May 9, 2025

DNREC Division of Water Resources
Wetlands and Subaqueous Lands
89 Kings Highway
Dover, DE 19901

Dear Mr. Jones:

On behalf of New Castle County (NCC) Department of Public Works, enclosed for your review is a Wetlands and Subaqueous Lands Section Permit Application for the Little Mill Creek Stream Restoration in New Castle County, Delaware (**Attachment A**). The purpose of the project is to restore Little Mill Creek and its tributaries within Woodland Run Park, located in Wilmington, DE (**Attachment B**). The project will provide ecological benefits and help reduce pollutant loading to the Christina River in support of the National Pollutant Discharge Elimination System (NPDES) Phase 1 general permit requirements.

Little Mill Creek Stream Restoration includes modifying the stream channel alignment and morphology while restoring a non-tidal wetland floodplain to manage sheer stress during higher flows. Restoration will result in permanent subaqueous lands impacts including converting stream channels to non-tidal wetlands for channel realignments and floodplain restoration, installing rip-rap and floodplain logs for channel and floodplain stabilization, and filling portions of existing channels to create side slopes for the proposed floodplain. Temporary impacts to subaqueous lands include installing sandbag dikes for stream pump-arounds during construction, and accessing through channels for construction purposes. The proposed channel re-alignments and floodplain restoration will also create new stream channels and non-tidal wetlands within the restored floodplain, and enhance portions of existing stream channels.

The proposed restoration will impact seven subaqueous land features, including five perennial waters, (WUS-A, WUS-B, WUS-D, WUS-F, WUS-M) and two intermittent waters (WUS-I, WUS-C). The project will have 85,374.75 square feet (1.9593 Ac) of permanent open water impacts and 2,845.14 square feet (0.0653 Ac) of temporary open water impacts while creating 41,419.35 square feet (0.9509 Ac) of open water and enhancing 20,038.35 square feet (0.4600 Ac) of open water. The open water impacts are necessary to restore the degraded stream and floodplain as a self-sustaining stream and wetland complex. The restoration will not impact DNREC jurisdictional wetlands. See the Environmental Compliance Plans (Sheets 70 – 80) in **Attachment**

D for impact details and the Natural Resources Inventory Memorandum in **Attachment C** for additional information on the waterway features.

Project Justification and Purpose:

The project will provide ecological enhancement, support the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, and help meet pollutant load reductions associated with the Chesapeake Bay Total Maximum Daily Load (TMDL).

Proposed Project Description:

The project entails restoring 4,815 linear feet of Little Mill Creek and 3,085 linear feet of adjacent tributaries within Woodland Run Park. The design consists of an integrated stream and wetland restoration approach that will lower the existing stream banks and adjacent floodplain to create a stream/floodplain system that is highly connected to groundwater as the existing floodplain width, potentially usable land, and property limits allow. The restoration will provide the following benefits: bank and bed stabilization, channel plan form improvements, floodplain reconnection, flood storage and gradual release of flood flows for reduction of shear stresses and velocities, sediment and carbon retention, groundwater discharge/recharge, wildlife and instream habitat improvements, nutrient trapping and processing, sewer infrastructure protection, wetland creation throughout the restored floodplain, and replacement of degraded riparian buffers with native woody and herbaceous vegetation. In addition to the restoration efforts, a proposed shared use path (SUP) and two new pedestrian bridge crossings are proposed to increase accessibility within Woodland Run Park for pedestrians and bicyclist as well as sanitary sewer maintenance crews .

Discussion of Impacts:

Seven DNREC jurisdictional resources will be impacted by the project, including five perennial streams and two intermittent streams. The subaqueous lands that will be impacted include features WUS-A (Little Mill Creek), WUS-B, WUS-C, WUS-D, WUS-F, WUS-I and WUS-M (Little Falls Creek). WUS-A, WUS-B, and WUS-M will be permanently impacted by channel re-alignments that include the installation of rip-rap underlayment, riffle grade control, clay channel barriers, buried channel/floodplain logs, and imbricated rock. WUS-C, WUS-D, and WUS-I will be permanently impacted by the proposed floodplain restoration and channel grading. WUS-F will be permanently impacted by streambed material that will be placed in the channel to raise the streambed and reconnect the channel to the surrounding floodplain. All the subaqueous land features will be temporarily impacted by construction access and erosion and sediment control (E&S) measures.

See **Attachment C, Appendix F, Natural Resources Inventory Plan** for further details on the subaqueous land features and **Attachment D, Final Design Plans** for more detail regarding the design and impacts.

Watercourse Fill Material Types:

The following materials will be used to fill watercourses for the proposed stream and floodplain restoration. For further design details, see the Final Design Plans in **Attachment D** and the Final Design Report in **Attachment E**.

Buried Channel/Floodplain Log: Tree trunks from native hardwood vegetation or harvested/cut from limbs stripped of leaves and loose bark that has been harvested onsite during construction. Buried logs in the channel will have a minimum trunk diameter of 10 inches and buried logs in the floodplain will have a minimum trunk diameter of 18 inches. The length of the logs shall range from 10 to 35 feet.

Channel Bed Fill: Material will be salvaged from the native channel bed material present at the restoration site. The salvaged channel bed material may consist of, but is not limited to, natural sediments, sand, gravel, pebbles, and small stones.

