

Stormwater Management Report

Drainage Study and Improvements

Dorwick Drive and Marwyck Drive

Prepared for:

Summit County Engineer
Northfield Center Township, Ohio

February 2025

Prepared By:

Burgess& Niple, Inc.
8160 Norton Parkway, Suite 200
Mentor, Ohio 44060

BURGESS & NIPLE

STORMWATER MANAGEMENT REPORT

**SUMMIT COUNTY ENGINEER
NORTHFIELD CENTER TOWNSHIP, OHIO**

PREPARED FOR:

SUMMIT COUNTY ENGINEER

FEBRUARY 2025

PREPARED BY:

**BURGESS & NIPLE, INC.
8160 NORTON PARKWAY, SUITE 200
MENTOR, OHIO 44060**

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	ii
1.0 INTRODUCTION	1
2.0 EXISTING FLOODING CONDITIONS.....	4
2.1 North of Marwyck	6
2.2 Dorwick and Pickwick	8
2.3 Dorwick and Beacon Hills	10
3.0 PROPOSED IMPROVEMENTS AND FLOOD REDUCTION BENEFITS	12
3.1 North of Marwick Improvements	14
3.2 Dorwick and Pickwick Improvements	16
3.3 Dorwick and Beacon Hills Improvements	18
3.4 Wetland Storage	20
3.5 Construction Phasing	21
4.0 PERMITTING REQUIREMENTS	22
4.1 Clean Water Act Section 404 Permit.....	22
4.2 Conditional Letter of Map Revision.....	22
5.0 SUMMARY	23

LIST OF FIGURES

Figure 1: Site Location Map	3
Figure 2: Existing Conditions Flooding for the 10-Year Storm	5
Figure 3: Existing Flood Depths During the 10-Year Storm North of Marwyck.....	7
Figure 4: Existing Flood Depths During the 10-Year Storm at Dorwick and Pickwick.....	9
Figure 5: Existing Flood Depths During the 10-Year Storm at Dorwick and Beacon Hills ..	11
Figure 6: Proposed Change in Flood Depth During the 10-Year Storm	13
Figure 7: Proposed Flood Reduction Depth During the 10-Year Storm North of Marwyck	15
Figure 8: Proposed Flood Reduction Depth During the 10-Year Storm at Dorwick and Pickwick.....	17
Figure 9: Proposed Flood Reduction Depth During the 10-Year Storm at Dorwick and Beacon Hills	19

LIST OF APPENDICES

Appendix	Description
A	SWMDM Transmittal Memo
B	PCSWMM Figures and Results
C	Conceptual Design Drawings
D	Detailed Cost Estimates
E	Waters Investigation

1.0 INTRODUCTION

This report describes the current flooding conditions and proposed improvements south of Fairhaven Drive, north of West Highland Road, and west of Olde 8 Road in Northfield Center Township (**Figure 1**). While the intent of the study is to reduce the impact of flooding on the streets, homes, and yards throughout the full neighborhood, the region identified as “Area of Interest” in **Figure 1** is the footprint in which the construction of proposed solutions was considered.

Analysis of the existing flooding conditions and the proposed solutions was performed using the Personal Computer Storm Water Management Model (PCSWMM). The PCSWMM model utilizes a combination of semi-distributed hydrologic methods to calculate runoff generation from rainfall, coupled with 1D and 2D hydraulic routing to simulate flow through pipes and channels to simulate flow leaving the drainage conveyance system. The model allows for analysis of stormwater quantity (hydrology) and its movement (hydraulics) within the watershed, facilitating the assessment of stormwater impacts and conveyance systems.

The existing storm sewer in the Area of Interest (AOI) was surveyed, and Geographic Information System (GIS) mapping was supplemented with channel cross sections to accurately capture the existing conveyance system in PCSWMM. The delineated drainage area was divided into 31 sub-catchments using publicly available Light Detection and Ranging (LiDAR) terrain data from 2011. The sub-catchments were then routed into the existing system relative to their upstream-most location. This allowed rainfall to enter from multiple different points throughout the system, capturing the complex flow dynamics. The LiDAR terrain was imported to PCSWMM to create a 2D mesh connected to the existing system, allowing flow to leave the system and flow across the terrain during a surcharge. The transmitted Stormwater Master Plan (SWMP) rainfall data files for Brandywine Creek were imported into PCSWMM for this study (**Appendix A**). The rainfall data prescribes to the Northeast Ohio Regional Sewer District (NEORS) Stormwater standards. The design storms have a 24-hour National Resource Conservation Service (NRCS) Type II distribution with cumulative rain depths based on the National Oceanic and Atmospheric Administration Atlas 14 (NOAA). All storms referred to in this report will simply be identified by their return period (e.g., “the 10-year storm”). The analysis included the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year storm events.

This report focuses on the results and proposed benefits to the 10-year storm. **Appendix B** includes the results from all other storm events from this study. Also included in **Appendix B** of this report are the unselected alternatives for flood reduction that did not achieve the same benefits as the preferred solutions.

The proposed improvements fall into three subareas referred to throughout this report as North of Marwyck, Dorwick and Pickwick, and Dorwick and Beacon Hills. This report will begin with a description of the existing flooding conditions, describe the flood reduction benefits associated with each of the proposed solutions, and finish with the permitting requirements of the improvements.

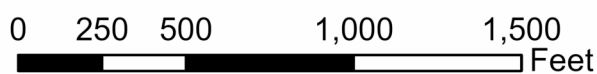
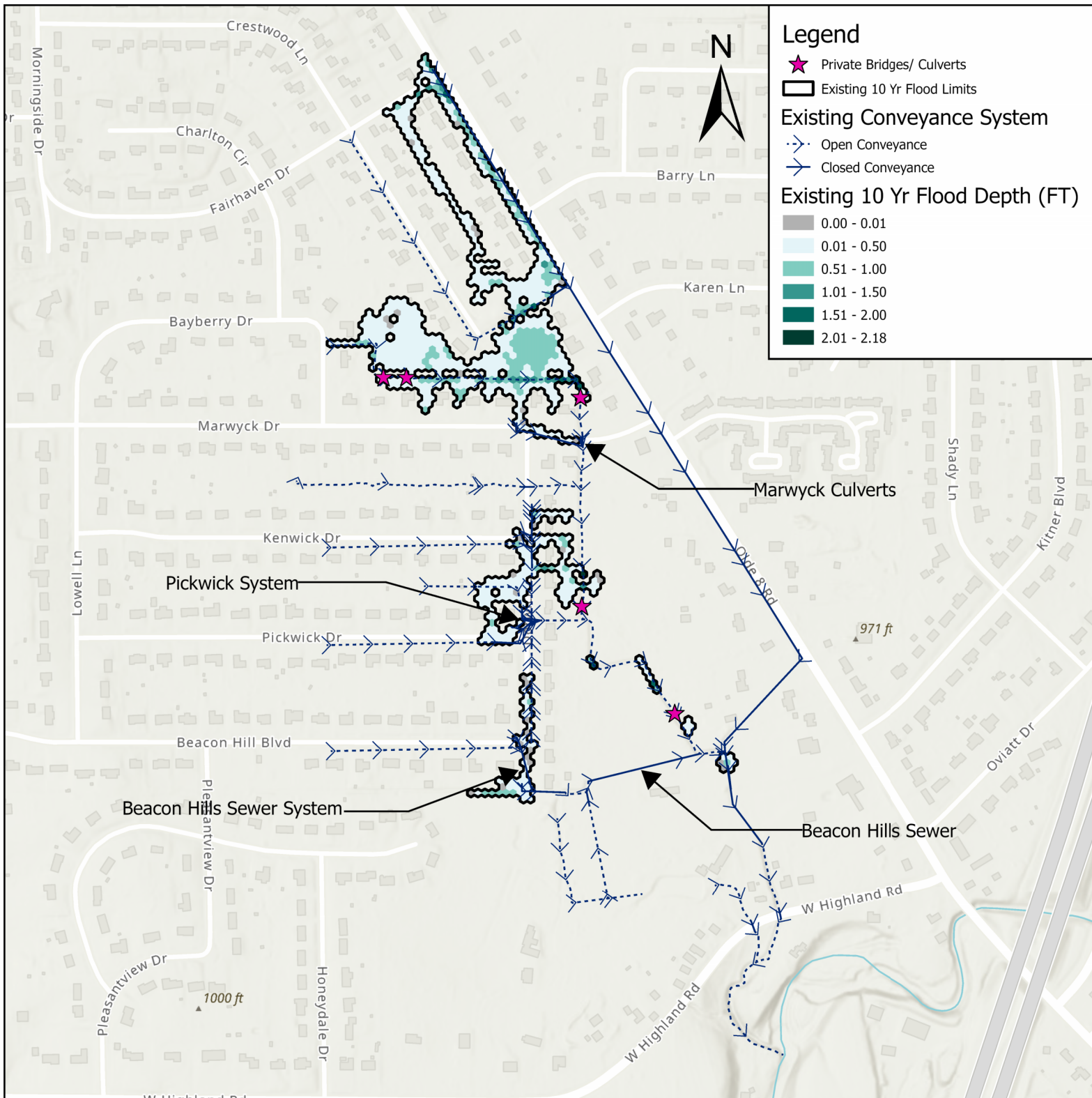
Figure 1: Site Location Map



2.0 EXISTING FLOODING CONDITIONS

This section of the report describes the existing flooding conditions during the 10-year storm. **Figure 2** shows the associated flood depths throughout the project area. As seen in the figure, open conveyance represents ditches while closed conveyance represent storm sewers and culverts. Flooding is not shown below a depth of 0.01 foot for clarity.

The condition of the existing culverts, storm sewers and catch basins were observed during survey and various field visits and found to be in reasonable condition. This was not a detailed investigation, but a general condition observation.



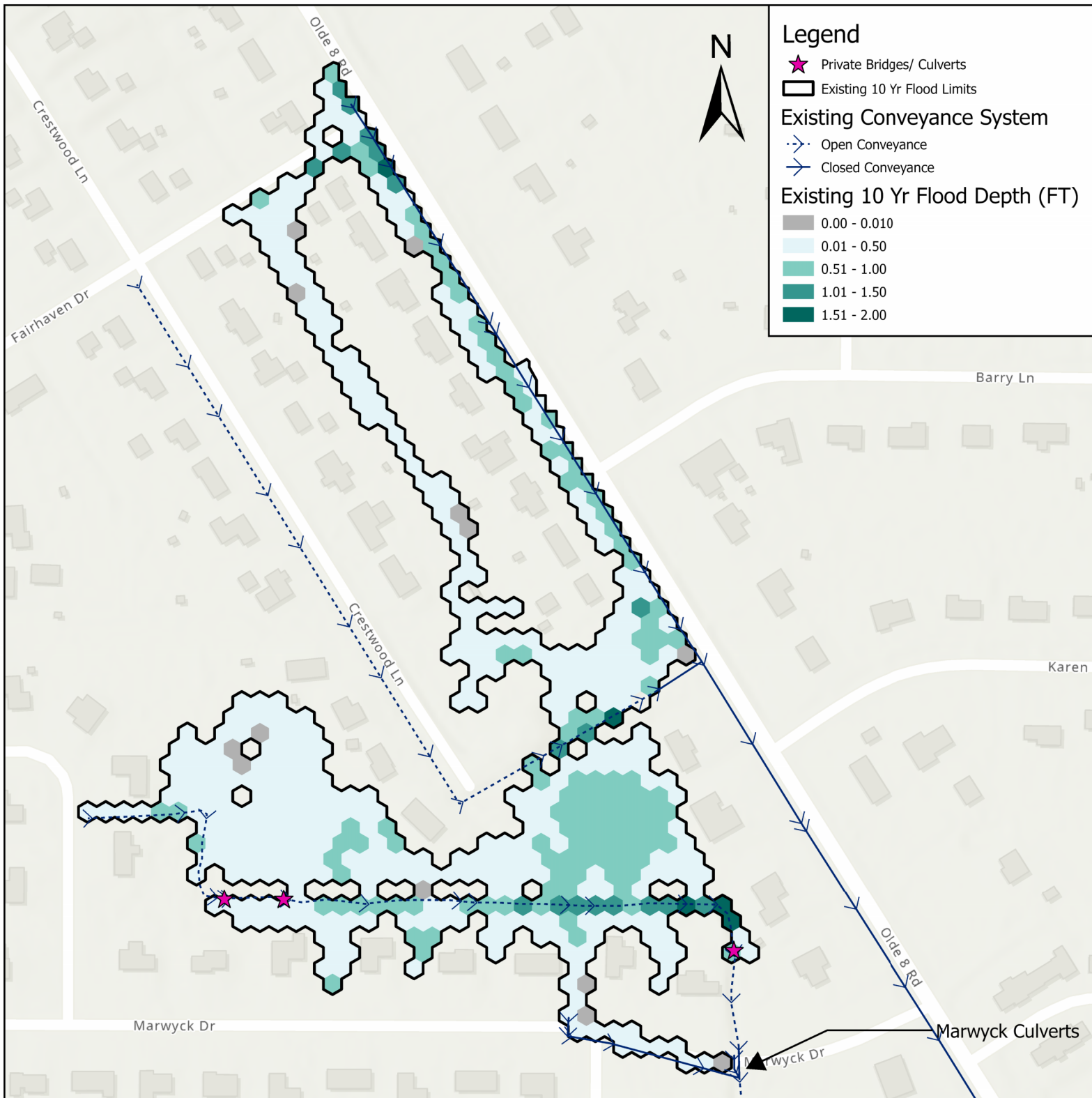
Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

**Figure 2: Existing Conditions
 Flooding for the 10-Year Storm**

2.1 North of Marwyck

As seen in **Figure 3**, the backyards north of Marwyck and west of Olde 8 Road show flood depths up to 1.5 feet outside of the conveyance system. This area is predominantly wetlands as seen on Sheet 03 of the conceptual design drawings in **Appendix C**. There are three private backyard bridges/culverts in the ditch behind Marwyck, which restrict the flow through the ditch. A triple barrel culvert conveys water under Marwyck Drive and are 18 inches in diameter each. Additionally, the Olde 8 storm sewer in this area is 24 inches in diameter. These items in combination lead to the flooding conditions north of Marwyck as they are not able to properly convey the 10-year storm.



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

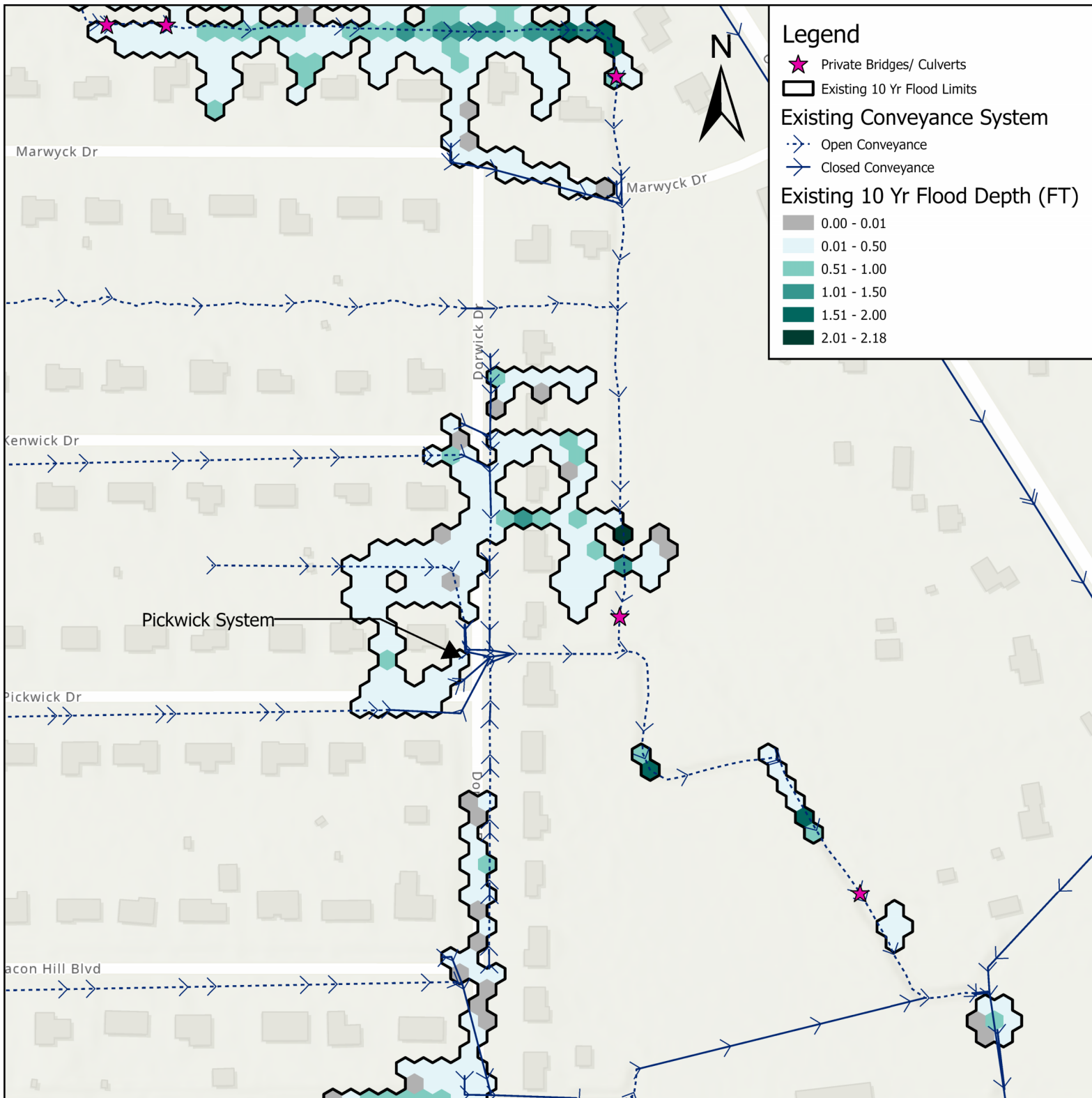
BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Figure 3: Existing Flood Depths
 During the 10-Year Storm
 North of Marwyck

2.2 Dorwick and Pickwick

As seen in **Figure 4**, flooding in the backyards between Dorwick and Olde 8 Road, as well as flooding along Dorwick and Pickwick show flood depths up to 1.5-feet outside of the conveyance system. The ditch through the backyards between Dorwick and Olde 8 has a private bridge/ culvert as well as tight bends in the ditch. Additionally, the Pickwick storm sewer system is made up of a complex arrangement of undersized storm sewers as seen on Sheet 04 of the conceptual design drawings in **Appendix C**. These items in combination lead to the flooding conditions along Dorwick and Pickwick Drive as they are not able to properly convey the 10-year storm.



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

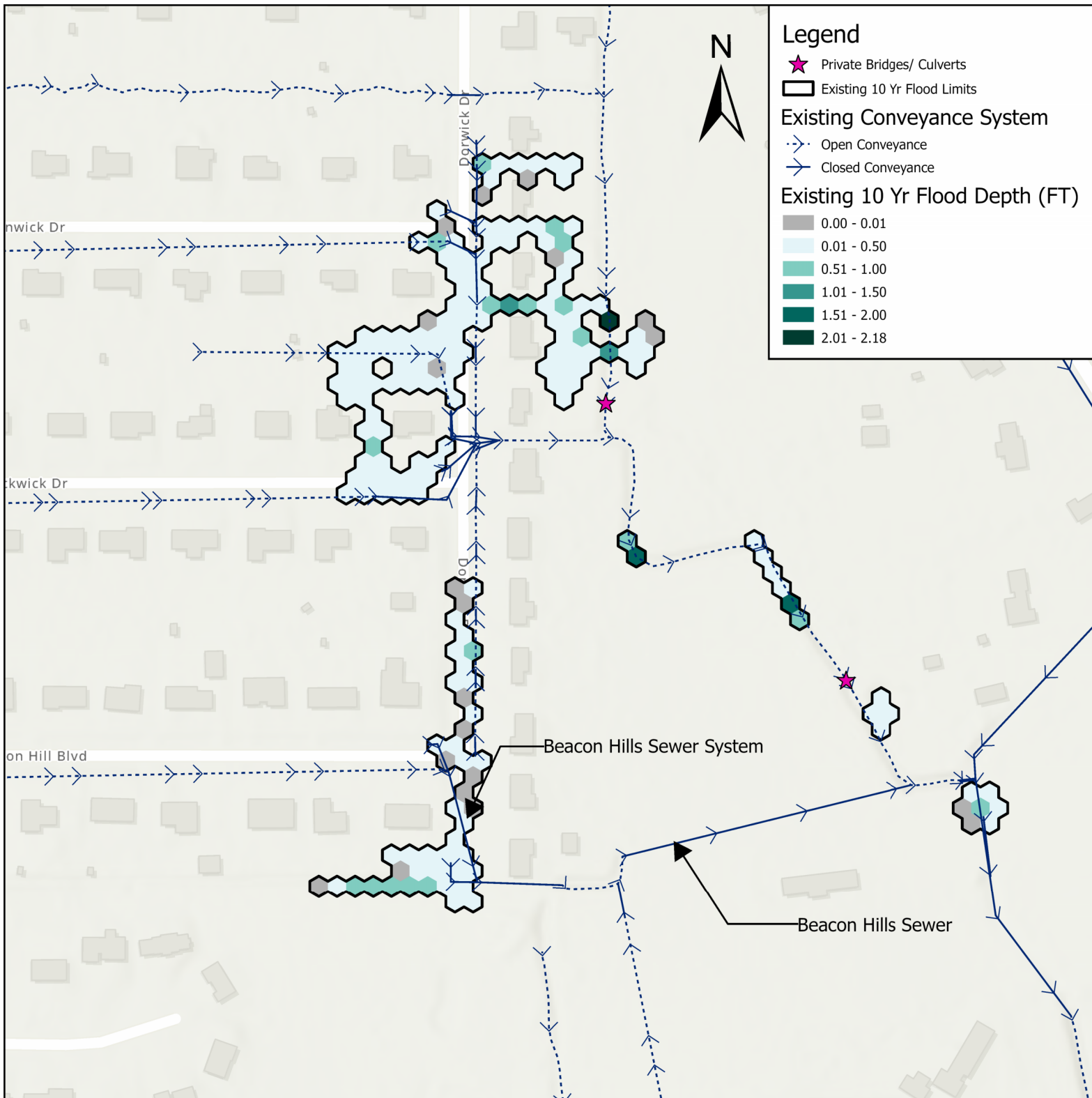
BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Figure 4: Existing Flood Depths
 During the 10-Year Storm at
 Dorwick and Pickwick

2.3 Dorwick and Beacon Hills

As seen in **Figure 5**, flooding along Dorwick Drive and in the backyards of Beacon Hills show flood depths up to 1-foot outside of the conveyance system. The Beacon Hills system along Dorwick Drive consists of an 18-inch and 24-inch storm sewer. The other Beacon Hills sewer consists of 30-inch storm sewer. These sewers in combination lead to flooding along Dorwick and Beacon Hills as they are not able to properly convey the 10-year storm. The VFW storm sewer operates within acceptable parameters in the existing condition 10-year storm. It should be noted that above the 10-year storm the VFW system begins to back up under the existing conditions.



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

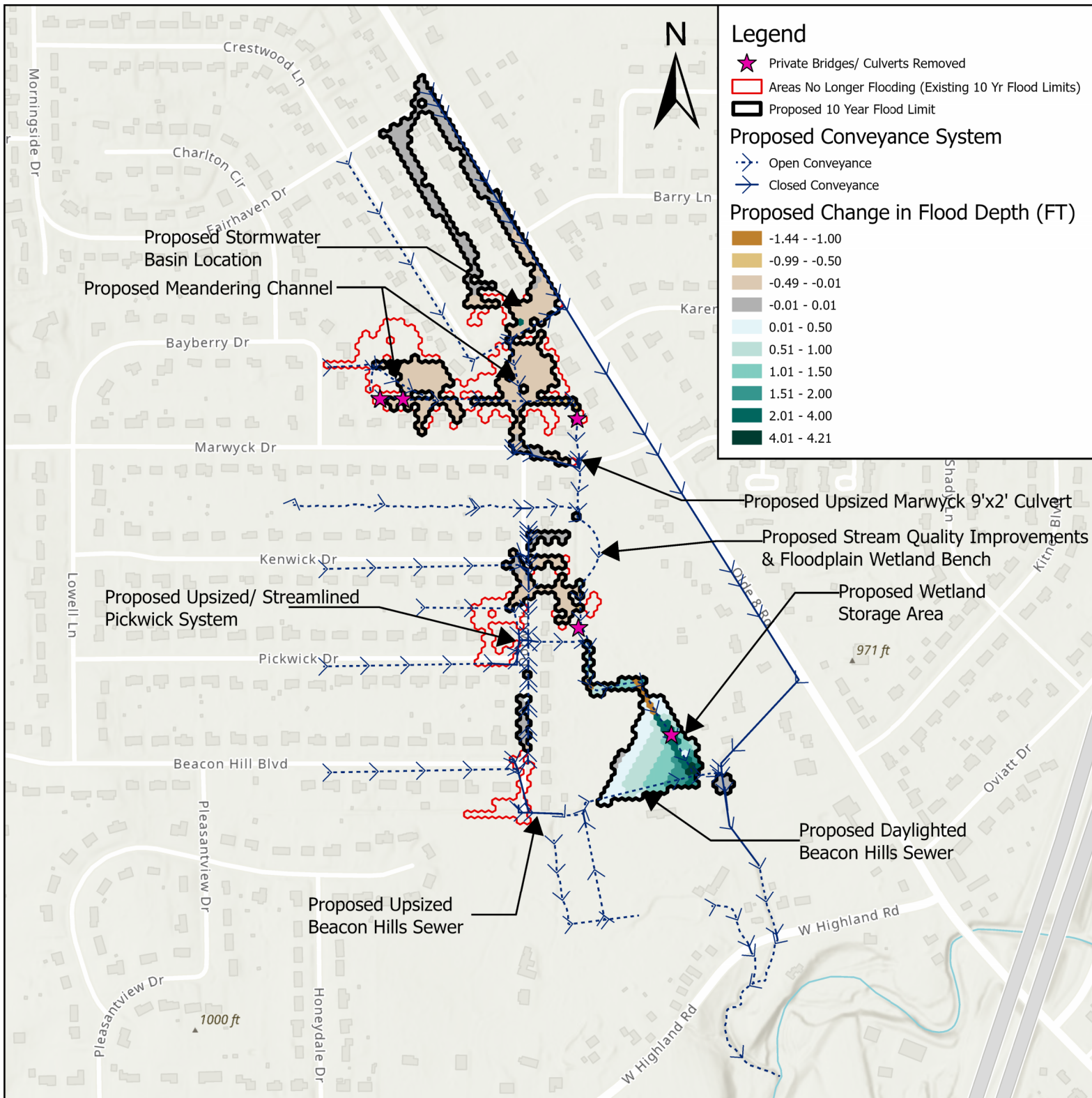
Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

**Figure 5: Existing Flood Depths
 During the 10-Year Storm at
 Dorwick and Beacon Hills**

3.0 PROPOSED IMPROVEMENTS AND FLOOD REDUCTION BENEFITS

This section of the report will describe the proposed improvements within each of the three subareas. The flood reduction benefits, as seen in **Figure 6**, will be discussed in depth and detailed cost reports can be found in **Appendix D**.

It should be noted that the rear yards to the west of Dorwick, between Marwyck, Kenwick, Pickwick, and Beacon Hills experience ponded water during rainfall events. These areas were intended to drain via a swale along the rear yard common property line to Dorwick Drive. During field visits and from ariel drawing review, it has been observed that this swale has been interrupted by lawn debris, fences, sheds, landscaping and other restrictions. Because there are many types and locations of interruption there is no global solution proposed for these areas. It is recommended that yard drains connecting along the north-south property lines be installed on a case-by-case basis. This work is not included in the proposed improvements and pricing for the work proposed by this report.



