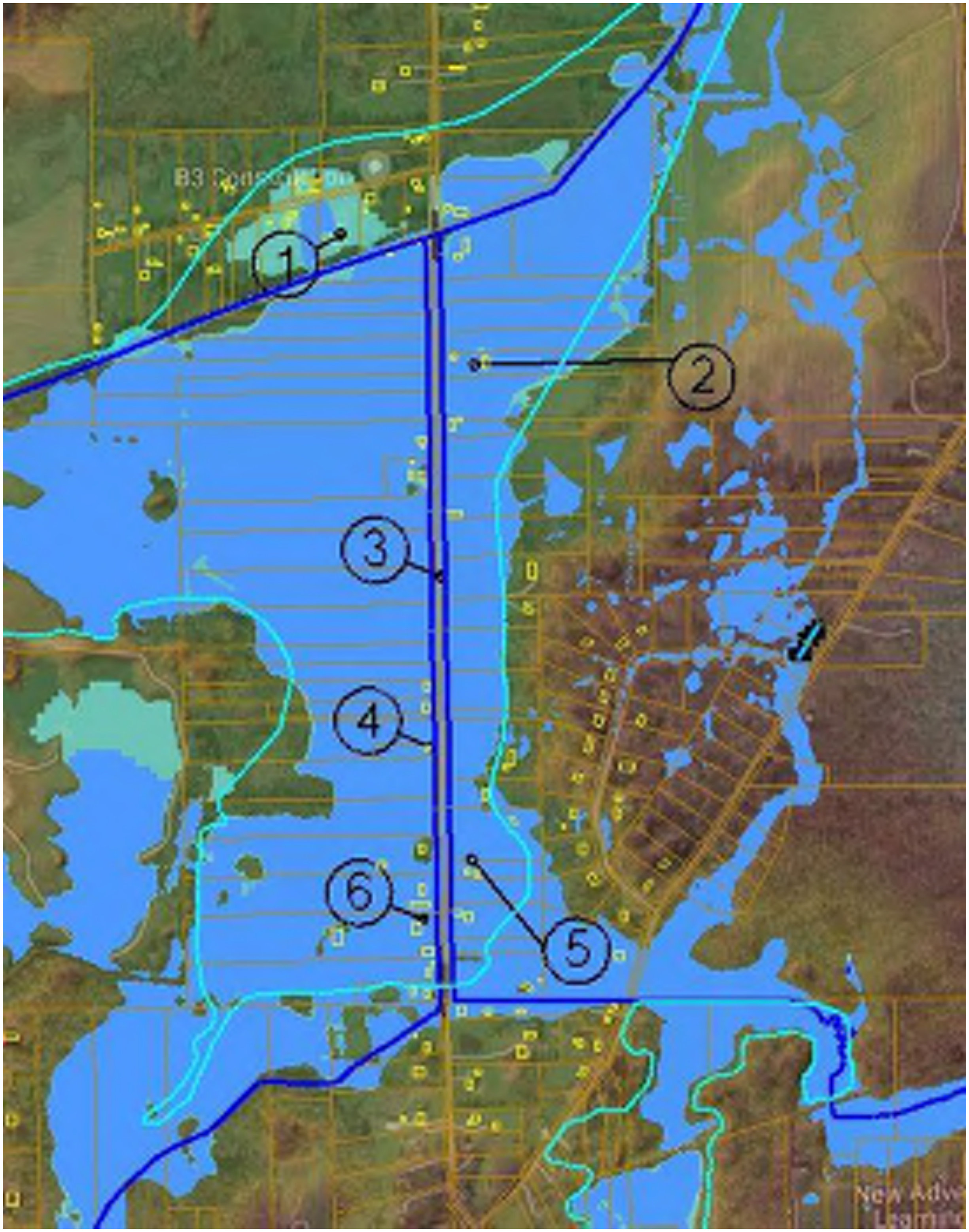
100-year - Existing Conditions and 2fa



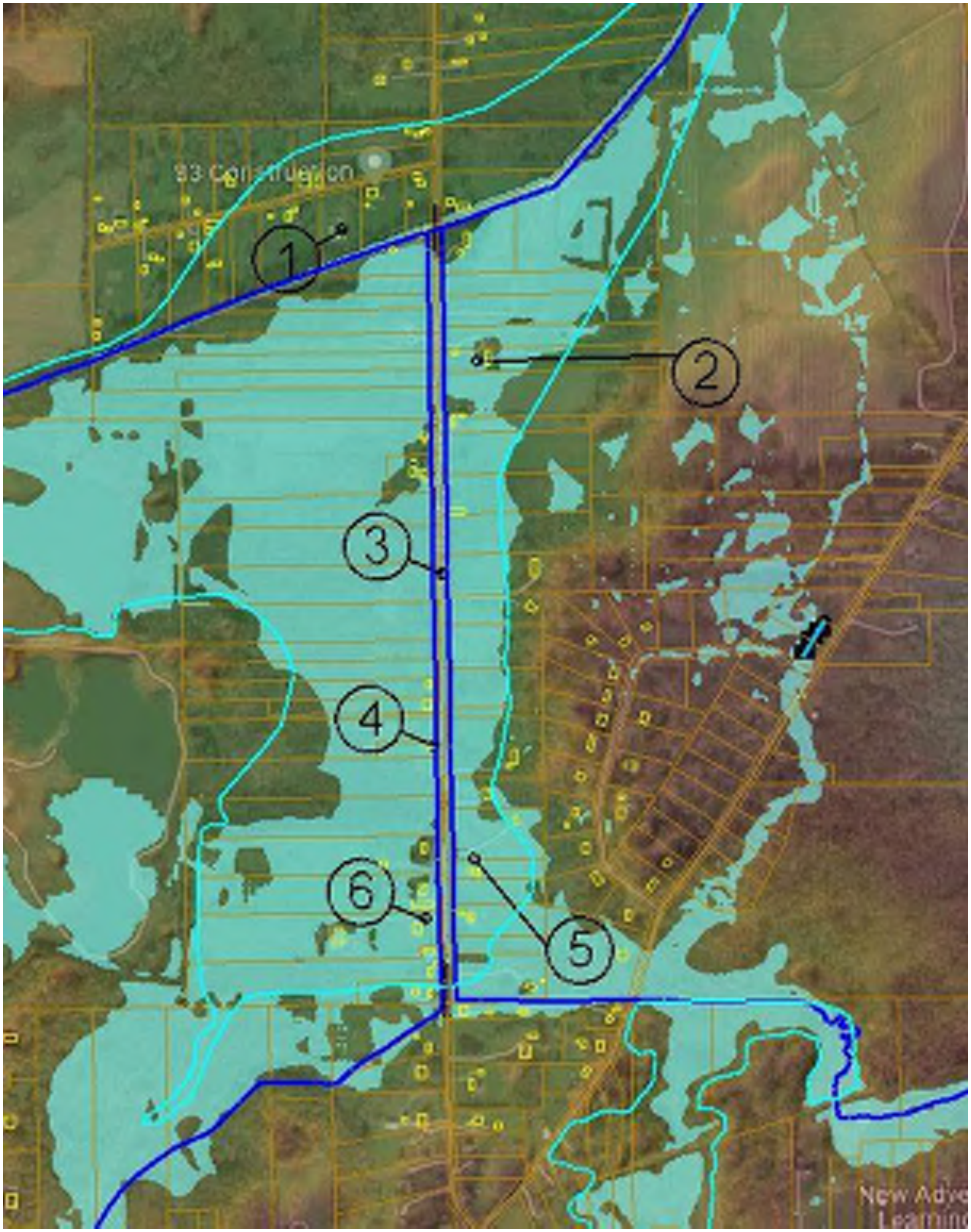
100-year - Existing Conditions and 2fb



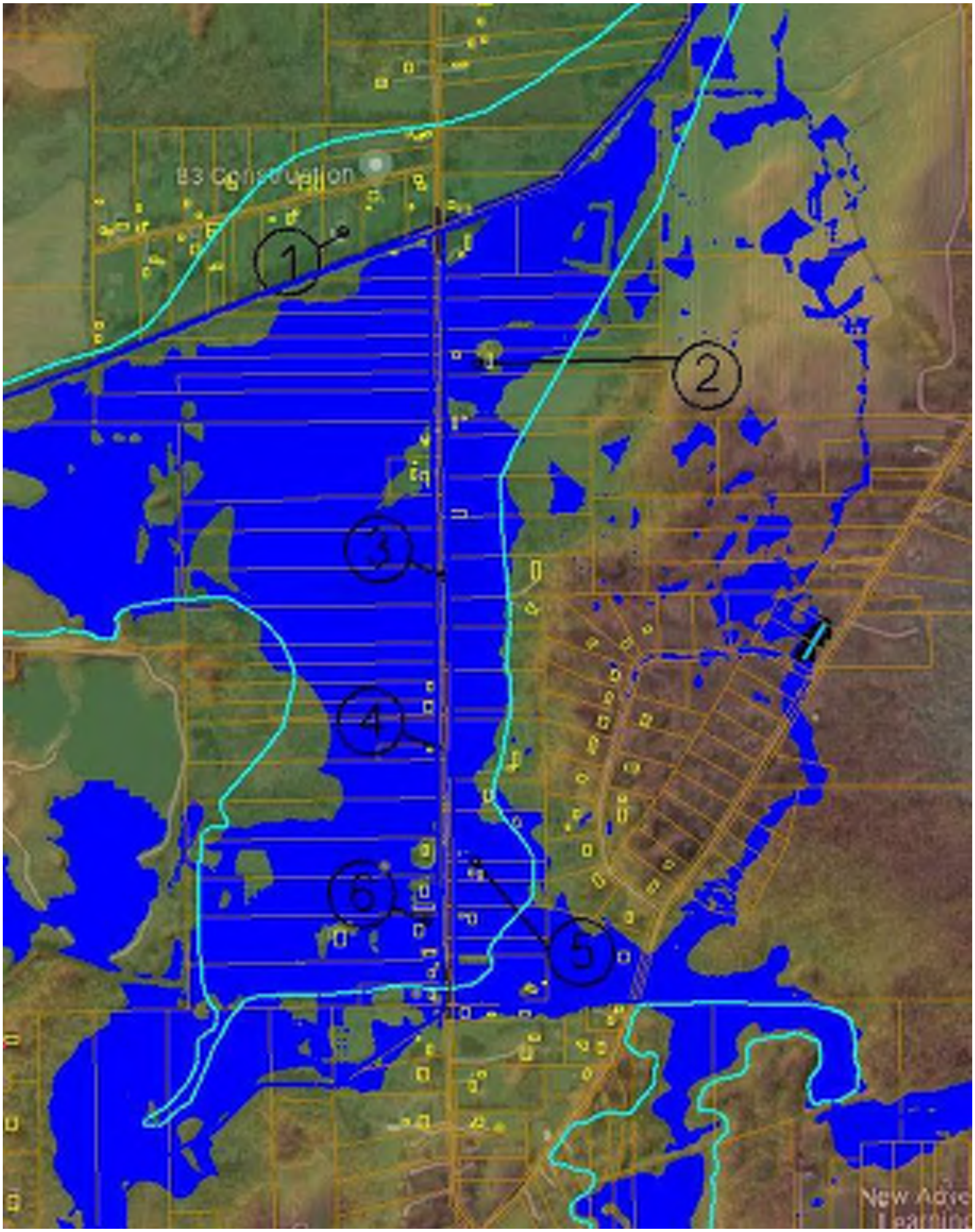
100-year - Existing Conditions and 2g



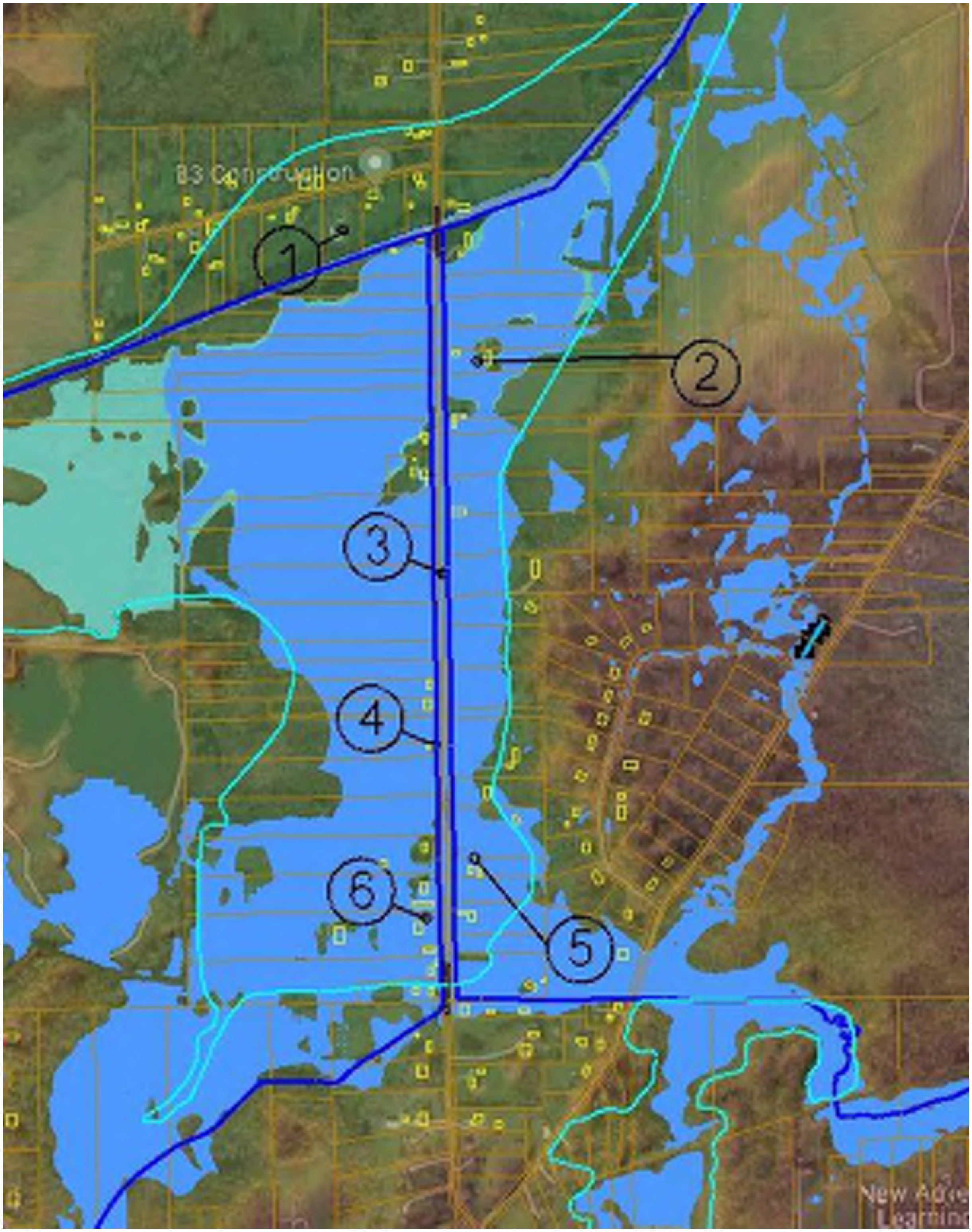
100-year - Existing Conditions and 2h



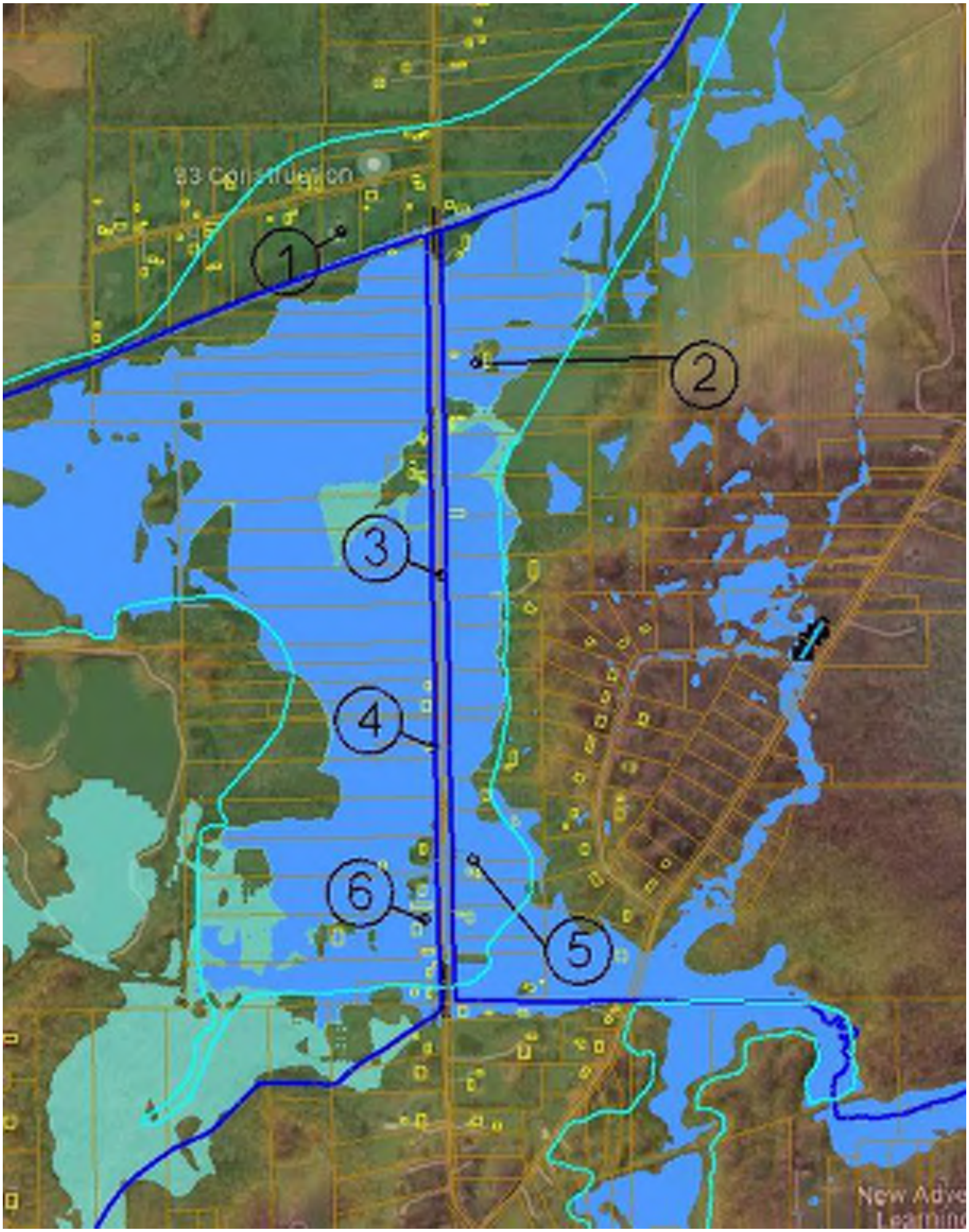
5-year - Existing Conditions



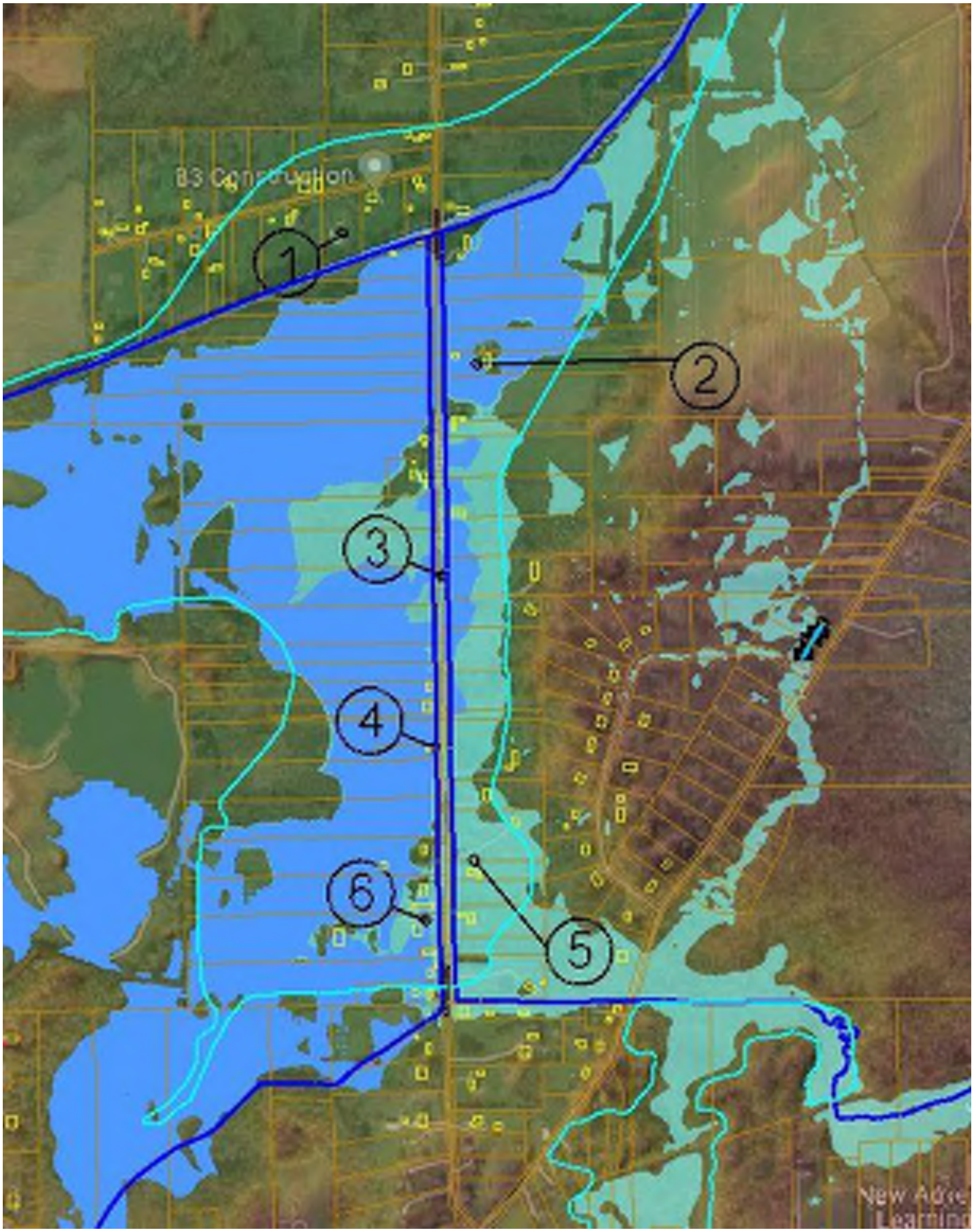
5-year - Existing Conditions and 2a



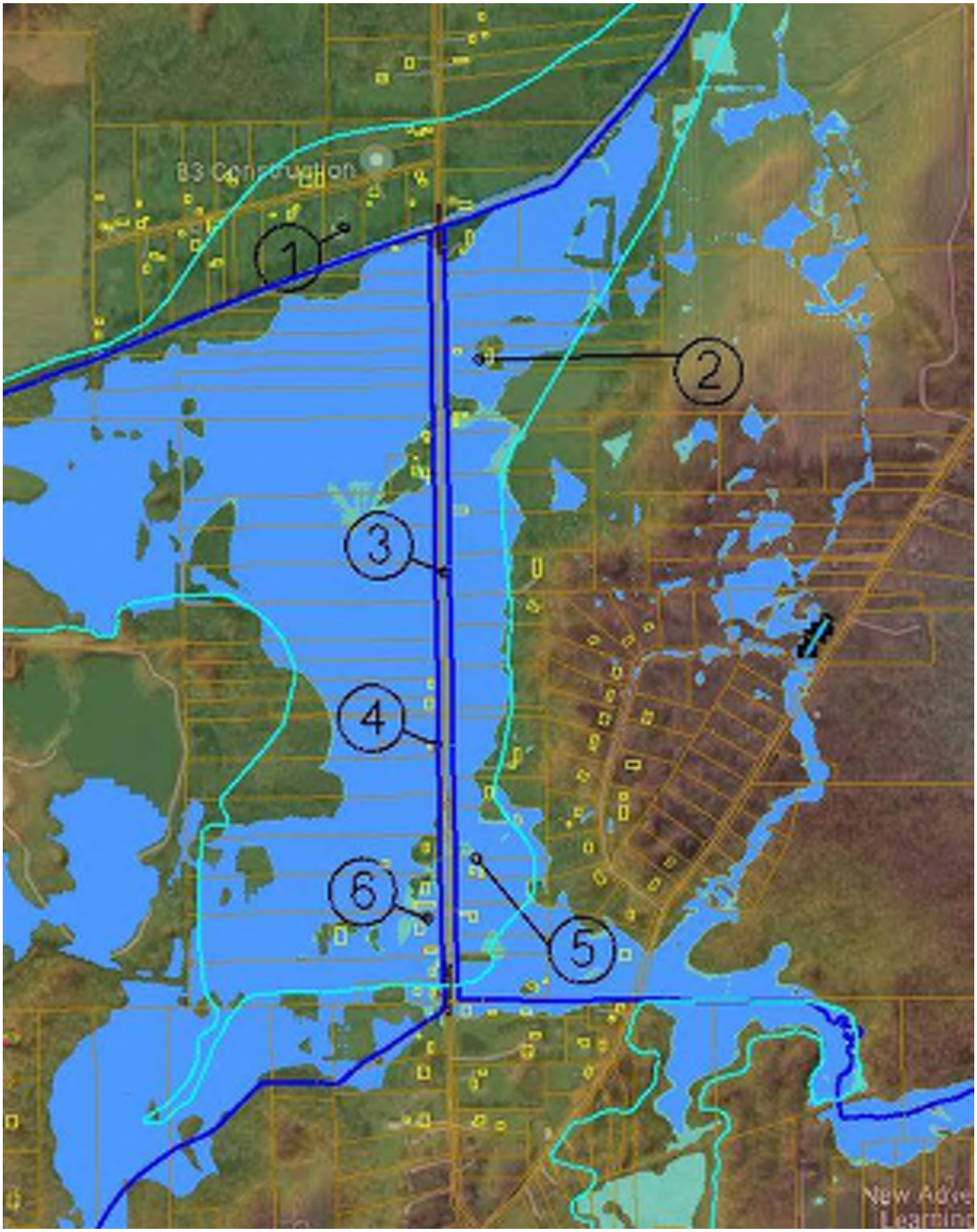
5-year - Existing Conditions and 2b



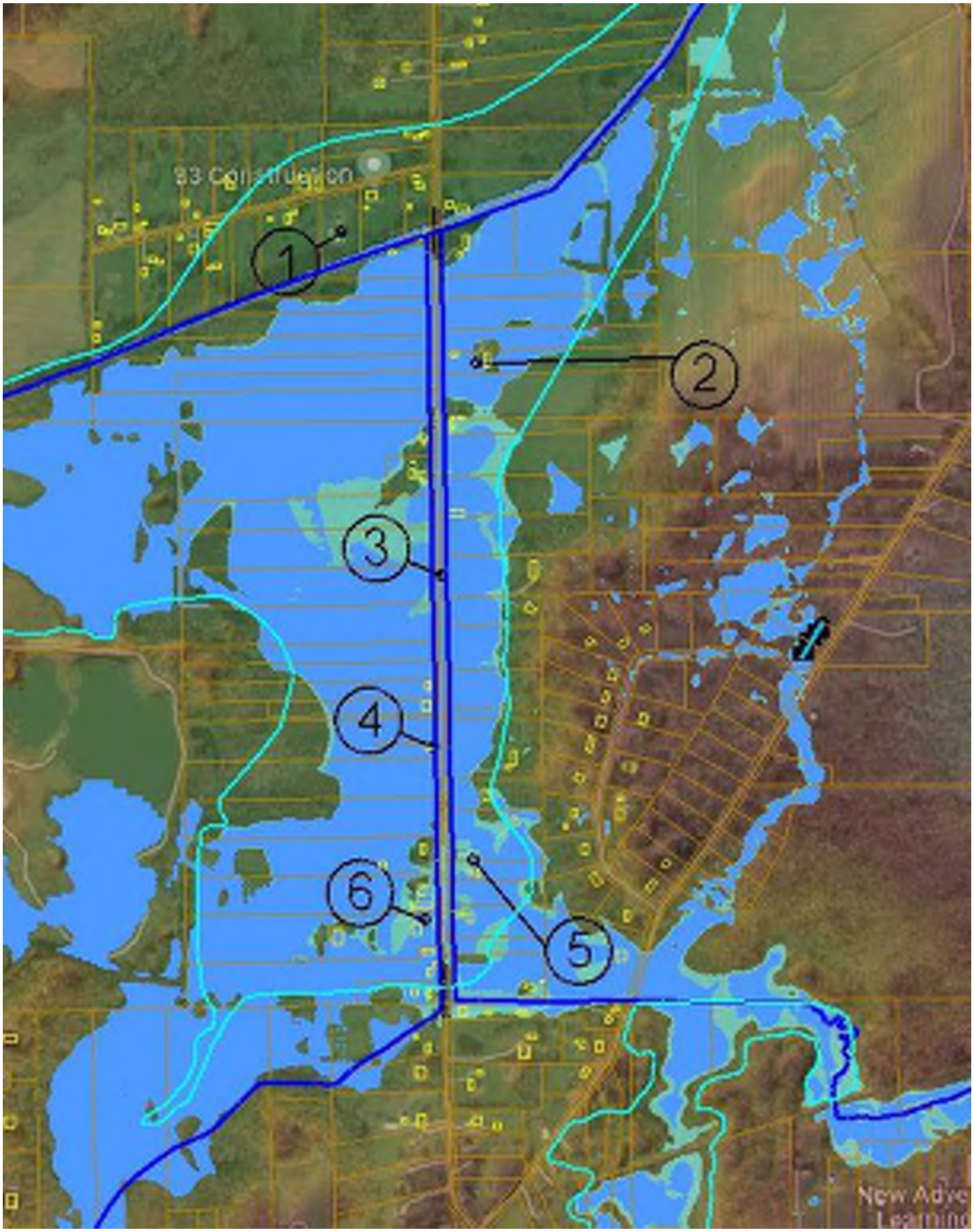
5-year - Existing Conditions and 2c



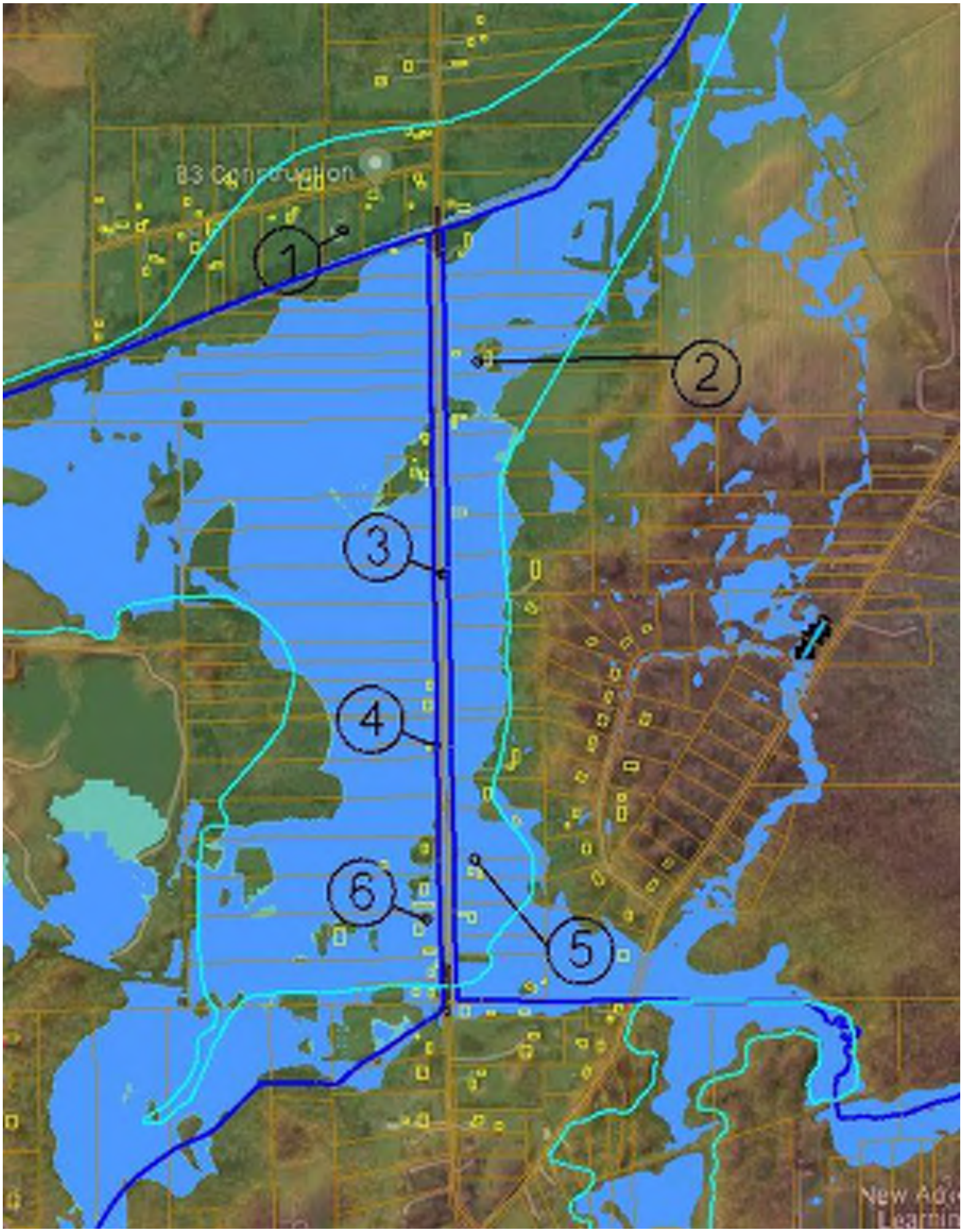
5-year - Existing Conditions and 2d



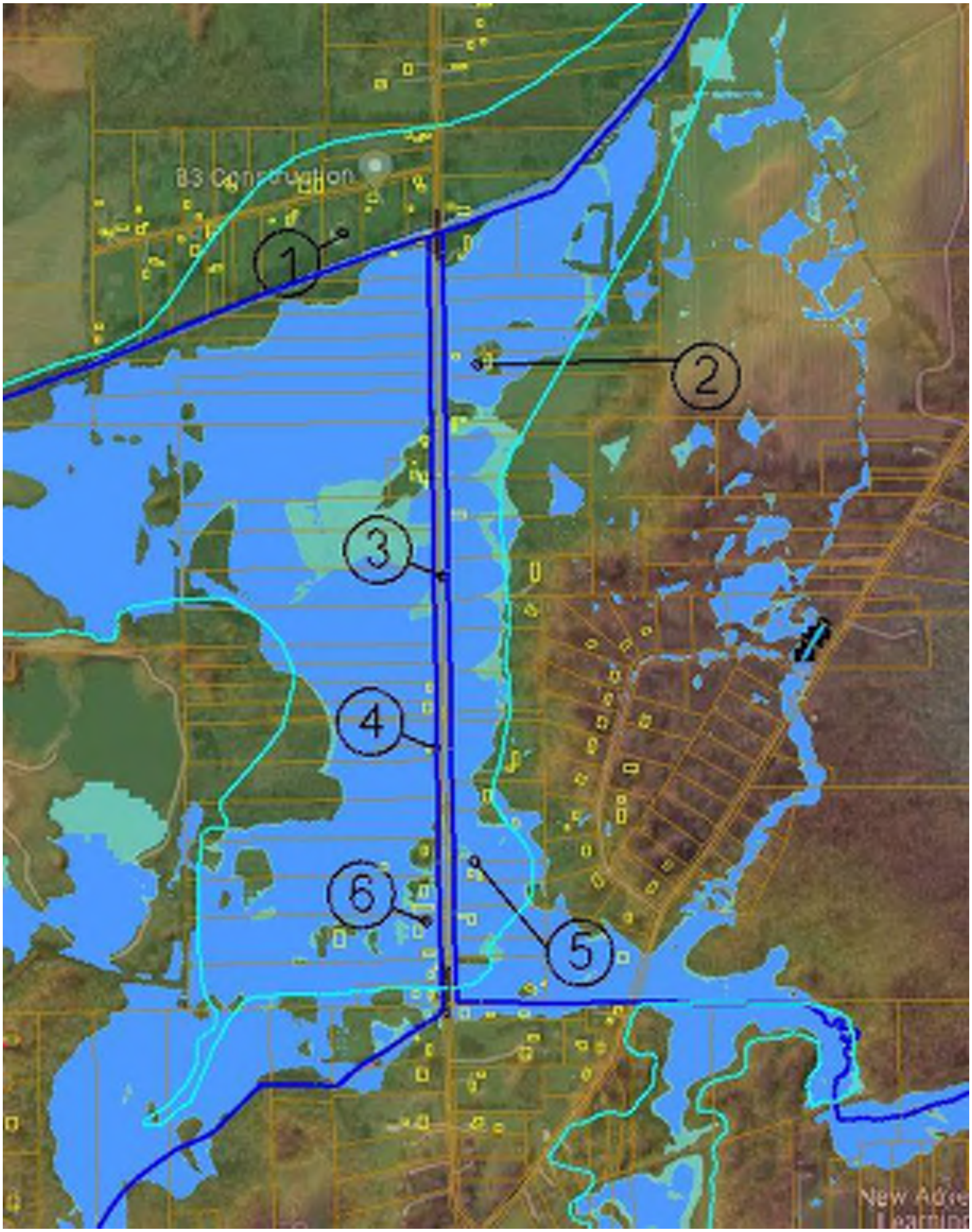
5-year - Existing Conditions and 2fa



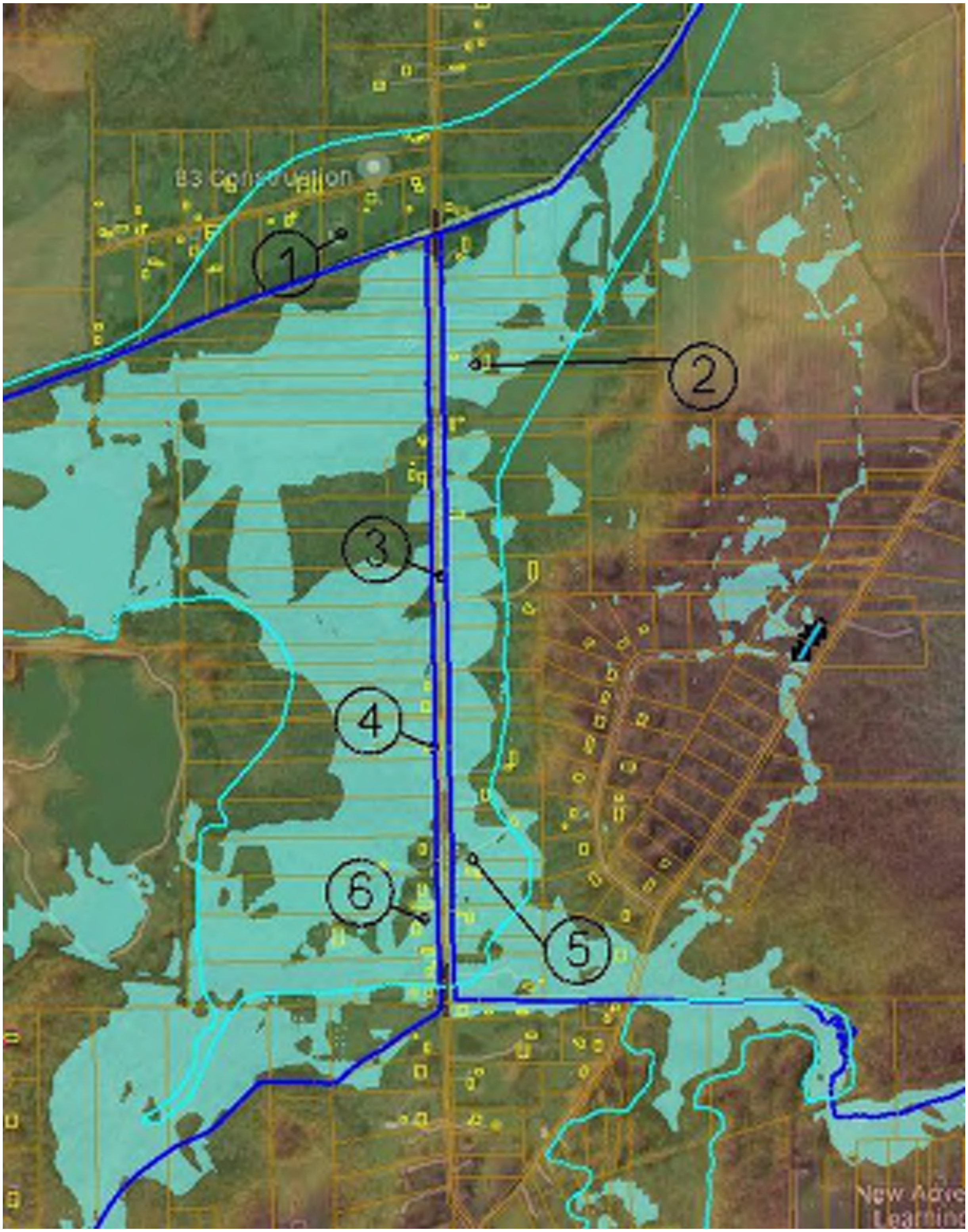
5-year - Existing Conditions and 2fb



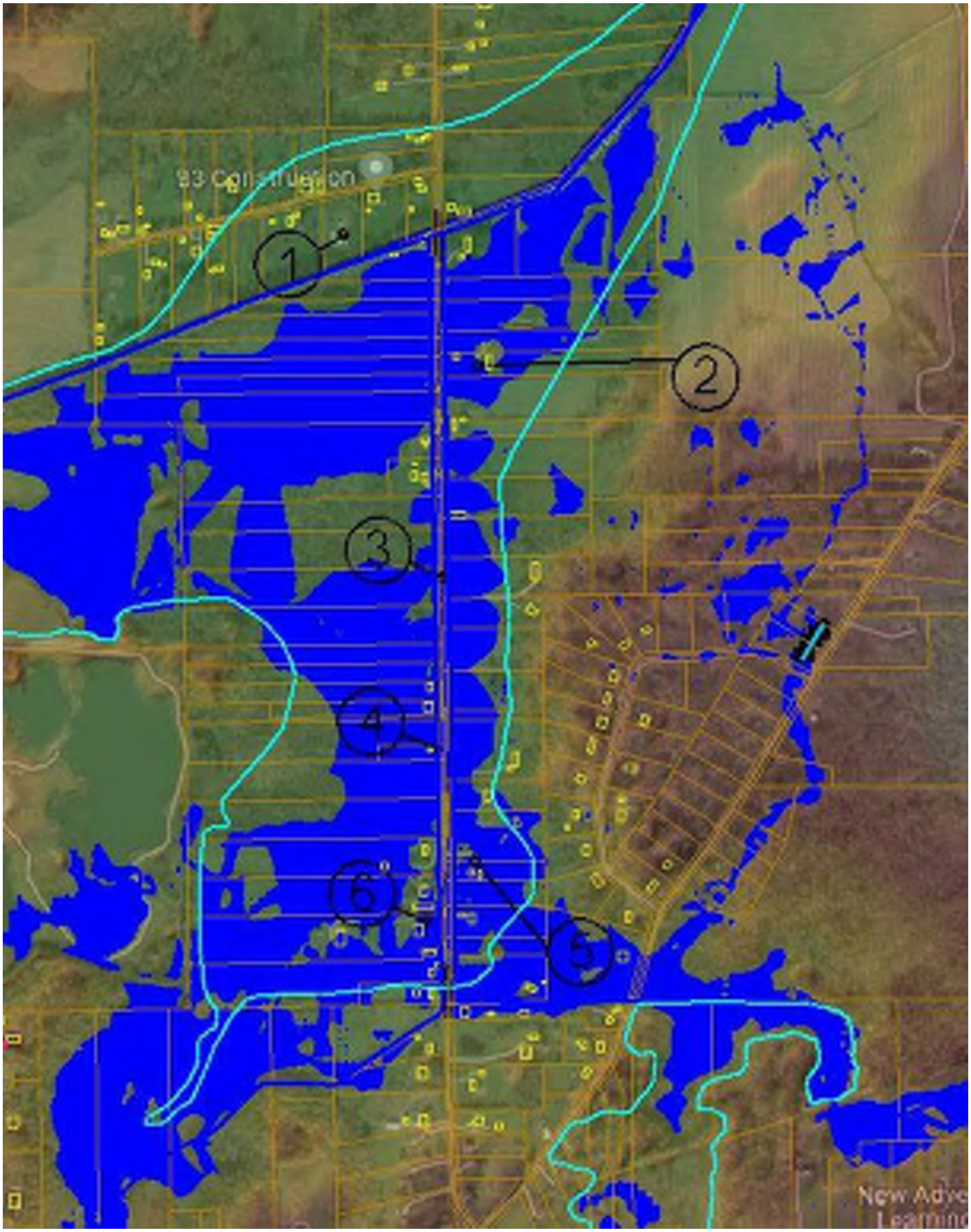
5-year - Existing Conditions and 2g



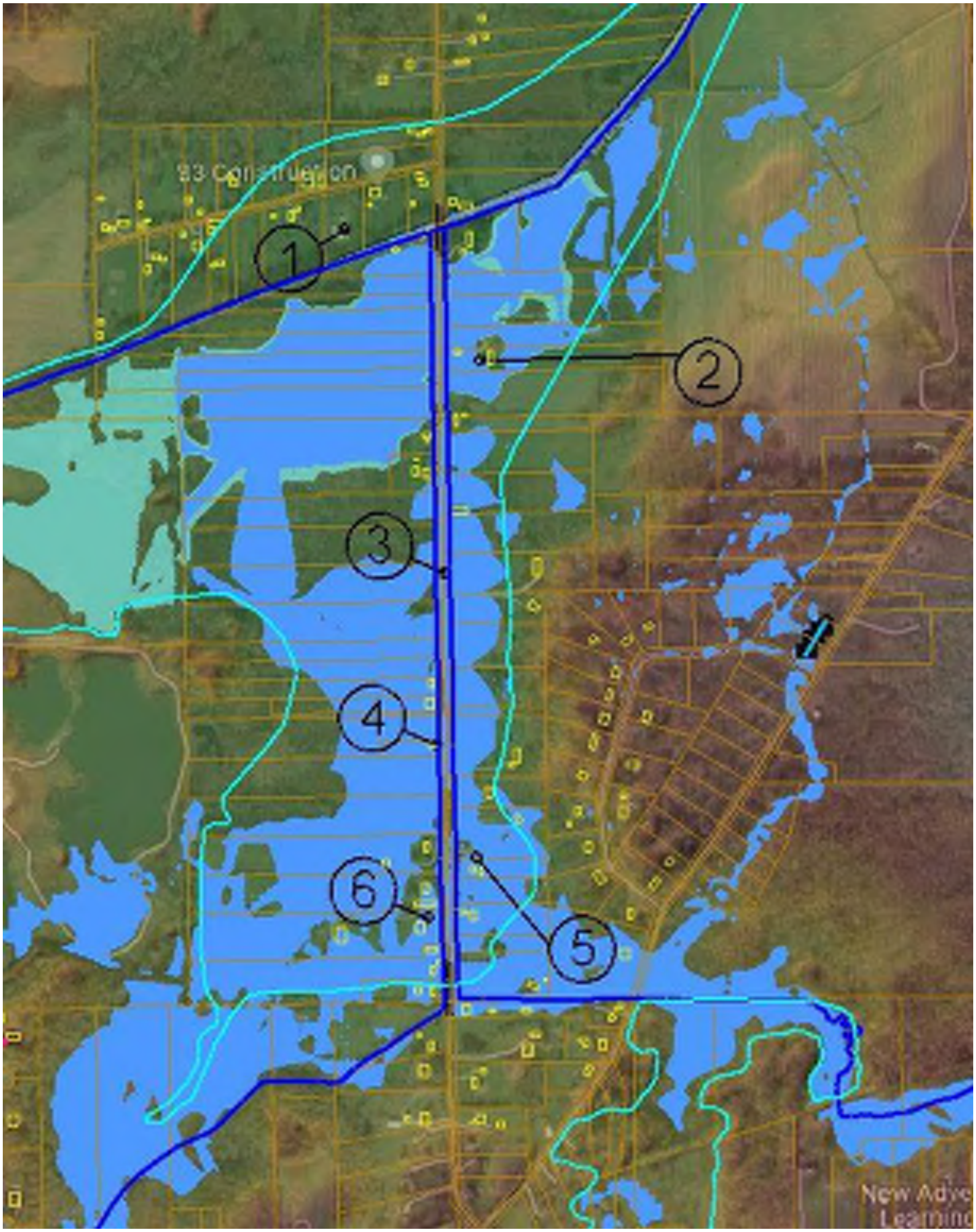
5-year - Existing Conditions and 2h



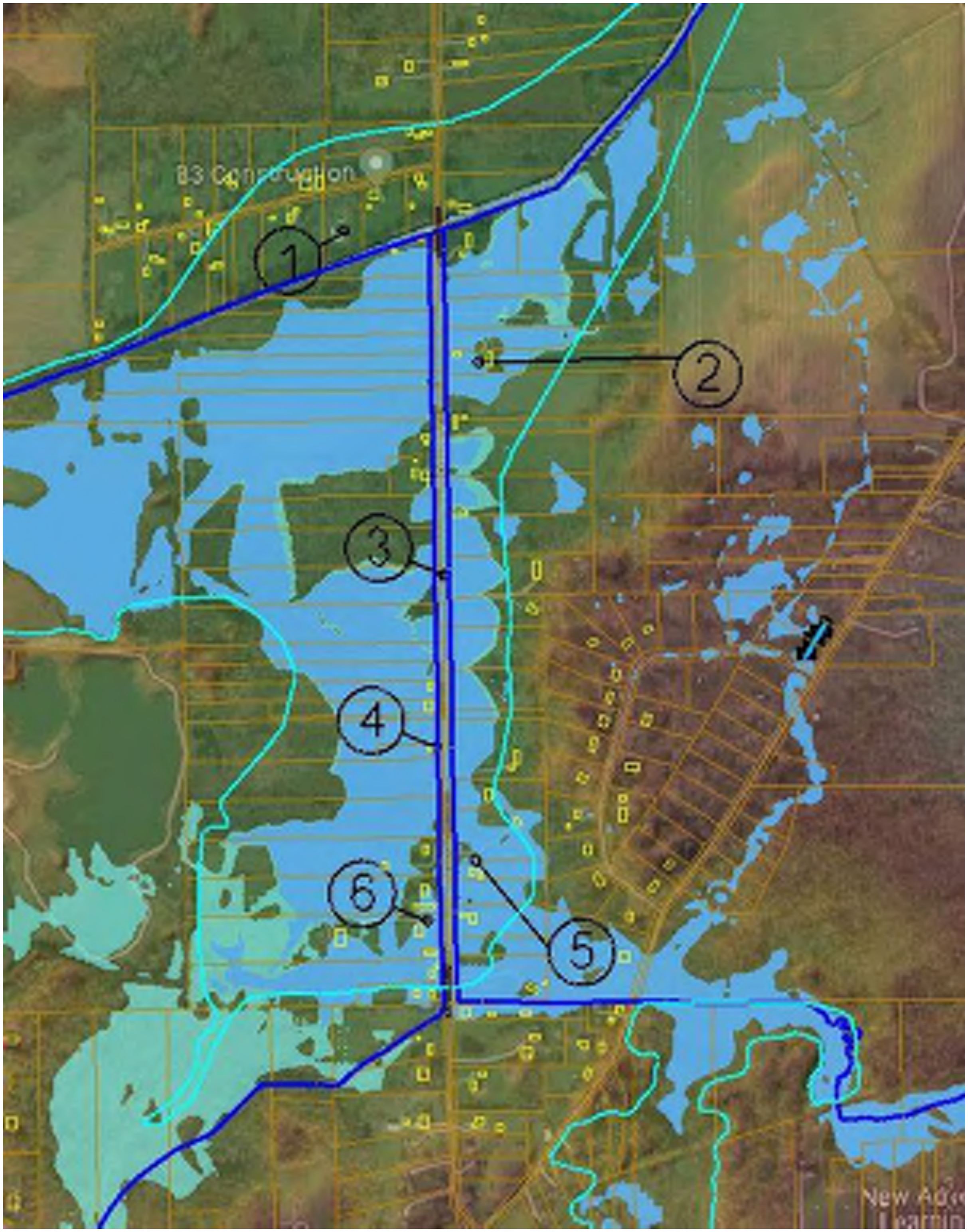
1-year - Existing Conditions



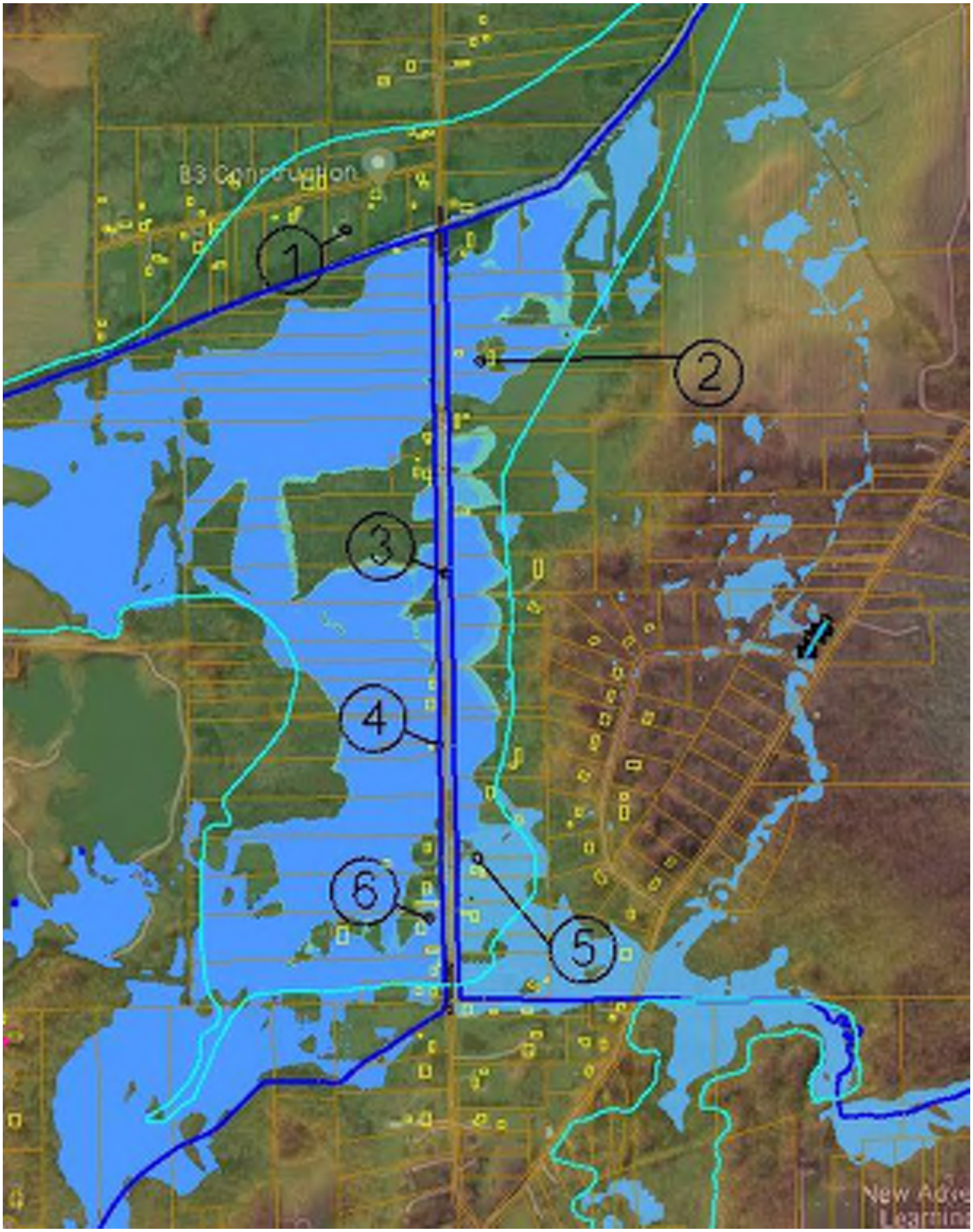
1-year - Existing Conditions and 2a



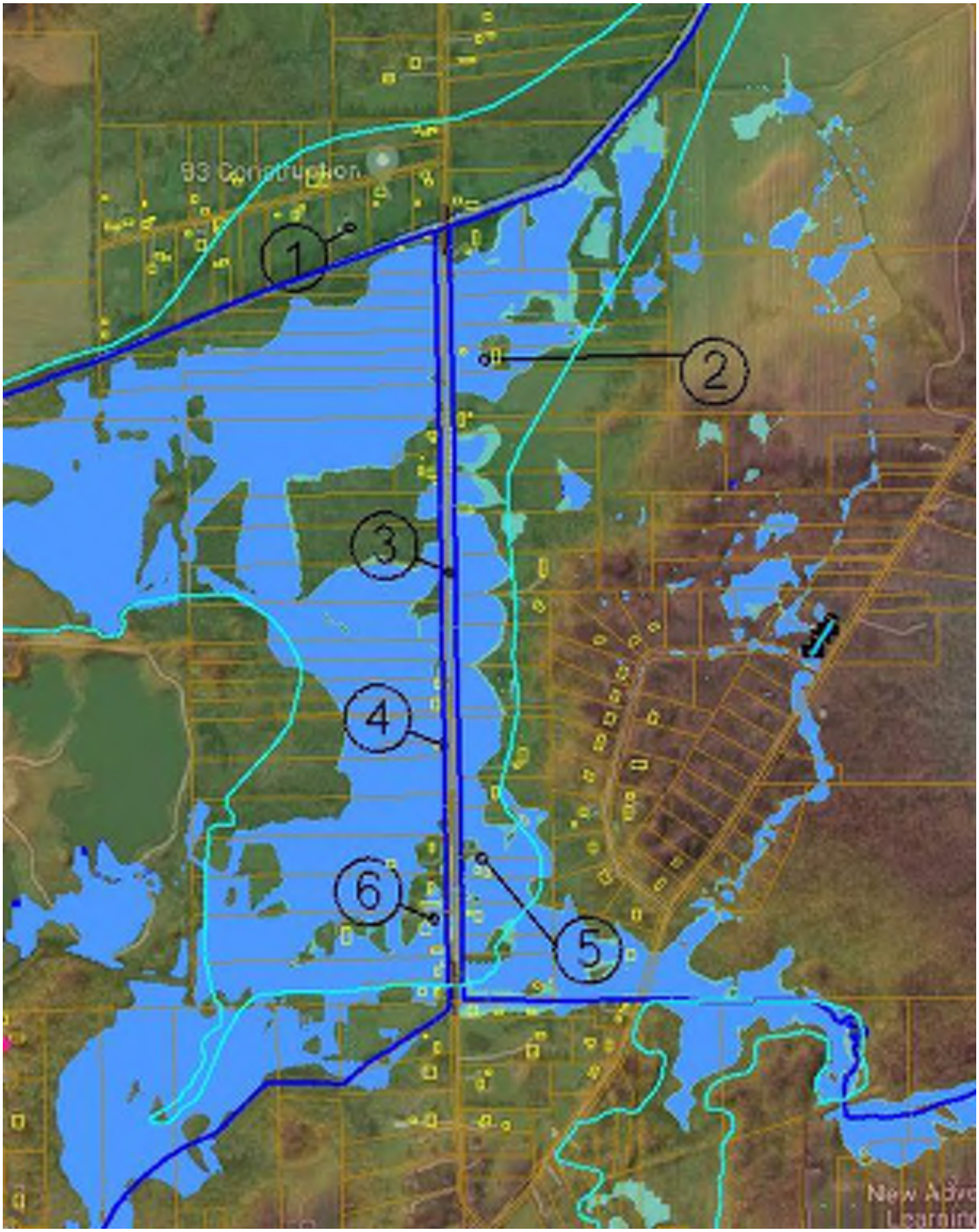
1-year - Existing Conditions and 2b



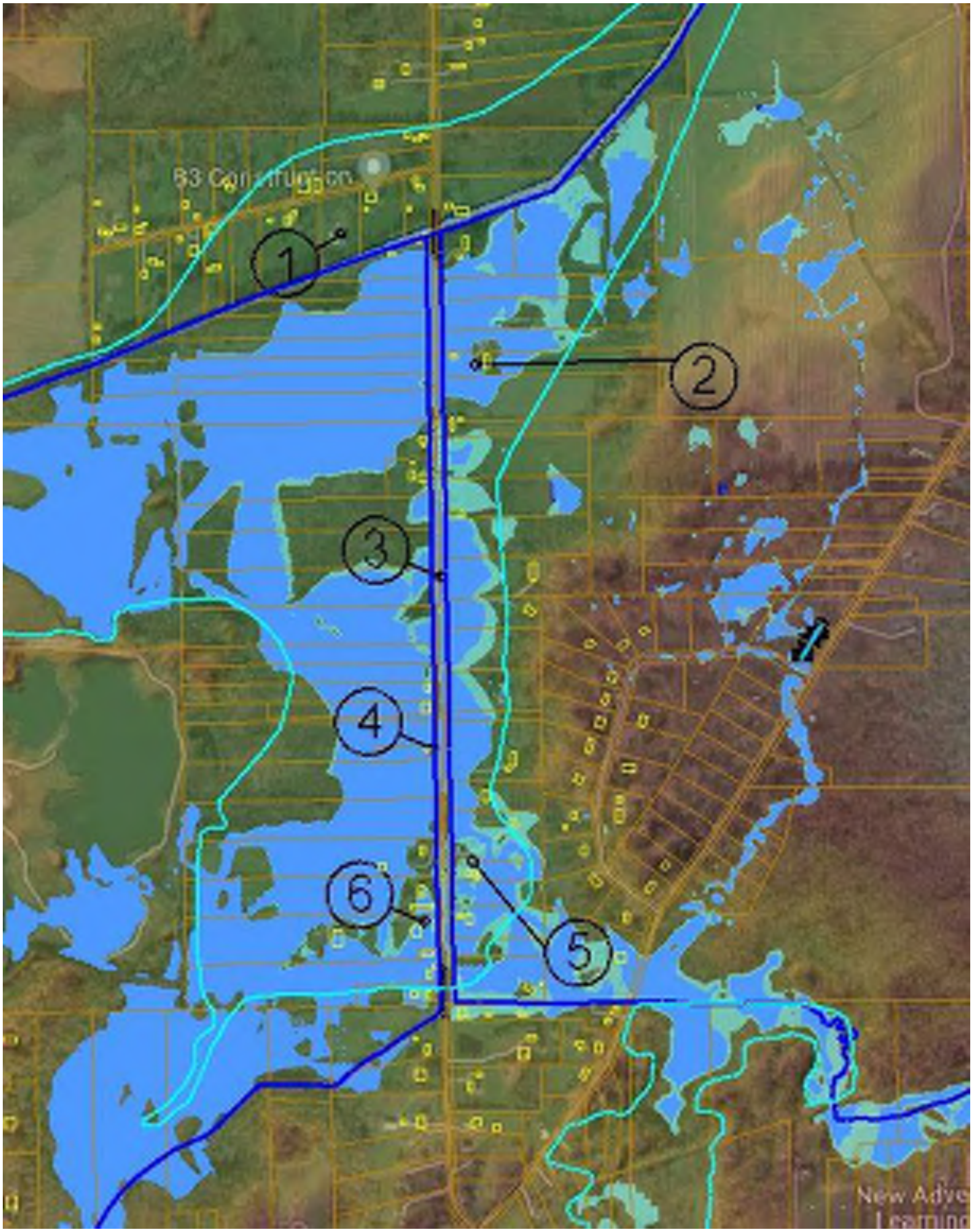
1-year - Existing Conditions and 2c



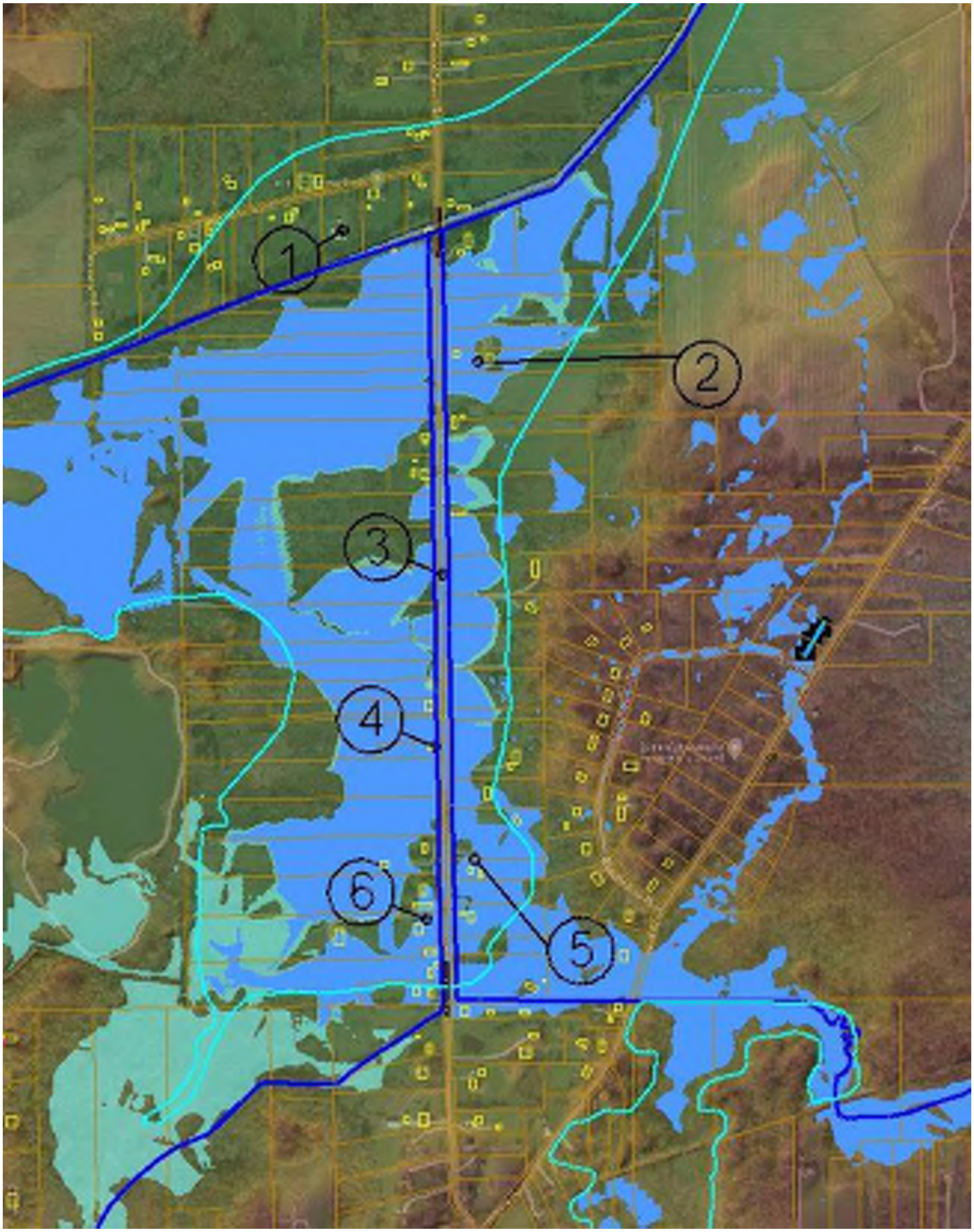
1-year - Existing Conditions and 2d



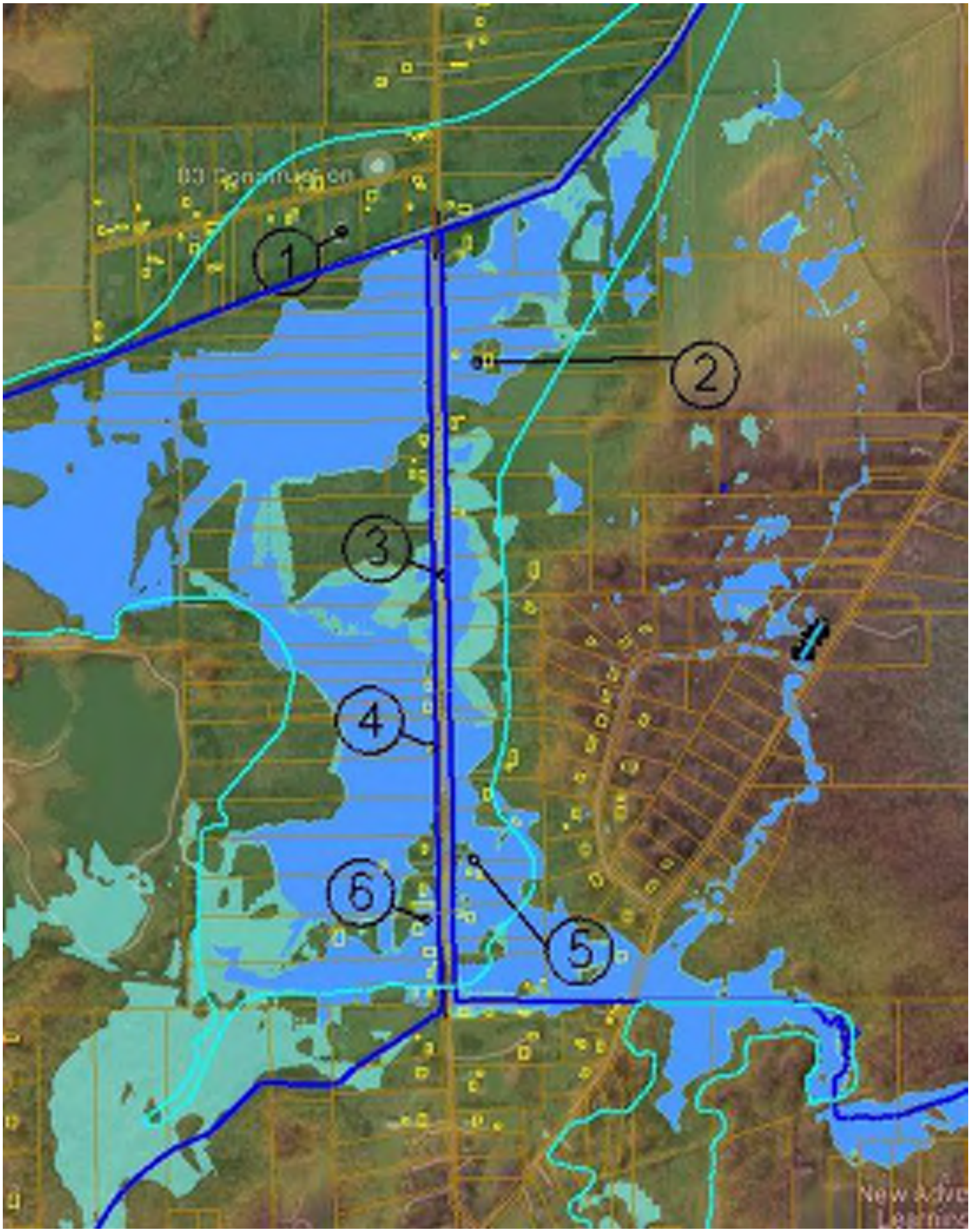
1-year - Existing Conditions and 2fa



1-year - Existing Conditions and 2fb



1-year - Existing Conditions and 2g



1-year - Existing Conditions and 2h

Appendix C – Cost Estimates

OSBORN OPINION OF PROBABLE COST (OPC)

DETAILED COST

Project No: **J20210247.000** Client: **Mantua Township** Date: **11/30/2022**

Project Description: **Black Brook Flood Study - Road Improvements** By: **LS**