Clay Chanel Barrier: Clay material from on or off-site that is free of roots, debris, organic or frozen material, and has a maximum clod size of 2 inches at the time of compaction. Clay loam, silty clay loam, sandy clay, silty clay, and or clay may be used (GC, SC, CL, OL, CH or OH by the Unified Soil Classification System).

Large Woody Debris (Root wad): Tree trunks with root wads from native hardwood vegetation that has been harvested onsite during construction. Large woody debris will consist of root wads with a minimum tree trunk diameter of twelve inches and a maximum trunk diameter of eighteen inches and a log or trunk length, not including the root mass, between seven feet and twelve feet.

Boulders & Matrix Stones: Boulders will consist of angular flat rock, and matrix stones will consist of irregular shaped rock. Both materials will be harvested from a commercial quarry operation and will be free of laminations, weak cleavages, and will not disintegrate from the action of air, salt water, and in handling and placing.

Riprap (R-4 to R-6): Riprap will consist of imported material that is hard and durable stone, free from structural defects and foreign substances such as soil, shale, and organic materials.

Discussion of Avoidance & Minimization Alternatives:

The purpose of the project is to restore the degraded conditions of the existing stream channels and wetlands within the project study area to obtain TMDL credit, and therefore impacts to regulated resources are unavoidable. Consideration of alternative sites is not applicable because the goal of the project is to address specific restoration needs at the project site.

The project has focused on minimizing impacts to regulatory resources throughout the design process. Three design alternatives were developed during the concept design stage that were

presented to New Castle County to determine the preferred alternative for the project. The three alternatives were developed based on different floodplain excavation widths, and include the following:

- Alternative 1 – 32 to 135 ft proposed floodplain width
- Alternative 2 – 70 to 225 ft proposed floodplain width
- Alternative 3 – 20 to 115 ft proposed floodplain width

A hybrid of Alternative 1 and 3 was selected to achieve the design goals and objectives of the project. The hybrid approach uses the general limits of restoration as defined by Alternative 3, and expands the limits of restoration where feasible to ensure that required TMDL credits are obtained while minimizing and/or eliminating impacts to existing sewer and park infrastructure. The hybrid alternative also minimizes impacts to natural resources (stream tributaries, non-tidal wetlands, forests, etc.) within the stream corridor due to its narrower floodplain width, while still providing the benefits of the restoration.

Impacts to WUS-A, WUS-B, and WUS-M cannot be minimized because these reaches are the focus of the proposed restoration. These reaches have been severely manipulated by anthropogenic impacts in the watershed, including floodplain encroachment by residential developments, straightening of the historic stream channels, ditching the floodplain for storm drain outfalls, and sewer and gas line construction within the stream valley. The reaches will be re-aligned and reconnected to the restored floodplain to create self-sustainable stream and wetland complexes. Streambed material from the pre-construction channels will be salvaged onsite and placed back into the restored channels. Restoration along these reaches will also include installing rock sills at upstream culvert outfalls, rock underlayment in constricted floodplain areas, riffle grade control and buried logs at stream gradient transitions, and clay barriers to prevent the pre-construction channels from re-forming.

Impacts to WUS-F have been minimized by stabilizing the channel in its existing location. The channel consists of an incised drainage ditch that appears to have been straightened in the past. A channel realignment is not proposed due to the higher quality forest and wetland to the west, and existing roadway/pedestrian trail to the east. The channel will be filled with salvaged streambed material to ensure it has positive drainage to tie into the WUS-A restored floodplain.

WUS-C, WUS-D and WUS-I consist of small ditches (1-3 ft wide) that will be impacted by excavation of the proposed WUS-A floodplain. Impacts to these channels were minimized by selecting a narrower proposed floodplain width (Alternative A). The downstream sections of these channels will be excavated (removed) to create the proposed floodplain, while the upstream banks will be re-graded for stabilization and temporarily impacted for construction access. These channels will drain into the restored WUS-A floodplain and provide a hydrology source to the wetland creation areas.

Coordination with Agencies:

The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPAC) was used to generate a species list for the project on August 28, 2024. The species list identified the potential presence of the candidate species monarch butterfly (*Danaus plexippus*) and the proposed endangered species Tricolored Bat (*Perimyotis subflavus*) within the project study area. Further coordination with USFWS regarding the monarch butterfly and Tricolored bat is not anticipated considering these species are currently not listed and therefore do not have Section 7 requirements.

The national Oceanic and Atmospheric Administration (NOAA) Endangered Species Act (ESA) Section 7 Mapper was used to determine if ESA-listed species or critical habitat is located within the project study area on November 11, 2022. Based on the Section 7 Mapper, no ESA-listed species or critical habitat were identified within the project study area.

An email requesting information on the presence of state rare, threatened, or endangered species within the project study area was sent to the Delaware Department of Natural Resources and Environmental Control (DNREC) on February 21, 2023. A response letter was received from DNREC on March 23, 2023, stating that there are currently no records of state-rare or federally listed plants, animals or natural communities at the project site. As a result, the project does not lie within a State Natural Heritage Site, nor does it lie within a Delaware National Estuarine Research Reserve. A review of DNREC's database revealed that there is no habitat within the project limits that would support the federally-listed threatened bog turtle (*Glyptemys muhlenbergii*), however the stream is a potential migration corridor between habitats and therefore DNREC requested that heavy machinery is kept a minimum of 100 feet away from stream/wetland habitats between March 1st and November 14th. If these conditions cannot be met, a qualified bog turtle surveyor may be required to monitor construction activities.