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Figure 6: Proposed Change in Flood Depth During the 10-Year Storm

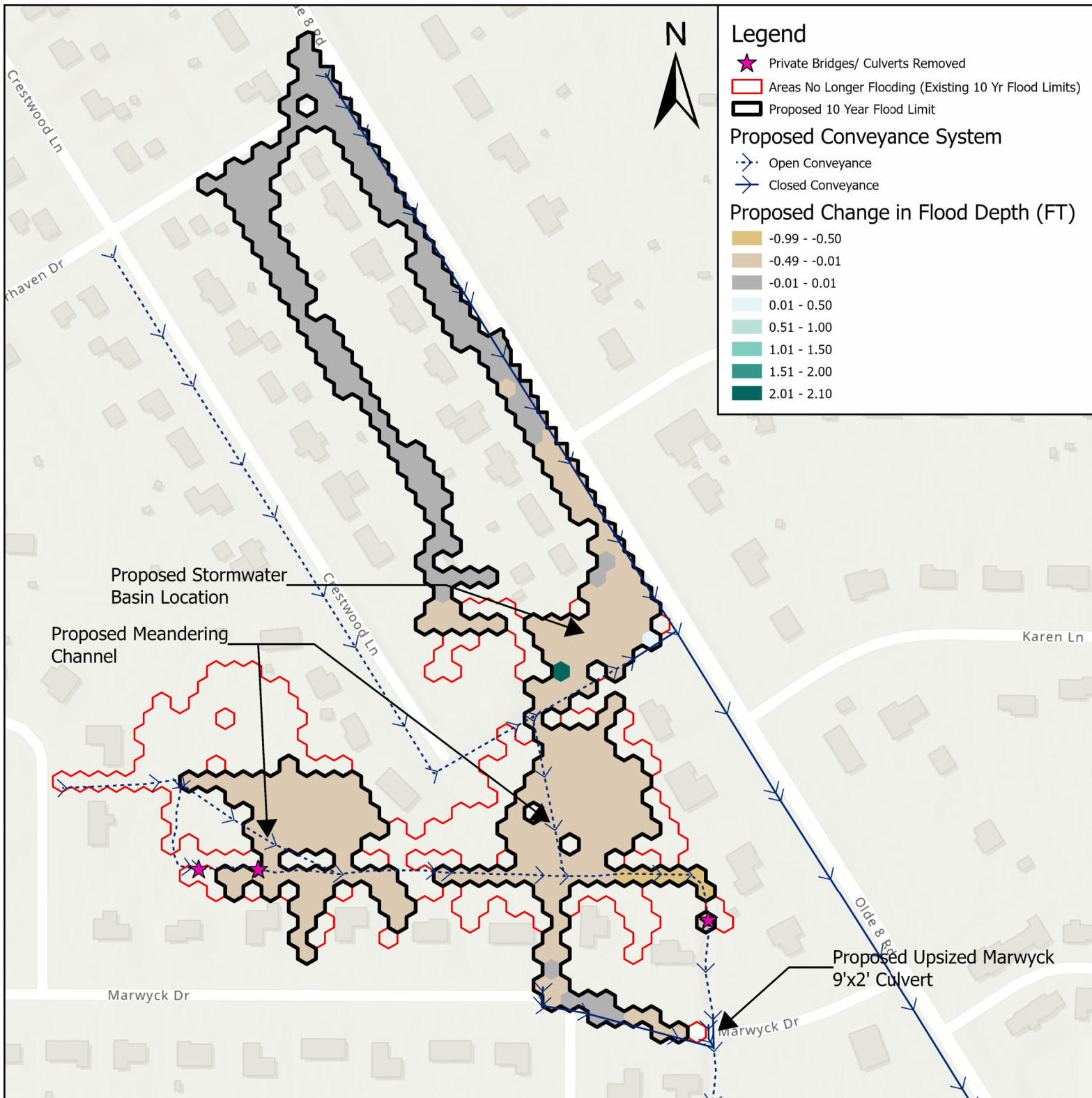
3.1 North of Marwyck Improvements

To address backyard flooding north of Marwyck and west of Olde 8 Road, the following improvements are proposed:

- Installing a stormwater basin
- Installing two meandering wetland channels
- Removing the private bridges and culverts
- Upsizing the Marwyck Drive culvert

Design of a stormwater basin approximately 2 feet deep x 200 feet long x 100 feet wide diverts stormwater from the Olde 8 ditch and wetland behind Marwyck. Removing the private bridges and culverts that restrict flow, designing two meandering wetland channels, and upsizing the Marwyck culvert to a 9-foot by 2-foot box culvert will increase conveyance of stormwater away from Marwyck.

These solutions reduce the flooding extent as well as the flood depth up to 1-foot in the backyards, ditches, and wetland as seen in **Figure 7**. It should be noted that the increase in flood depths in this area are solely within the proposed basin. This portion of the project is anticipated to cost \$416,000. Detailed cost breakdowns are available in **Appendix D**.



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Figure 7: Proposed Flood Reduction Depth During the 10-Year Storm North of Marwyck

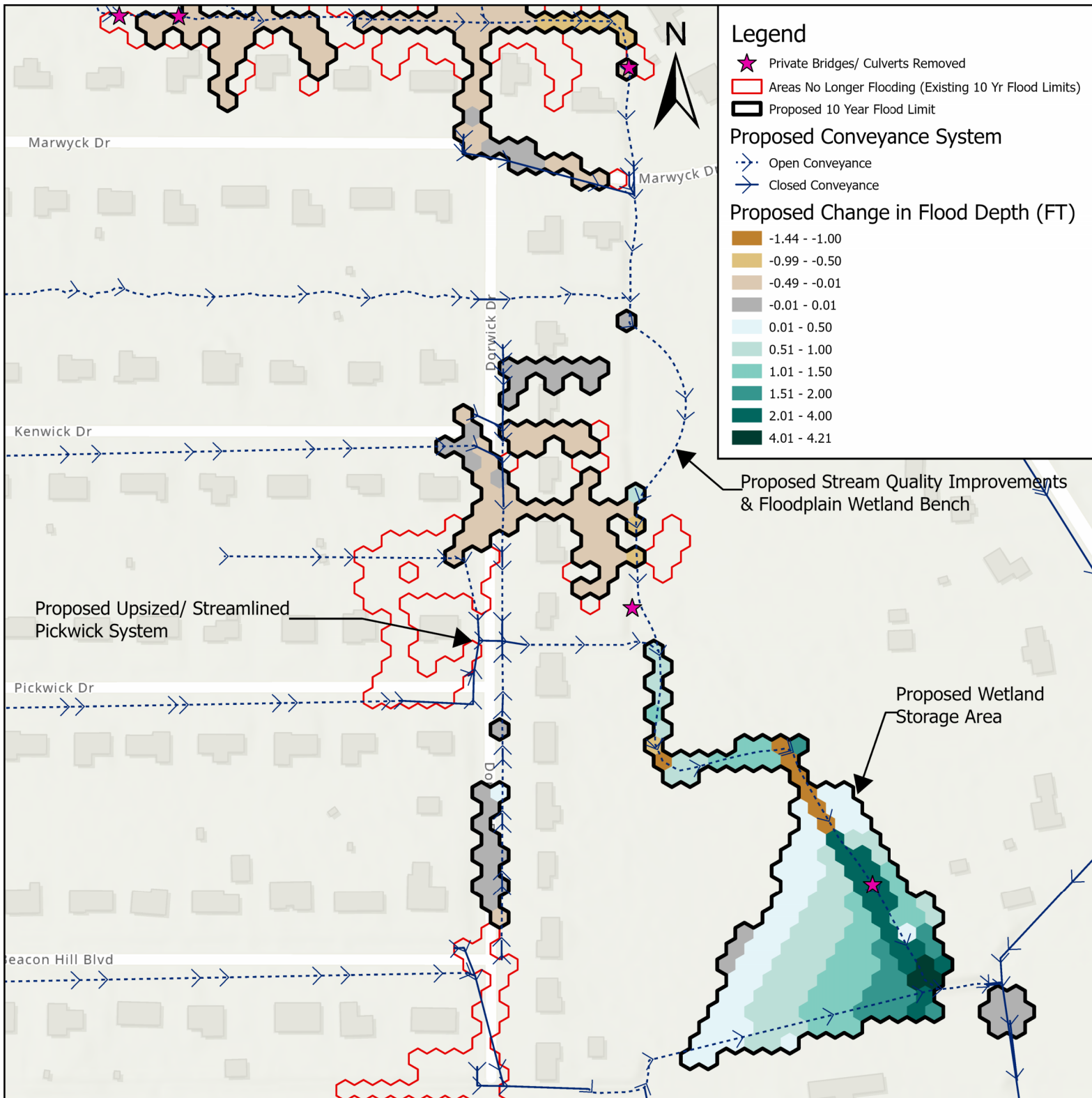
3.2 Dorwick and Pickwick Improvements

To address flooding in the backyards between Dorwick and Olde 8 Road, as well as flooding along Dorwick and Pickwick, the following improvements are proposed:

- Revising the Pickwick storm sewer system
- Removing the private bridges/culverts
- Installing meandering bends and a floodplain wetland bench

Upsizing and simplifying the Pickwick system, as seen on Sheet 09 in **Appendix C** and removing the private bridges/culverts increases conveyance of stormwater away from Pickwick and Dorwick. Installing a meandering bend and floodplain wetland bench in the ditch provides quality and quantity improvements and reduces the risk of erosion, incision, and bank failure by reducing slope and promoting a healthy riffle-pool pattern.

These solutions reduce the flooding extent as well as the flood depth up to 1-foot in the backyards and ditches as seen in **Figure 8**. It should be noted that the increase in flood depths in this area are due to the new ditch alignment that was previously dry land under the existing conditions. Additionally, removal of the private bridge/culvert has allowed previously ponded water to flow into low ground in the terrain. This portion of the project is anticipated to cost \$354,000. Detailed cost breakdowns are available in **Appendix D**.



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Figure 8: Proposed Flood Reduction Depth During the 10-Year Storm at Dorwick and Pickwick

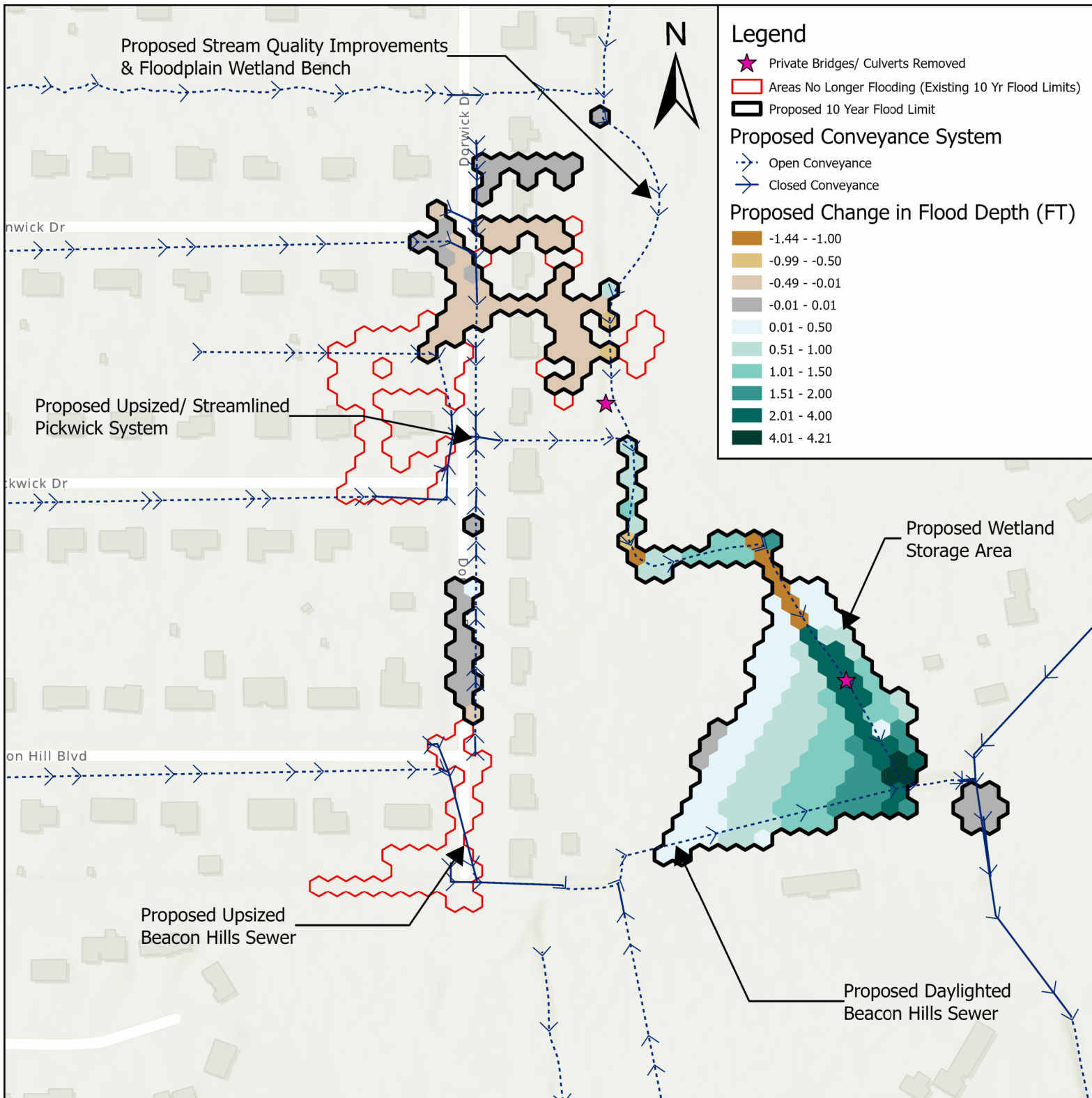
3.3 Dorwick and Beacon Hills Improvements

To address flooding along Dorwick Drive and in the backyards of Beacon Hills, the following improvements are proposed:

- Upsizing a Beacon Hills storm sewer
- Daylighting a Beacon Hills storm sewer

Upsizing one Beacon Hills storm sewer and daylighting one Beacon Hills storm sewer, as seen on Sheet 09 in **Appendix C**, increases conveyance of stormwater away from Pickwick and Dorwick.

These solutions reduce the flooding extent as well as the flood depth up to 1-foot in the backyards and ditches as seen in **Figure 9**. This portion of the project is anticipated to cost \$163,000. Detailed cost breakdowns are available in **Appendix D**.



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Figure 9: Proposed Flood Reduction Depth During the 10-Year Storm at Dorwick and Beacon Hills

3.4 Wetland Storage

The flood solutions presented in sections 3.1 to 3.3 serve to increase conveyance of stormwater away from the backyards and roads currently flooding. The increased conveyance reduces the flooding depth and extent upstream; however, the downstream system was not designed to convey this increased volume of stormwater. Therefore, it is proposed to create a new wetland storage area to offset the increased stormwater conveyance and to allow the downstream VFW culvert system to operate within allowable criteria up to the 100-year storm.

Creating a wetland also has environmental advantages including restoration of habitat and increased pollutant removal. Wetland creation in Ohio is supported by the H2Ohio grant program; a reimbursement program that funds wetland creation. This portion of the project is anticipated to cost \$1,024,000. Detailed cost breakdowns are available in **Appendix D**.

3.5 Construction Phasing

This section will discuss the hydraulic implications of splitting these improvements up into separate projects which may be necessary for funding reasons. The detention basin east of Crestwood Lane can be built at any time. It will attenuate flows already established. The wetland basins east of Dorwick Drive should be built before any of the various storm sewer, ditch and culvert improvements. The storm sewer and culvert improvements increase conveyance of the storm runoff. This increased conveyance is offset by the detention effects of the wetland basins whereby protecting the downstream properties by reducing the flow back to pre-project flows.

4.0 PERMITTING REQUIREMENTS

This section of the report will detail the anticipated permitting requirements for the proposed project.

4.1 Clean Water Act Section 404 Permit

This project anticipates impacts to jurisdictional streams and wetlands and will be eligible for a Clean Water Act (CWA) Section 404 authorization under Nationwide Permit (NWP) No. 27 (Aquatic Habitat Restoration, Enhancement, and Establishment Activities). In accordance with current NWP No. 27 terms and conditions, a Preconstruction Notification (PCN) will need to be submitted to and approved by the U.S. Army Corps of Engineers' (USACE) Buffalo District prior to beginning any work.

As a part of the PCN preparation process, Endangered Species Act coordination with the U.S. Fish & Wildlife Service (USFWS) and the Ohio Department of Natural Resources' (ODNR's) Division of Wildlife will occur. Coordination with the Ohio Historic Preservation Office (OHPO) will also be required under the National Historic Preservation Act (NHPA). A Waters Investigation Report is required with the submittal of the NWP to the USACE. This report is complete and can be found in **Appendix E**.

The CWA Section 404 NWP PCN does not have a cost associated with it. The agency coordination generally takes 60 days. After agency coordination, it generally takes 6 months to receive the permit from the USACE Buffalo District.

4.2 Conditional Letter of Map Revision

This project and the proposed solutions are outside of the floodplain limits for Brandywine Creek and do not require a Federal Emergency Management Agency (FEMA) conditional letter of map revision.

5.0 SUMMARY

This report described the current flooding conditions and proposed improvements for three subareas in Northfield Center Township: North of Marwyck, Dorwick and Pickwick, and Dorwick and Beacon Hills. This report focused on the results and proposed benefits to the 10-year design storm.

The backyards north of Marwyck and west of Olde 8 Road showed flood depths up to 1.5 feet outside of the conveyance system (**Figure 3**). There are three private backyard bridges/culverts in the ditch behind Marwyck, triple barrel 18-inch culverts under Marwyck Drive, and a 24-inch storm sewer along Olde 8 Road. These items lead to the flooding conditions north of Marwyck as they are not able to properly convey the 10-year storm. Design of a stormwater basin diverts stormwater from the Olde 8 ditch and wetland behind Marwyck. Removing the private bridges and culverts, designing two meandering wetland channels, and upsizing the Marwyck culvert increase conveyance of stormwater away from Marwyck. These solutions reduce the flooding extent as well as the flood depth up to 1-foot in the backyards, ditches, and wetland (**Figure 7**).

Flooding in the backyards between Dorwick and Olde 8 Road, as well as flooding along Dorwick and Pickwick show flood depths up to 1.5 feet outside of the conveyance system (**Figure 4**). The ditch through the backyards between Dorwick and Olde 8 has a private bridge/culvert as well as tight bends in the ditch. Additionally, the Pickwick storm sewer system is made up of a complex arrangement of undersized storm sewers. These items lead to the flooding conditions along Dorwick and Pickwick Drive as they are not able to properly convey the 10-year storm. Upsizing and simplifying the Pickwick system and removing the private bridges/culverts increases conveyance of stormwater away from Pickwick and Dorwick. Installing a meandering bend and floodplain wetland bench in the ditch provides quality improvements and reduces the risk of erosion, incision, and bank failure. These solutions reduce the flooding extent as well as the flood depth up to 1-foot in the backyards and ditches (**Figure 8**).

Flooding along Dorwick Drive and in the backyards of Beacon Hills show flood depths up to 1-foot outside of the conveyance system (**Figure 5**). The Beacon Hills system along Dorwick Drive consists of an 18-inch and 24-inch storm sewer. The other Beacon Hills sewer consists of 30-inch storm sewer. These sewers lead to flooding along Dorwick and Beacon Hills as they are not able to properly convey the 10-year storm. Upsizing one sewer and

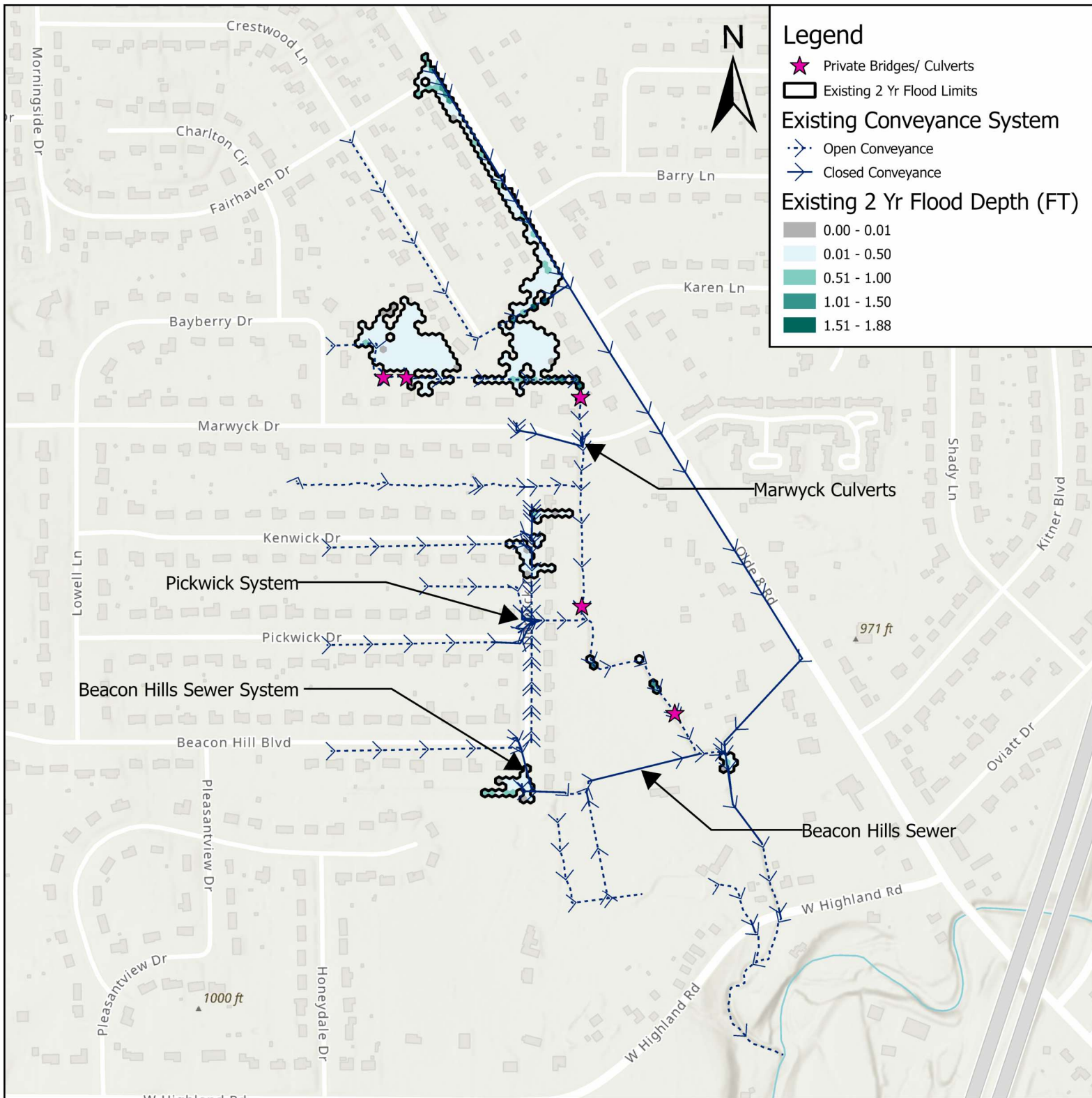
daylighting one sewer increases conveyance of stormwater away from Pickwick and Dorwick.

Creating a wetland downstream of the proposed improvements serves as a detention basin to offset the increased conveyance from the upstream improvements and allows the VFW culvert system to operate within allowable criteria up to the 100-year storm. These solutions reduce the flooding extent as well as the flood depth up to 1-foot in the backyards and ditches (**Figure 9**).

The total anticipated cost of the proposed improvement in the three subareas (North of Marwyck, Dorwick and Pickwick, and Dorwick and Beacon Hills) and wetland storage area are \$416,00, \$354,000, \$163 ,000, and \$1,024,000 respectively. The total combined cost is \$1,957,000.

APPENDIX B

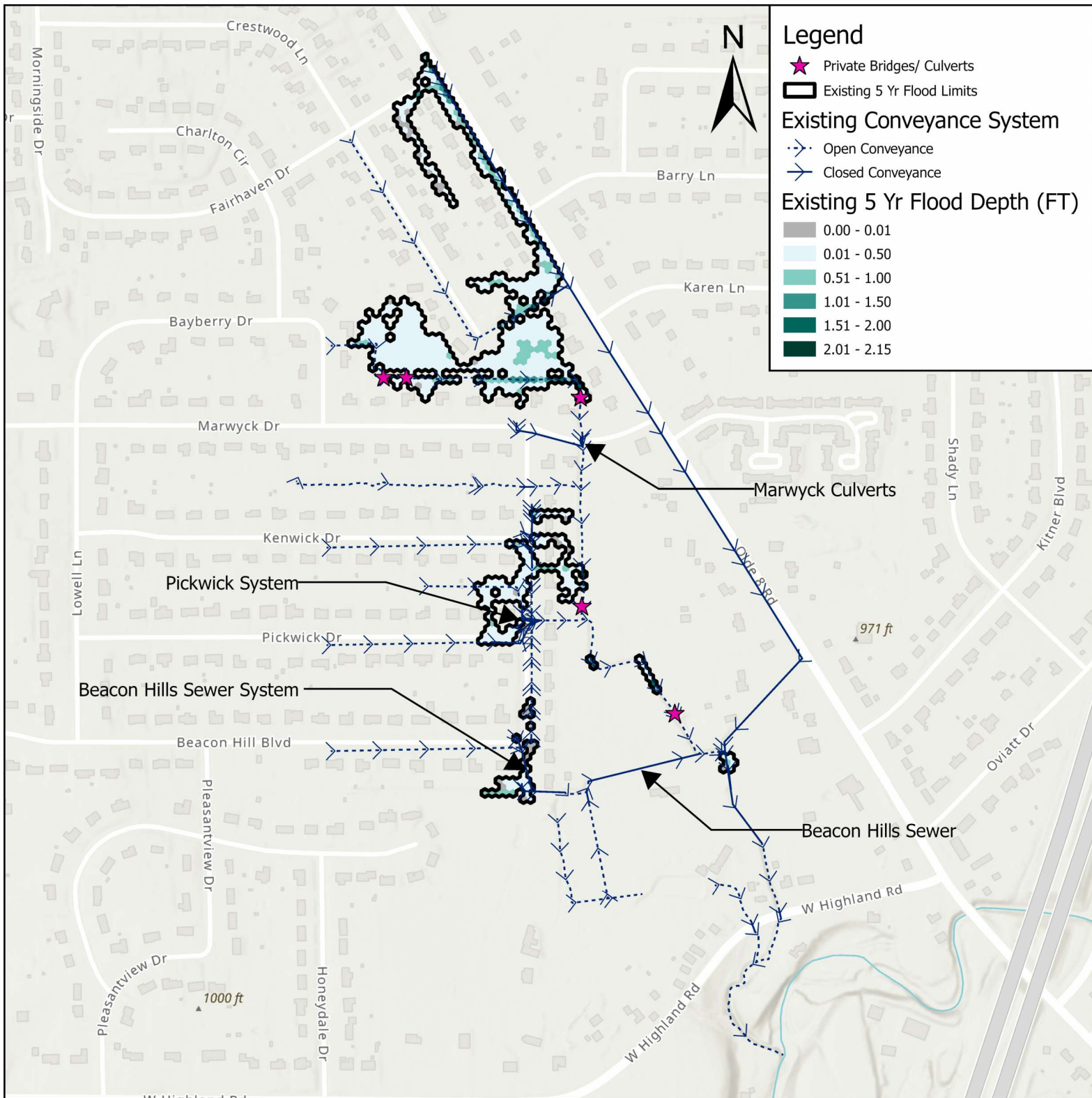
PCSWMM FIGURES AND RESULTS



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Existing Conditions Flooding for the 2-Year Storm



Legend

- ★ Private Bridges/ Culverts
- ▭ Existing 5 Yr Flood Limits

Existing Conveyance System

- ⋯ Open Conveyance
- Closed Conveyance

Existing 5 Yr Flood Depth (FT)

- 0.00 - 0.01
- 0.01 - 0.50
- 0.51 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00
- 2.01 - 2.15