Design Status/Level: ☑ Schematic ☐ Design Development ☐ Construction Documents ☐ Other % Complete:

Discipline: ☐ Architectural ☑ Civil ☐ Structural ☐ HVAC ☐ Plumbing ☐ Process ☐ Fire Protection ☐ Electrical ☐ Technology ☐ Transportation

Div./ID#	Item Description	Unit	Quantity	Unit Cost	Cost
ITEM 624	MOBILIZATION	LS	1	$ 30,000.00	$ 30,000
ITEM 623	CONSTRUCTION LAYOUT STAKES AND SURVEYING	LS	1	$ 20,000.00	$ 20,000
ITEM 614	MAINTAINING TRAFFIC	LS	1	$ 15,000.00	$ 15,000
ITEM 201	CLEARING AND GRUBBING	LS	1	$ 40,000.00	$ 40,000
ITEM 832	STORMWATER POLLUTION PREVENTION PLAN	LS	1	$ 25,000.00	$ 25,000
ITEM 202	PAVEMENT REMOVED	SY	11,400	$ 10.00	$ 114,000
ITEM 203	EXCAVATION	CY	20,000	$ 25.00	$ 500,000
ITEM 203	EMBANKMENT (RAISE ROAD AND DRIVEWAYS 2 FEET AVG.)	CY	20,000	$ 10.00	$ 200,000
ITEM 202	PIPE REMOVED (ASSUME 35 PIPES AT 12' LONG)	LF	420	$ 35.00	$ 14,700
ITEM 204	SUBGRADE COMPACTION	SY	11,400	$ 2.50	$ 28,500
ITEM 304	AGGREGATE BASE (6")	CY	2,150	$ 60.00	$ 129,000
ITEM 302	ASPHALT CONCRETE BASE COURSE 449 (3")	CY	950	$ 145.00	$ 137,750
ITEM 402	ASPHALT CONCRETE INTERMEDIATE COURSE (2")	CY	630	$ 170.00	$ 107,100
ITEM 441	ASPHALT CONCRETE SURFACE COURSE 448, TYPE 1 (1.5")	CY	475	$ 225.00	$ 106,875
ITEM 611	CONDUIT, TYPE A (10'X6' CONCRETE) 35 @12' LENGTHS	LF	420	$ 1,200.00	$ 504,000
ITEM 611	CONDUIT, TYPE B, 3 - 36" DIA. ACROSS MANTUA CENTER RD	LF	75	$ 200.00	$ 15,000
ITEM 511	HEADWALLS	EA	6	$ 2,500.00	$ 15,000
ITEM 659	TOPSOIL (2")	CY	1,300	$ 35.00	$ 45,500
ITEM 659	SEEDING AND MULCHING	SY	3,000	$ 2.00	$ 6,000
	MISC. ITEMS (FENCING, MAIL BOXES, ETC.)	ALLOW	1	$ 150,000.00	$ 150,000
SUB TOTAL THIS PAGE					**$2,203,425.00**

Opinion of Probable Cost (OPC) - Detailed Cost

Project No: **J20210247.000** Client: **Mantua Township** Date: **11/30/2022**

Project Description: **Black Brook Flood Study - Road Improvements** By: **LS**

Div./ID#	Item Description	Unit	Quantity	Unit Cost	Cost