A letter requesting review of cultural resources within the project study area was sent to the State Historic Preservation Office (SHPO) on March 15, 2023. SHPO responded in a letter dated September 4, 2024, stating that no historic properties or cultural resources will be effected by the project. There are three known historic properties adjacent to the area of potential effect (APE) that will not be impacted by the project and there is one known archaeological site adjacent to the APE, however the site was destroyed by existing residential development.

All agency correspondence can be found in **Attachment C, Appendix B.**

In consideration of the project's scope, NCC Department of Public Works is also submitting information for USACE Nationwide Permit #27. If you have any questions or require additional information, please contact Karl Hellmann at khellman@rkk.com. Thank you for your time and continued cooperation.

Sincerely,

Mathew Nyambega 05/09/2025
Mathew Nyambega
Civil Engineer
New Castle County, Department of Public Works

Enclosures:

- Attachment A – Basic Application Form with Property Deeds
- Attachment B – Location Map
- Attachment C – Natural Resources Inventory Memo with Photo Documentation
- Attachment D – Final Design Plans
- Attachment E – Final Design Report
- Attachment F – Adjacent Property Owner Information

CC: Mike Harris– NCC
Tara Cutillo, Nick Riley, Justin Reel, Karl Hellmann – RK&K

ATTACHMENT A

Basic Application Form
with Property Deeds

WETLANDS AND SUBAQUEOUS LANDS SECTION PERMIT APPLICATION FORM

For Subaqueous Lands, Wetlands, Marina and 401 Water Quality Certification Projects

State of Delaware
Department of Natural Resources and Environmental Control
Division of Water

Wetlands and Subaqueous Lands Section

APPLICATION FOR APPROVAL OF
SUBAQUEOUS LANDS, WETLANDS, MARINA
AND WATER QUALITY CERTIFICATION PROJECTS

Last Revised on: March 28, 2017

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

Application Instructions:

1. Complete each section of this basic application and appropriate appendices as thoroughly and accurately as possible. Incomplete or inaccurate applications will be returned.

2. All applications must be accompanied by a scaled plan view and cross-section view plans that show the location and design details for the proposed project. Full construction plans must be submitted for major projects.

3. All applications must have an original signature page and proof of ownership or permitted land use agreement.

4. Submit an original and two (2) additional copies of the application (total of 3) with the appropriate application fee and public notice fee* (prepared in separate checks) to:

Department of Natural Resources and Environmental Control
Wetlands and Subaqueous Lands Section
89 Kings Highway
Dover, Delaware 19901

*Application and public notice fees are non-refundable regardless of the Permit decision or application status.

5. No construction may begin at the project site before written approval has been received from this office.

Helpful Information:

1.	Tax Parcel Information:	New Castle County	(302) 395-5400
		Kent County	(302) 736-2010
		Sussex County	(302) 855-7878
2.	Recorder of Deeds:	New Castle County	(302) 571-7550
		Kent County	(302) 744-2314
		Sussex County	(302) 855-7785

3. A separate application and/or approval may be required through the Army Corps of Engineers. Applicants are strongly encouraged to contact the Corps for a determination of their permitting requirements. For more information, contact the Philadelphia District Regulator of the Day at (215) 656-6728 or visit their website at: http://www.nap.usace.army.mil/Missions/Regulatory.aspx.

4. For questions about this application or the Wetlands and Subaqueous Lands Section, contact us at (302) 739-9943 or visit our website at: http://www.dnrec.delaware.gov/wr/Services/Pages/WetlandsAndSubaqueousLands.aspx. Office hours are Monday through Friday 8:00 AM to 4:30 PM, except on State Holidays.

APPLICANT'S REVIEW BEFORE MAILING

DID YOU COMPLETE THE FOLLOWING?

X Yes	BASIC APPLICATION
X Yes	SIGNATURE PAGE (Page 3)
X Yes	APPLICABLE APPENDICES
X Yes	SCALED PLAN VIEW
X Yes	SCALED CROSS-SECTION OR ELEVATION VIEW PLANS
X Yes	VICINITY MAP
X Yes	COPY OF THE PROPERTY DEED & SURVEY
X Yes	THREE (3) COMPLETE COPIES OF THE APPLICATION PACKET
X Yes	APPROPRIATE APPLICATION FEE & PUBLIC NOTICE FEE (Separate checks made payable to the State of Delaware)

Submit 3 complete copies of the application packet to:

Department of Natural Resources and Environmental Control
Wetlands and Subaqueous Lands Section
89 Kings Highway
Dover, Delaware 19901

Before signing and mailing your application packet, please read the following:

The Department requests that the contractor or party who will perform the construction of your proposed project, if other than the applicant, sign the application signature page along with the applicant in the spaces provided. When the application is signed by the contractor as well as the applicant, the Department will issue the Permit to both parties. For Leases, the contractor will receive a separate construction authorization that will make them subject to all of the terms and conditions of the Lease relating to the construction