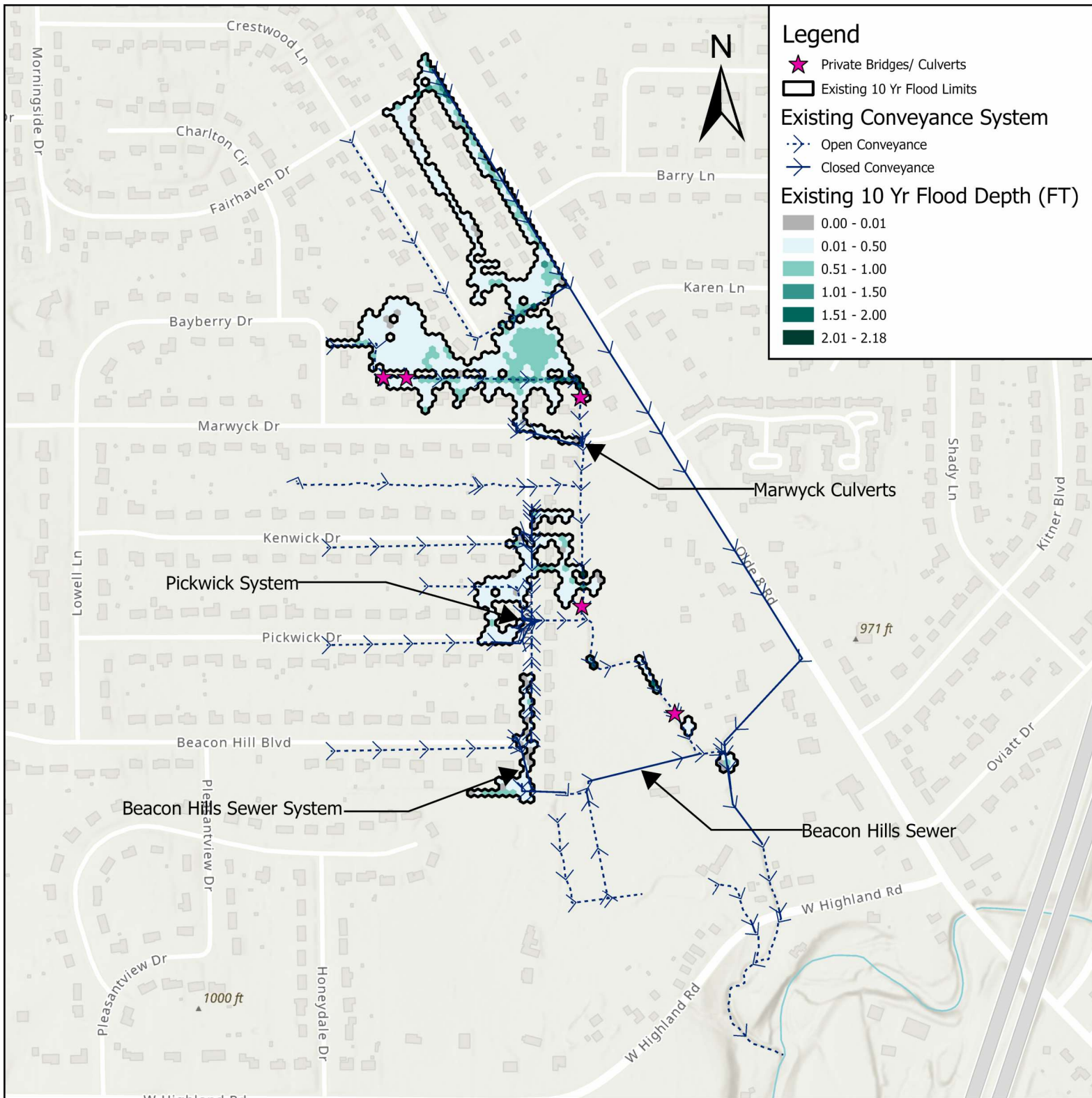


Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

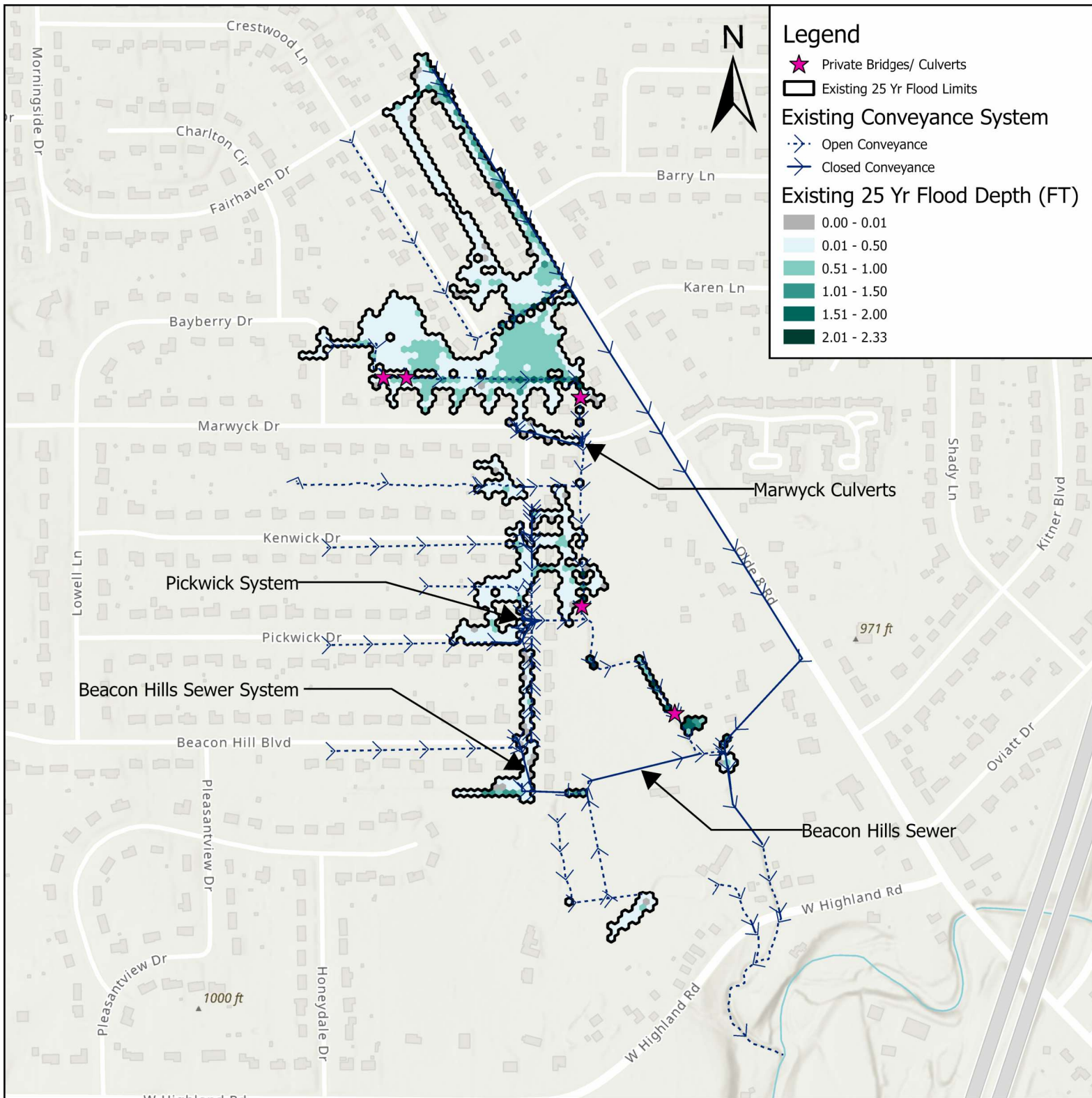
Existing Conditions Flooding for the 5-Year Storm



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Figure 2: Existing Conditions
 Flooding for the 10-Year Storm

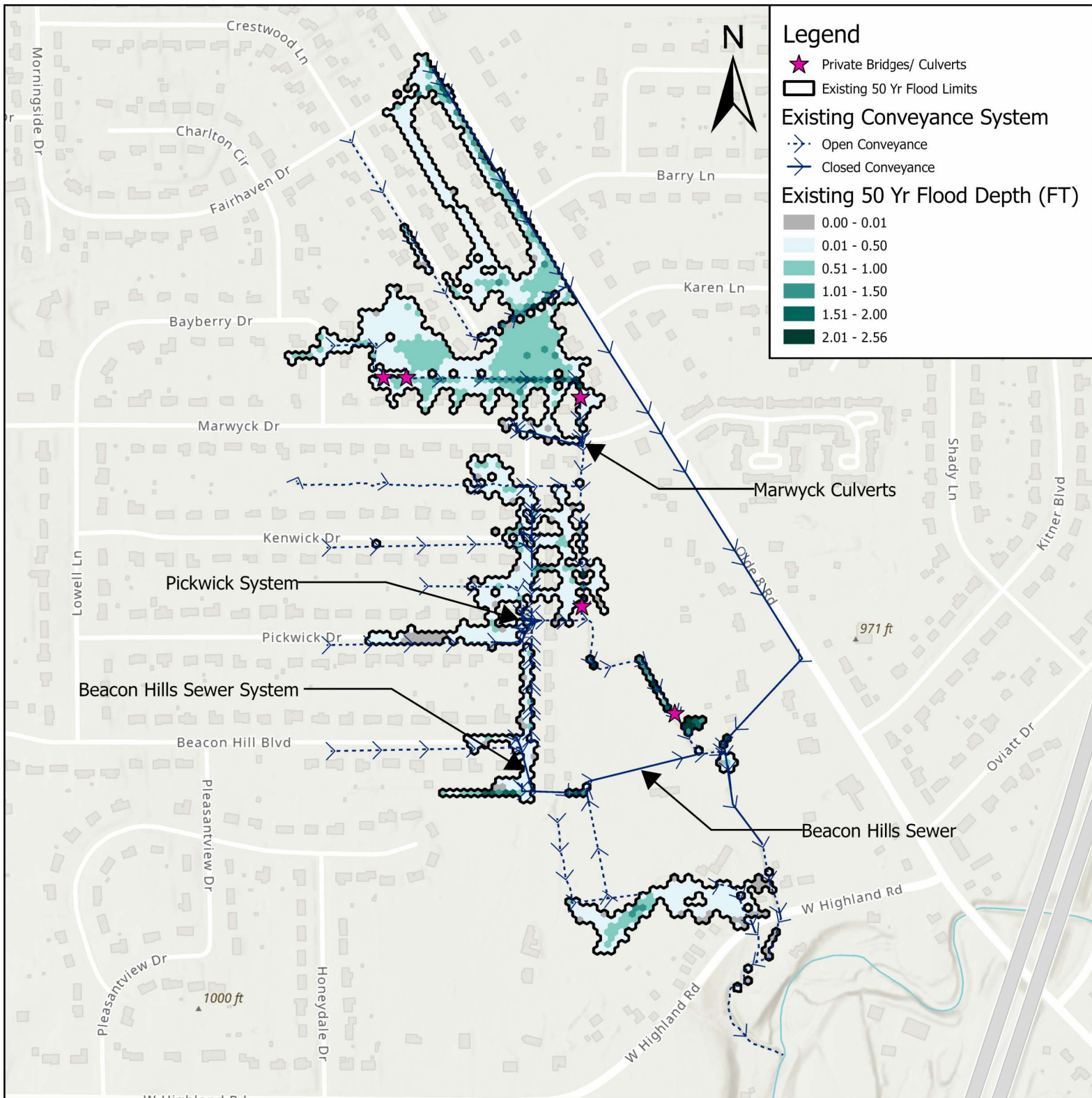


Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Existing Conditions Flooding for the 25-Year Storm

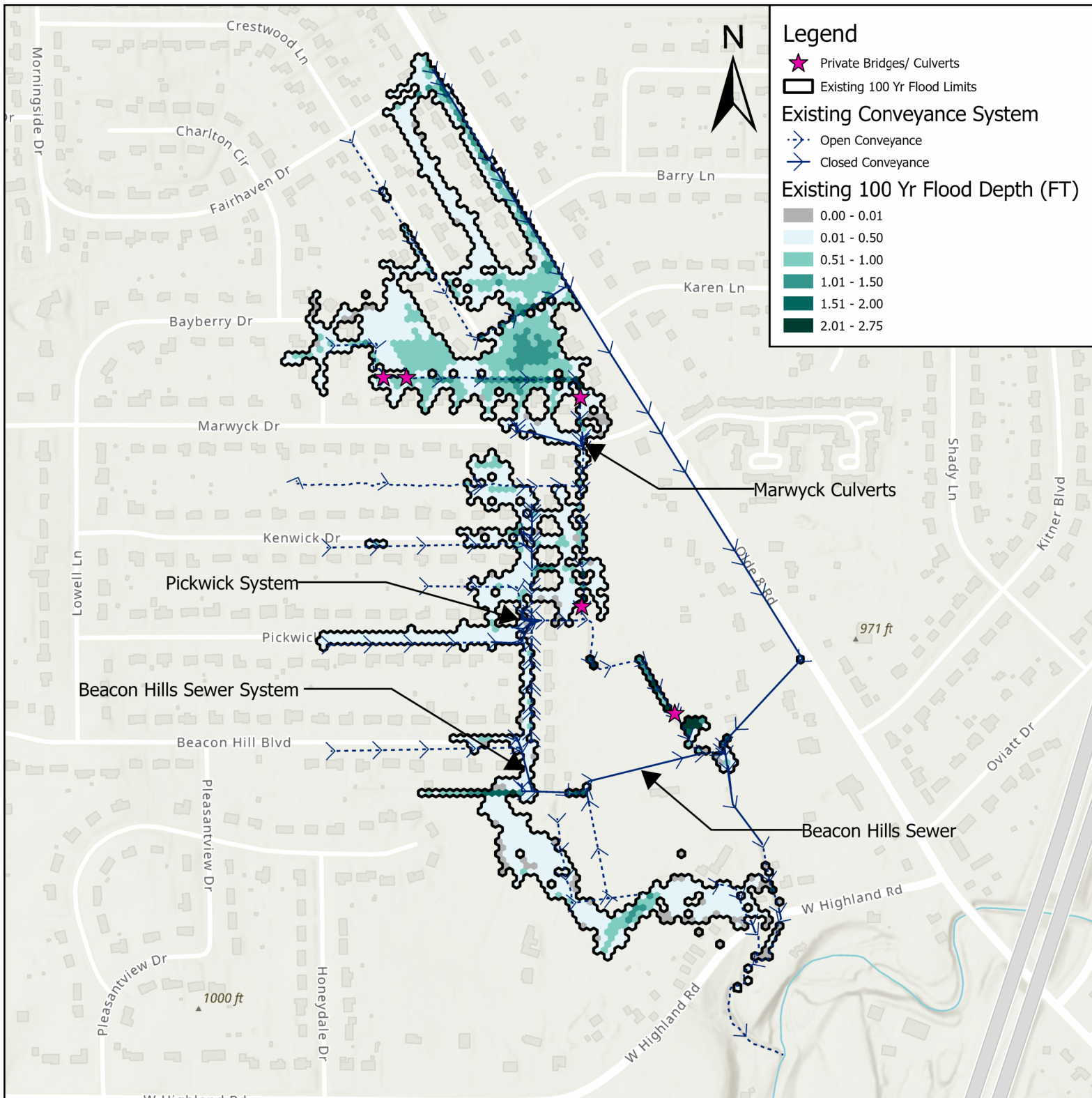


Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

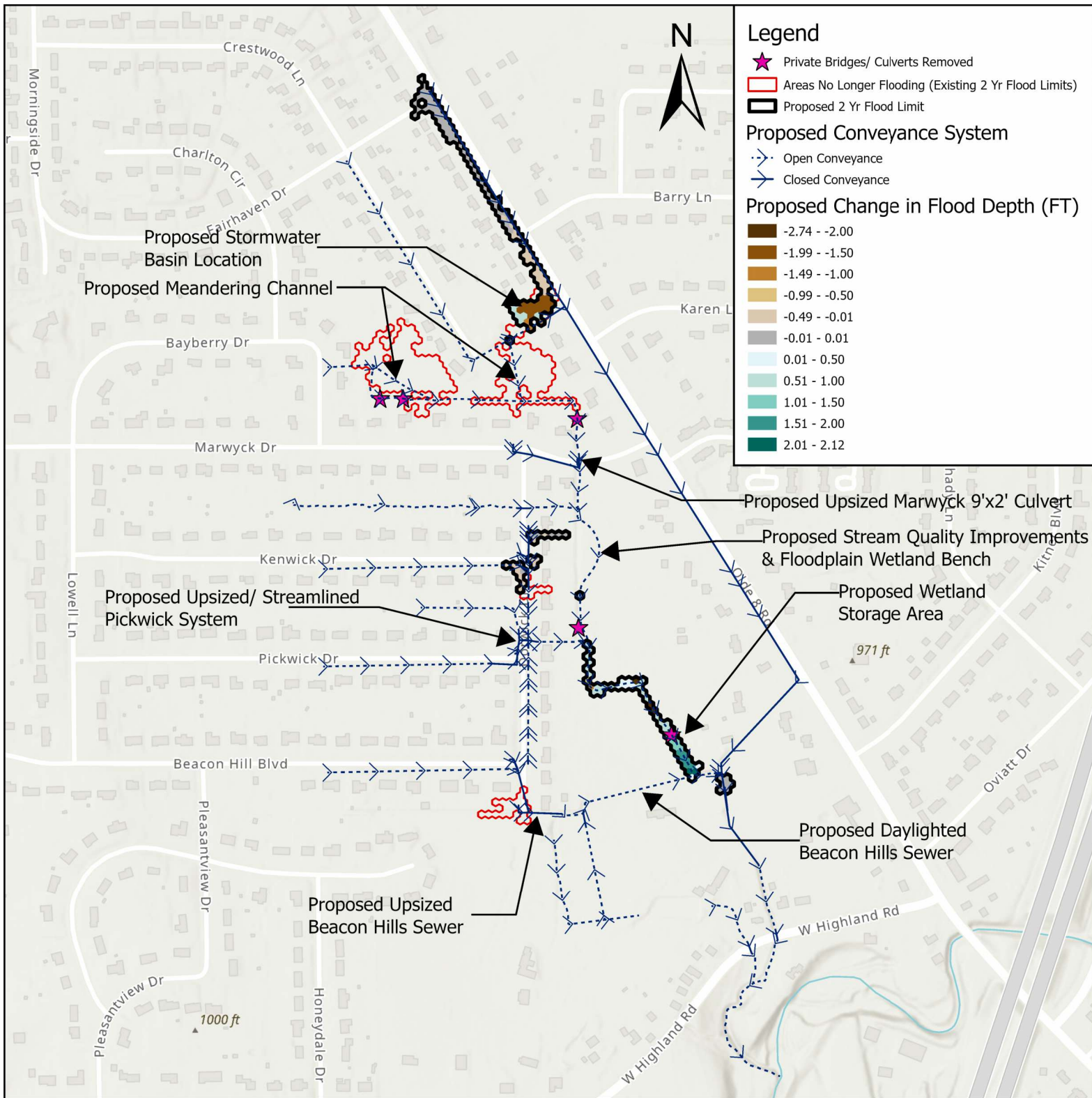
Existing Conditions Flooding for the 25-Year Storm



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Existing Conditions Flooding for the 100-Year Storm

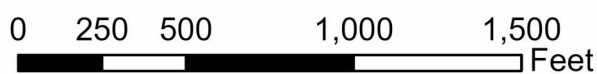
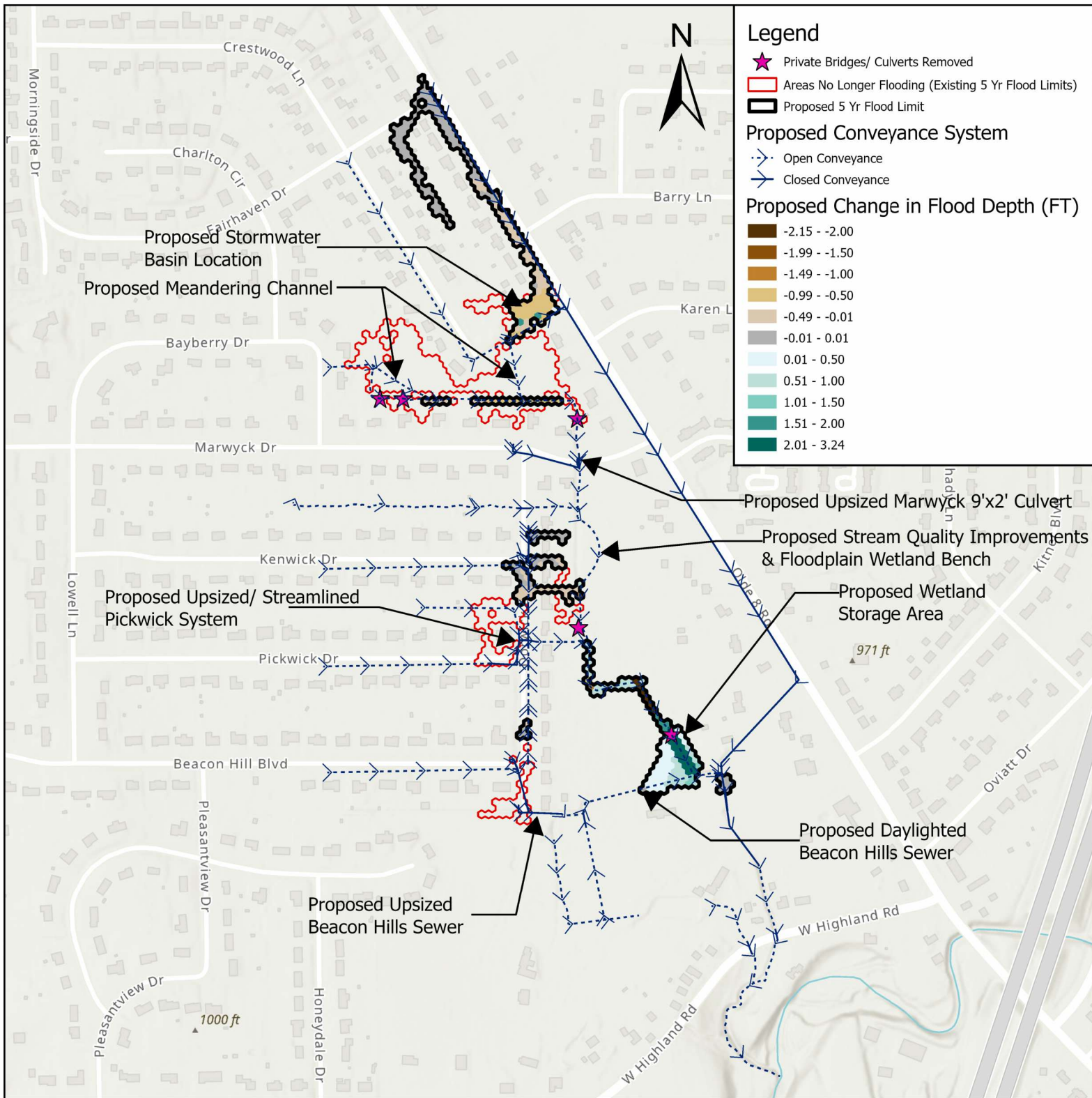


Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Proposed Change in Flood Depth During the 2-Year Storm

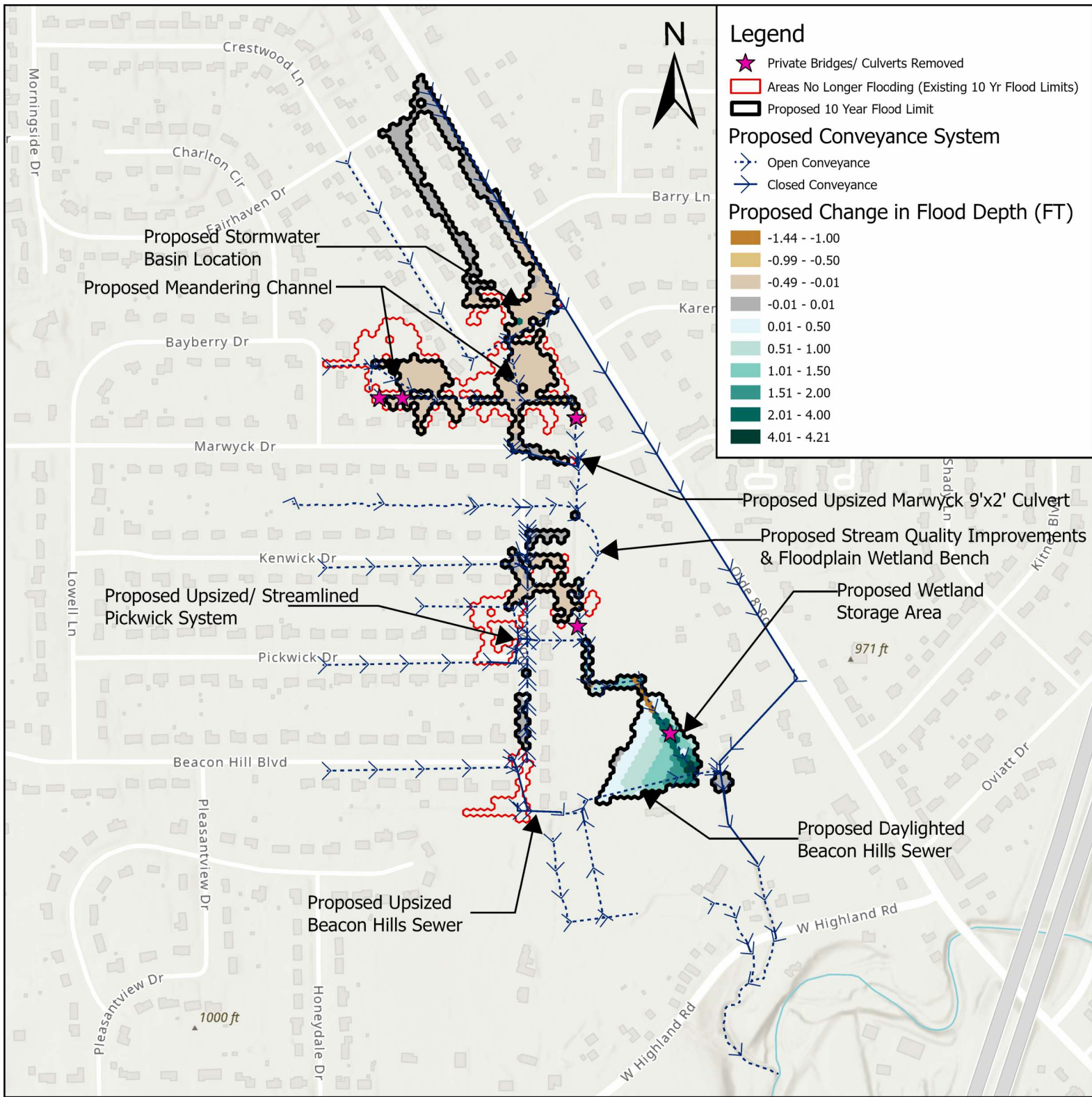


Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Proposed Change in Flood Depth During the 5-Year Storm



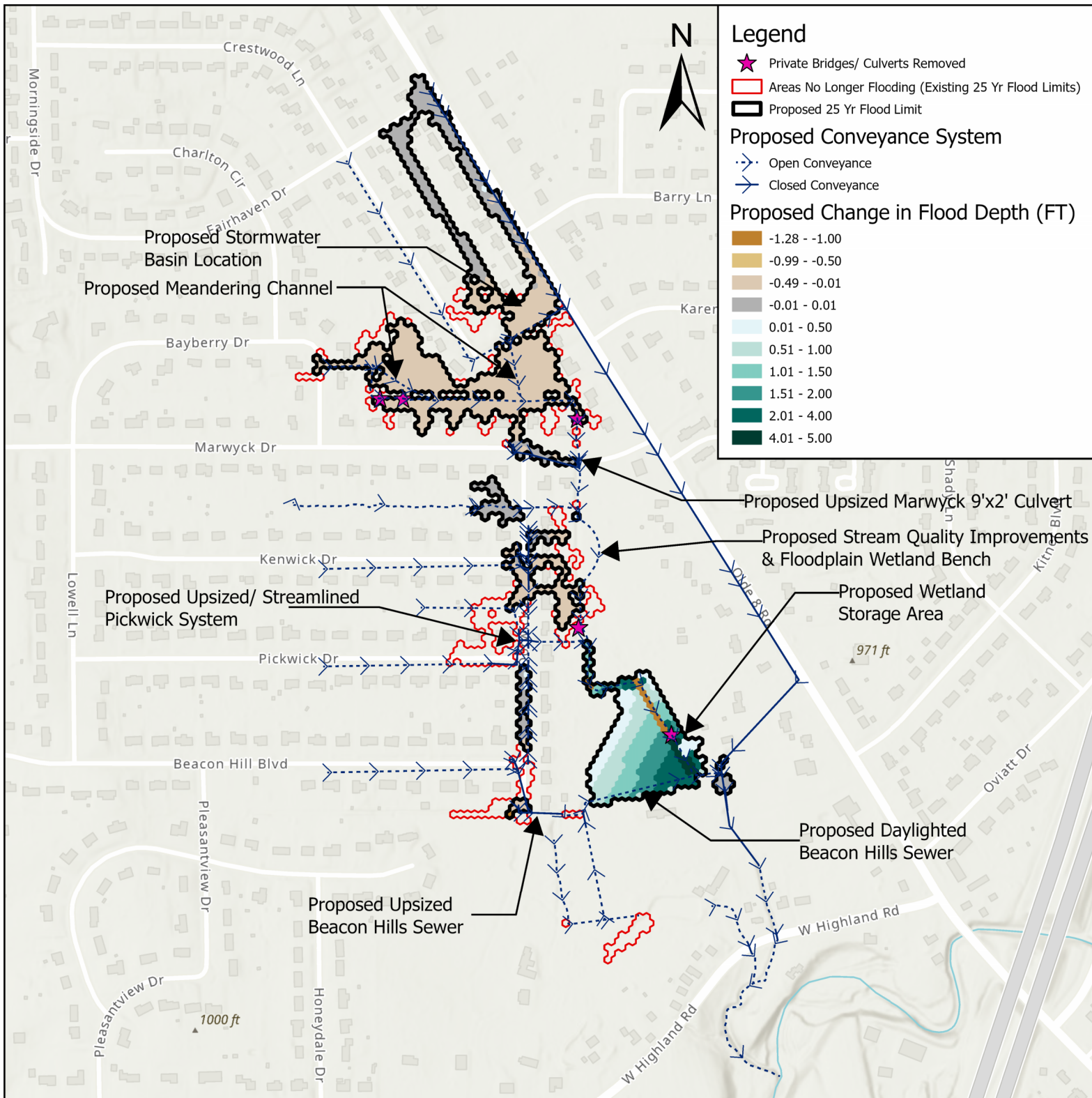
0 250 500 1,000 1,500 Feet

Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Figure 6: Proposed Change in Flood Depth During the 10-Year Storm