SUB TOTAL THIS PAGE	
SUB TOTAL PREVIOUS PAGE	**$2,203,425.00**
SUB-TOTAL	**$2,203,425.00**
10% DESIGN	**$220,342.50**
10% CONSTRUCTION CONTINGENCY	**$220,342.50**
TOTAL	**$2,644,110.00**

PROPERTY ACQUISITION COST ESTIMATE

Parcel ID	Parcel No.	Owner	Property Address	Land Value	Improvements Value	Total Value (Appraised 100%)	House (Y/N)	Acquisition Expenses	Relocation Expenses and Demolition
14	23-010-00-00-030-000	FALL RANDEN R	12438 Mantua Center	$ 31,400	$ 99,600	$ 131,000	Yes	$ 15,000.00	$ 40,000.00
15	23-009-00-00-008-000	MACIK SAMANTHA J	12413 Mantua Center	$ 31,300	$ 30,100	$ 61,400	Yes	$ 15,000.00	$ 40,000.00
16	23-009-00-00-007-000	MACIK SAMANTHA J	Mantua Center	$ 5,900	$ -	$ 5,900	No		
17	23-009-00-00-006-000	PISZCZOR JULIA ANN AKA JULIA A	Mantua Center	$ 5,900	$ -	$ 5,900	No	$ 5,000.00	
18	23-009-00-00-005-000	SISKA STEVEN C	Mantua Center	$ 9,200	$ -	$ 9,200	No	$ 5,000.00	
19	23-009-00-00-004-000	SISKA STEVEN C	Mantua Center	$ 9,200	$ -	$ 9,200	No		
20	23-009-00-00-003-000	BOGNAR GERALD W	Mantua Center	$ 10,700	$ -	$ 10,700	No	$ 5,000.00	
21	23-009-00-00-002-000	BOGNAR GERALD W	Mantua Center	$ 7,800	$ -	$ 7,800	No		
22	23-009-00-00-001-000	POTTER DAVID GEORGE	Mantua Center	$ 12,500	$ -	$ 12,500	No	$ 5,000.00	
23	23-015-00-00-024-001	KEATON BETTELOU ANN	Mantua	$ 15,900	$ -	$ 15,900	No		
24	23-015-00-00-023-001	KEATON BETTELOU ANN	12265 Mantua Center	$ 29,200	$ 78,400	$ 107,600	Yes	$ 15,000.00	$ 40,000.00
28	23-015-00-00-020-001	SUMMERSET DEVELOPMENT LTD	12167 Mantua Center	$ 12,400	$ -	$ 12,400	No	$ 5,000.00	
29	23-015-00-00-019-001	SUMMERSET DEVELOPMENT LTD	Mantua Center	$ 8,300	$ -	$ 8,300	No		
30	23-010-00-00-031-001	SCHARF SHIRLEY	12408 Mantua Center	$ 33,200	$ 149,200	$ 182,400	Yes	$ 15,000.00	$ 40,000.00
32	23-010-00-00-032-000	RSPJ FARM LLC	Mantua Center	$ 20,600	$ -	$ 20,600	No	$ 5,000.00	
33	23-010-00-00-033-000	RSPJ Farm LLC	Mantua Center	$ 25,500	$ -	$ 25,500	No		