Section 1: Applicant Identification

1. Applicant's Name: Mathew Nyambega
   Mailing Address: 187-A Old Churchman's Rd,
   New Castle, DE 19720
   Telephone #: 302-395-5746
   Fax #:
   E-mail: Mathew.Nyambega@newcastlede.gov

2. Consultant's Name: Karl Hellmann
   Mailing Address: 700 East Pratt Street, Suite 500
   Baltimore, MD 21202
   Company Name: RK&K
   Telephone #: 410-462-9263
   Fax #:
   E-mail: khellmann@rkk.com

3. Contractor's Name: TBD
   Mailing Address:
   Company Name:
   Telephone #:
   Fax #:
   E-mail:

Section 2: Project Description

4. Check those that apply:
☒ New Project/addition to existing project? ☐ Repair/Replace existing structure? (If checked, must answer #16)

5. Project Purpose (attach additional sheets as necessary):

New Castle County (NCC) is proposing to restore Little Mill Creek and tributaries within Woodland Park as a project to provide ecological enhancement, support the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, and help meet pollutant load reductions associated with the Chesapeake Bay Total Maximum Daily Load (TMDL). In addition to the restoration efforts of Little Mill Creek, a proposed shared use path (SUP) and two new pedestrian bridge crossings are proposed to increase accessibility within Woodland Park for sanitary sewer maintenance crews as well as pedestrians and bicyclist.

	A. Boat Docking Facilities		G. Bulkheads		N. Preliminary Marina Checklist
	B. Boat Ramps	X	H. Fill		O. Marinas
	C. Road Crossings		I. Rip-Rap Sills and Revetments		P. Stormwater Management
X	D. Channel Modifications/Dams	X	J. Vegetative Stabilization		Q. Ponds and Impoundments
	E. Utility Crossings		K. Jetties, Groins, Breakwaters		R. Maintenance Dredging
	F. Intake or Outfall Structures		M. Activities in State Wetlands		S. New Dredging

Section 3: Project Location

7. Project Site Address: Woodland Park
   2130 Faulkland Rd
   Wilmington, DE,19805
   County: ☒ N.C. ☐ Kent ☐ Sussex
   Site owner name (if different from applicant):
   Address of site owner:

8. Driving Directions: From I-95, take DE-141 N to Centerville Rd. Take exit 5 from DE-141 N. Turn left onto Hillside Drive. The project area is located behind residential properties between Hillside Drive and Wagoner Drive.
(Attach a vicinity map identifying road names and the project location)

9. Tax Parcel ID Number: 0703510042 Subdivision Name: Woodland

WSLS Use Only: **Permit #s:** _____ _____ _____ _____

Type **SP** ☐ **SL** ☐ **SU** ☐ **WE** ☐ **WQ** ☐ **LA** ☐ **SA** ☐ **MP** ☐ **WA** ☐

Corps Permit: SPGP 18 ☐ **20** ☐ **Nationwide Permit #:** _____ **Individual Permit #**_____
Received Date: _____ **Project Scientist:** _____
Fee Received? Yes ☐ **No** ☐ **Amt: $**_____ **Receipt #:** _____
Public Notice #: _____ **Public Notice Dates: ON** _____ **OFF**_____

Section 3: Project Location (Continued)

10. Name of waterbody at Project Location: Little Mill Creek & Little Falls Creek waterbody is a tributary to: Christina River

11. Is the waterbody: ☐ Tidal ☒ Non-tidal Waterbody width at mean low or ordinary high water 15'-20'

12. Is the project: ☒ On public subaqueous lands? ☐ On private subaqueous lands?*
☐ In State-regulated wetlands? ☒ In Federally-regulated wetlands?

*If the project is on private subaqueous lands, provide the name of the subaqueous lands owner:

(Written permission from the private subaqueous lands owner must be included with this application)

13. Present Zoning: ☐ Agricultural ☒ Residential ☐ Commercial ☐ Industrial ☐ Other

Section 4: Miscellaneous

14. A. List the names and complete mailing addresses of the immediately adjoining property owners on all sides of the project (attach additional sheets as necessary):
See Attachment E

B. For wetlands and marina projects, list the names and complete mailing addresses of property owners within a 1,000 foot radius of the project (attach additional sheets as necessary):
N/A

15. Provide the names of DNREC and/or Army Corps of Engineers representatives whom you have discussed the project with:
None at this time.

A. Have you had a State Jurisdictional Determination performed on the property? ☐ Yes ☒ No
B. Has the project been reviewed in a monthly Joint Permit Processing Meeting? ☐ Yes ☒ No
*If yes, what was the date of the meeting? _____

16. Are there existing structures or fill at the project site in subaqueous lands? ☐ Yes ☒ No
*If yes, provide the permit and/or lease number(s):

*If no, were structures and/or fill in place prior to 1969? ☐ Yes ☒ No

17. Have you applied for or obtained a Federal permit from the Army Corps of Engineers?
☐ No ☒ Pending ☐ Issued ☐ Denied Date: _____

Type of Permit: NWP 27 Federal Permit or ID #: _____

18. Have you applied for permits from other Sections within DNREC?
☒ No ☐ Pending ☐ Issued ☐ Denied Date: _____ Permit or ID #: _____

Type of permit (circle all that apply): Septic Well NPDES Storm Water

Other: _____

Section 5: Signature Page

19. Agent Authorization:

If you choose to complete this section, all future correspondence to the Department may be signed by the duly authorized agent. In addition, the agent will become the primary point of contact for all correspondence from the Department.