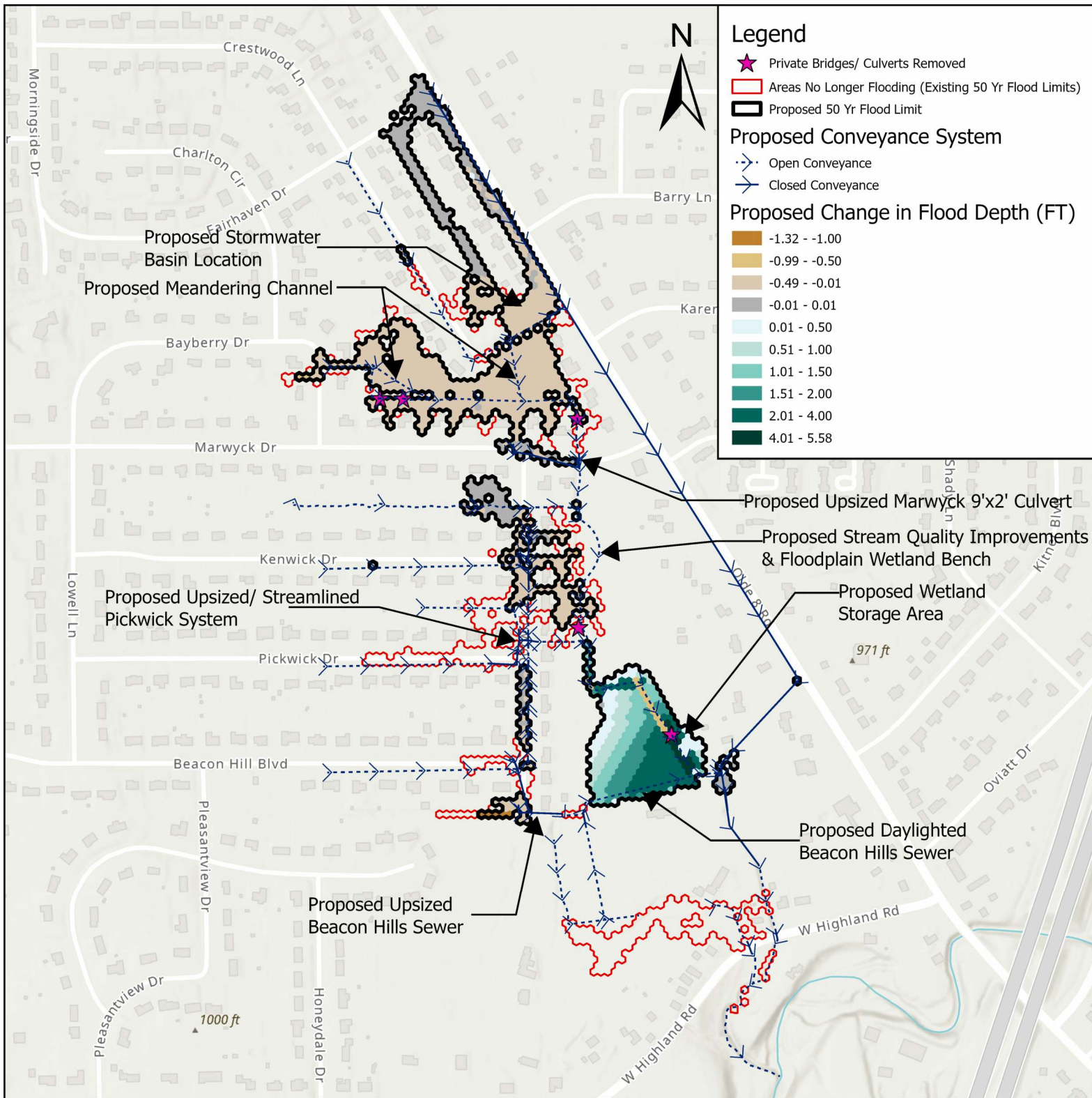


Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

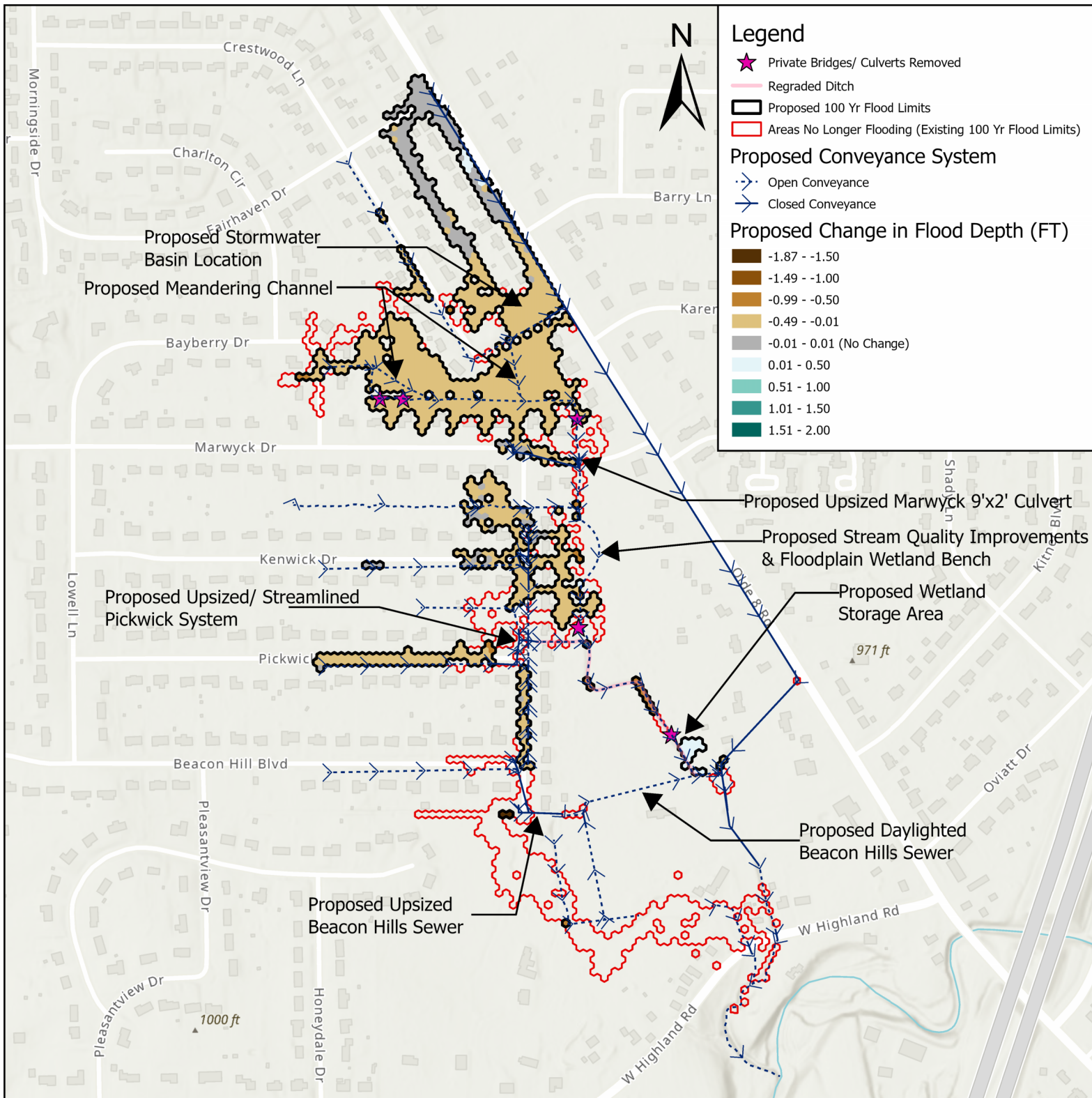
Proposed Change in Flood Depth During the 25-Year Storm



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Proposed Change in Flood Depth During the 50-Year Storm

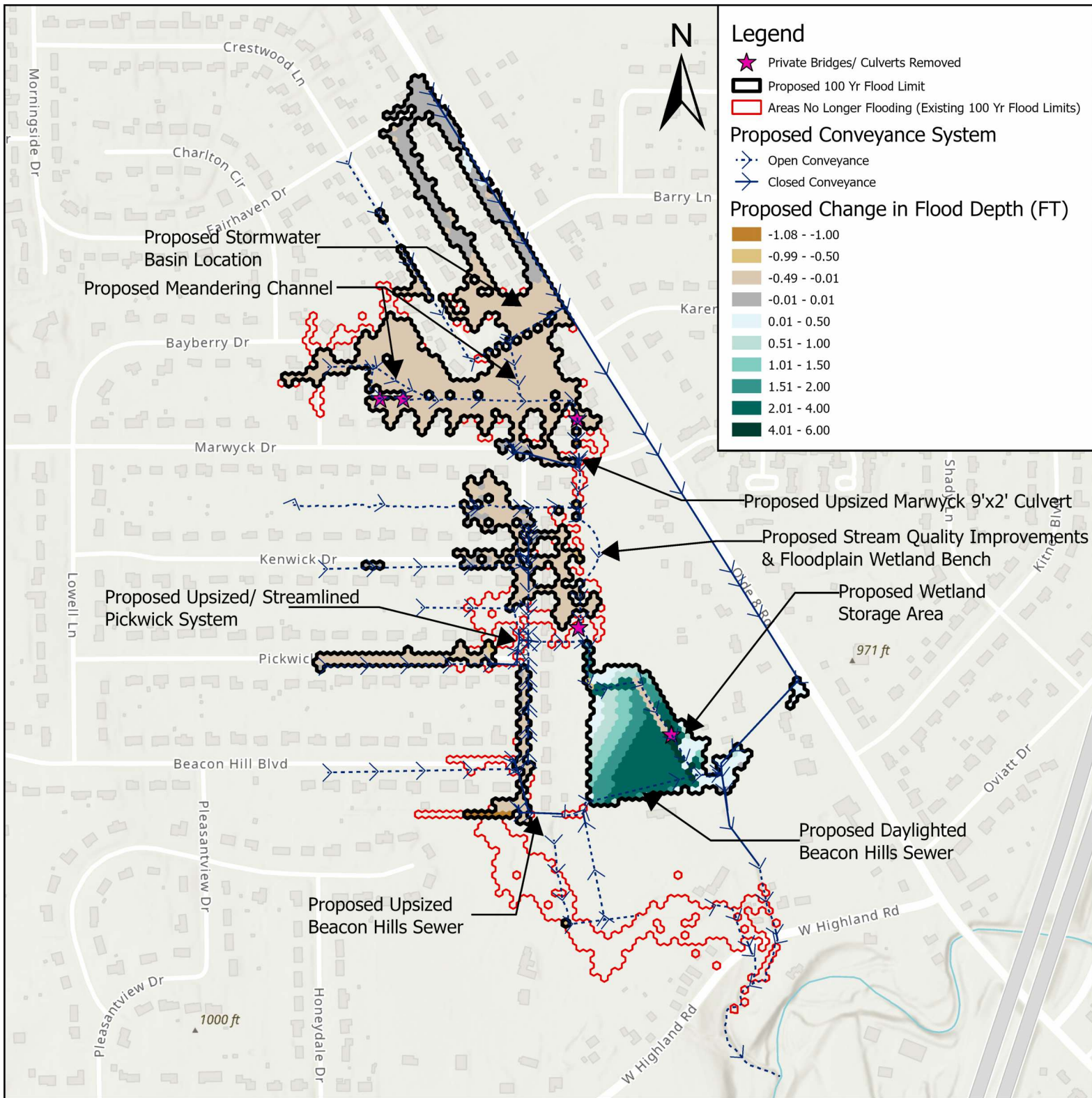


Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Proposed Change in Flood Depth During the 100-Year Storm (72" VFW Option)



Non Orthophotography Data: Microsoft Imagery
 Map Projection: State Plane - Ohio North
 Map Datum: NAD83 (2011)

BURGESS & NIPLE
 Engineers ■ Planners ■ Environmental Scientists

Summit County Engineer
 Drainage Study and Improvements
 Dorwick Drive and Marwyck Drive
 Northfield Center Township, Ohio

Proposed Change in Flood Depth During the 100-Year Storm

APPENDIX C

CONCEPTUAL DESIGN DRAWINGS

SUMMIT COUNTY ENGINEER

DRAINAGE STUDY AND IMPROVEMENTS

MARWYCK AND DORWICK DRIVE

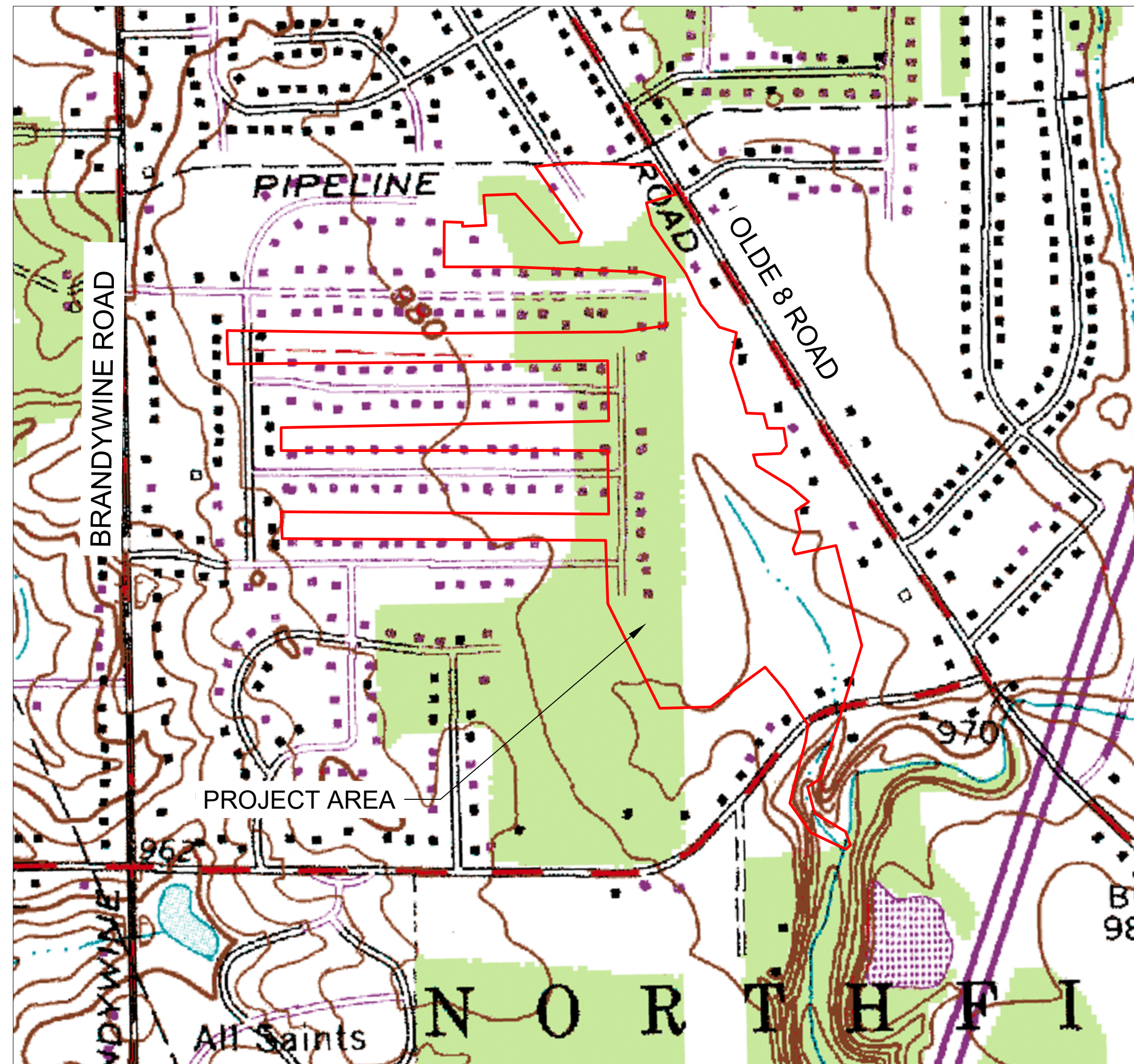
NORTHFIELD CENTER TOWNSHIP

FEBRUARY 2025

50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308



SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP



Sheet List Table	
Sheet Number	Sheet Title
01	TITLE SHEET
02	OVERALL EXISTING SITE PLAN
03	EXISTING SITE PLAN 1
04	EXISTING SITE PLAN 2
05	EXISTING SITE PLAN 3
06	PROPOSED SITE PLAN 1
07	PROPOSED SITE PLAN 2
08	PROPOSED SITE PLAN 3
09	PROPOSED PICKWICK & DORWICK PLAN
10	WETLAND CROSS SECTIONS 1
11	WETLAND CROSS SECTIONS 2
12	STREAM DETAILS 1
13	STREAM DETAILS 2

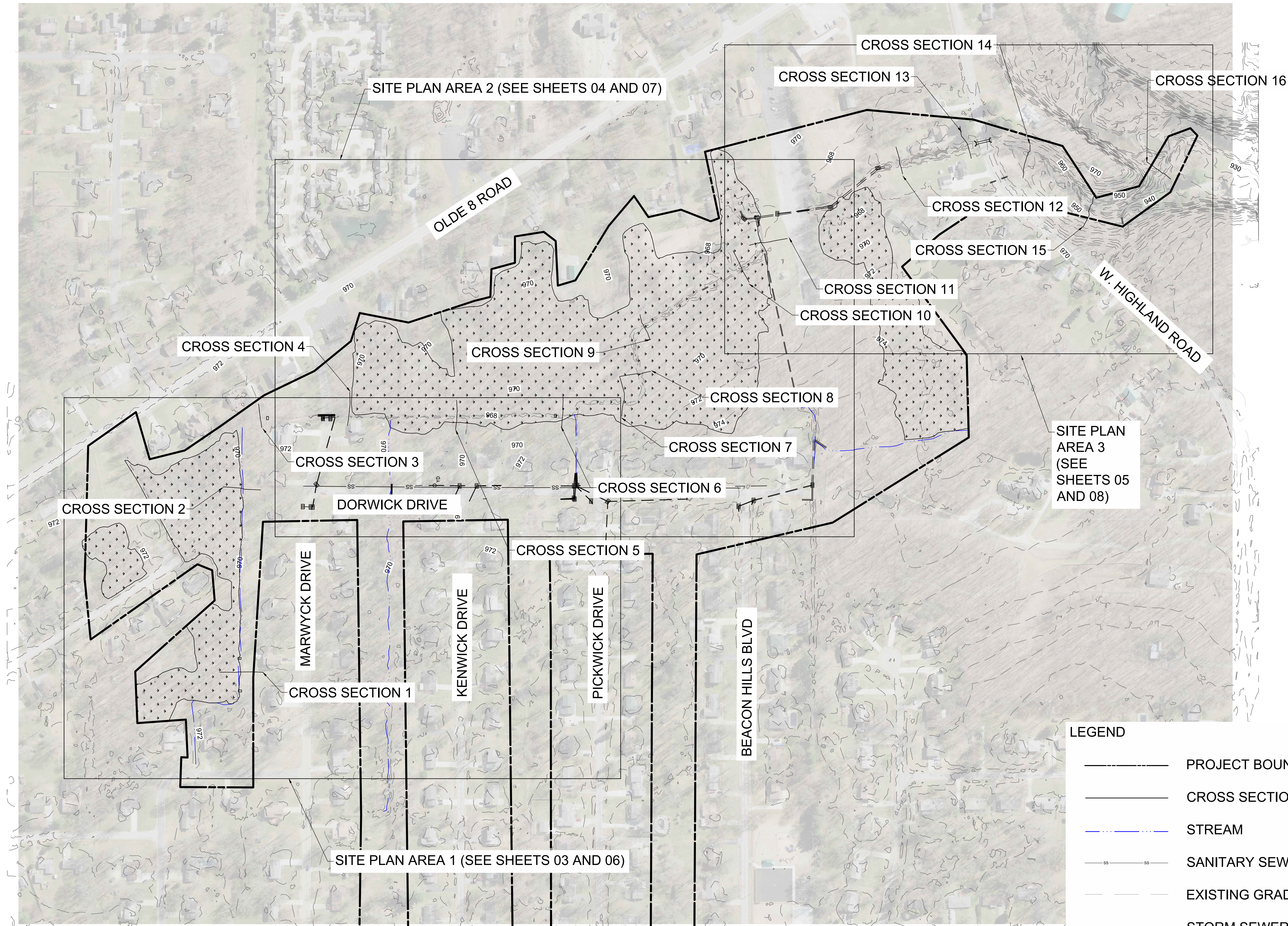
NO.	DESCRIPTION	DATE		
			REVISIONS	

JOB NO: PR61121
 DATE: FEB 2025
 DESIGNED BY: MRK
 DRAWN BY: MLB
 CHECKED BY: MRK
 APPROVED BY: BWT
 SCALE: NONE

TITLE SHEET

01

SHEET: 01 OF 13



LEGEND

- PROJECT BOUNDARY
- CROSS SECTIONS
- STREAM
- SANITARY SEWER
- EXISTING GRADE
- STORM SEWER
- WETLAND

OVERALL SITE PLAN
 SCALE: 1" = 150'

50 SOUTH MAIN STREET,
 SUITE 600
 AKRON, OHIO 44308



SUMMIT COUNTY ENGINEER
 DRAINAGE STUDY AND IMPROVEMENTS
 MARWYCK AND DORWICK DRIVE
 NORTHFIELD CENTER TOWNSHIP

NO.	DESCRIPTION	DATE

JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

OVERALL EXISTING SITE PLAN



LEGEND

	PROJECT BOUNDARY
	CROSS SECTIONS
	STREAM
	SANITARY SEWER
	STORM SEWER
	EXISTING GRADE
	TO BE REMOVED
	WETLAND

EXISTING SITE PLAN 1
 SCALE: 1" = 60'

50 SOUTH MAIN STREET,
 SUITE 600
 AKRON, OHIO 44308
B&N
 burgessniple.com

SUMMIT COUNTY ENGINEER
 DRAINAGE STUDY AND IMPROVEMENTS
 MARWYCK AND DORWICK DRIVE
 NORTHFIELD CENTER TOWNSHIP

NO.	DESCRIPTION	DATE

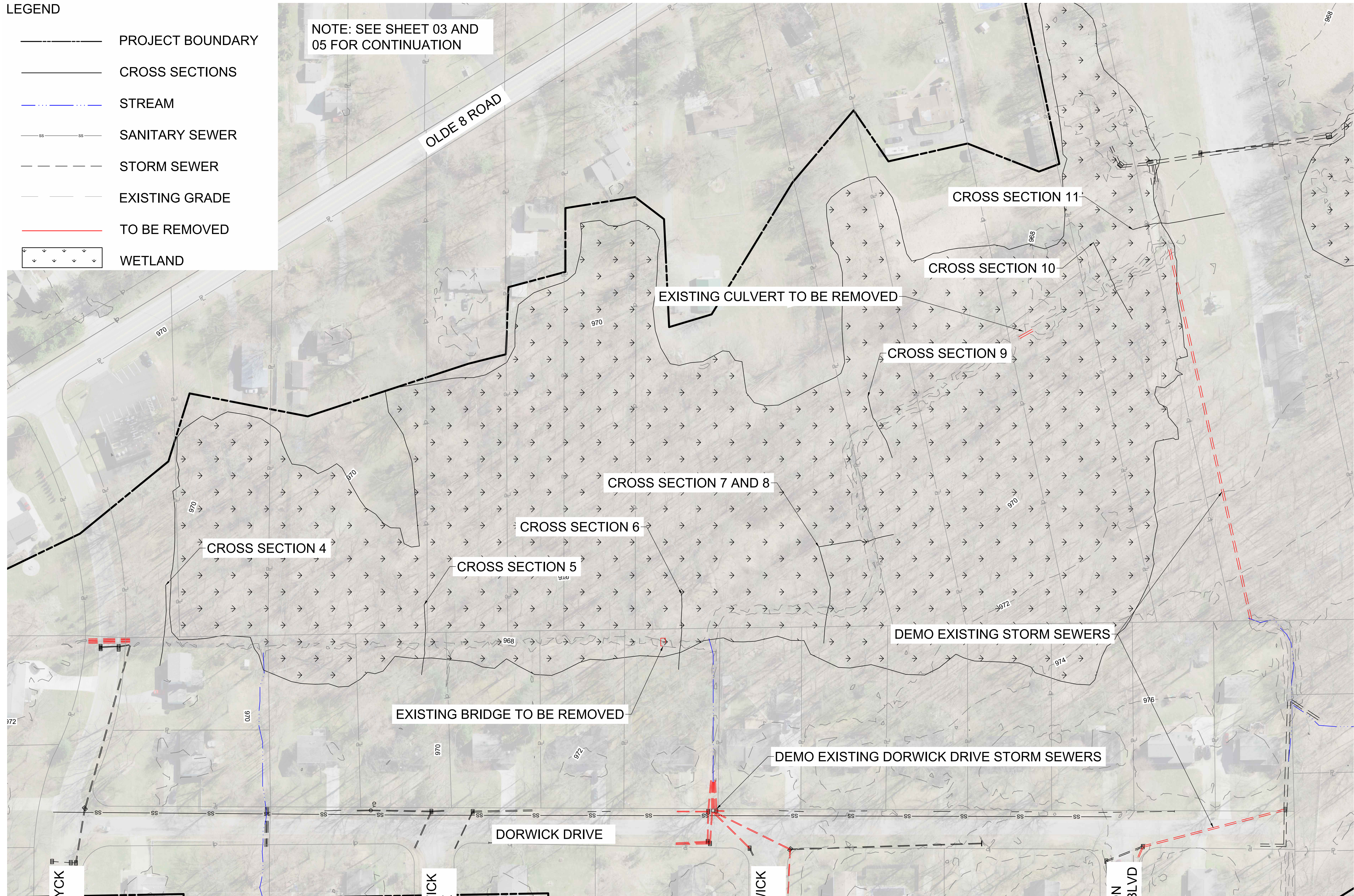
JOB NO: PR61121
 DATE: FEB 2025
 DESIGNED BY: MRK
 DRAWN BY: MLB
 CHECKED BY: MRK
 APPROVED BY: BWT
 SCALE: AS NOTED

EXISTING SITE PLAN 1

LEGEND

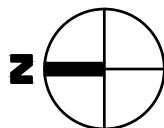
- PROJECT BOUNDARY
- CROSS SECTIONS
- STREAM
- SS — SANITARY SEWER
- - - STORM SEWER
- - - EXISTING GRADE
- TO BE REMOVED
- ← ← ← ← ← WETLAND

NOTE: SEE SHEET 03 AND 05 FOR CONTINUATION



EXISTING SITE PLAN 2

SCALE: 1" = 60'



50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308

B&N
burgessniple.com

SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

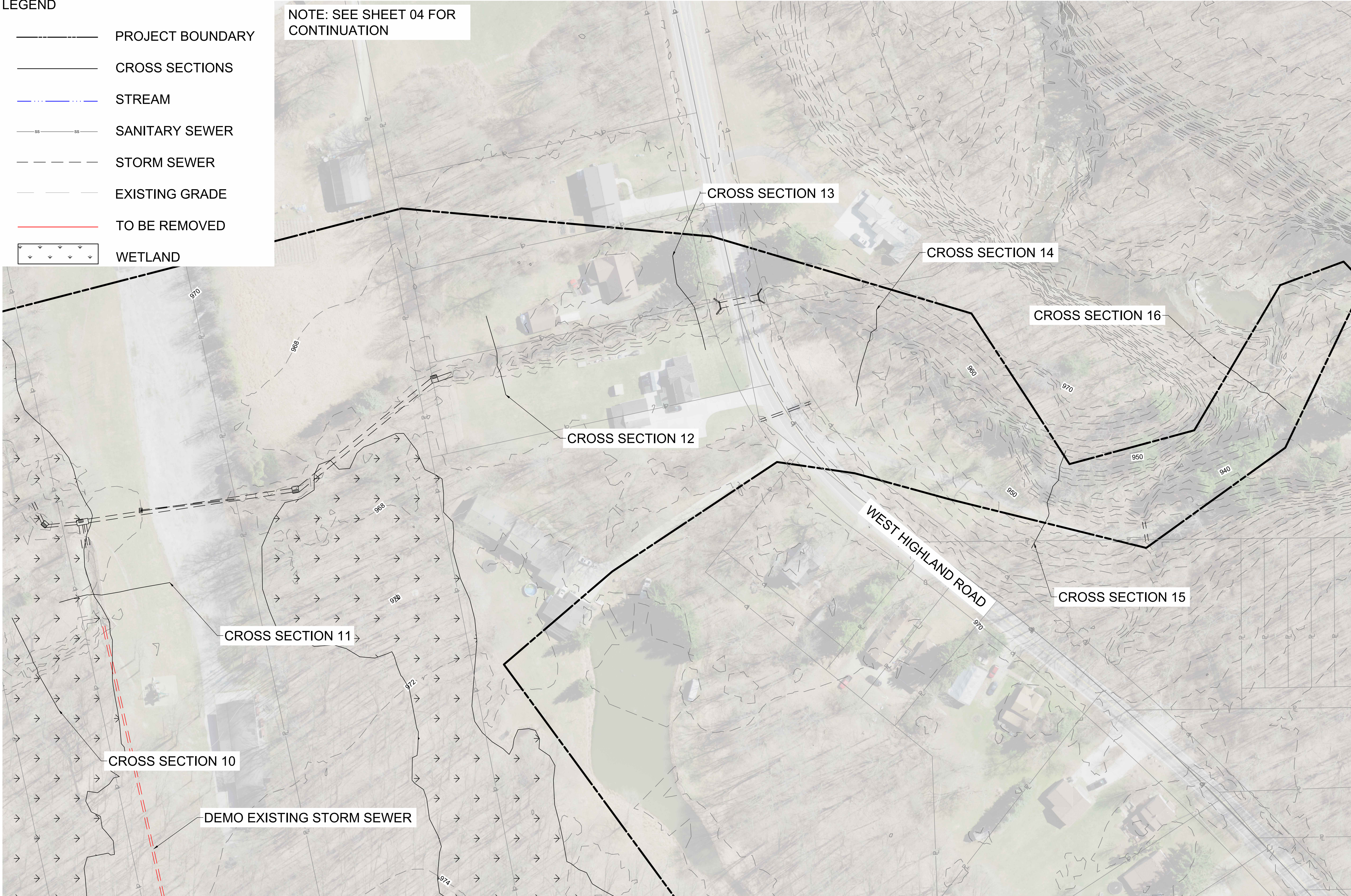
NO.	DESCRIPTION	DATE

JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

EXISTING SITE PLAN 2

- LEGEND**
- PROJECT BOUNDARY
 - CROSS SECTIONS
 - STREAM
 - SANITARY SEWER
 - STORM SEWER
 - EXISTING GRADE
 - TO BE REMOVED
 - WETLAND

NOTE: SEE SHEET 04 FOR CONTINUATION



EXISTING SITE PLAN 3

SCALE: 1" = 50'