34	23-010-00-00-034-000	KORNER MEREDITH E	12330 Mantua Center	$ 20,600	$ -	$ 20,600	No		
35	23-010-00-00-035-001	KORNER MEREDITH E	12330 Mantua Center	$ 41,500	$ 77,000	$ 118,500	Yes	$ 15,000.00	$ 40,000.00
36	23-010-00-00-036-000	PATEREK SAM	Mantua Center	$ 31,100	$ -	$ 31,100	No		
37	23-016-00-00-001-000	PATEREK SAM	12290 Mantua Center	$ 31,600	$ 72,700	$ 104,300	Yes	$ 15,000.00	$ 40,000.00
38	23-016-00-00-002-000	SAYRE STANLEY R (TRUSTEE)	Mantua Center	$ 22,800	$ -	$ 22,800	No	$ 5,000.00	
39	23-016-00-00-004-000	TOOTHMAN PATRICK G SR	12246 Mantua Center	$ 21,700	$ 10,400	$ 32,100	Yes	$ 15,000.00	$ 40,000.00
40	23-016-00-00-006-000	BELLAR CHRISTOPHER D & MARLA (J&S)	Mantua Center	$ 22,800	$ -	$ 22,800	No		
41	23-016-00-00-007-000	BELLAR CHRISTOPHER D AKA CHRISTOPHER DAVID	12196 Mantua Center	$ 43,700	$ 156,600	$ 200,300	Yes	$ 15,000.00	$ 40,000.00
42	23-016-00-00-008-000	MIHELICK MARTIN D & LORI L (J&S)	12166 Mantua Center	$ 33,800	$ 131,800	$ 165,600	Yes	$ 15,000.00	$ 40,000.00
43	23-016-00-00-009-000	COLLINS ROBERT W & KARLA	12138 Mantua Center	$ 39,200	$ 10,500	$ 49,700	Yes	$ 15,000.00	$ 40,000.00
44	23-015-00-00-018-000	BEACH TRAVIS & RACHEL L SCHINDLER (J&S)	Mantua Center	$ 8,300	$ -	$ 8,300	No		
45	23-015-00-00-017-000	BEACH TRAVIS & RACHEL L SCHINDLER (J&S)	12119 Mantua Center	$ 33,300	$ 103,800	$ 137,100	Yes	$ 15,000.00	$ 40,000.00
46	23-015-00-00-016-000	BUGARCIC MIKE & SVETLANA (J&S)	12104 Mantua Center	$ 30,100	$ 119,700	$ 149,800	Yes	$ 15,000.00	$ 40,000.00
47	23-015-00-00-015-000	TPRCO LLC	Mantua Center	$ 5,300	$ -	$ 5,300	No	$ 5,000.00	
48	23-015-00-00-014-000	TPRCO LLC	Mantua Center	$ 12,000	$ -	$ 12,000	No		
49	23-015-00-00-013-000	LYONS JOHN J	12100 Mantua Center	$ 2,700	$ 54,900	$ 57,600	Yes	$ 15,000.00	$ 40,000.00
50	23-015-00-00-012-000	TPRCO LLC	Mantua Center	$ 12,400	$ -	$ 12,400	No	$ 5,000.00	