I do not wish to authorize an agent to act on my behalf ☐

I wish to authorize an agent as indicated below ☐

I, Mathew Nyambega, hereby designate and authorize Karl Hellmann
(Name of Applicant) (Name of Agent)
to act on my behalf in the processing of this application and to furnish any additional information requested by the Department.

Authorized Agent's Name: Karl Hellmann
Mailing Address: 700 East Pratt Street, Suite 500
Baltimore, MD 21202
Telephone #: 410-462-9263
Fax #:
E-mail: khellmann@rkk.com

20. Agent's Signature:

I hereby certify that the information on this form and on the attached plans are true and accurate to the best of my knowledge. I further understand that the Department may request information in addition to that set forth herein if deemed necessary to appropriately consider this application.

Karl Hellmann
Agent's Signature

4/24/25
Date

21. Applicant's Signature:

I hereby certify that the information on this form and on the attached plans are true and accurate to the best of my knowledge and that I am required to inform the Department of any changes or updates to the information provided in this application. I further understand that the Department may request information in addition to that set forth herein if deemed necessary to appropriately consider this application. I grant permission to authorized Department representatives to enter upon the premises for inspection purposes during working hours.

Mathew Nyambega
Applicant's Signature

05/09/2025
Date

Mathew Nyambega
Print Name

22. Contractor's Signature:

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TBD
Contractor's Name

Date

Print Name

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   E-mail: khellmann@rkk.com

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Corps Permit: SPGP 18 ☐ **20** ☐ **Nationwide Permit #:** _____ **Individual Permit #**_____
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Fee Received? Yes ☐ **No** ☐ **Amt: $**_____ **Receipt #:** _____
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Section 3: Project Location (Continued)

10. Name of waterbody at Project Location: Little Mill Creek & Little Falls Creek waterbody is a tributary to: Christina River

11. Is the waterbody: ☐ Tidal ☒ Non-tidal Waterbody width at mean low or ordinary high water 15'-20'

12. Is the project: ☒ On public subaqueous lands? ☐ On private subaqueous lands?*
☐ In State-regulated wetlands? ☒ In Federally-regulated wetlands?

*If the project is on private subaqueous lands, provide the name of the subaqueous lands owner:

(Written permission from the private subaqueous lands owner must be included with this application)

13. Present Zoning: ☐ Agricultural ☒ Residential ☐ Commercial ☐ Industrial ☐ Other

Section 4: Miscellaneous

14. A. List the names and complete mailing addresses of the immediately adjoining property owners on all sides of the project (attach additional sheets as necessary):
See Attachment E

B. For wetlands and marina projects, list the names and complete mailing addresses of property owners within a 1,000 foot radius of the project (attach additional sheets as necessary):
N/A

15. Provide the names of DNREC and/or Army Corps of Engineers representatives whom you have discussed the project with:
None at this time.

A. Have you had a State Jurisdictional Determination performed on the property? ☐ Yes ☒ No
B. Has the project been reviewed in a monthly Joint Permit Processing Meeting? ☐ Yes ☒ No
*If yes, what was the date of the meeting? _____

16. Are there existing structures or fill at the project site in subaqueous lands? ☐ Yes ☒ No
*If yes, provide the permit and/or lease number(s):

*If no, were structures and/or fill in place prior to 1969? ☐ Yes ☒ No

17. Have you applied for or obtained a Federal permit from the Army Corps of Engineers?
☐ No ☒ Pending ☐ Issued ☐ Denied Date: _____

Type of Permit: NWP 27 Federal Permit or ID #: _____

18. Have you applied for permits from other Sections within DNREC?
☒ No ☐ Pending ☐ Issued ☐ Denied Date: _____ Permit or ID #: _____

Type of permit (circle all that apply): Septic Well NPDES Storm Water

Other: _____

Section 5: Signature Page

19. Agent Authorization:

If you choose to complete this section, all future correspondence to the Department may be signed by the duly authorized agent. In addition, the agent will become the primary point of contact for all correspondence from the Department.

I do not wish to authorize an agent to act on my behalf ☐

I wish to authorize an agent as indicated below ☐

I, Mathew Nyambega, hereby designate and authorize Karl Hellmann
(Name of Applicant) (Name of Agent)
to act on my behalf in the processing of this application and to furnish any additional information requested by the Department.

Authorized Agent's Name: Karl Hellmann
Mailing Address: 700 East Pratt Street, Suite 500
Baltimore, MD 21202
Telephone #: 410-462-9263
Fax #:
E-mail: khellmann@rkk.com

20. Agent's Signature:

I hereby certify that the information on this form and on the attached plans are true and accurate to the best of my knowledge. I further understand that the Department may request information in addition to that set forth herein if deemed necessary to appropriately consider this application.