50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308



SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

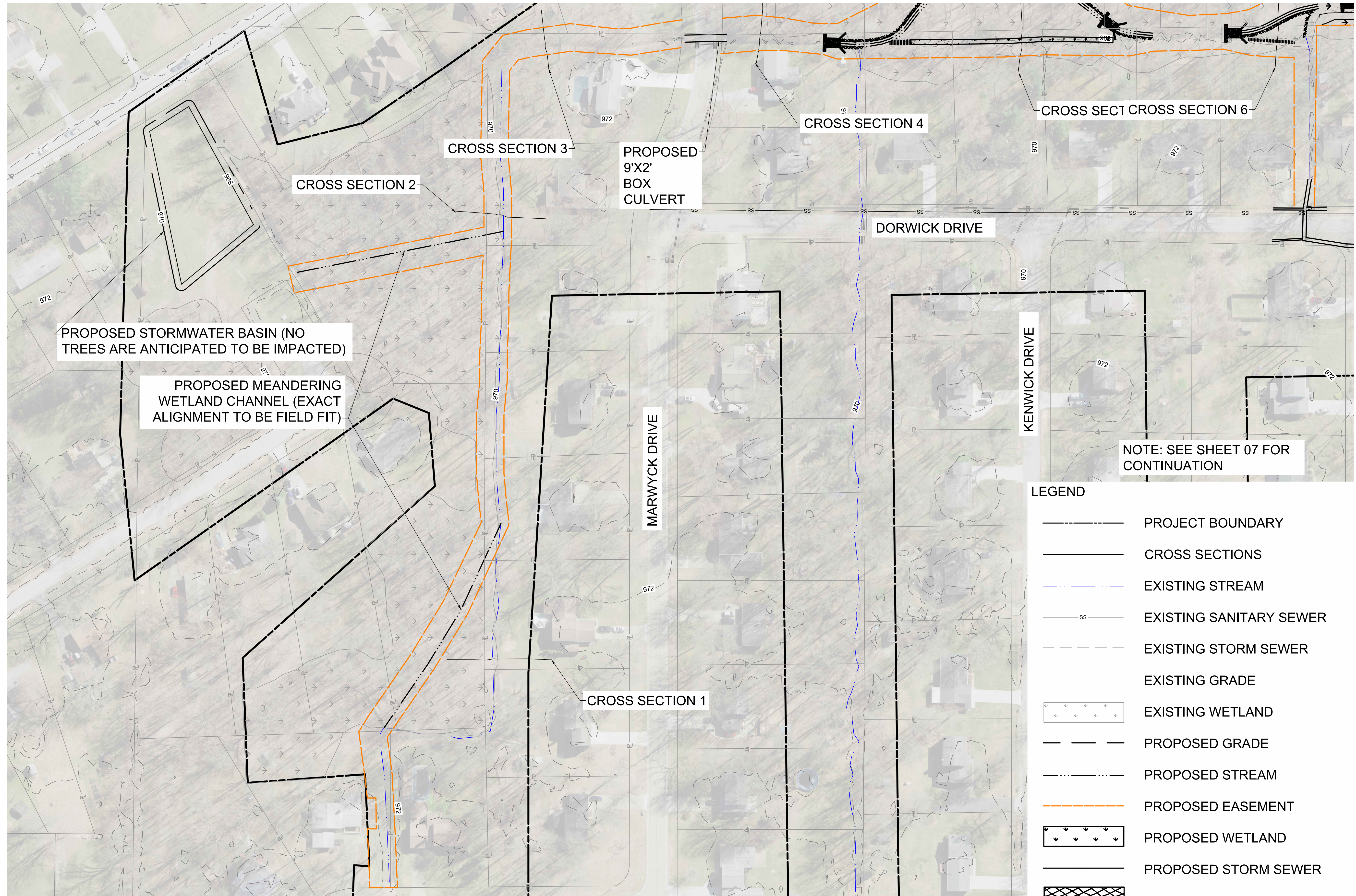
NO.	DESCRIPTION	DATE

JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

EXISTING SITE PLAN 3

05

SHEET: 05 OF 13



PROPOSED STORMWATER BASIN (NO TREES ARE ANTICIPATED TO BE IMPACTED)

PROPOSED MEANDERING WETLAND CHANNEL (EXACT ALIGNMENT TO BE FIELD FIT)

PROPOSED 9'X2' BOX CULVERT

CROSS SECTION 2

CROSS SECTION 3

CROSS SECTION 4

CROSS SECT CROSS SECTION 6

DORWICK DRIVE

MARWYCK DRIVE

KENWICK DRIVE

CROSS SECTION 1

NOTE: SEE SHEET 07 FOR CONTINUATION

LEGEND

- PROJECT BOUNDARY
- CROSS SECTIONS
- EXISTING STREAM
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING GRADE
- EXISTING WETLAND
- PROPOSED GRADE
- PROPOSED STREAM
- PROPOSED EASEMENT
- PROPOSED WETLAND
- PROPOSED STORM SEWER
- PROPOSED ROOT WADS
- PROPOSED CLAY PLUG

PROPOSED SITE PLAN 1

SCALE: 1" = 60'



50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308



SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

NO.	DESCRIPTION	DATE

JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

PROPOSED SITE PLAN 1

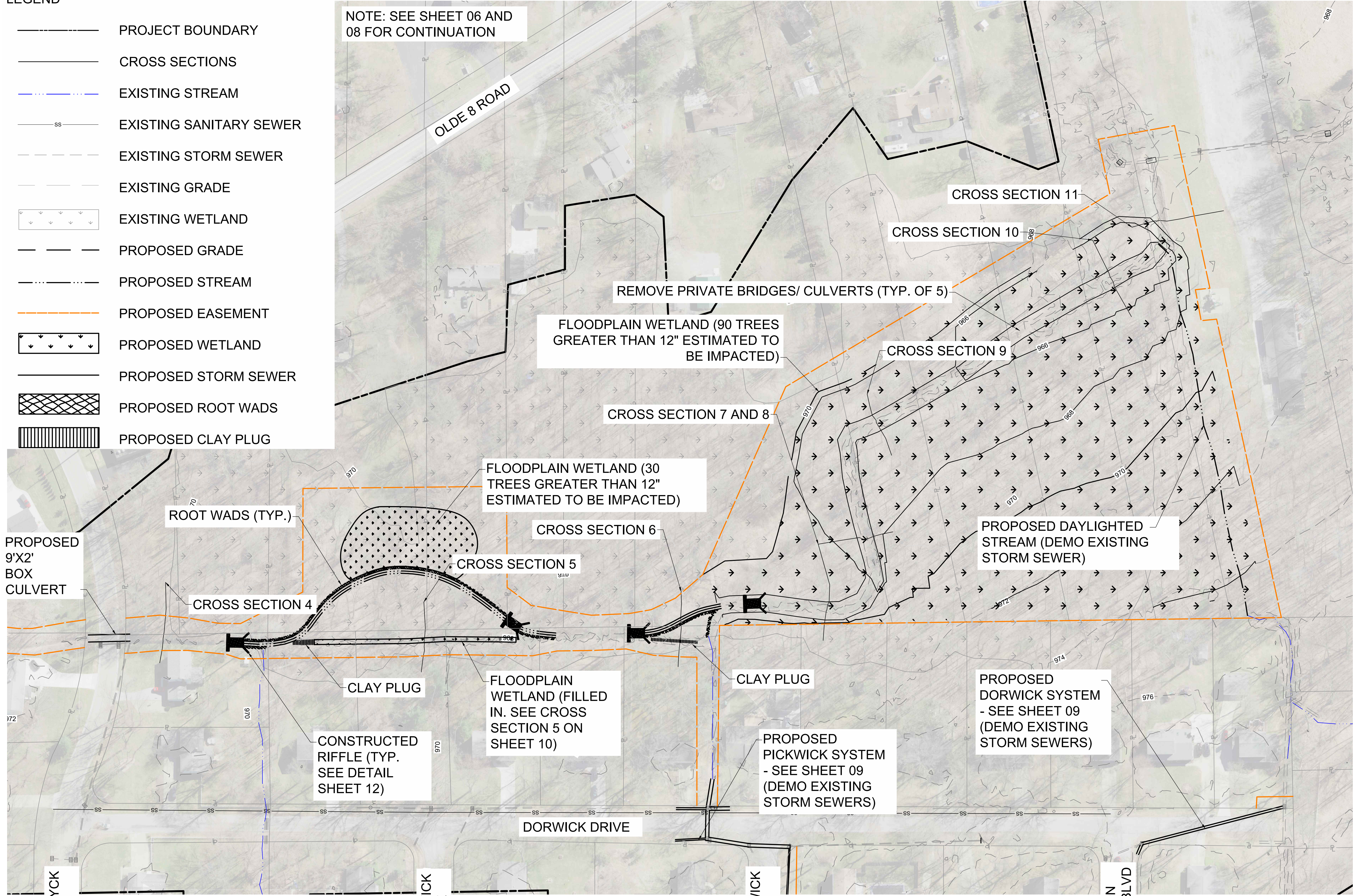
06

SHEET: 06 OF 13

LEGEND

- PROJECT BOUNDARY
- CROSS SECTIONS
- EXISTING STREAM
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING GRADE
- EXISTING WETLAND
- PROPOSED GRADE
- PROPOSED STREAM
- PROPOSED EASEMENT
- PROPOSED WETLAND
- PROPOSED STORM SEWER
- PROPOSED ROOT WADS
- PROPOSED CLAY PLUG

NOTE: SEE SHEET 06 AND 08 FOR CONTINUATION



PROPOSED 9'X2' BOX CULVERT

ROOT WADS (TYP.)

FLOODPLAIN WETLAND (30 TREES GREATER THAN 12" ESTIMATED TO BE IMPACTED)

FLOODPLAIN WETLAND (90 TREES GREATER THAN 12" ESTIMATED TO BE IMPACTED)

REMOVE PRIVATE BRIDGES/ CULVERTS (TYP. OF 5)

PROPOSED DAYLIGHTED STREAM (DEMO EXISTING STORM SEWER)

CONSTRUCTED RIFFLE (TYP. SEE DETAIL SHEET 12)

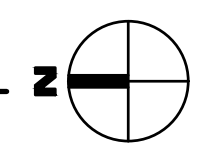
FLOODPLAIN WETLAND (FILLED IN. SEE CROSS SECTION 5 ON SHEET 10)

PROPOSED PICKWICK SYSTEM - SEE SHEET 09 (DEMO EXISTING STORM SEWERS)

PROPOSED DORWICK SYSTEM - SEE SHEET 09 (DEMO EXISTING STORM SEWERS)

PROPOSED SITE PLAN 2

SCALE: 1" = 60'




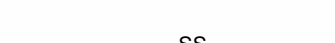






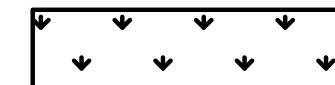





NO.	DESCRIPTION	REVISIONS	
		DATE	

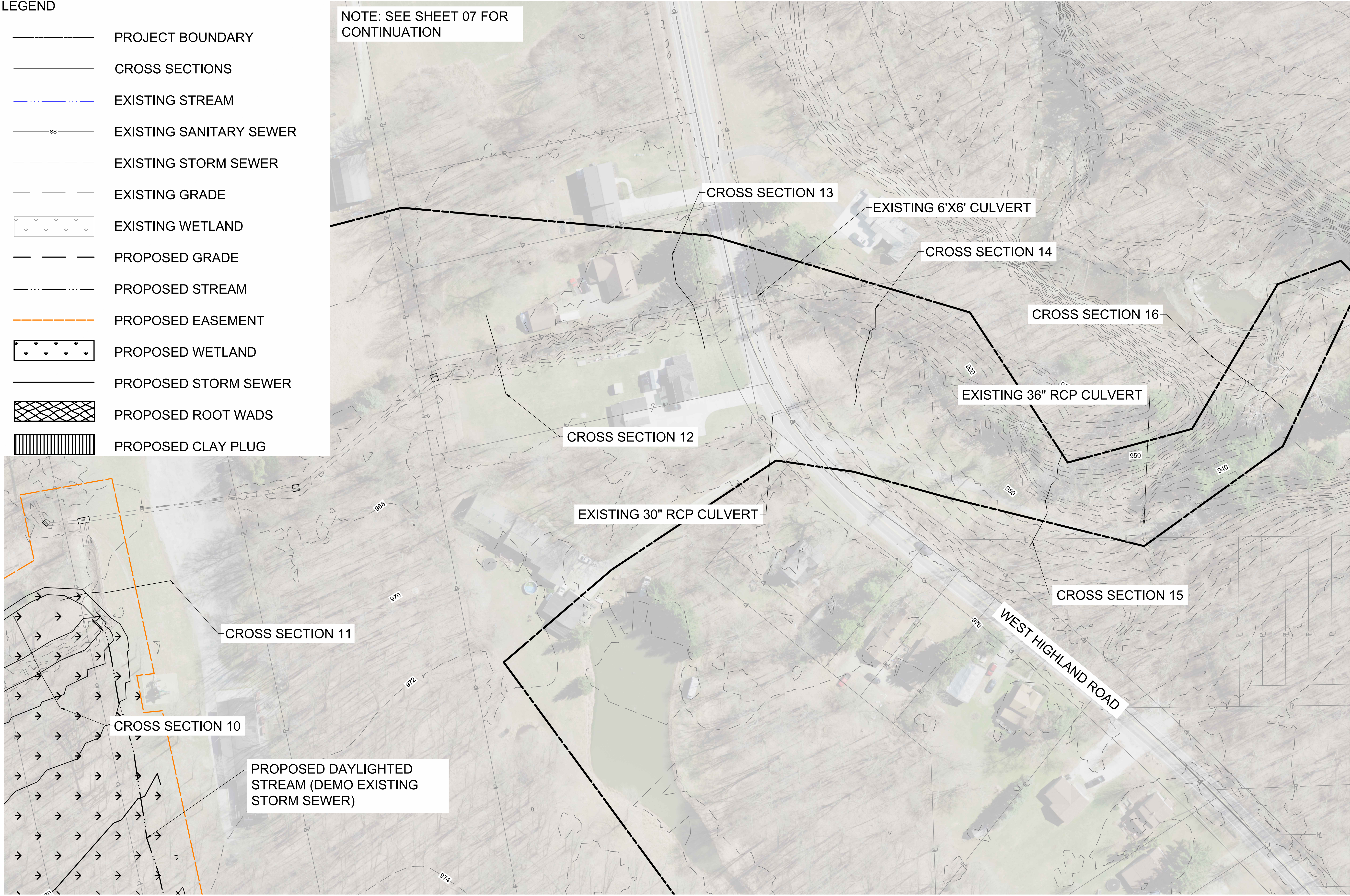
JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

PROPOSED SITE PLAN 2

LEGEND

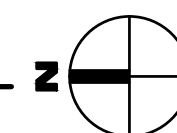
-  PROJECT BOUNDARY
-  CROSS SECTIONS
-  EXISTING STREAM
-  EXISTING SANITARY SEWER
-  EXISTING STORM SEWER
-  EXISTING GRADE
-  EXISTING WETLAND
-  PROPOSED GRADE
-  PROPOSED STREAM
-  PROPOSED EASEMENT
-  PROPOSED WETLAND
-  PROPOSED STORM SEWER
-  PROPOSED ROOT WADS
-  PROPOSED CLAY PLUG

NOTE: SEE SHEET 07 FOR CONTINUATION



PROPOSED SITE PLAN 3

SCALE: 1" = 50'



50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308



SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

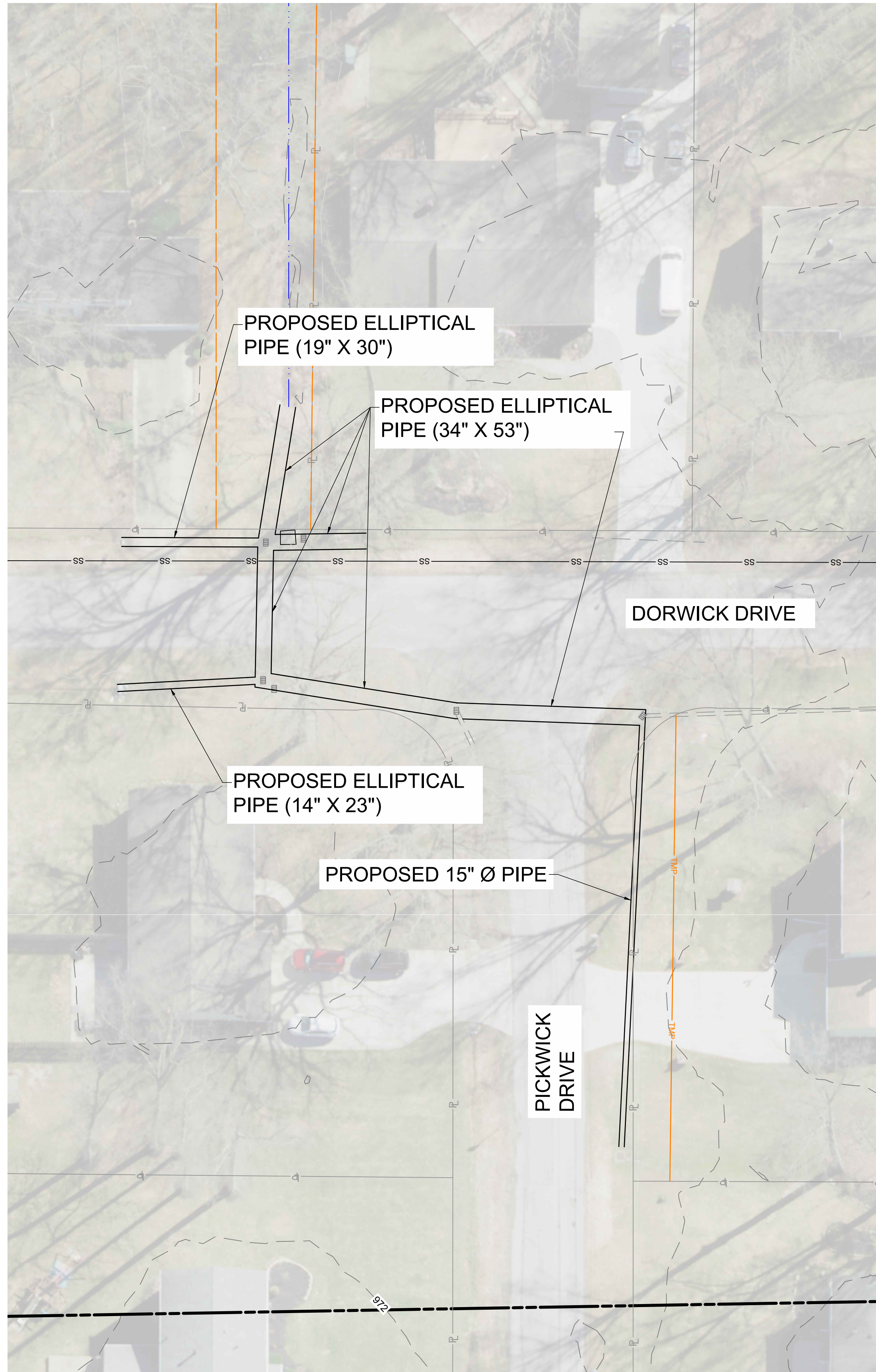
NO.	DESCRIPTION	REVISIONS	
		DATE	

JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

PROPOSED SITE PLAN 3

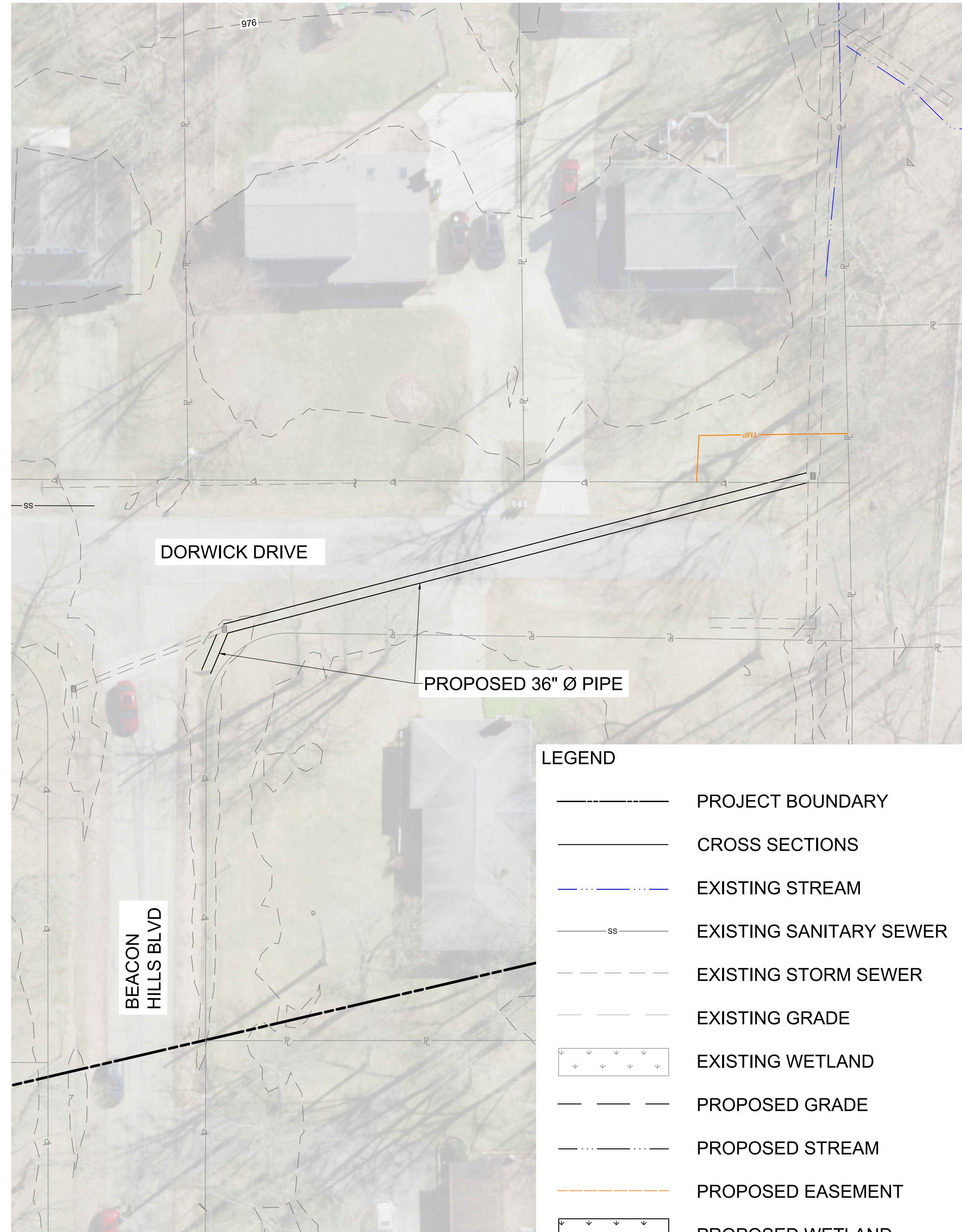
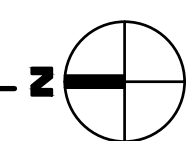
08

SHEET: 08 OF 13



PROPOSED PICKWICK SYSTEM

SCALE: 1" = 20'



PROPOSED DORWICK SYSTEM

SCALE: 1" = 20'



LEGEND

- PROJECT BOUNDARY
- CROSS SECTIONS
- EXISTING STREAM
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING GRADE
- EXISTING WETLAND
- PROPOSED GRADE
- PROPOSED STREAM
- PROPOSED EASEMENT
- PROPOSED WETLAND
- PROPOSED STORM SEWER

50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308



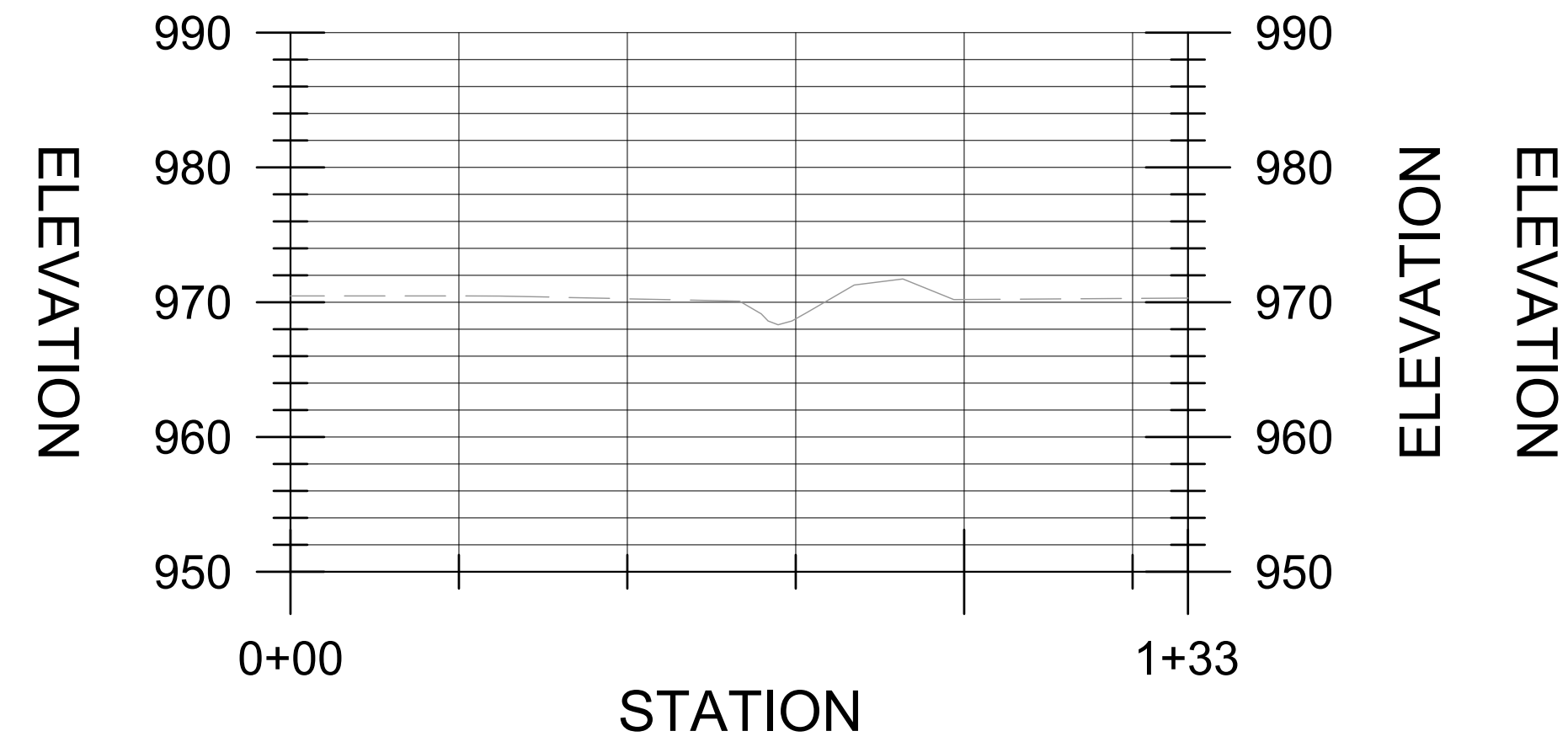
SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

NO.	DESCRIPTION	REVISIONS	
		DATE	

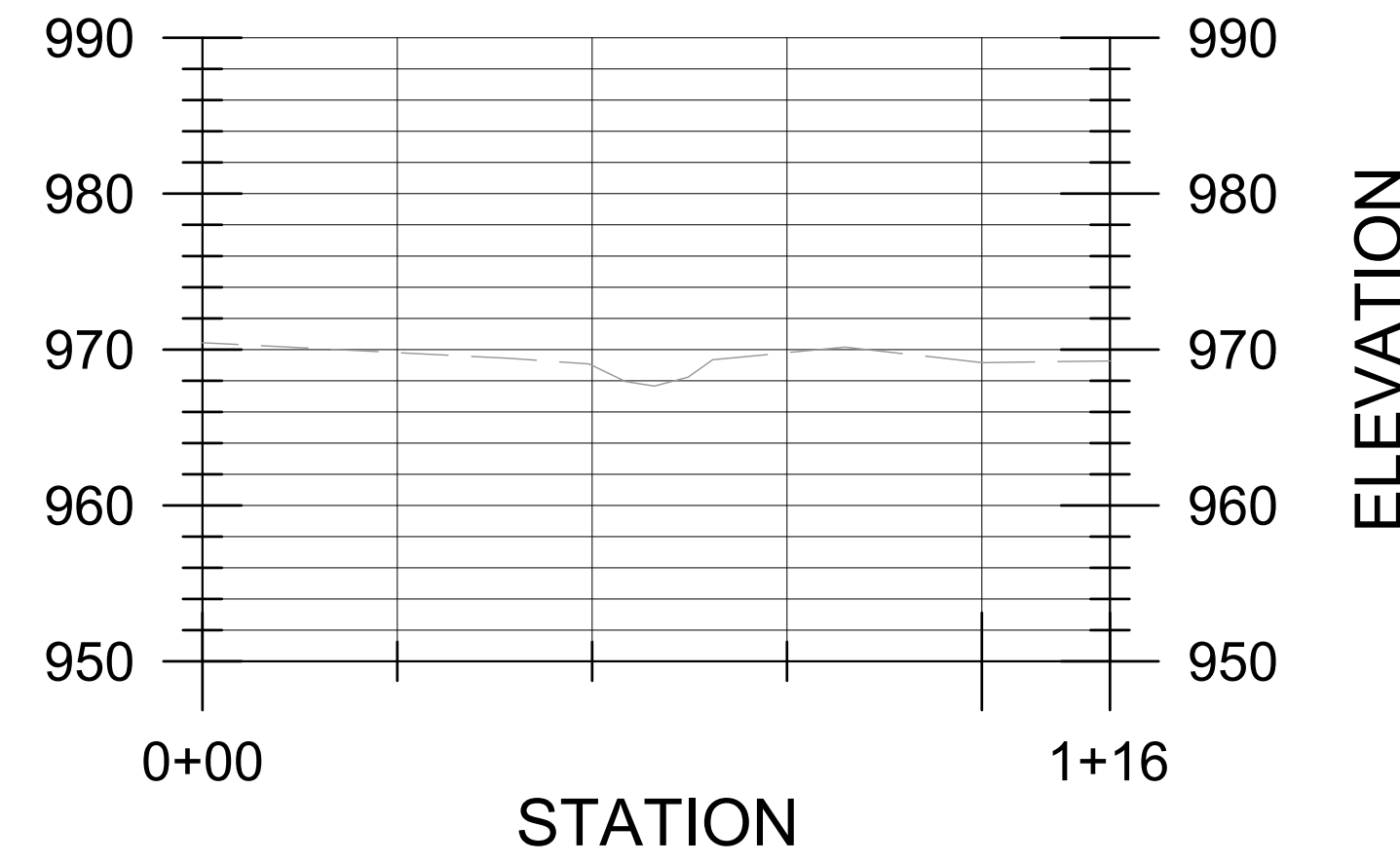
JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