51	23-015-00-00-011-000	TPRCO LLC	Mantua Center	$ 12,400	$ -	$ 12,400	No		
52	23-015-00-00-010-000	HIGGINS THEODORE R & MARION L (J&S)	12011 Mantua Center	$ 37,500	$ 184,000	$ 221,500	Yes	$ 15,000.00	$ 40,000.00
53	23-015-00-00-009-000	HOCEVAR DOUG & ANDREA (J&S)	11993 Mantua Center	$ 37,500	$ 263,700	$ 301,200	Yes	$ 15,000.00	$ 40,000.00
54	23-015-00-00-007-001	LILLEY DAVID W & SUSAN L (J&S)	11967 Mantua Center	$ 38,300	$ 299,800	$ 338,100	Yes	$ 15,000.00	$ 40,000.00
55	23-015-00-00-007-000	CASPER FRANK & BURCHETT TAMARA (J&S)	11935 Mantua Center	$ 37,600	$ 70,200	$ 107,800	Yes	$ 15,000.00	$ 40,000.00
56	23-015-00-00-006-000	PICHAN JOHN E (TRUSTEE)	11919 Mantua Center	$ 32,300	$ 77,700	$ 110,000	Yes	$ 15,000.00	$ 40,000.00
57	23-016-00-00-010-000	RYCKMAN RICHARD A	Mantua Center	$ 17,400	$ -	$ 17,400	No	$ 5,000.00	
58	23-016-00-00-011-000	RYCKMAN RICHARD A	Mantua Center	$ 3,400	$ -	$ 3,400	No		
59	23-016-00-00-012-000	RYCKMAN RICHARD A	12074 Mantua Center	$ 43,500	$ 124,200	$ 167,700	Yes	$ 15,000.00	$ 40,000.00
60	23-016-00-00-013-000	MAY ANDREW M	12058 Mantua Center	$ 35,500	$ 148,500	$ 184,000	Yes	$ 15,000.00	$ 40,000.00
61	23-016-00-00-014-000	BERZINSKAS JAMES ANTHONY @3 TRUSTEES	12012 Mantua Center	$ 41,100	$ 132,000	$ 173,100	Yes	$ 15,000.00	$ 40,000.00
62	23-016-00-00-015-000	MIHELICK JOHNATHON	Mantua Center	$ 10,700	$ -	$ 10,700	No		
63	23-016-00-00-016-000	MIHELICK JOHNATHON	12002 Mantua Center	$ 33,500	$ 97,100	$ 130,600	Yes	$ 15,000.00	$ 40,000.00
64	23-016-00-00-017-000	SUHAJ JEFFREY A & CHRISTINE D (J&S)	11968 Mantua Center	$ 36,200	$ 89,300	$ 125,500	Yes	$ 15,000.00	$ 40,000.00
65	23-016-00-00-019-000	SUHAJ JEFFREY A & CHRISTINE D (J&S)	Mantua Center	$ 9,200	$ -	$ 9,200	No		
66	23-016-00-00-020-000	TOOTHMAN PAT	11930 Mantua Center	$ 23,100	$ 24,600	$ 47,700	No	$ 5,000.00	$ 10,000.00
					Totals	***$ 3,736,900***		***$ 400,000***	***$ 930,000***
								TOTAL	**$ 5,066,900**