Karl Hellmann
Agent's Signature

4/24/25
Date

21. Applicant's Signature:

I hereby certify that the information on this form and on the attached plans are true and accurate to the best of my knowledge and that I am required to inform the Department of any changes or updates to the information provided in this application. I further understand that the Department may request information in addition to that set forth herein if deemed necessary to appropriately consider this application. I grant permission to authorized Department representatives to enter upon the premises for inspection purposes during working hours.

Mathew Nyambega
Applicant's Signature

05/09/2025
Date

Mathew Nyambega
Print Name

22. Contractor's Signature:

I hereby certify that the information on this form and on the attached plans are true and accurate to the best of my knowledge, and that I am required to inform the Department of any changes or updates to the information provided in this application. I further understand that the Department may request information in addition to that set forth herein if deemed necessary to appropriately consider this application.

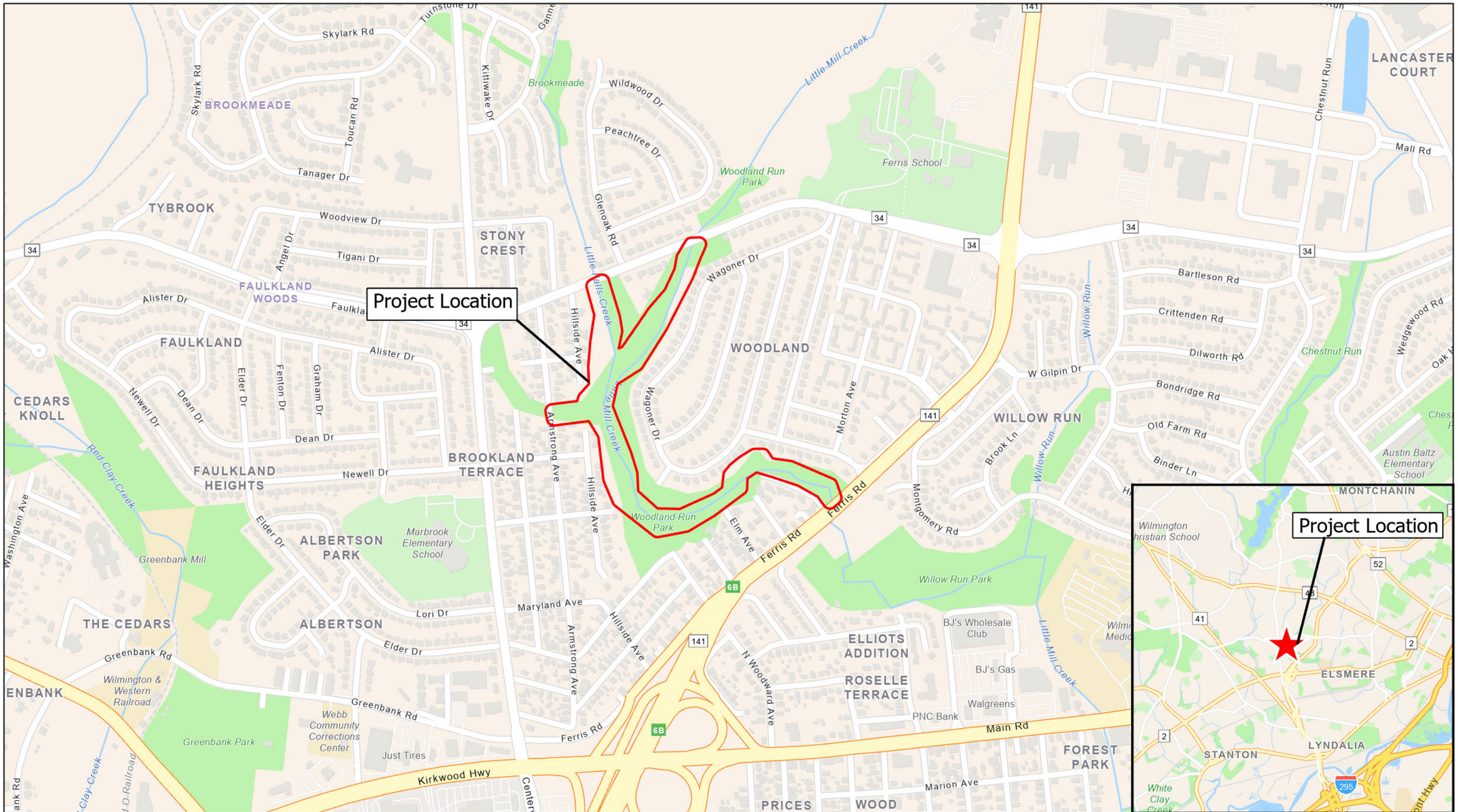
TBD
Contractor's Name

Date

Print Name

ATTACHMENT B

Location Map



Little Mill Creek Restoration at Woodland Park

September 2024

Vicinity Map

LEGEND

Project Study Area

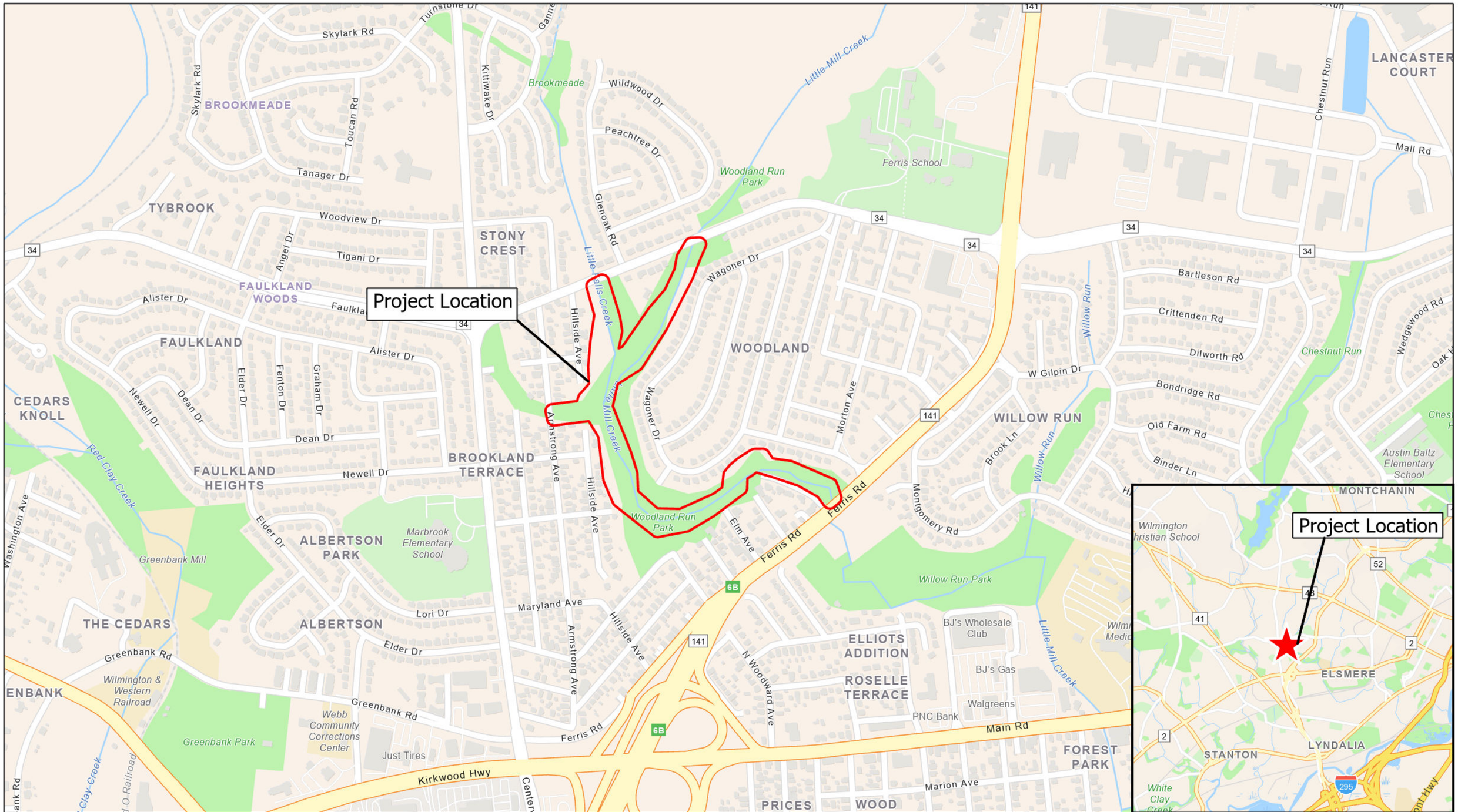
0 325 650 Feet

1 inch = 650 feet

N

ATTACHMENT B

Location Map



Little Mill Creek Restoration at Woodland Park

September 2024

Vicinity Map

LEGEND

Project Study Area

0 325 650 Feet

1 inch = 650 feet

N

ATTACHMENT C