PROPOSED PICKWICK & DORWICK PLAN

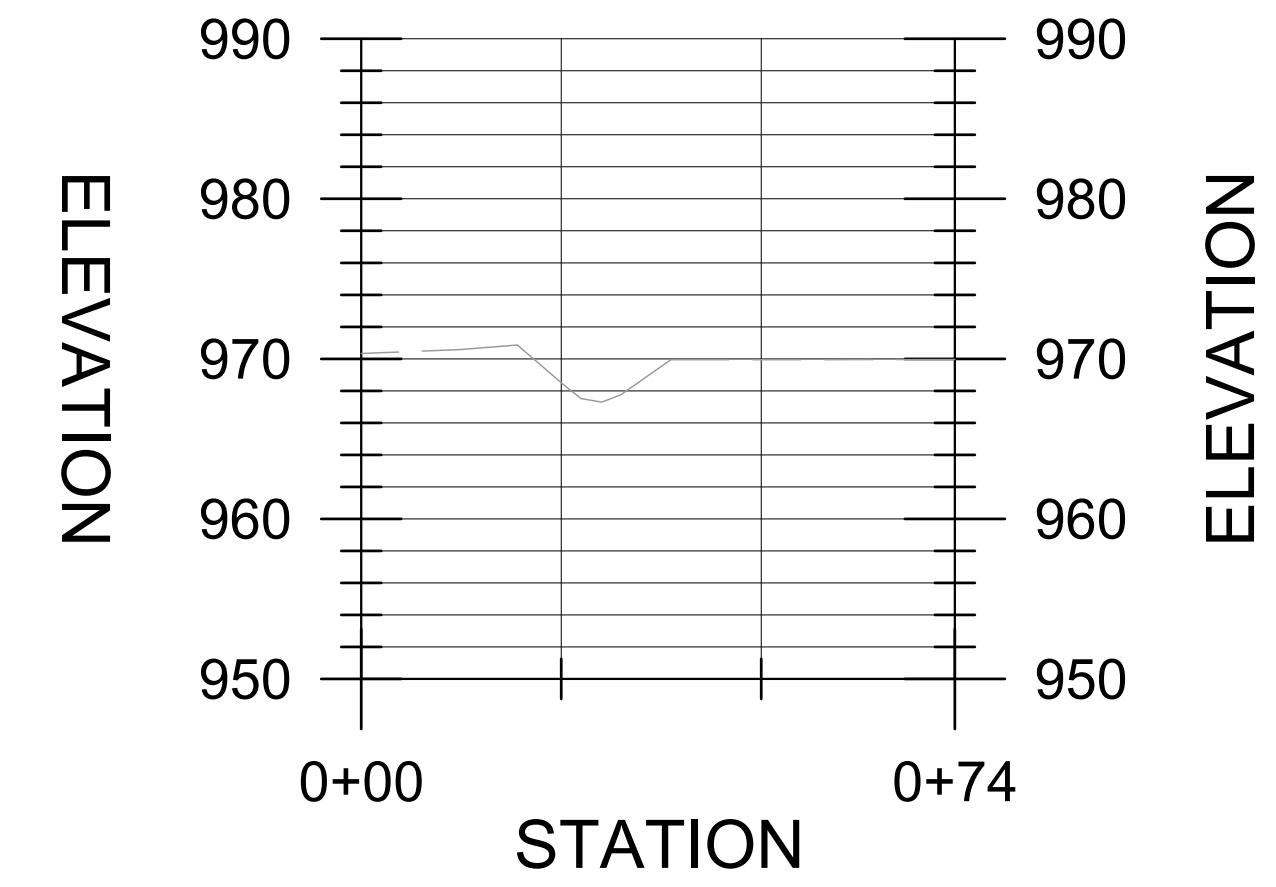
09



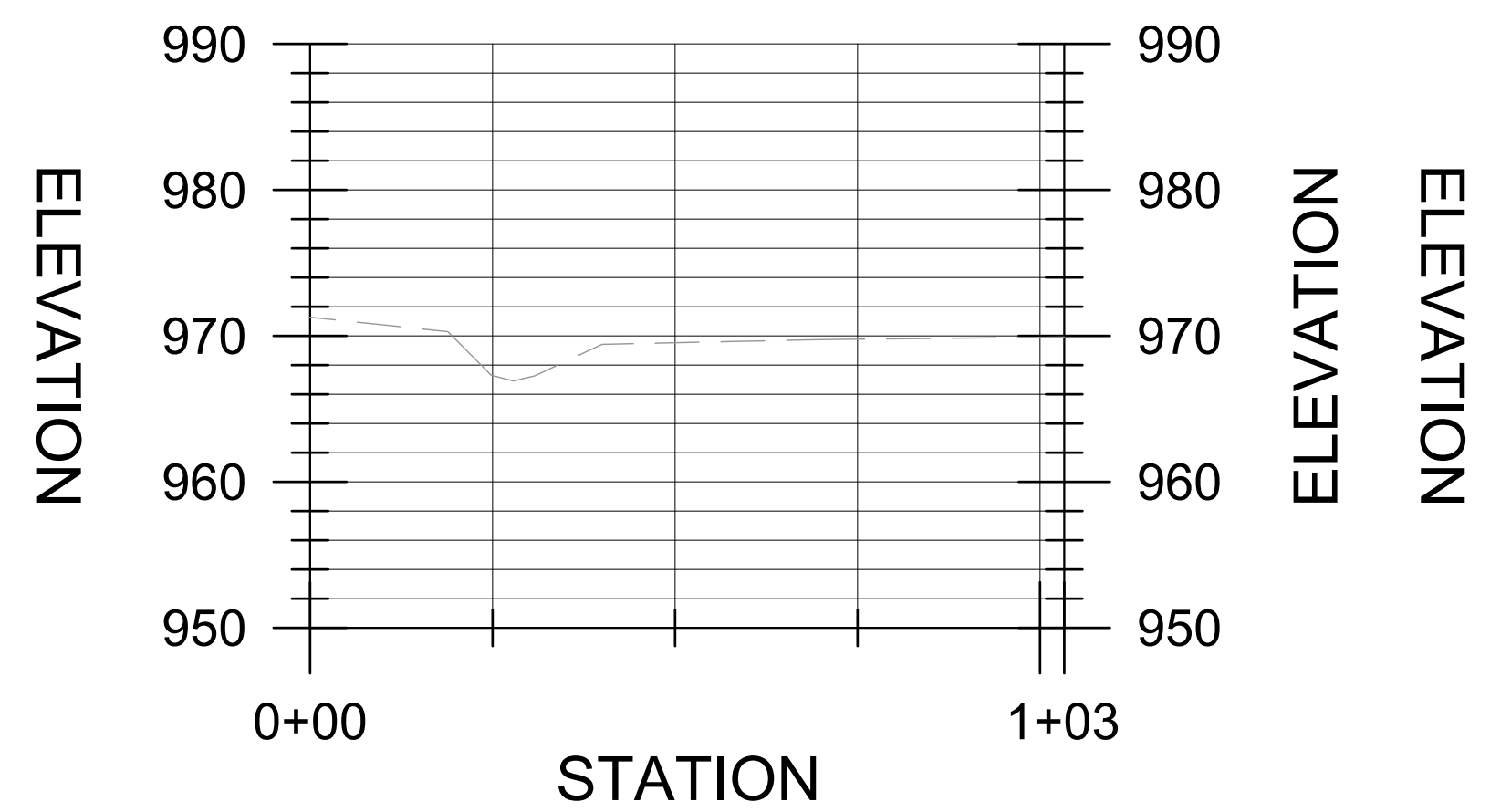
CROSS SECTION 1
SCALE: NONE



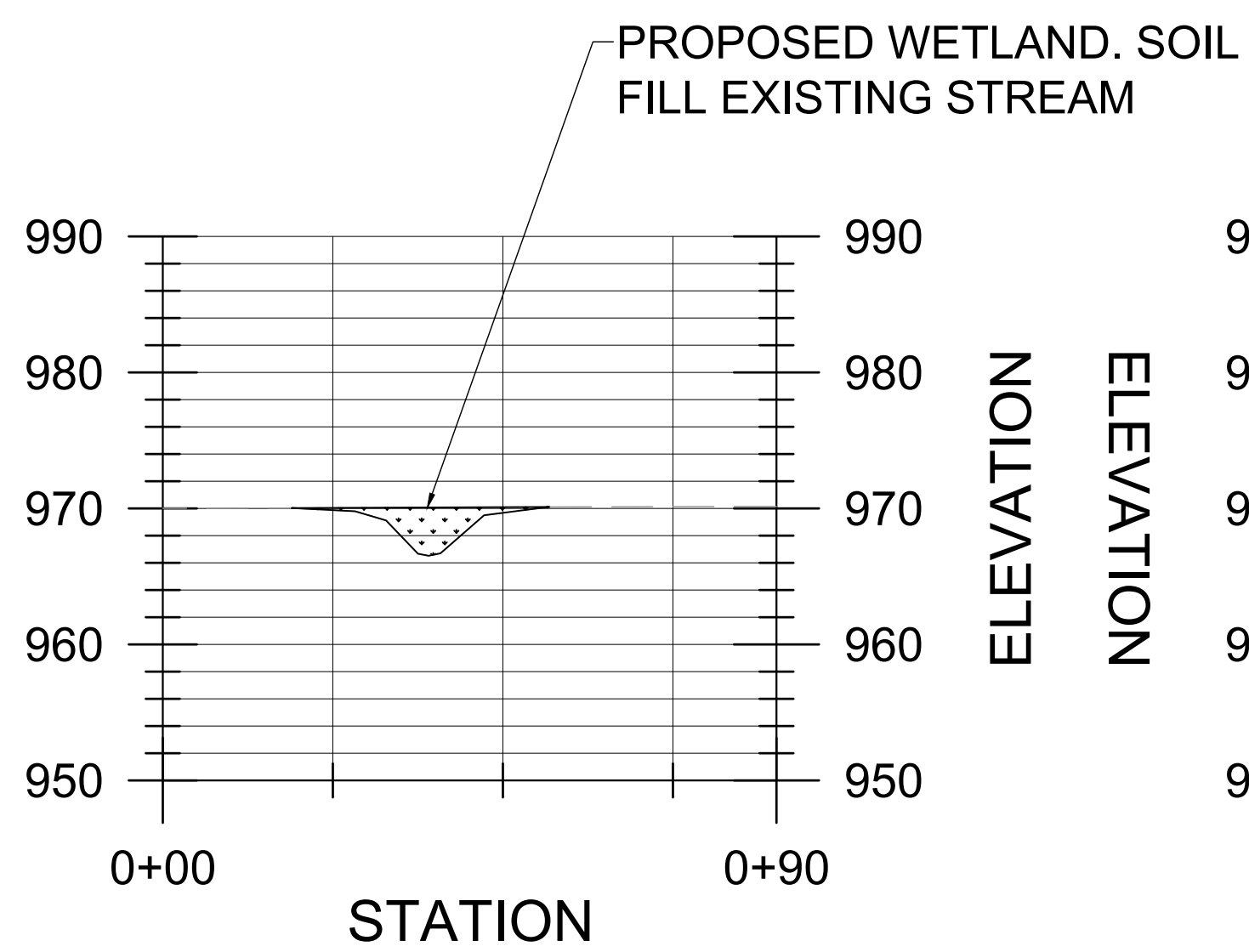
CROSS SECTION 2
SCALE: NONE



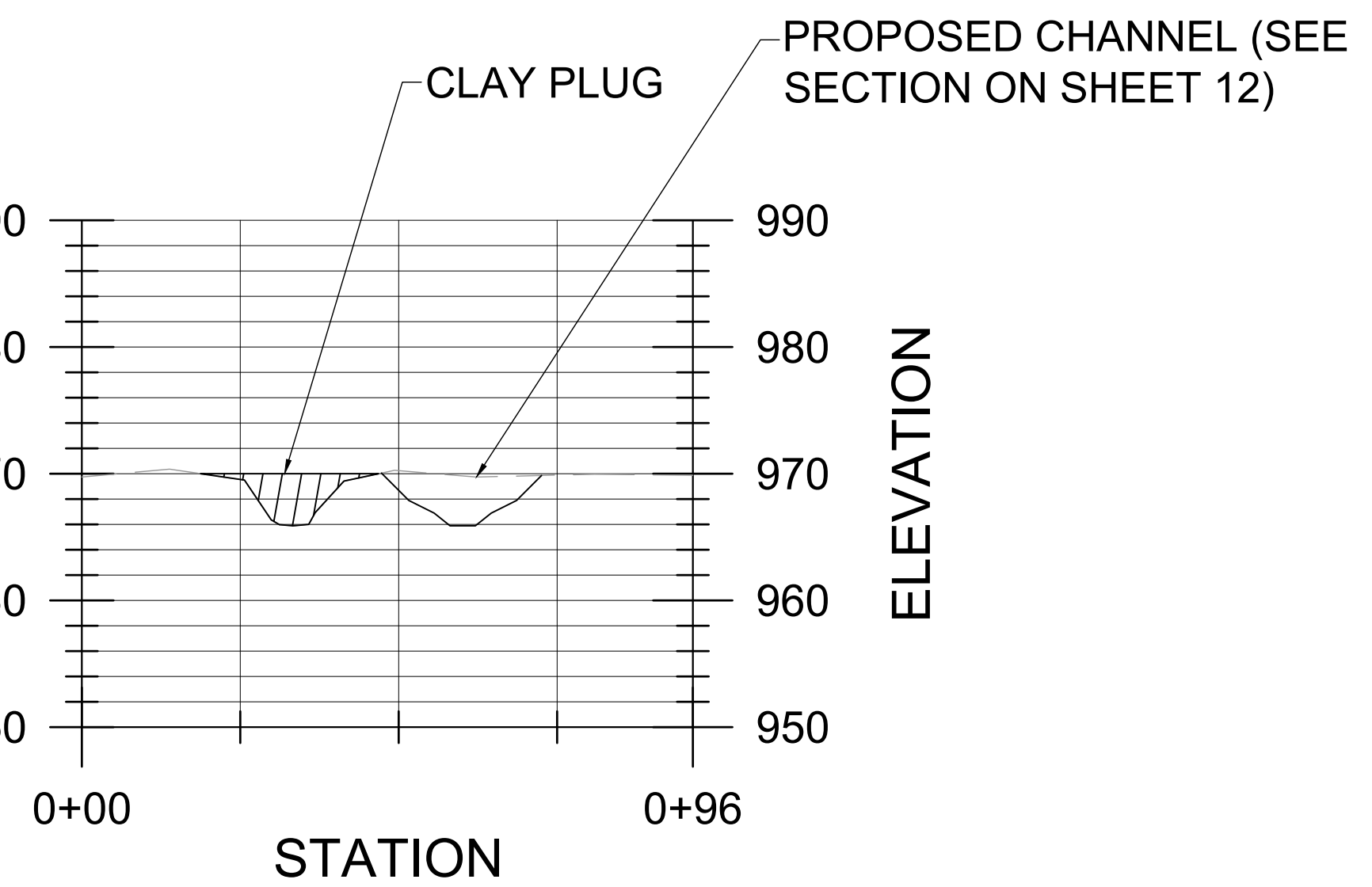
CROSS SECTION 3
SCALE: NONE



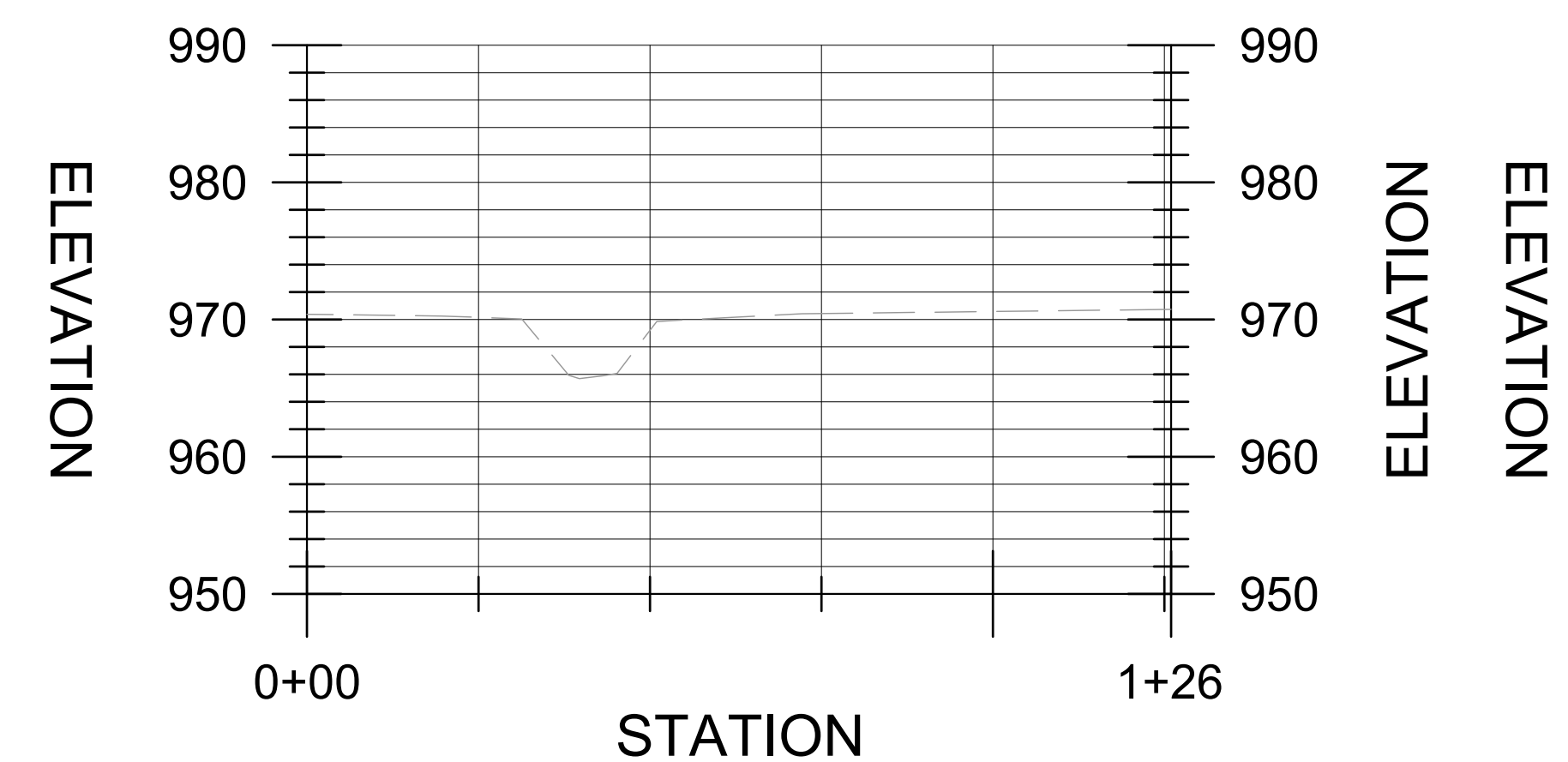
CROSS SECTION 4
SCALE: NONE



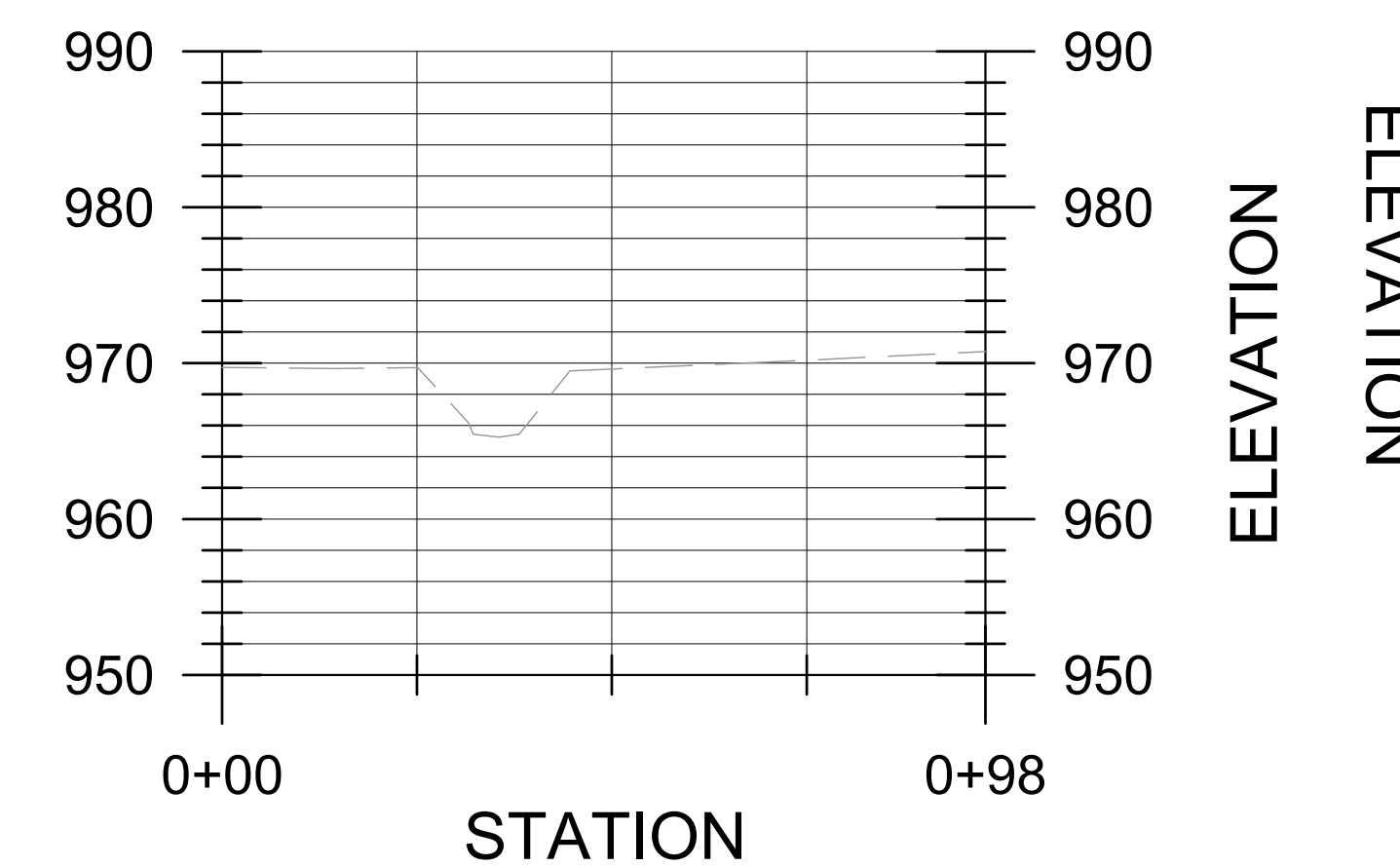
CROSS SECTION 5
SCALE: NONE



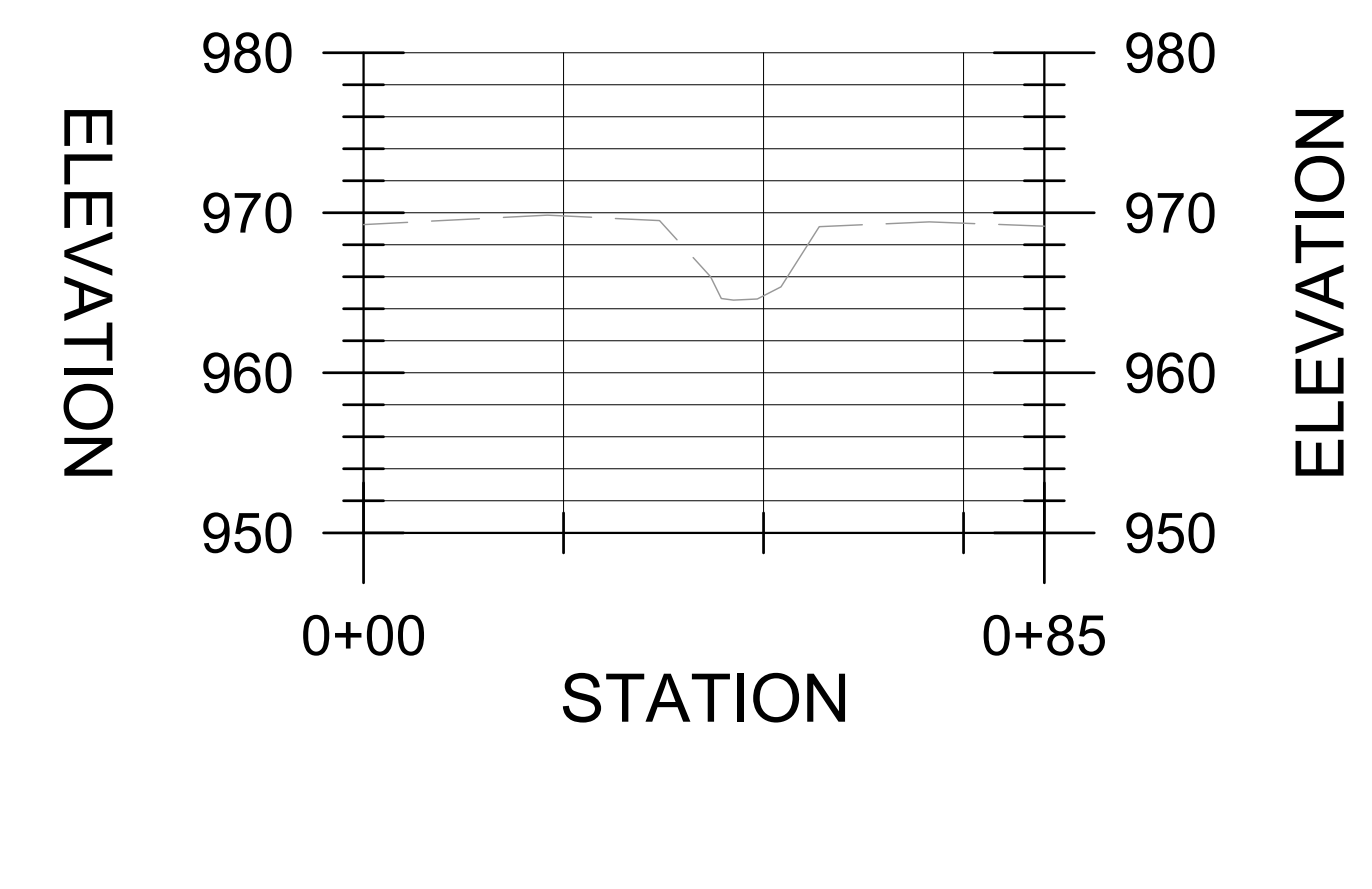
CROSS SECTION 6
SCALE: NONE



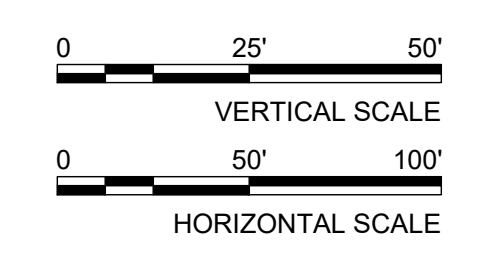
CROSS SECTION 7
SCALE: NONE



CROSS SECTION 8
SCALE: NONE



CROSS SECTION 9
SCALE: NONE



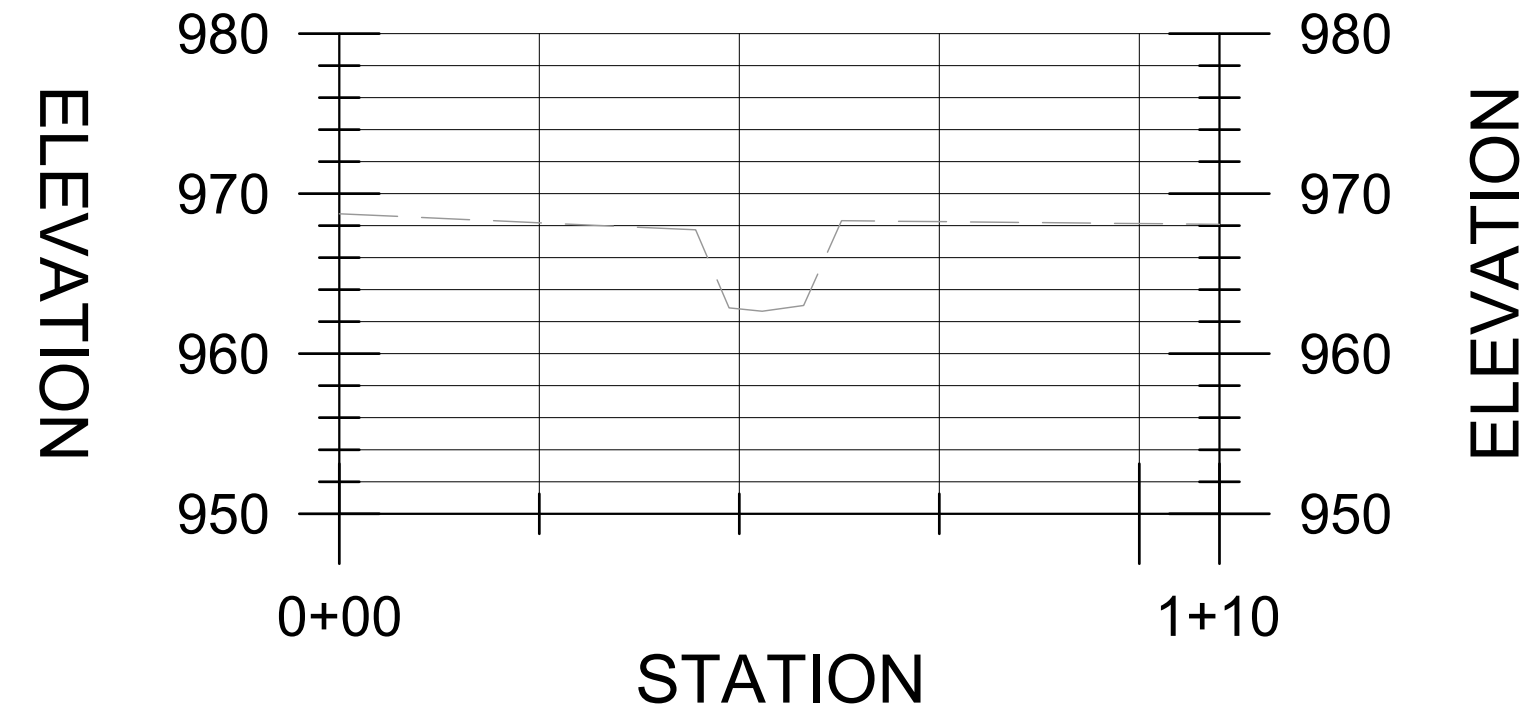
50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308
B&N
burgessniple.com

SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

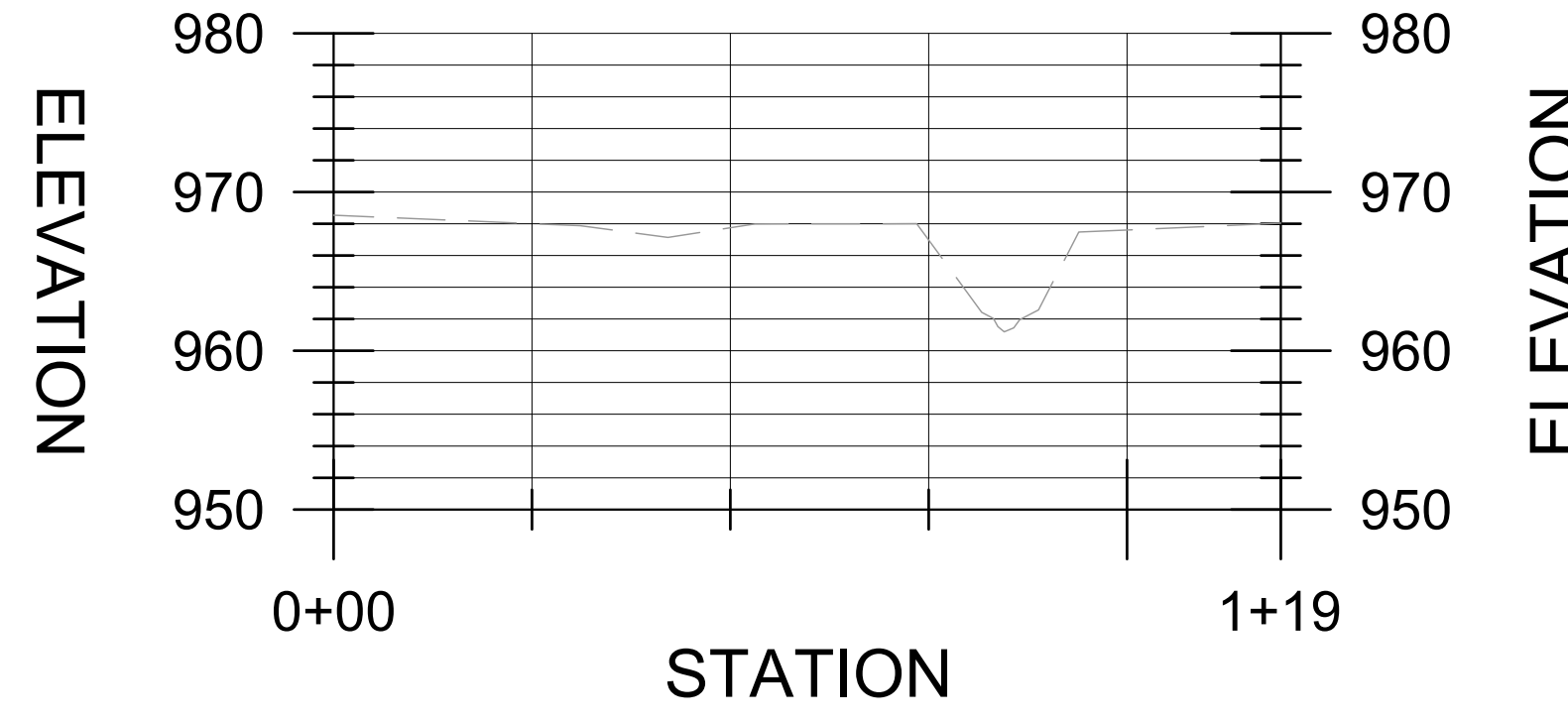
NO.	DESCRIPTION	DATE

JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

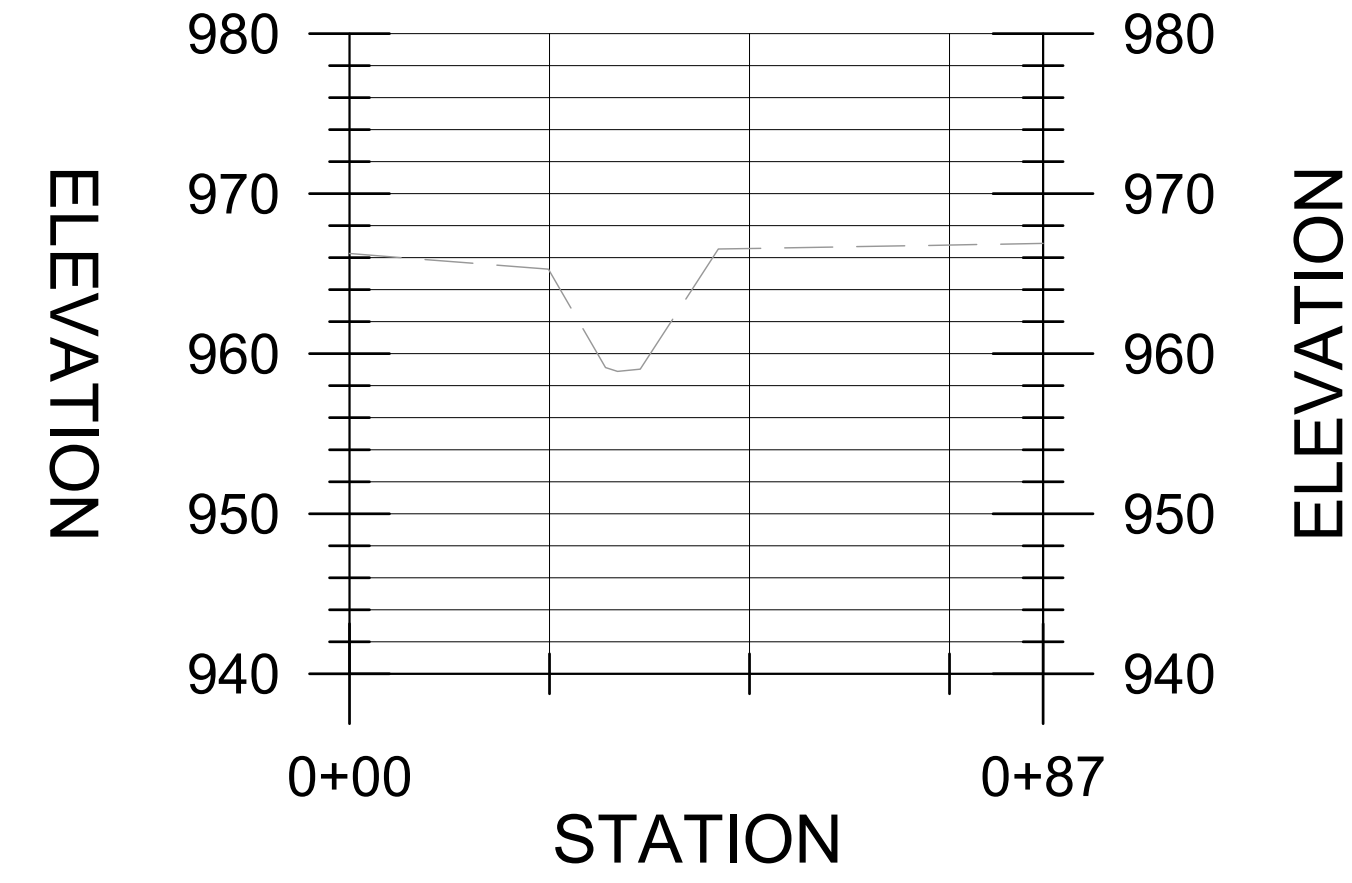
WETLAND CROSS SECTIONS 1



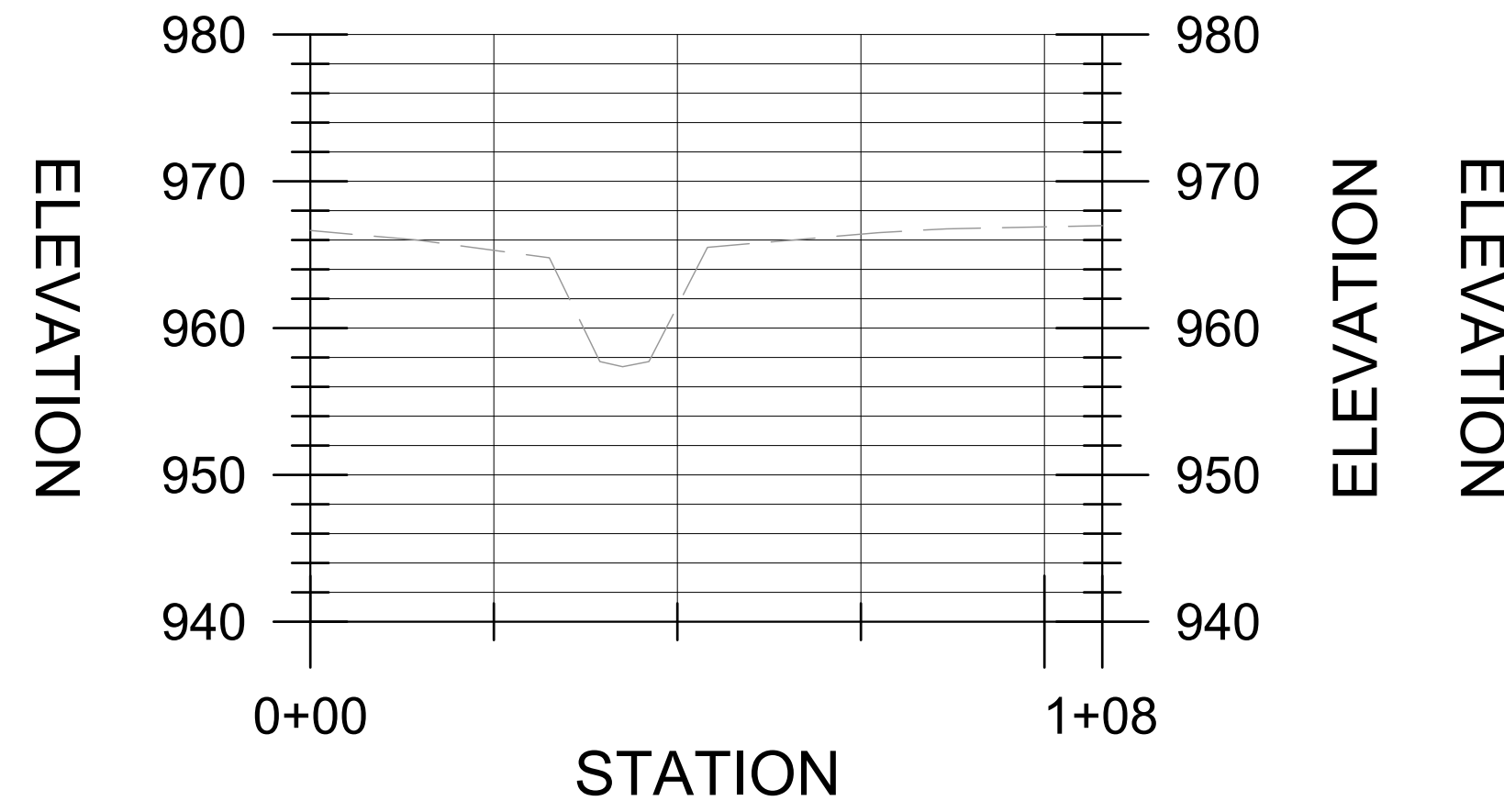
CROSS SECTION 10
SCALE: NONE



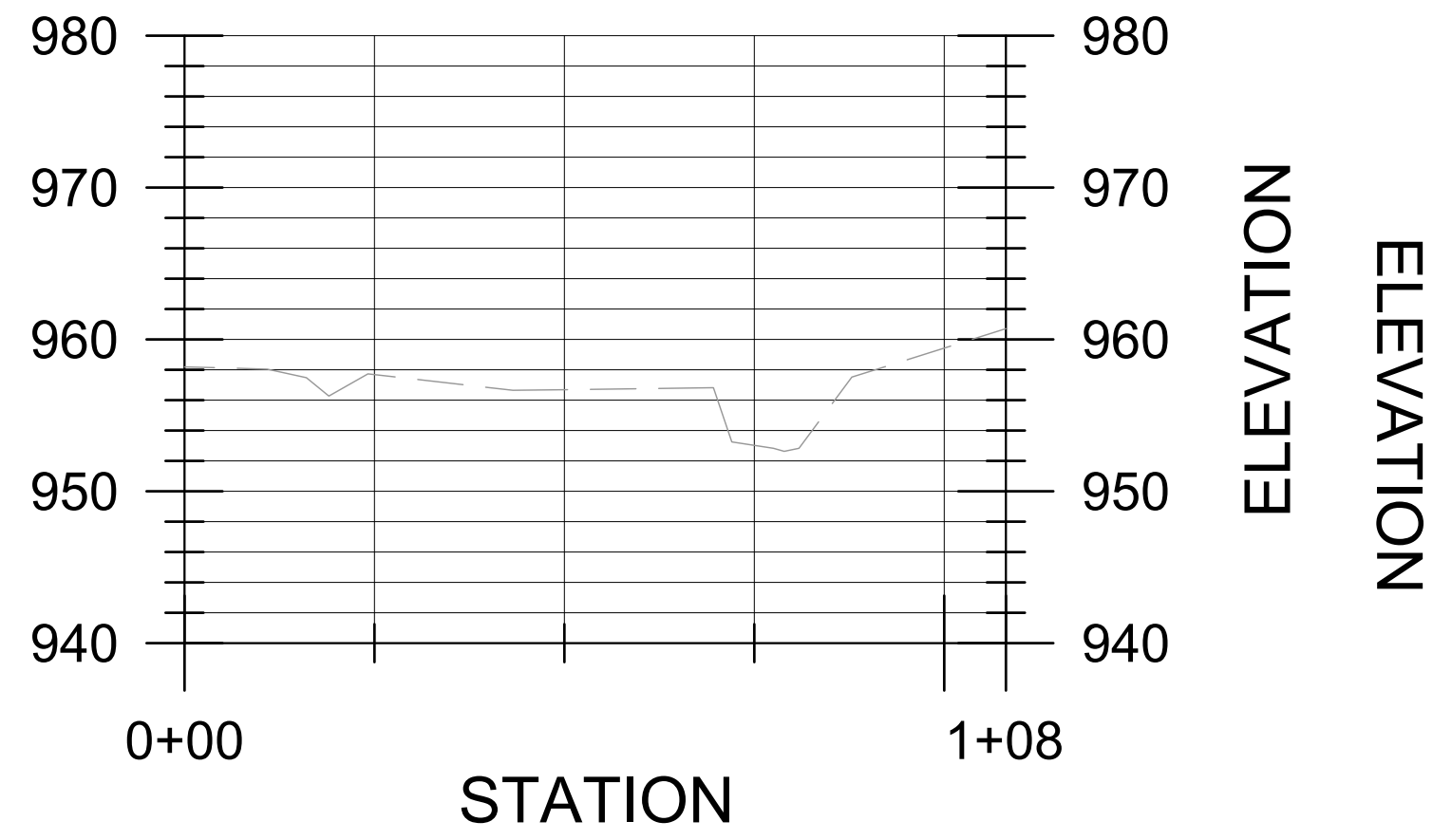
CROSS SECTION 11
SCALE: NONE



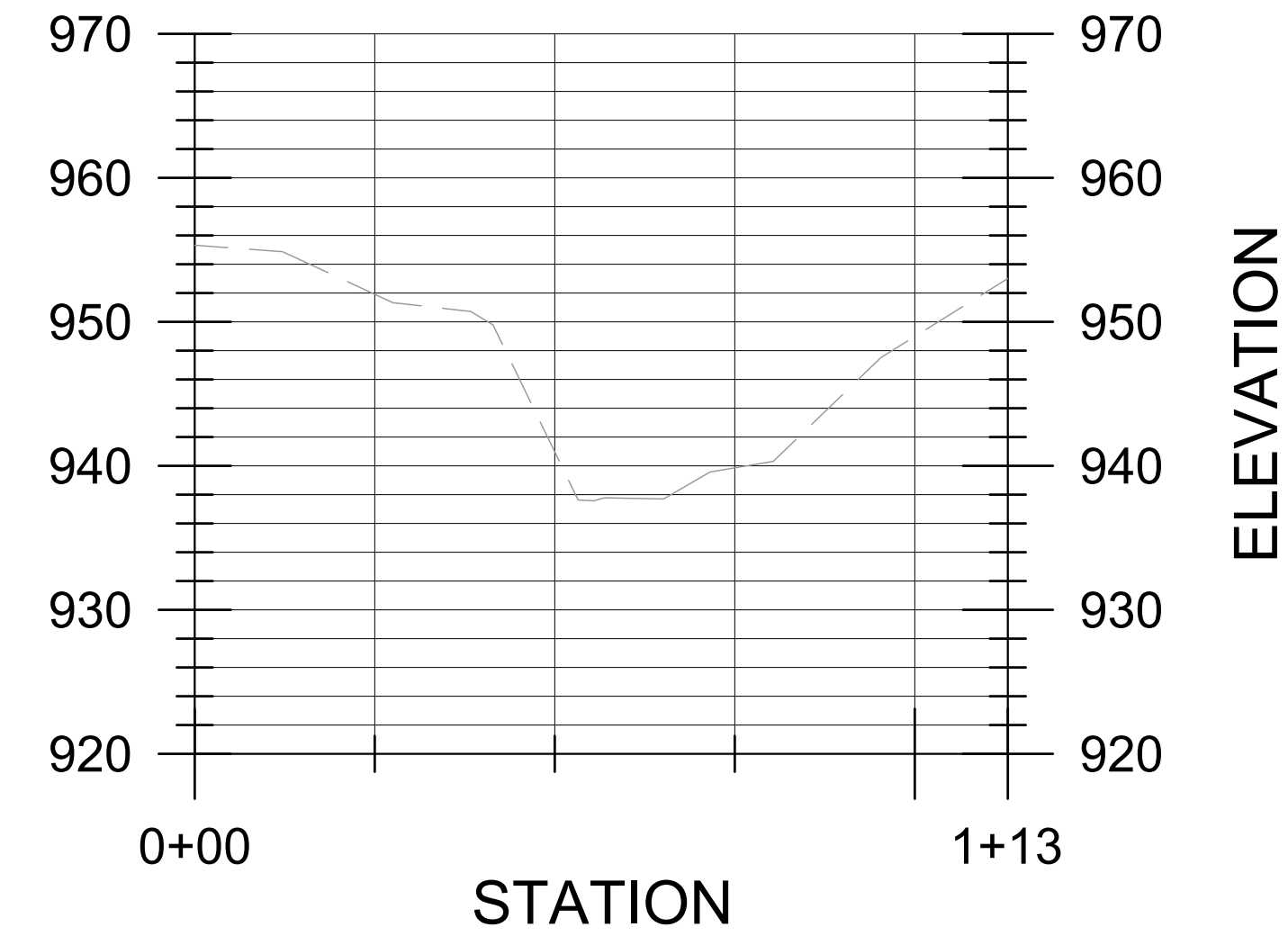
CROSS SECTION 12
SCALE: NONE



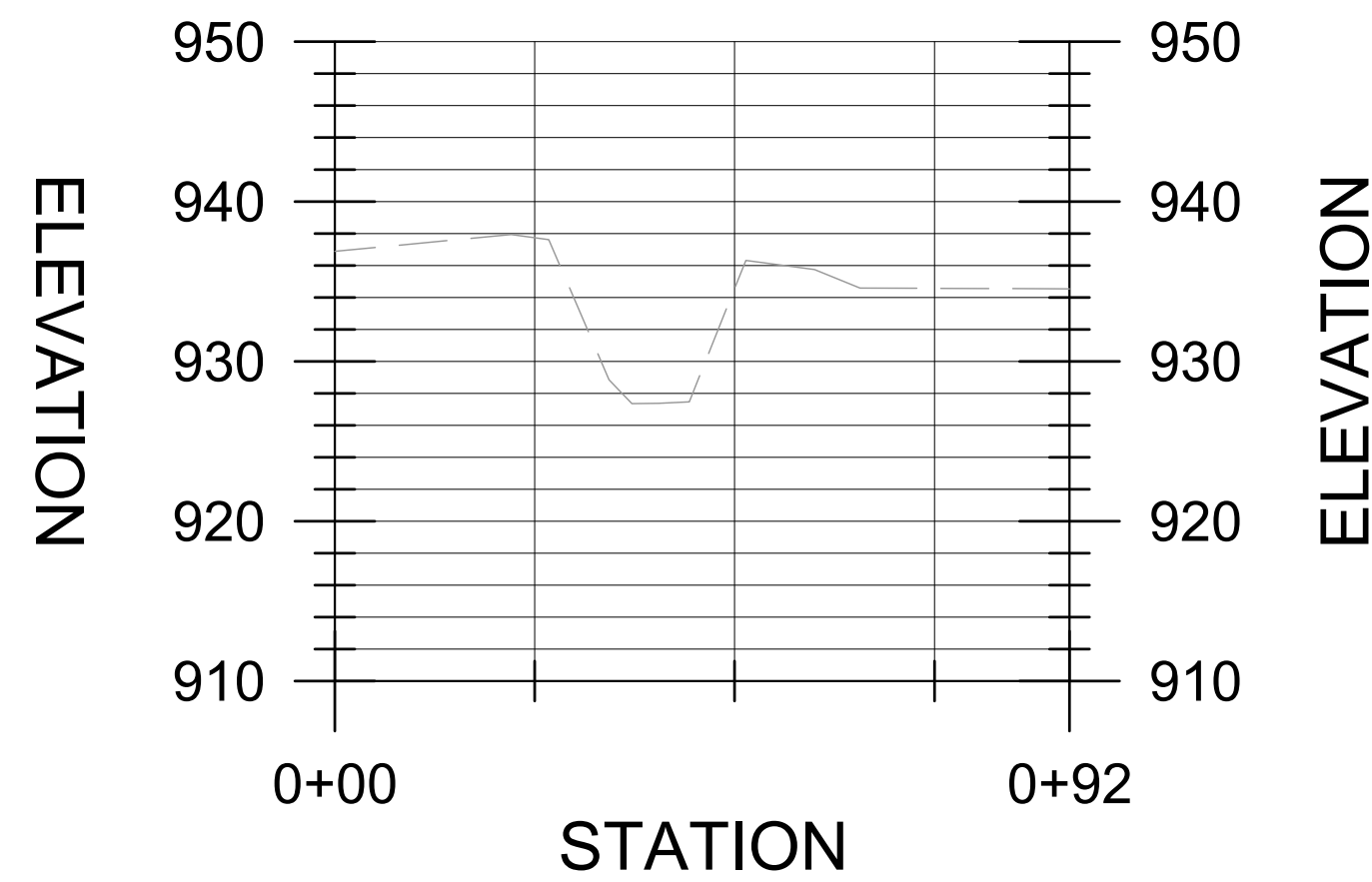
CROSS SECTION 13
SCALE: NONE



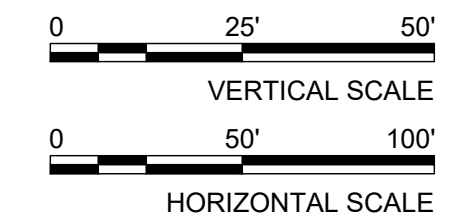
CROSS SECTION 14
SCALE: NONE



CROSS SECTION 15
SCALE: NONE



CROSS SECTION 16
SCALE: NONE



50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308

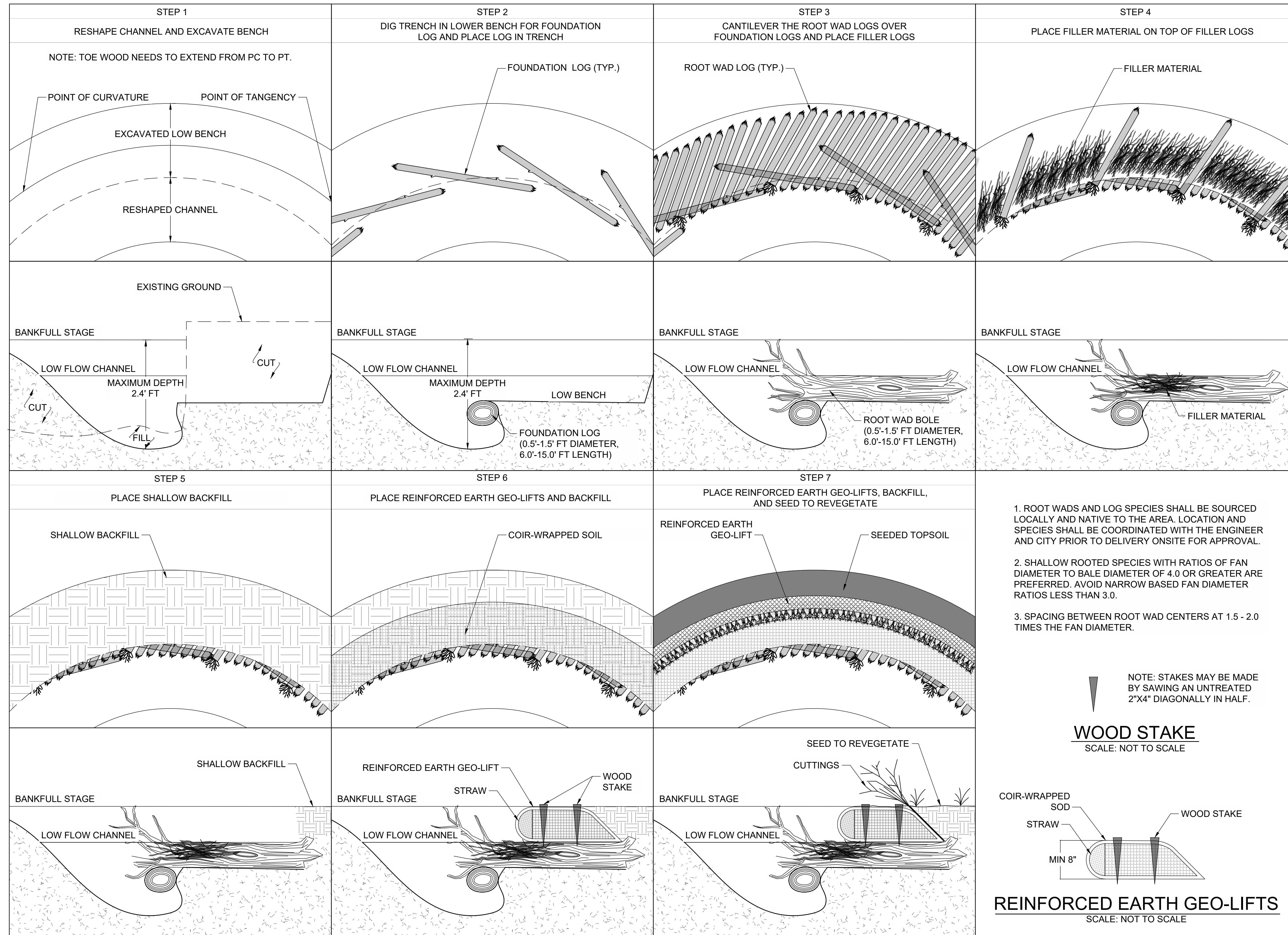
B&N
burgessniple.com

SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

REVISIONS	
NO.	DESCRIPTION

JOB NO: PR61121
DATE: FEB 2025
DESIGNED BY: MRK
DRAWN BY: MLB
CHECKED BY: MRK
APPROVED BY: BWT
SCALE: AS NOTED

WETLAND CROSS SECTIONS 2



TYPICAL TOE WOOD DETAIL
SCALE: NOT TO SCALE

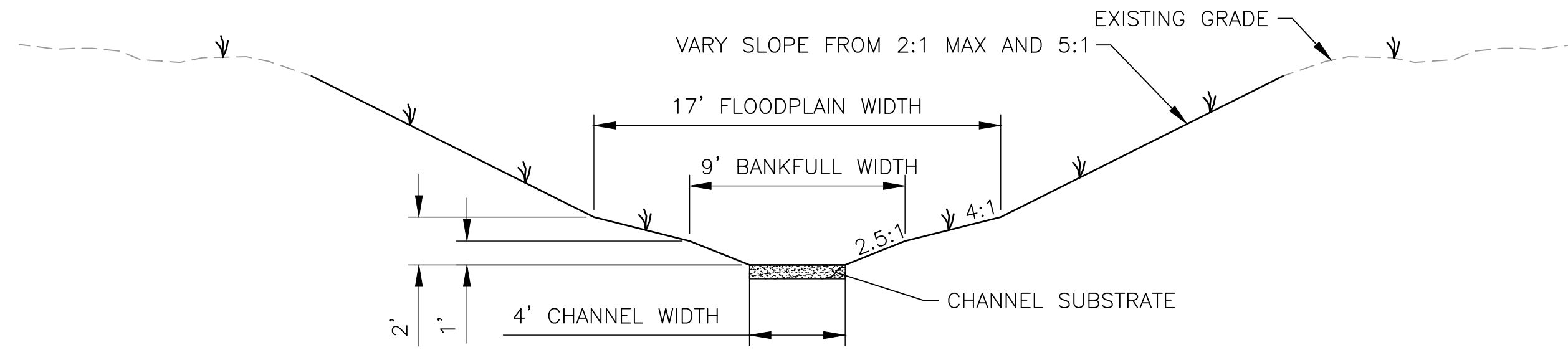
50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308
B&N
burgessniple.com

SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

NO.	DESCRIPTION	REVISIONS	
		DATE	

JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

STREAM DETAILS 1

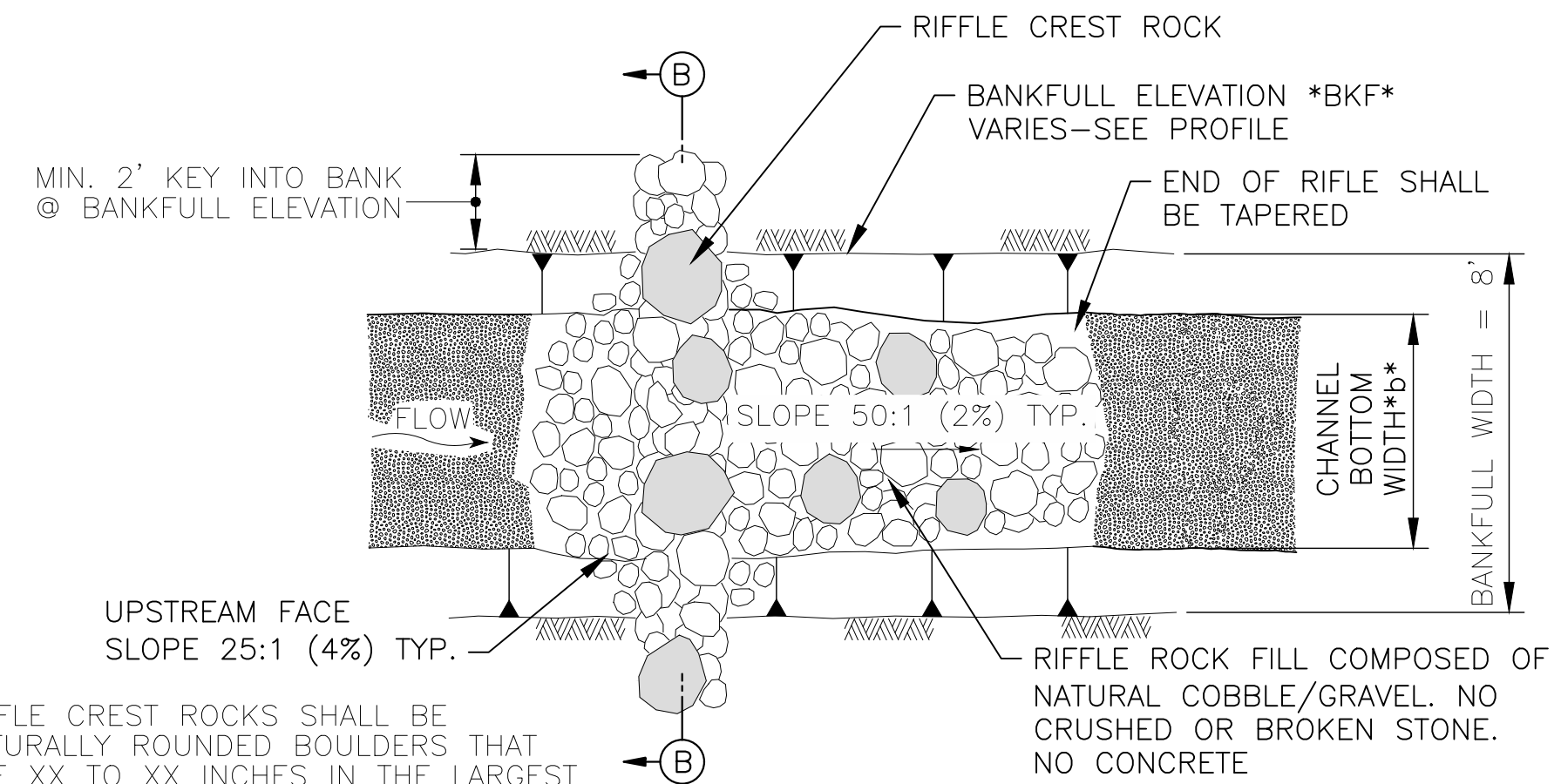


TYPICAL CHANNEL/FLOODPLAIN SECTION
SCALE: 1" = 5'

CONSTRUCTED RIFFLE NOTES:

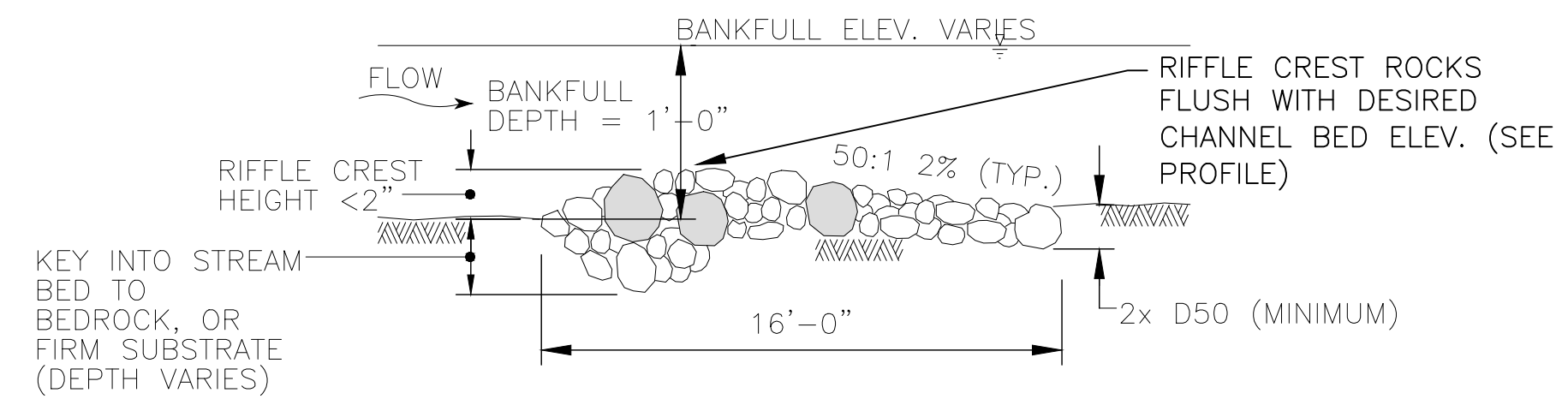
THE FOLLOWING SPECIFICATION IS DESIGNED TO REPLACE AND RESTORE COURSE (GRAVEL, COBBLE, BOULDER AND BEDROCK) SUBSTRATE TO THE STREAM CHANNEL IN CASES WHERE COARSE SUBSTRATES ARE ABSENT FOLLOWING CHANNEL EXCAVATION. THE PURPOSE OF THIS RESTORATION MEASURE IS TO PROVIDE NATURAL SUBSTRATE AND EROSION AND SCOUR PROTECTION IN THE CHANNEL.

1. SUBSTRATES COMPRISED OF GRAVEL (0.08-2.5 INCHES), COBBLE (2.5-10.1 INCHES), AND/OR BOULDER (10.1-80 INCHES), ALSO REFERRED TO IN THIS SPECIFICATION AS COARSE SUBSTRATE OR ALLUVIUM, THAT ARE REMOVED FROM THE STREAM DURING CHANNEL EXCAVATION WILL BE TEMPORARILY STOCKPILED IN A NON-WETLAND/AQUATIC SITE FOR REUSE IN THE RESTORED CHANNEL.
2. SUBSTRATE WILL BE NATURAL IN COLOR (WHITE, BROWN, YELLOW, OR TAN).
3. SUBSTRATE SHALL BE FREE OF IMPURITIES AND CONTAMINANTS.
4. SUBSTRATE SHALL BE NATURAL AND FREE OF SLAG.
5. SIZING IS BASED ON THE B-AXIS OF THE ROCK.
6. FOR GRADING OF POOLS, REUSE EXISTING SITE MATERIAL. OVER 50% OF POOL MATERIAL SHOULD BE HARVESTED GRAVEL SUBSTRATE FROM THE EXISTING STREAM. COMPOSITION OF FINES, INCLUDING SOIL, SILT, AND SAND SHOULD BE LIMITED.

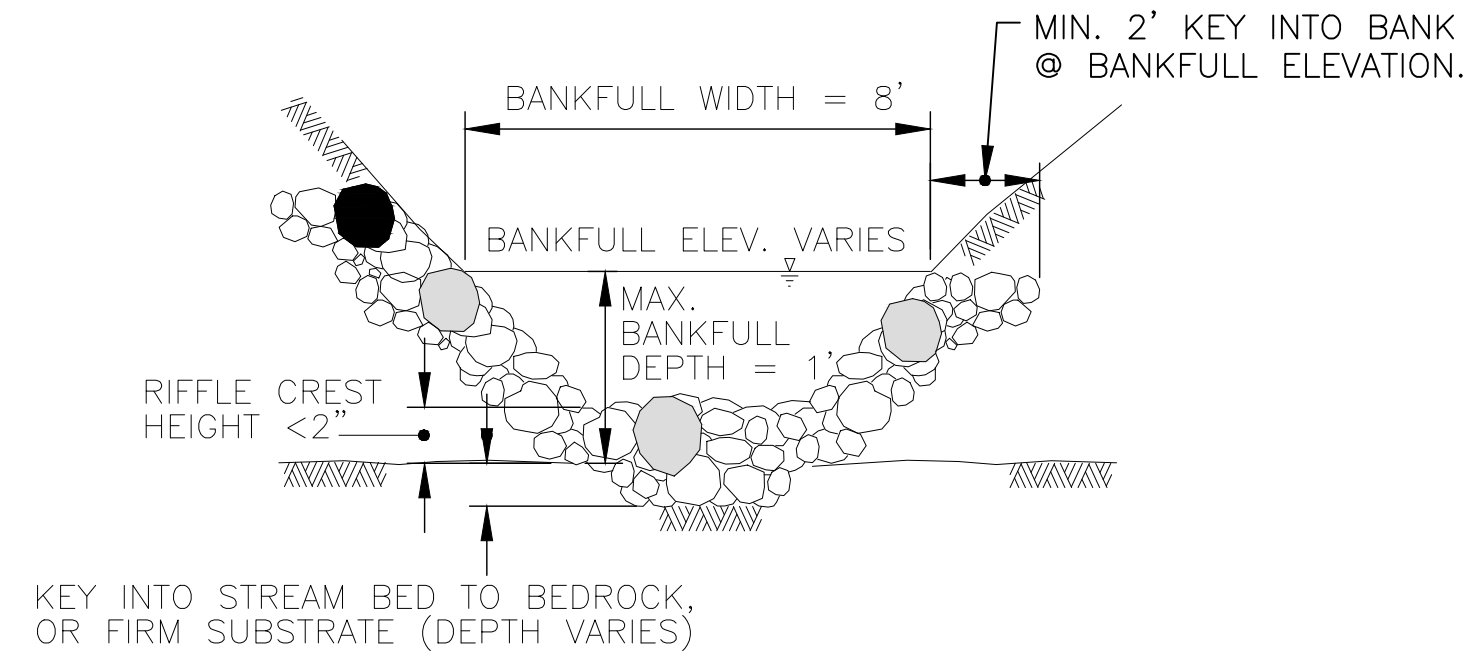


RIFFLE CREST ROCKS SHALL BE NATURALLY ROUNDED BOULDERS THAT ARE XX TO XX INCHES IN THE LARGEST DIMENSION. NO DIMENSION STONE. CONCENTRATE LARGER ROCK RIFFLE MATERIAL AT RIFFLE CRESTS AND IN SUBPAVEMENT. USE NATURAL COBBLE OR BOULDERS. NO CRUSHED OR BROKEN STONE. NO CONCRETE.

RIFFLE STRUCTURE PLAN VIEW



RIFFLE STRUCTURE PROFILE



RIFFLE STRUCTURE SECTION B-B

TYPICAL RIFFLE CONSTRUCTION DETAILS

SCALE: NONE

50 SOUTH MAIN STREET,
SUITE 600
AKRON, OHIO 44308



SUMMIT COUNTY ENGINEER
DRAINAGE STUDY AND IMPROVEMENTS
MARWYCK AND DORWICK DRIVE
NORTHFIELD CENTER TOWNSHIP

NO.	DESCRIPTION	DATE

JOB NO:	PR61121
DATE:	FEB 2025
DESIGNED BY:	MRK
DRAWN BY:	MLB
CHECKED BY:	MRK
APPROVED BY:	BWT
SCALE:	AS NOTED

STREAM DETAILS 2

APPENDIX D

DETAILED COST ESTIMATES

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Improvement Summary

Improvement	TOTAL COST
3.1 North of Marwyck	
Detention Basin - East of Crestwood	\$224,000
Marwyck Dr. - Culvert Crossing	\$116,000
North of Marwyck Dr. -Meandering Ditches	\$47,000
Culvert/Footbridge Removed (North of Marwyck)	\$9,000
Mobilization	\$10,000
Maintenance of Traffic	\$5,000
Bonding	\$5,000
3.1 North of Marwyck Subtotal	\$416,000
3.2 Dorwick and Pickwick	
Dorwick Dr. & Pickwick - Storm Sewer Improvements	\$261,000
Dorwick Dr. & Beacon Hills Blvd. - Storm Sewer Improvements	\$62,000
Culvert/Footbridge Removed (West of Dorwick)	\$6,000
Mobilization	\$10,000
Maintenance of Traffic	\$10,000
Bonding	\$5,000
3.2 Dorwick and Pickwick Subtotal	\$354,000
3.3 Dorwick and Beacon Hills	
Dorwick Dr. - Wetland Creation & Channel Realignment East of Kenwick Dr.	\$136,000
Dorwick Dr. - Daylight Channel at South End	\$16,000
Mobilization	\$4,000
Maintenance of Traffic	\$5,000
Bonding	\$2,000
3.3 Dorwick and Beacon Hills Subtotal	\$163,000
3.4 Wetland Storage	
Dorwick Dr. - Wetland Creation Upstream of VFW Culvert	\$969,000
Mobilization	\$40,000
Maintenance of Traffic	\$5,000
Bonding	\$10,000
3.4 Dorwick and Beacon Hills Subtotal	\$1,024,000
Total	\$1,957,000

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Remove Existing Obstructions (Footbridge/Culvert)

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
202	Culvert/Footbridge Removed (North of Marwyck)	3	EA	\$3,000	\$9,000
202	Culvert/Footbridge Removed (West of Dorwick)	2	EA	\$3,000	\$6,000
				Subtotal	\$15,000
				Contingency (25%)	\$4,000
				Total	\$19,000

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Detention Basin - East of Crestwood

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
203	Earthwork (Excavation/Embankment)	1500	CY	\$50	\$75,000
203	Stone Access Drive	75	CY	\$100	\$7,500
611	Outlet Structure	1	EA	\$20,000	\$20,000
611	Manhole	4	EA	\$6,000	\$24,000
611	36" Conduit	200	FT	\$200	\$40,000
659	Seeding & Mulching	1500	SY	\$2	\$3,000
832	Sediment and Erosion Control	1	LS	\$10,000	\$10,000
				Subtotal	\$179,500
				Contingency (25%)	\$44,500
				Total	\$224,000

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Marwyck Dr. - Culvert Crossing

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
202	Pipe Removed	180	FT	\$25	\$4,500
441	Drive and Pavement Removal & Restoration	60	SY	\$100	\$6,000
601	Concrete Masonry (Headwalls)	24	CY	\$1,000	\$24,000
611	9'x2' Box Culvert (Likely 9x4 with invert buried)	36	FT	\$1,600	\$57,600
				Subtotal	\$92,100
				Contingency (25%)	\$23,900
				Total	\$116,000

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
North of Marwyck Dr. -Meandering Ditches

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
201	Clearing and Grubbing	1	LS	\$10,000	\$10,000
203	Earthwork (Excavation/Embankment)	300	CY	\$50	\$15,000
659	Seed & Mulching	1300	SY	\$2	\$2,600
832	Sediment and Erosion Control	1	LS	\$5,000	\$5,000
N/A	Timber Mats	1	LS	\$5,000	\$5,000
				Subtotal	\$37,600
				Contingency (25%)	\$9,400
				Total	\$47,000

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Dorwick Dr. & Pickwick - Storm Sewer Improvements

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
202	Pipe Removed	350	FT	\$25	\$8,750
441	Drive and Pavement Removal & Restoration	50	SY	\$100	\$5,000
611	Junction Basin	2	EA	\$25,000	\$50,000
611	Catch Basin	5	EA	\$4,000	\$20,000
611	15" Conduit	120	FT	\$100	\$12,000
611	14"x23" Conduit	40	FT	\$200	\$8,000
611	19"x30" Conduit	40	FT	\$250	\$10,000
611	34"x54" Conduit	210	FT	\$450	\$94,500
				Subtotal	\$208,250
				Contingency (25%)	\$52,750
				Total	\$261,000

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Dorwick Dr. & Beacon Hills Blvd. - Storm Sewer Improvements

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
202	Pipe Removed	120	FT	\$25	\$3,000
441	Drive and Pavement Removal & Restoration	100	SY	\$100	\$10,000
611	Catch Basin	2	EA	\$4,000	\$8,000
611	36" Conduit	120	FT	\$240	\$28,800
				Subtotal	\$49,800
				Contingency (25%)	\$12,200
				Total	\$62,000

**DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Dorwick Dr. - Wetland Creation & Channel Realignment East of Kenwick Dr.**

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
N/A	Bankfull Wetland Excavation	1,500	CY	\$50	\$75,000
N/A	Wetland Microtopography/Woody Debris Habitat	1	LS	\$5,000	\$5,000
N/A	Invasive Removal	1.5	AC	\$2,000	\$3,000
N/A	Trees (5-Gallon)	150	EA	\$120	\$18,000
N/A	Live Stakes (Along Stream)	300	EA	\$8	\$2,400
N/A	Riparian Seed Mix/Cover (ERN-178)	1	AC	\$3,800	\$3,800
N/A	Upland Seed Mix/Cover (ERN-155)	0.5	AC	\$2,500	\$1,250
N/A	Ditch Grading	500	FT	\$20	\$10,000
N/A	Timber Matting	1	LS	\$15,000	\$15,000
832	Sediment and Erosion Control	1	LS	\$15,000	\$15,000
				Subtotal	\$108,450
				Contingency (25%)	\$27,550
				Total	\$136,000

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Dorwick Dr. - Daylight Channel at South End

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
202	Pipe Removed	500	FT	\$25	\$12,500
203	Earthwork (Excavation/Embankment) N/A Included in Wetland Creation	0	CY	\$50	\$0
659	Seeding amd Mulching N/A Included in Wetland Creation				
832	Sediment and Erosion Control N/A Included in Wetland Creation				
				Subtotal	\$12,500
				Contingency (25%)	\$3,500
				Total	\$16,000

DRAINAGE STUDY AND IMPROVEMENTS NORTHFIELD CENTER TOWNSHIP
Dorwick Dr. - Wetland Creation Upstream of VFW Culvert

ODOT ITEM	DESCRIPTION	QTY	UNIT	TOTAL UNIT COST	TOTAL COST
N/A	Bankfull Wetland Excavation	12,500	CY	\$50	\$625,000
N/A	Wetland Microtopography/Woody Debris Habitat	1	LS	\$10,000	\$10,000
N/A	Invasive Removal	5	AC	\$2,000	\$10,000
N/A	Trees (5-Gallon)	500	EA	\$120	\$60,000
N/A	Live Stakes (Along Stream)	1000	EA	\$8	\$8,000
N/A	Riparian Seed Mix/Cover (ERN-178)	3	AC	\$3,800	\$11,400
N/A	Upland Seed Mix/Cover (ERN-155)	2	AC	\$2,500	\$5,000
N/A	Ditch Grading	800	FT	\$20	\$16,000
N/A	Timber Matting	1	LS	\$15,000	\$15,000
832	Sediment and Erosion Control	1	LS	\$15,000	\$15,000
				Subtotal	\$775,400
				Contingency (25%)	\$193,600
				Total	\$969,000

APPENDIX E

WATERS INVESTIGATION

Appendix H
Site Photographs



Photo 1: Standing on west side of the small park in northern portion, facing east.



Photo 2: View of the park facing west, standing at the fence on east side.



Photo 3: View of Soil Point 1 within Wetland 1, facing north.



Photo 4: Soil Point 1 in Wetland 1, facing east.



Photo 5: Soil Point 1 in Wetland 1, facing south.



Photo 6: Soil Point 1 in Wetland 1, facing west.



Photo 7: View of the soils from Soil Point 1 from within Wetland 1.



Photo 8: View of Soil Point 2 outside Wetland 2, facing northwest.

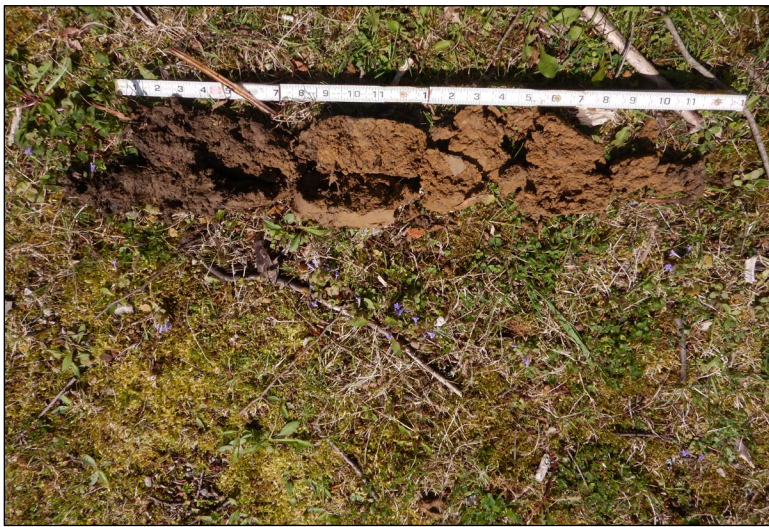


Photo 9: View of the soils from Soil Point 2 outside Wetland 2.



Photo 10: View of Soil Point 3 within Wetland 2, facing west.



Photo 11: Soil Point 3 within Wetland 2, facing south.



Photo 12: Soil Point 3 in Wetland 2, facing east.



Photo 13: Soil Point 3 in Wetland 2, facing north.



Photo 14: View of the soils from Soil Point 3 from within Wetland 2.



Photo 15: Location of Soil Point 4 outside of Wetland 2, facing north.



Photo 16: Looking at the soil from Soil Point 4 from outside Wetland 2.



Photo 17: Standing in middle of Wetland 2, facing west.



Photo 18: Standing in the middle of Wetland 2, facing east.



Photo 19: North, intermittent portion of Stream 1, facing east. Wetland 2 on the left.



Photo 20: Intermittent portion of Stream 1, facing west. Wetland 2 on the right.



Photo 21: North portion for perennial Stream 1, standing at Marwyck Drive and facing north.



Photo 22: Standing at Marwyck Drive and facing south. Facing downstream of Stream 1.



Photo 23: The beginning of Stream 2, facing east.



Photo 24: Middle of Stream 2 between Marwyck and Kenwick, facing east.



Photo 25: Stream 2 before running through a culvert under Dorwick Drive, facing east.



Photo 26: Standing at the culvert on Dorwick Drive viewing downstream Stream 2, facing east.



Photo 27: View of the study area between Pickwick and Kenwick, no water resources found. Photo facing east.



Photo 28: View of the study area between Pickwick and Beacon Hill, facing west. No water resources found.



Photo 29: Standing in the middle of Dorwick Drive, facing north.



Photo 30: Standing in the middle of Dorwick Drive, facing south.



Photo 31: View of the location of Soil Point 5 within Wetland 3, facing north.



Photo 32: Soil Point 5 within Wetland 3, facing east.



Photo 33: Soil Point 5 within Wetland 3, facing south.



Photo 34: Soil Point 5 within Wetland 3, facing west.



Photo 35: View of the soils from Soil Point 5 from within Wetland 3.



Photo 36: View of Soil Point 6 outside Wetland 3, facing west.



Photo 37: View of the soils from Soil Point 6 from outside Wetland 3.



Photo 38: Representative view of Wetland 3, facing north, standing around the central portion of the wetland.



Photo 39: View of the culverts west of the VFW, north of the parking lot that carry Stream 1 under the parking lot to the south. Photo facing east.



Photo 40: Stream 1 facing upstream and north, standing at the curve before the culvert at the VFW.



Photo 41: View of Soil Point 7 within Wetland 3, facing north.



Photo 42: Soil Point 7 in Wetland 3, facing east.



Photo 43: Soil Point 7 in Wetland 3, facing south.



Photo 44: Soil Point 7 in Wetland 3, facing west.

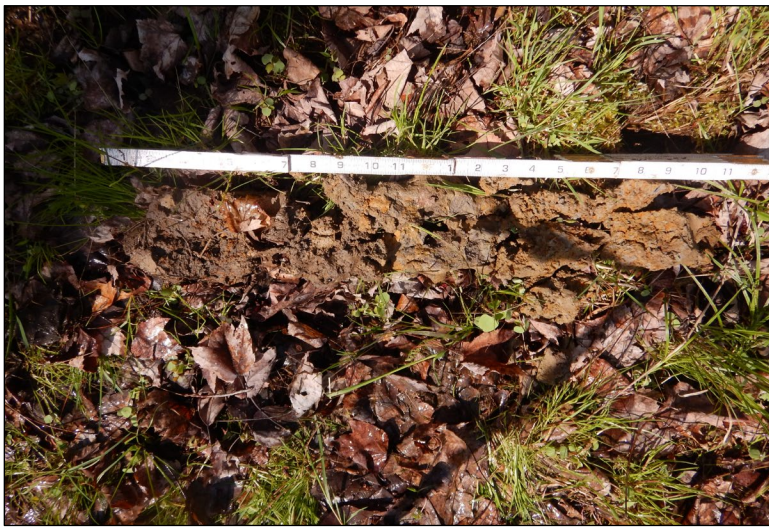


Photo 45: View of the soils from Soil Point 7 from within Wetland 3.



Photo 46: Location of Soil Point 8 outside of Wetland 3, facing north.



Photo 47: View of the soils from Soil Point 8 from outside Wetland 3.



Photo 48: Looking at Soil Point 9 within Wetland 4, facing north.



Photo 49: View of the soils from Soil Point 9 from within Wetland 4.



Photo 50: Looking at Soil Point 10 outside Wetland 4, facing north.



Photo 51: View of the soils from Soil Point 10 from outside Wetland 4.



Photo 52: Standing at north portion of Stream 4 on the east bank, facing upstream and northwest.



Photo 53: Stream 4 facing southwest and downstream.



Photo 54: View of the culverts on the west side of Stream 3, facing north.



Photo 55: Standing at the beginning of the curve in Stream 3, facing north and downstream. Stream curves to the right.



Photo 56: Standing in the middle portion of Stream 3 and facing upstream and west.



Photo 57: View of the southern portion of Stream 1, south of Highland Road. Facing upstream and northeast.



Photo 58: The southern portion of Stream 1, facing downstream and southwest.



Photo 59: View of Stream 5 south of Highland Road. Facing upstream and north.



Photo 60: Stream 5 standing on the west bank, facing east.