Source: Online Portage County Land Records Accesssed March 2022.

OSBORN OPINION OF PROBABLE COST (OPC)

DETAILED COST

Project No: **J20210247.000** Client: **Mantua Township** Date: **11/30/2022**
Project Description: **Black Brook Flood Study - Nature Based Improvements** By: **LS**

Design Status/Level: ☑ Schematic ☐ Design Development ☐ Construction Documents ☐ Other % Complete:

Discipline: ☐ Architectural ☑ Civil ☐ Structural ☐ HVAC ☐ Plumbin ☐ Process ☐ Fire Protection ☐ Electrical ☐ Technology ☐ Transportation

Div./ID#	Item Description	Unit	Quantity	Unit Cost	Cost
	Permitting	LS	1	$ 100,000.00	$ 100,000
	Wetland Restoration	Acre	20	$ 15,000.00	$ 300,000
	Stream Restoration	LF	1,000	$ 700.00	$ 700,000
	Wetland Enhancement	Acre	10	$ 200,000.00	$ 2,000,000
	Floodplain reconnection	LF	800	$ 500.00	$ 400,000
	BMPs (Wet Detention Ponds)	cf	225,000	$ 1.00	$ 225,000
	Property Acquisition/easements	LS	1	$ 250,000.00	$ 250,000
SUB TOTAL THIS PAGE					**$3,975,000.00**

Opinion of Probable Cost (OPC) - Detailed Cost

Project No: **J20210247.000** Client: **Mantua Township** Date: **11/30/2022**
Project Description: **Black Brook Flood Study - Nature Based Improvements** By: **LS**

Div./ID#	Item Description	Quantity	Unit	Unit Cost	Cost
SUB TOTAL THIS PAGE					
SUB TOTAL PREVIOUS PAGE					**$3,975,000.00**
SUB-TOTAL					**$3,975,000.00**
10% DESIGN CONTINGENCY					**$397,500.00**
10% CONSTRUCTION CONTINGENCY					**$397,500.00**
TOTAL					**$4,770,000.00**

Appendix D – Project Summary

Mantua Township

Black Brook Flood Study

Hazard Mitigation Grant Program
Project Data Summary

Parcel No.	Property Address	Storm Event	Pre-Mitigation Water Elevation	Pre-Mitigation Discharge (cfs)	Scenario 2a Post-Mitigation Water Elevation	Scenario 2a Post-Mitigation Discharge (cfs)	Scenario 2b Post-Mitigation Water Elevation	Scenario 2b Post-Mitigation Discharge (cfs)	Scenario 2c Post-Mitigation Water Elevation	Scenario 2c Post-Mitigation Discharge (cfs)	Scenario 2d Post-Mitigation Water Elevation	Scenario 2d Post-Mitigation Discharge (cfs)	Scenario 2fa Post-Mitigation Water Elevation	Scenario 2fa Post-Mitigation Discharge (cfs)	Scenario 2fb Post-Mitigation Water Elevation	Scenario 2fb Post-Mitigation Discharge (cfs)	Scenario 2g Post-Mitigation Water Elevation	Scenario 2g Post-Mitigation Discharge (cfs)	Scenario 2h Post-Mitigation Water Elevation	Scenario 2h Post-Mitigation Discharge (cfs)
23-009-00-00-023-000	12481 Mantua Center Rd	1	n/a	3.85	n/a	0.14	n/a	5.19	n/a	0.68	n/a	1.47	n/a	0.67	n/a	0.26	n/a	2.28	n/a	1.65
		5	n/a	83.06	n/a	81.96	n/a	44.34	n/a	34.72	n/a	122.97	n/a	26.89	n/a	62.75	n/a	41.89	n/a	35.45
		100	n/a	202.61	n/a	202.61	n/a	114.86	n/a	184.57	n/a	235.9	n/a	163.08	n/a	135.97	n/a	188.8	n/a	179.51
23-009-00-00-022-000	12471 Mantua Center Rd	1	n/a	3.85	n/a	0.14	n/a	5.19	n/a	0.68	n/a	1.47	n/a	0.67	n/a	0.26	n/a	2.28	n/a	1.65
		5	n/a	83.06	n/a	81.96	n/a	44.34	n/a	34.72	n/a	122.97	n/a	26.89	n/a	62.75	n/a	41.89	n/a	35.45
		100	n/a	202.61	1146.01	202.61	n/a	114.86	n/a	184.57	n/a	235.9	n/a	163.08	n/a	135.97	n/a	188.8	n/a	179.51
23-009-00-00-021-000	3981 Herman Rd	1	n/a	3.85	n/a	0.14	n/a	5.19	n/a	0.68	n/a	1.47	n/a	0.67	n/a	0.26	n/a	2.28	n/a	1.65
		5	n/a	83.06	n/a	81.96	n/a	44.34	n/a	34.72	n/a	122.97	n/a	26.89	n/a	62.75	n/a	41.89	n/a	35.45
		100	1146.00	202.61	1146.01	202.61	n/a	114.86	n/a	184.57	n/a	235.9	n/a	163.08	n/a	135.97	n/a	188.8	n/a	179.51
23-009-00-00-020-000	3967 Herman Rd	1	n/a	3.85	n/a	0.14	n/a	5.19	n/a	0.68	n/a	1.47	n/a	0.67	n/a	0.26	n/a	2.28	n/a	1.65
		5	n/a	83.06	n/a	81.96	n/a	44.34	n/a	34.72	n/a	122.97	n/a	26.89	n/a	62.75	n/a	41.89	n/a	35.45
		100	1146.00	202.61	1146.01	202.61	n/a	114.86	n/a	184.57	n/a	235.9	n/a	163.08	n/a	135.97	n/a	188.8	n/a	179.51
23-009-00-00-009-000	12451 Mantua Center Rd	1	n/a	3.85	1139.76	0.14	1139.22	5.19	1139.33	0.68	1139.29	1.47	1139.18	0.67	1138.99	0.26	1139.59	2.28	1139.54	1.65
		5	n/a	83.06	1143.68	81.96	1141.8	44.34	1143.51	34.72	1143.62	122.97	1143.57	26.89	1143.41	62.75	1143.63	41.89	1143.45	35.45
		100	1146.00	202.61	1146.01	202.61	1144.72	114.86	1145.65	184.57	1145.17	235.9	1145.58	163.08	1145.2	135.97	1145.84	188.8	1145.69	179.51
23-009-00-00-009-001	4028 Herman Rd	1	n/a	3.85	1140.43	0.14	1140.13	5.19	1140.7	0.68	1140.56	1.47	1140.6	0.67	1140.55	0.26	1140.62	2.28	1140.6	1.65
		5	n/a	83.06	1143.78	81.96	1142.26	44.34	1143.66	34.72	1143.68	122.97	1143.68	26.89	1143.6	62.75	1143.7	41.89	1143.6	35.45
		100	1146.00	202.61	1146.01	202.61	1144.75	114.86	1145.66	184.57	1145.18	235.9	1145.49	163.08	1145.2	135.97	1145.84	188.8	1145.7	179.51
23-009-00-00-010-000	4002 Herman Rd	1	n/a	3.85	1140.11	0.14	1140.01	5.19	1140.13	0.68	1140.07	1.47	1140.08	0.67	1140.07	0.26	1140.12	2.28	1139.61	1.65
		5	n/a	83.06	1143.74	81.96	1141.88	44.34	1143.56	34.72	1143.58	122.97	1143.61	26.89	1143.48	62.75	1143.66	41.89	1143.46	35.45
		100	1146.00	202.61	1146.01	202.61	1144.74	114.86	1145.66	184.57	1145.18	235.9	1145.49	163.08	1145.2	135.97	1145.84	188.8	1145.7	179.51
23-009-00-00-012-000	3968 Herman Rd	1	n/a	3.85	1140.76	0.14	n/a	5.19	1140.76	0.68	1140.75	1.47	1140.76	0.67	1140.76	0.26	1140.76	2.28	1140.76	1.65
		5	n/a	83.06	1143.58	81.96	1141.48	44.34	1143.4	34.72	1143.38	122.97	1143.44	26.89	1143.31	62.75	1143.49	41.89	1143.28	35.45
		100	1146	202.61	1146.02	202.61	1144.74	114.86	1145.66	184.57	1145.22	235.9	1145.5	163.08	1145.21	135.97	1145.85	188.8	1145.7	179.51
23-009-00-00-011-000	Herman	1	n/a	3.85	1141.23	0.14	n/a	5.19	1141.23	0.68	1141.22	1.47	1141.22	0.67	1141.23	0.26	1141.22	2.28	1141.23	1.65
		5	n/a	83.06	1143.58	81.96	1141.47	44.34	1143.39	34.72	1143.38	122.97	1143.44	26.89	1143.31	62.75	1143.49	41.89	1143.28	35.45
		100	1146.01	202.61	1146.02	202.61	1144.69	114.86	1145.66	184.57	1145.17	235.9	1145.49	163.08	1145.2	135.97	1145.84	188.8	1145.7	179.51
23-009-00-00-012-002	Herman	1	n/a	3.85	1141.47	0.14	n/a	5.19	1141.47	0.68	1141.47	1.47	1141.47	0.67	1141.47	0.26	1141.47	2.28	1141.47	1.65
		5	n/a	83.06	1143.58	81.96	1141.47	44.34	1143.39	34.72	1143.38	122.97	1143.44	26.89	1143.31	62.75	1143..49	41.89	1143.27	35.45
		100	1145.99	202.61	1146.02	202.61	1144.69	114.86	1145.66	184.57	1145.17	235.9	1145.49	163.08	1145.2	135.97	1145.84	188.8	1145.7	179.51
23-009-00-00-012-001	3916 Herman	1	n/a	3.85	1141.78	0.14	n/a	5.19	1141.79	0.68	1141.78	1.47	1141.79	0.67	1141.78	0.26	1141.79	2.28	1141.79	1.65
		5	n/a	83.06	1143.58	81.96	1141.47	44.34	1143.39	34.72	1143.38	122.97	1143.44	26.89	1143.3	62.75	1143.49	41.89	1143.27	35.45
		100	n/a	202.61	1146.02	202.61	1144.69	114.86	1145.66	184.57	1145.17	235.9	1145.59	163.08	1145.2	135.97	1145.85	188.8	1145.7	179.51
23-010-00-00-028-000	Mantua Center	1	1138.41	3.85	1138.95	0.14	1137.71	5.19	1137.77	0.68	1137.6	1.47	1137.65	0.67	1137.6	0.26	1137.76	2.28	1137.56	1.65
		5	1143.34	83.06	1143.34	81.96	1141.23	44.34	1143.14	34.72	1143.08	122.97	1143.18	26.89	1143.06	62.75	1143.23	41.89	1143.04	35.45
		100	1145.93	202.61	1145.93	202.61	1144.54	114.86	1145.57	184.57	1145.01	235.9	1145.39	163.08	1145.08	135.97	1145.76	188.8	1145.61	179.51
23-010-00-00-029-000	12472 Mantua Center	1	1138.48	3.85	1138.48	0.14	1137.79	5.19	1137.85	0.68	1137.81	1.47	1137.82	0.67	1137.8	0.26	1137.85	2.28	1137.79	1.65
		5	1143.51	83.06	1143.5	81.96	1141.36	44.34	1143.32	34.72	1143.26	122.97	1143.36	26.89	1143.24	62.75	1143.43	41.89	1143.2	35.45
		100	1145.98	202.61	1145.95	202.61	1144.65	114.86	1145.63	184.57	1145.1	235.9	1145.46	163.08	1145.16	135.97	1145.81	188.8	1145.67	179.51
23-010-00-00-030-000	12438 Mantua Center	1	1139.17	3.85	1138.89	0.14	1138.02	5.19	1138.11	0.68	1138.52	1.47	1138.1	0.67	1138.4	0.26	1138.53	2.28	1138.75	1.65
		5	1143.61	83.06	1143.61	81.96	1141.86	44.34	1143.46	34.72	1143.5	122.97	1143.48	26.89	1143.41	62.75	1143.56	41.89	1143.33	35.45
		100	1146.05	202.61	1145.99	202.61	1144.69	114.86	1145.63	184.57	1145.47	235.9	1145.65	163.08	1145.17	135.97	1145.82	188.8	1145.67	179.51
23-009-00-00-008-000	12413 Mantua Center	1	1144.37	3.85	1144.37	0.14	1144.19	5.19	1144.28	0.68	1144.26	1.47	1144.28	0.67	1144.26	0.26	1144.28	2.28	1144.26	1.65
		5	1144.7	83.06	1144.7	81.96	1144.48	44.34	1144.61	34.72	1144.65	122.97	1144.62	26.89	1144.56	62.75	1144.65	41.89	1144.55	35.45
		100	1146.02	202.61	1146.02	202.61	1144.97	114.86	1145.67	184.57	1145.28	235.9	1145.51	163.08	1145.23	135.97	1145.85	188.8	1145.72	179.51
23-009-00-00-007-000	Mantua Center	1	1144.38	3.85	1144.38	0.14	1144.19	5.19	1144.29	0.68	1144.28	1.47	1144.29	0.67	1144.27	0.26	1144.29	2.28	1144.27	1.65
		5	1144.82	83.06	1144.82	81.96	1144.49	44.34	1144.65	34.72	1144.69	122.97	1144.65	26.89	1144.58	62.75	1144.76	41.89	1144.58	35.45
		100	1146.03	202.61	1146.03	202.61	1145.11	114.86	1145.7	184.57	1145.41	235.9	1145.55	163.08	1145.31	135.97	1145.87	188.8	1145.73	179.51
23-009-00-00-006-000	Mantua Center	1	1144.43	3.85	1144.43	0.14	1144.19	5.19	1144.35	0.68	1144.34	1.47	1144.35	0.67	1144.34	0.26	1144.35	2.28	1144.33	1.65
		5	1144.82	83.06	1144.82	81.96	1144.53	44.34	1144.72	34.72	1144.73	122.97	1144.73	26.89	1144.65	62.75	1144.76	41.89	1144.65	35.45
		100	1146.04	202.61	1146.04	202.61	1145.11	114.86	1145.71	184.57	1145.43	235.9	1145.56	163.08	1145.32	135.97	1145.88	188.8	1145.74	179.51
23-009-00-00-005-000	Mantua Center	1	1144.43	3.85	1144.43	0.14	1144.19	5.19	1144.36	0.68	1144.35	1.47	1144.36	0.67	1144.35	0.26	1144.36	2.28	1144.34	1.65
		5	1144.83	83.06	1144.83	81.96	1144.54	44.34	1144.73	34.72	1144.74	122.97	1144.74	26.89	1144.66	62.75	1144.77	41.89	1144.66	35.45
		100	1146.05	202.61	1146.05	202.61	1145.14	114.86	1145.74	184.57	1145.51	235.9	1145.6	163.08	1145.37	135.97	1145.9	188.8	1145.77	179.51
23-009-00-00-004-000	Mantua Center	1	1144.46	3.85	1144.47	0.14	1144.19	5.19	1144.43	0.68	1144.42	1.47	1144.43	0.67	1144.43	0.26	1144.45	2.28	1144.42	1.65
		5	1144.93	83.06	1144.9	81.96	1144.54	44.34	1144.82	34.72	1144.8	122.97	1144.81	26.89	1144.78	62.75	1144.85	41.89	1144.77	35.45
		100	1146.1	202.61	1146.1	202.61	1145.14	114.86	1145.93	184.57	1145.87	235.9	1145.89	163.08	1145.87	135.97	1146.03	188.8	1145.94	179.51
23-009-00-00-003-000	Mantua Center	1	1146.43	3.85	1146.51	0.14	1144.19	5.19	1146.51	0.68	1146.47	1.47	1146.48	0.67	1146.36	0.26	1146.45	2.28	1146.45	1.65
		5	1147.09	83.06	1147.05	81.96	1144.54	44.34	1147.1	34.72	1147.09	122.97	1147.01	26.89	1147.01	62.75	1147.06	41.89	1146.92	35.45
		100	1147.34	202.61	1147.3	202.61	1145.14	114.86	1147.36	184.57	1147.35	235.9	1147.31	163.08	1147.31	135.97	1147.28	188.8	1147.31	179.51
23-009-00-00-002-000	Mantua Center	1	1144.51	3.85	1144.5	0.14	1144.19	5.19	1144.47	0.68	1144.47	1.47	1144.48	0.67	1144.47	0.26	1144.47	2.28	1144.46	1.65
		5	1144.93	83.06	1144.93	81.96	1144.54	44.34	1144.86	34.72	1144.84	122.97	1144.85	26.89	1144.83	62.75	1144.89	41.89	1144.82	35.45
		100	1146.06	202.61	1146.06	202.61	1145.15	114.86	1145.77	184.57	1145.61	235.9	1145.65	163.08	1145.54	135.97	1145.91	188.8	1145.79	179.51
23-009-00-00-001-000	Mantua Center	1	1146.93	3.85	1146.92	0.14	1144.19	5.19	1146.93	0.68	1146.93	1.47	1146.86	0.67	1146.9	0.26	1146.85	2.28	1146.81	1.65
		5	1147.08	83.06	1147.07	81.96	1144.54	44.34	1147.08	34.72	1147.07	122.97	1147.1	26.89	1147.04	62.75	1147.05	41.89	1147.01	35.45
		100	1147.53	202.61	1147.48	202.61	1145.14	114.86	1147.44	184.57	1147.41	235.9	1147.5	163.08	1147.46	135.97	1147.47	188.8	1147.43	179.51
23-015-00-00-024-001	Mantua	1	1144.68	3.85	1144.65	0.14	1145.72	5.19	1144.63	0.68	1144.64	1.47	1145.62	0.67	1145.23	0.26	1145.59	2.28	1144.59	1.65
		5	1145.29	83.06	1145.24	81.96	1146.05	44.34	1145.86	34.72	1144.88	122.97	1145.92	26.89	1144.82	62.75	1145.95	41.89	1145.79	35.45
		100	1146.36	202.61	1146.38	202.61	1146.4	114.86	1146.33	184.57	1145.64	235.9	1146.2	163.08	1146.14	135.97	1146.33	188.8	1146.34	179.51
23-015-00-00-023-001	12265 Mantua Center	1	1145.8	3.85	1145.8	0.14	1145.8	5.19	1145.62	0.68	1145.2	1.47	1145.65	0.67	1145.23	0.26	1145.62	2.28	1144.56	1.65
		5	1146.15	83.06	1146.14	81.96	1146.15	44.34	1145.96	34.72	1144.82	122.97	1146.03	26.89	1145.91	62.75	1146.06	41.89	1145.85	35.45
		100	1146.48	202.61	1146.48	202.61	1146.48	114.86	1146.45	184.57	1145.53	235.9	1146.3	163.08	1146.23	135.97	1146.45	188.8	1146.41	179.51
23-015-00-00-024-000	Mantua Center	1	1145.05	3.85	1145.05	0.14	1145.84	5.19	1145.63	0.68	1145.2	1.47	1145.67	0.67	1145.23	0.26	1145.63	2.28	1145	1.65
		5	1146.16	83.06	1146.15	81.96	1146.16	44.34	1146	34.72	1145.08	122.97	1146.05	26.89	1145.97	62.75	1146.09	41.89	1145.91	35.45
		100	1146.53	202.61	1146.53	202.61	1146.52	114.86	1146.49	184.57	1146.04	235.9	1146.33	163.08	1146.25	135.97	1146.49	188.8	1146.44	179.51