Natural Resources Inventory Memo with Photographic Documentation

700 East Pratt Street, Suite 500
Baltimore, MD 21202
Phone 410.728.2900
www.rkk.com

MEMORANDUM

Date: April 25, 2025

To: New Castle County (NCC)

From: Karl Hellmann – RK&K

CC: Tara Cutillo & Justin Reel – RK&K

Re: Little Mill Creek Restoration at Woodland Park – Natural Resources Inventory

EXECUTIVE SUMMARY

On behalf of New Castle County (NCC), RK&K conducted a Natural Resources Inventory (NRI), including a wetland and waterway delineation, walk-through forest stand characterization, and individual tree inventory within the Little Mill Creek Restoration at Woodland Park project study area in New Castle County, Delaware (**Appendix A, Figures 1 & 2**). The restoration project entails restoring a section of Little Mill Creek and several tributaries within Woodland Park from Faulkland Road downstream to Centre Road (SR 141). The proposed restoration includes approximately 4,815 linear feet of the mainstem, 1,215 linear feet of tributary channels, and 1,870 linear feet of outfall channels.

RK&K Environmental scientists conducted the NRI field work on November 17th, and December 1st and 13th, 2022. RK&K identified one palustrine emergent wetland (PEM), seven Waters of the U.S., six forest stands, 22 specimen trees and nine stand-alone trees within the project study area. Any proposed impacts to wetlands, waters, or subaqueous lands will require coordination with the US Army Corps of Engineers (USACE) and Department of Natural Resources and Environmental Control (DNREC). Impacts to forest stands and specimen trees will require coordination with NCC Department of Land Use.