23-015-00-00-022-000	Mantua Center	1	1145.6	3.85	1145.85	0.14	1145.85	5.19	1145.65	0.68	1145.58	1.47	1145.69	0.67		1145.56	0.26	1145.65	2.28	1145.53	1.65
		5	1146.18	83.06	1146.18	81.96	1146.18	44.34	1146.02	34.72	1145.64	122.97	1146.08	26.89		1145.99	62.75	1146.1	41.89	1145.95	35.45
		100	1146.56	202.61	1146.56	202.61	1146.56	114.86	1146.52	184.57	1146.05	235.9	1146.34	163.08		1146.26	135.97	1146.52	188.8	1146.47	179.51
23-015-00-00-021-000	Mantua Center	1	1146.12	3.85	1146.11	0.14	1145.87	5.19	1145.96	0.68	1146.08	1.47	1146.11	0.67		1146.09	0.26	1146.09	2.28	1146.01	1.65
		5	1146.18	83.06	1146.18	81.96	1146.18	44.34	1146.13	34.72	1146.15	122.97	1146.14	26.89		1146.12	62.75	1146.1	41.89	1146.12	35.45
		100	1146.59	202.61	1146.59	202.61	1146.59	114.86	1164.54	184.57	1146.19	235.9	1146.35	163.08		1146.27	135.97	1146.55	188.8	1146.49	179.51
23-015-00-00-020-000	12167 Mantua Center	1	1146.21	3.85	1146.21	0.14	1146.18	5.19	1146.14	0.68	1146.15	1.47	1146.18	0.67		1146.15	0.26	1146.15	2.28	1146.1	1.65
		5	1146.3	83.06	1146.3	81.96	1146.3	44.34	1146.27	34.72	1146.26	122.97	1146.26	26.89		1146.23	62.75	1146.27	41.89	1146.2	35.45
		100	1146.62	202.61	1146.62	202.61	1146.63	114.86	1146.59	184.57	1146.34	235.9	1146.39	163.08		1146.33	135.97	1146.59	188.8	1146.53	179.51
23-015-00-00-019-000	Mantua Center	1	1146.24	3.85	1146.27	0.14	1146.24	5.19	1146.17	0.68	1146.17	1.47	1146.21	0.67		1146.18	0.26	1146.18	2.28	1146.11	1.65
		5	1146.36	83.06	1146.36	81.96	1146.35	44.34	1146.31	34.72	1146.3	122.97	1146.31	26.89		1146.27	62.75	1146.32	41.89	1146.26	35.45
		100	1146.7	202.61	1146.71	202.61	1146.7	114.86	1146.66	184.57	1146.42	235.9	1146.44	163.08		1146.39	135.97	1146.66	188.8	1146.6	179.51
23-010-00-00-031-001	12408 Mantua Center	1	1144.34	3.85	1144.35	0.14	1144.19	5.19	1144.26	0.68	1144.24	1.47	1144.26	0.67		1144.24	0.26	1144.26	2.28	1144.24	1.65
		5	1144.65	83.06	1144.65	81.96	1144.45	44.34	1144.56	34.72	1144.87	122.97	1144.56	26.89		1144.52	62.75	1144.6	41.89	1144.52	35.45
		100	1146.01	202.61	1146.01	202.61	1144.88	114.86	1145.66	184.57	1145.18	235.9	1145.49	163.08		1145.21	135.97	1145.84	188.8	1145.69	179.51
23-010-00-00-031-000	Mantua Center	1	1146.37	3.85	1144.03	0.14	1146.74	5.19	1146.51	0.68	1142.27	1.47	1146.62	0.67		1146.73	0.26	1146.72	2.28	1146.72	1.65
		5	1144.07	83.06	1146.79	81.96	1146.68	44.34	1146.73	34.72	1143.84	122.97	1146.54	26.89		1146.41	62.75	1146.75	41.89	1146.74	35.45
		100	1146.48	202.61	1146.72	202.61	1146.71	114.86	1146.75	184.57	1145.1	235.9	1146.74	163.08		1146.81	135.97	1146.83	188.8	1146.76	179.51
23-010-00-00-032-000	Mantua Center	1	1146.12	3.85	1146.31	0.14	1146.26	5.19	1146.32	0.68	1144.24	1.47	1146.23	0.67		1146.23	0.26	1146.35	2.28	1146.3	1.65
		5	1146.29	83.06	1146.3	81.96	1146.35	44.34	1146.29	34.72	1144.59	122.97	1146.33	26.89		1146.33	62.75	1146.33	41.89	1146.28	35.45
		100	1146.2	202.61	1146.36	202.61	1146.34	114.86	1146.35	184.57	1145.19	235.9	1146.34	163.08		1146.33	135.97	1146.34	188.8	1146.37	179.51
23-010-00-00-033-000	Mantua Center	1	1146.02	3.85	1146.01	0.14	1146.01	5.19	1146.03	0.68	1144.25	1.47	1146.01	0.67		1146.01	0.26	1146.02	2.28	1146.02	1.65
		5	1146.16	83.06	1146.02	81.96	1146.09	44.34	1146.2	34.72	1144.47	122.97	1146.04	26.89		1146.04	62.75	1146.19	41.89	1146.03	35.45
		100	1146.92	202.61	1146.83	202.61	1146.82	114.86	1146.74	184.57	1145.13	235.9	1146.78	163.08		1146.79	135.97	1146.23	188.8	1146.84	179.51
23-010-00-00-034-000	12330 Mantua Center	1	1144.37	3.85	1144.27	0.14	1144.22	5.19	1144.27	0.68	1144.25	1.47	1144.27	0.67		1144.25	0.26	1144.27	2.28	1144.24	1.65
		5	1144.7	83.06	1144.69	81.96	1144.3	44.34	1144.6	34.72	1144.47	122.97	1144.62	26.89		1144.55	62.75	1144.65	41.89	1144.55	35.45
		100	1146.15	202.61	1146.13	202.61	1146.09	114.86	1146.16	184.57	1145.13	235.9	1145.51	163.08		1145.24	135.97	1146.13	188.8	1146.12	179.51
23-010-00-00-035-001	12330 Mantua Center	1	1144.38	3.85	1144.38	0.14	1144.25	5.19	1144.27	0.68	1144.25	1.47	1144.27	0.67		1144.25	0.26	1144.27	2.28	1144.25	1.65
		5	1144.71	83.06	1144.71	81.96	1144.5	44.34	1144.62	34.72	1144.47	122.97	1144.63	26.89		1144.56	62.75	1144.66	41.89	1144.56	35.45
		100	1146.02	202.61	1146.02	202.61	1144.99	114.86	1145.67	184.57	1145.14	235.9	1145.51	163.08		1145.25	135.97	1145.85	188.8	1145.71	179.51
23-010-00-00-036-000	Mantua Center	1	1145.09	3.85	1145.09	0.14	1145.09	5.19	1144.31	0.68	1144.26	1.47	1144.32	0.67		1144.26	0.26	1144.31	2.28	1144.26	1.65
		5	1152.2	83.06	1152.32	81.96	1152.46	44.34	1145.45	34.72	1144.49	122.97	1145.48	26.89		1145.41	62.75	1152.38	41.89	1145.28	35.45
		100	1146.66	202.61	1154.95	202.61	1154.83	114.86	1154.84	184.57	1145.23	235.9	1146.04	163.08		1146.11	135.97	1154.95	188.8	1154.94	179.51
23-016-00-00-001-000	12290 Mantua Center	1	1145.43	3.85	1146.01	0.14	1146.01	5.19	1146.03	0.68	1144.25	1.47	1144.36	0.67	1144.25	1144.25	0.26	1146.01	2.28	1144.24	1.65
		5	1146.11	83.06	1146.11	81.96	1146.11	44.34	1146.04	34.72	1144.5	122.97	1146.03	26.89		1146.01	62.75	1146.04	41.89	1146.03	35.45
		100	1148.06	202.61	1148.06	202.61	1148.06	114.86	1148.06	184.57	1145.28	235.9	1148.05	163.08		1148.04	135.97	1148.06	188.8	1148.04	179.51
23-016-00-00-002-000	Mantua Center	1	1148.02	3.85	1148.02	0.14	1148.02	5.19	1148.02	0.68	1144.09	1.47	1148.01	0.67		1144.13	0.26	1148.02	2.28	1148.01	1.65
		5	1148.08	83.06	1148.1	81.96	1148.1	44.34	1148.1	34.72	1144.53	122.97	1148.02	26.89		1146.11	62.75	1148.1	41.89	1148.02	35.45
		100	1148.15	202.61	1148.14	202.61	1148.14	114.86	148.15	184.57	1145.39	235.9	1148.12	163.08		1148.11	135.97	1148.15	188.8	1148.14	179.51
23-016-00-00-004-000	12246 Mantua Center	1	1148.11	3.85	1148.45	0.14	1148.57	5.19	1148.52	0.68	1144	1.47	1148.42	0.67		1145.24	0.26	1148.54	2.28	1148.4	1.65
		5	1148.57	83.06	1148.65	81.96	1148.63	44.34	1148.61	34.72	1144.57	122.97	1148.6	26.89		1148.02	62.75	1148.63	41.89	1148.58	35.45
		100	1148.7	202.61	1148.66	202.61	1148.65	114.86	1148.68	184.57	1145.48	235.9	1148.65	163.08		1144.64	135.97	1148.69	188.8	1150.09	179.51
23-016-00-00-006-000	Mantua Center	1	1150.15	3.85	1150.27	0.14	1150.24	5.19	1150.27	0.68	1145.2	1.47	1145.69	0.67		1145.24	0.26	1150.23	2.28	1144.61	1.65
		5	1150.39	83.06	1150.36	81.96	1150.36	44.34	1150.36	34.72	1144.59	122.97	1150.24	26.89		1150.2	62.75	1150.33	41.89	1150.14	35.45
		100	15042	202.61	1150.33	202.61	1150.44	114.86	1150.37	184.57	1145.51	235.9	1150.34	163.08		1150.33	135.97	1150.13	188.8	1150.09	179.51
23-016-00-00-007-000	12196 Mantua Center	1	1145.85	3.85	1146.12	0.14	1146.18	5.19	1146.19	0.68	1145.2	1.47	1162.41	0.67		1145.24	0.26	1146.12	2.28	1144.61	1.65
		5	1166.5	83.06	1166.42	81.96	1166.49	44.34	1166.49	34.72	1144.6	122.97	1166.37	26.89		1166.39	62.75	1166.46	41.89	1166.37	35.45
		100	1168.33	202.61	1168.33	202.61	1168.34	114.86	1168.32	184.57	1145.52	235.9	1166.6	163.08		1166.61	135.97	1166.83	188.8	1150.13	179.51
23-016-00-00-008-000	12166 Mantua Center	1	1146.13	3.85	1154.33	0.14	1154.32	5.19	1154.33	0.68	1145.2	1.47	1145.69	0.67		1145.24	0.26	1154.33	2.28	1144.62	1.65
		5	1154.22	83.06	1154.36	81.96	1154.27	44.34	1154.36	34.72	1144.61	122.97	1154.36	26.89		1154.32	62.75	1154.24	41.89	1154.34	35.45
		100	1154.35	202.61	1154.27	202.61	1154.37	114.86	1154.41	184.57	1145.53	235.9	1154.41	163.08		1154.44	135.97	1154.27	188.8	1154.37	179.51
23-016-00-00-009-000	12138 Mantua Center	1	1148.51	3.85	1145.87	0.14	1145.87	5.19	1145.65	0.68	1145.2	1.47	1145.7	0.67		1145.25	0.26	1145.65	2.28	1144.72	1.65
		5	1146.22	83.06	1146.22	81.96	1146.22	44.34	1146.04	34.72	1144.68	122.97	1146.1	26.89		1146.01	62.75	1146.13	41.89	1154.95	35.45
		100	1157.64	202.61	1157.72	202.61	1157.78	114.86	1157.78	184.57	1145.63	235.9	1146.42	163.08		1146.31	135.97	1157.69	188.8	1157.66	179.51
23-015-00-00-018-000	Mantua Center	1	1146.27	3.85	1146.26	0.14	1146.27	5.19	1146.19	0.68	1146.19	1.47	1146.23	0.67		1146.2	0.26	1146.19	2.28	1146.13	1.65
		5	1146.41	83.06	1146.4	81.96	1146.41	44.34	1146.36	34.72	1146.35	122.97	1146.36	26.89		1146.31	62.75	1146.36	41.89	1146.3	35.45
		100	1146.78	202.61	1146.78	202.61	1146.78	114.86	1146.73	184.57	116.5	235.9	1146.51	163.08		1146.44	135.97	1146.73	188.8	1146.67	179.51
23-015-00-00-017-000	12119 Mantua Center	1	1146.3	3.85	1146.29	0.14	1146.29	5.19	1146.21	0.68	1146.21	1.47	1146.25	0.67		1146.21	0.26	1146.21	2.28	1146.14	1.65
		5	1146.45	83.06	1146.45	81.96	1146.45	44.34	1146.4	34.72	1146.38	122.97	1146.4	26.89		1164.34	62.75	1146.4	41.89	1146.33	35.45
		100	1146.85	202.61	1146.85	202.61	1146.85	114.86	1146.8	184.57	1146.55	235.9	1146.57	163.08		1146.49	135.97	1146.8	188.8	1146.75	179.51
23-015-00-00-016-000	12104 Mantua Center	1	1146.31	3.85	1146.31	0.14	1146.31	5.19	1146.22	0.68	1146.22	1.47	1146.26	0.67		1146.22	0.26	1146.22	2.28	1146.14	1.65
		5	1146.48	83.06	1146.48	81.96	1146.48	44.34	1146.43	34.72	1146.41	122.97	1146.42	26.89		1146.36	62.75	1146.43	41.89	1146.35	35.45
		100	1146.9	202.61	1146.9	202.61	1146.91	114.86	1146.86	184.57	1146.59	235.9	1146.62	163.08		1146.53	135.97	1146.86	188.8	1146.81	179.51
23-015-00-00-015-000	Mantua Center	1	1146.32	3.85	1146.32	0.14	1146.32	5.19	1146.22	0.68	1146.23	1.47	1146.27	0.67		1146.23	0.26	1146.22	2.28	1146.14	1.65
		5	1146.49	83.06	1146.49	81.96	1146.5	44.34	1146.43	34.72	1146.42	122.97	1146.43	26.89		1146.37	62.75	1146.44	41.89	1146.36	35.45
		100	1146.92	202.61	1146.91	202.61	1146.92	114.86	1146.88	184.57	1146.61	235.9	1146.64	163.08		1146.54	135.97	1146.88	188.8	1146.84	179.51
23-015-00-00-014-000	Mantua Center	1	1146.36	3.85	1146.36	0.14	1146.36	5.19	1146.25	0.68	1146.26	1.47	1146.31	0.67		1146.27	0.26	1146.25	2.28	1146.16	1.65
		5	1146.58	83.06	1146.58	81.96	1146.57	44.34	1146.5	34.72	1146.48	122.97	1146.5	26.89		1146.43	62.75	1146.5	41.89	1146.41	35.45
		100	1147.07	202.61	1147.07	202.61	1147.07	114.86	1147.03	184.57	1146.7	235.9	1146.77	163.08		1146.64	135.97	1147.03	188.8	1146.99	179.51
23-015-00-00-013-000	12100 Mantua Center	1	1146.36	3.85	1146.36	0.14	1146.36	5.19	1146.25	0.68	1146.26	1.47	1146.31	0.67		1146.26	0.26	1146.25	2.28	1146.16	1.65
		5	1146.57	83.06	1146.57	81.96	1146.57	44.34	1146.5	34.72	1146.48	122.97	1146.49	26.89		1146.43	62.75	1146.5	41.89	1146.41	35.45
		100	1147.06	202.61	1147.07	202.61	1147.07	114.86	1147.03	184.57	1146.7	235.9	1164.76	163.08		1146.63	135.97	1147.03	188.8	1146.98	179.51

23-015-00-00-012-000	Mantua Center	1	1148.02	3.85	1148.02	0.14	1148.02	5.19	1146.32	0.68	1148.02	1.47	1148.02	0.67		1148.02	0.26	1146.27	2.28	1146.18	1.65
		5	1148.03	83.06	1148.03	81.96	1148.03	44.34	1146.58	34.72	1148.03	122.97	1148.03	26.89		1148.03	62.75	1148.02	41.89	1148.02	35.45
		100	1148.29	202.61	1148.05	202.61	1148.28	114.86	1147.17	184.57	1148.28	235.9	1148.28	163.08		1148.28	135.97	1148.04	188.8	1148.04	179.51
23-015-00-00-011-000	Mantua Center	1	1148.03	3.85	1148.03	0.14	1148.03	5.19	1146.52	0.68	1148.03	1.47	1148.03	0.67		1148.03	0.26	1146.28	2.28	1146.26	1.65
		5	1148.06	83.06	1148.06	81.96	1148.06	44.34	1146.88	34.72	1148.06	122.97	1148.06	26.89		1148.06	62.75	1148.04	41.89	1148.04	35.45
		100	1148.08	202.61	1148.09	202.61	1148.09	114.86	1146.36	184.57	1148.09	235.9	1148.09	163.08		1148.1	135.97	1148.08	188.8	1148.07	179.51
23-015-00-00-010-000	12011 Mantua Center	1	1148.09	3.85	1148.1	0.14	1148.1	5.19	1147.25	0.68	1148.08	1.47	1148.08	0.67		1148.09	0.26	1147.33	2.28	1146.86	1.65
		5	1148.2	83.06	1148.14	81.96	1148.18	44.34	1147.75	34.72	1148.2	122.97	1148.15	26.89		1148.19	62.75	1148.12	41.89	1148.13	35.45
		100	1148.21	202.61	1148.24	202.61	1148.22	114.86	1148.11	184.57	1148.26	235.9	1148.24	163.08		1148.26	135.97	1148.23	188.8	1148.13	179.51
23-015-00-00-009-000	11993 Mantua Center	1	1148.15	7.33	1148.14	7.33	1148.14	7.33	1148.11	7.33	1148.13	0	1148.15	2.82		1148.14	0.18	1148.1	7.33	1148.05	3.2
		5	1148.22	7.34	1148.21	7.35	1148.22	7.35	1148.23	7.35	1148.21	0	1148.22	7.33		1148.22	1.37	1148.16	7.35	1148.15	7.33
		100	1148.34	7.08	1148.34	7.08	1148.34	7.08	1148.6	7.08	1148.33	0	1148.33	7.33		1148.33	7.33	1148.25	7.08	1148.25	7.21
23-015-00-00-007-001	11967 Mantua Center	1	1149.04	7.33	1148.96	7.33	1149.03	7.33	1148.18	7.33	1148.78	0	1149.07	2.82		1149.06	0.18	1147.97	7.33	1148.12	3.2
		5	1149.14	7.34	1148.92	7.35	1148.96	7.35	1148.38	7.35	1149.12	0	1149.17	7.33		1149.14	1.37	1149.05	7.35	1149.1	7.33
		100	1149.32	7.08	1149.04	7.08	1149.29	7.08	1148.74	7.08	1149.27	0	1149.07	7.33		1149.07	7.33	1149.26	7.08	1149.21	7.21
23-015-00-00-007-000	11935 Mantua Center	1	1149.34	7.33	1149.47	7.33	1149.44	7.33	1148.33	7.33	1149.52	0	1149.47	2.82		1149.46	0.18	1148.09	7.33	1148.19	3.2
		5	1149.58	7.34	1149.57	7.35	1149.67	7.35	1148.59	7.35	1149.52	0	1149.67	7.33		1149.57	1.37	1149.54	7.35	1149.53	7.33
		100	1149.79	7.08	1149.73	7.08	1149.77	7.08	1148.9	7.08	1149.75	0	1149.84	7.33		1149.84	7.33	1149.63	7.08	1149.57	7.21
23-015-00-00-006-000	11919 Mantua Center	1	1148.48	7.33	1148.29	7.33	1148.29	7.33	1148.41	7.33	1148.12	0	1148.13	2.82		1148.12	0.18	1148.29	7.33	1148.22	3.2
		5	1148.96	7.34	1148.95	7.35	1148.96	7.35	1149.95	7.35	1148.15	0	1148.48	7.33		1148.15	1.37	1148.94	7.35	1148.52	7.33
		100	1149.39	7.08	1149.38	7.08	1149.39	7.08	1149.39	7.08	1148.89	0	1149.12	7.33		1148.55	7.33	1149.39	7.08	1149.36	7.21
23-016-00-00-010-000	Mantua Center	1	1152.18	3.85	1152.38	0.14	1152.4	5.19	1152.4	0.68	1145.37	1.47	1152.34	0.67		1152.32	0.26	1152.42	2.28	1152.35	1.65
		5	1152.59	83.06	1152.56	81.96	1152.63	44.34	1152.59	34.72	1144.76	122.97	1152.37	26.89		1152.48	62.75	1152.63	41.89	1152.39	35.45
		100	1152.98	202.61	1153.03	202.61	1152.91	114.86	1152.93	184.57	1145.66	235.9	1152.73	163.08		1152.75	135.97	1152.93	188.8	1152.96	179.51
23-016-00-00-011-000	Mantua Center	1	1152.29	3.85	1152.31	0.14	1152.33	5.19	1152.21	0.68	1145.68	1.47	1152.13	0.67		1152.25	0.26	1152.35	2.28	1152.2	1.65
		5	1152.53	83.06	1152.43	81.96	1152.37	44.34	1152.42	34.72	1144.77	122.97	1152.31	26.89		1152.32	62.75	1152.36	41.89	1152.23	35.45
		100	1152.77	202.61	1152.83	202.61	1152.9	114.86	1152.9	184.57	1145.67	235.9	1152.51	163.08		1152.65	135.97	1152.9	188.8	1152.9	179.51
23-016-00-00-012-000	12074 Mantua Center	1	1150.3	3.85	1146.32	0.14	1150.3	5.19	1150.29	0.68	1146.25	1.47	1150.21	0.67		1150.26	0.26	1150.3	2.28	1146.22	1.65
		5	1152.71	83.06	1152.71	81.96	1152.65	44.34	1152.71	34.72	n/a	122.97	1150.28	26.89		1150.3	62.75	1152.7	41.89	1150.31	35.45
		100	1152.97	202.61	1152.78	202.61	1153.13	114.86	1153.05	184.57	1145.66	235.9	1152.91	163.08		1152.83	135.97	1152.9	188.8	1152.96	179.51
23-016-00-00-013-000	12058 Mantua Center	1	1148.84	3.85	1150.18	0.14	1148.72	5.19	1148.81	0.68	1146.26	1.47	1148.04	0.67		1146.28	0.26	1148.81	2.28	1150.22	1.65
		5	1148.92	83.06	1148.92	81.96	1148.79	44.34	1148.99	34.72	n/a	122.97	1148.85	26.89		1148.62	62.75	1148.95	41.89	1148.82	35.45
		100	1149.04	202.61	1149.19	202.61	1149.12	114.86	1149.19	184.57	n/a	235.9	1149.07	163.08		1148.97	135.97	1149.22	188.8	1149.11	179.51
23-016-00-00-014-000	12012 Mantua Center	1	1148.5	7.33	1148.89	7.33	1148.39	7.33	1148.43	7.33	1146.26	0	1148.11	2.82		1148.08	0.18	1148.48	7.33	1148.11	3.2
		5	1148.65	7.34	1148.54	7.35	1148.64	7.35	1148.58	7.35	n/a	0	1148.62	7.33		1148.53	1.37	1148.66	7.35	1148.6	7.33
		100	1148.78	7.08	1148.66	7.08	1148.66	7.08	1148.73	7.08	n/a	0	1148.7	7.33		1148.61	7.33	1148.66	7.08	1148.77	7.21
23-016-00-00-015-000	Mantua Center	1	1148.42	7.33	1148.46	7.33	1148.4	7.33	1148.43	7.33	1146.26	0	1148.33	2.82		1148.33	0.18	1148.42	7.33	1148.34	3.2
		5	1148.48	7.34	1148.48	7.35	1148.53	7.35	1148.48	7.35	n/a	0	1148.46	7.33		1148.33	1.37	1148.48	7.35	1148.41	7.33
		100	1148.77	7.08	1148.76	7.08	1148.77	7.08	1148.77	7.08	n/a	0	1148.54	7.33		1148.41	7.33	1148.78	7.08	1148.76	7.21
23-016-00-00-016-000	12002 Mantua Center	1	1148.53	7.33	1148.41	7.33	1148.82	7.33	1148.81	7.33	n/a	0	1148.63	2.82		1148.34	0.18	1148.77	7.33	1148.58	3.2
		5	1148.75	7.34	1149.24	7.35	1149..22	7.35	1149.19	7.35	n/a	0	1148.89	7.33		1148.57	1.37	1149.22	7.35	1148.92	7.33
		100	1149.96	7.08	1149.93	7.08	1149.91	7.08	1149.89	7.08	n/a	0	1149.53	7.33		1148.92	7.33	1149.93	7.08	1149.92	7.21
23-016-00-00-017-000	11968 Mantua Center	1	1149.91	7.33	1148.82	7.33	1149.88	7.33	1149.88	7.33	1146.64	0	1149.78	2.82		1149.51	0.18	1149.88	7.33	1149.8	3.2
		5	1150.07	7.34	1150.08	7.35	1150.07	7.35	1150.05	7.35	n/a	0	1149.91	7.33		1149.72	1.37	1150.07	7.35	1149.91	7.33
		100	1150.48	7.08	1150.51	7.08	1150.49	7.08	1150.51	7.08	n/a	0	1150.17	7.33		1149.93	7.33	1150.48	7.08	1150.49	7.21
23-016-00-00-019-000	Mantua Center	1	1150.21	7.33	1149.86	7.33	1150.19	7.33	1150.21	7.33	1147.27	0	1150.14	2.82		1150.03	0.18	1150.22	7.33	1150.14	3.2
		5	1150.37	7.34	1150.237	7.35	1150.37	7.35	1150.37	7.35	n/a	0	1150.22	7.33		1150.13	1.37	1150.37	7.35	1150.24	7.33
		100	1150.78	7.08	1150.79	7.08	1150.79	7.08	1150.77	7.08	n/a	0	1150.48	7.33		1150.25	7.33	1150.79	7.08	1150.48	7.21
23-016-00-00-020-000	11930 Mantua Center	1	1150.31	7.33	1150.21	7.33	1150.21	7.33	1150.21	7.33	1146.73	0	1150.15	2.82		1150.1	0.18	1150.22	7.33	1149.56	3.2
		5	1150.46	7.34	1150.45	7.35	1150.46	7.35	1150.45	7.35	n/a	0	1150.24	7.33		1150.19	1.37	1150.45	7.35	1150.26	7.33
		100	1150.94	7.08	1150.94	7.08	1150.93	7.08	1150.92	7.08	n/a	0	1150.59	7.33		1150.24	7.33	1150.94	7.08	1150.91	7.21