Supplemental information supporting the NRI is included in **Appendices A** through **F**, as follows:

Appendix A: Figures
Appendix B: Agency Correspondence
Appendix C: Datasheets
Appendix D: Photographic Documentation
Appendix E: Tree Inventory Table
Appendix F: Natural Resources Inventory (NRI) Plan

BACKGROUND INFORMATION

RK&K environmental scientists conducted a desktop investigation of mapped information prior to beginning the field investigation. The desktop investigation of the available mapped information

identified site topography; vegetative cover; tidal and non-tidal waters and wetlands; 100-year floodplains; and hydric and highly erodible soils. Mapped resources reviewed for this project include:

- The United States Geologic Survey (USGS) Topographic Quadrangle Mapping
- The United States Department of Agriculture, Natural Resource Conservation Service (USDA-NRCS) *Web Soil Survey (WSS) for New Castle County, Delaware*
- US Fish and Wildlife Service, National Wetlands Inventory (NWI)
- Delaware Department of Natural Resources and Environmental Control (DNREC) Tidal and Nontidal Wetlands Mapping
- Federal Emergency Management Agency (FEMA) 100-year Floodplain

Desktop investigation results are summarized below:

Geology and Topography

The Little Mill Creek Restoration at Woodland Park is located in New Castle County, DE (**Appendix A, Figure 1**), within the Eastern Mountains and Piedmont physiographic province. The Eastern Mountains and Piedmont physiographic province is composed of hard, crystalline igneous and metamorphic rocks, and extends from the inner edge of the Coastal Plain westward to Catoctin Mountain, the eastern boundary of the Blue Ridge Province. Bedrock in the eastern part of the Piedmont consists of schist, gneiss, gabbro, and other highly metamorphosed sedimentary and igneous rocks of probable volcanic origin. The rocks of the western part of the Piedmont are diverse and include phyllite, slate, marble, and moderately to slightly metamorphosed volcanic rocks. Gently undulating plains underlain by un-metamorphosed bedrock of triassic red shale, siltstone, and sandstone occur in three areas in the western Piedmont. Elevations within the project study area range from 80 to 102 feet above sea level (**Appendix A, Figure 3 & 4**).

Soils

The USDA-NRCS Web Soil Survey for New Castle County, Delaware identified five mapped soil units within the project study area (**Appendix A, Figure 4**). Four highly erodible soils were identified within the project study area, as shown in **Table 1** below. Three non-hydric soil units, one predominantly non-hydric soil unit, and one partially hydric soil unit was mapped within the project study area.

Table 1. Soil Map Units within the Project Study Area

Map Unit Symbol	Map Unit Name	K-factor (Whole Soil) *	Drainage Class	Hydric Rating**	
DcB	Delanco-Codorus-Hatboro complex, 0 to 8 percent slopes, flooded	.37 (HE)	Moderately well drained	25	Predominantly Non-Hydric
ErB	Elsinboro-Delanco-Urban land complex, 0 to 8 percent slopes	.49 (HE)	Well drained	0	Non-Hydric
GhB	Glenelg-Wheaton-Urban land complex, 0 to 8 percent slopes	.28	Well drained	0	Non-Hydric
Hw	Hatboro-Codorus complex, 0 to 3 percent slopes, frequently flooded	.37 (HE)	Poorly drained	50	Partially Hydric
NxB	Neshaminy-Urban land complex, 0 to 8 percent slopes	.37 (HE)	Well drained	0	Non-Hydric

**Erodibility Coefficient – Value assigned to soil types by NRCS. K > 0.35 are considered to be highly erodible (HE) soils.*

***Hydric Rating – Value is based on the percentage of hydric soils within the soil type. Non-hydric soils have a value of 0, predominantly non-hydric soils have a value between 0 and 33, partially hydric soils have a value between 33 and 66, predominantly hydric soils have a value between 66 and 99, and hydric soils have a value of 100.*

Wetlands and Waters of the United States

The project is located in the Brandywine-Christina (02040205) 8-digit watershed. DNREC mapping identified Little Mill Creek (R4SBC) and Little Falls Creek (R4SBC) within the project study area. NWI mapping identified one stream (R4SBC) within the project study area (**Appendix A, Figure 5**).

100-Year Floodplain

The lower half of the project study area falls within the 100-year floodplain according to Federal Emergency Management Agency (FEMA) GIS data for New Castle County (**Appendix A, Figure 5**). Most of the lower half of the project study area is in Zone AE (Base Flood Elevations determined) and the upper half is within Zone A (Special Flood Hazard Area). Part of the project study area is in Zone X with a 0.2% chance of annual flood hazard.

Rare, Threatened, and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPAC) was used to generate a species list for the project on January 15, 2025. The tricolored bat (*Perimyotis subflavus*) and monarch butterfly (*Danaus plexippus*) were identified on the species list. The monarch butterfly and tricolored bat are candidate and proposed endangered species, respectively, and therefore do not currently have Section 7 requirements. The Northern Long-eared Bat and Tricolored Bat Range-wide Determination Key was also completed for the project on January 15, 2025, resulting in a determination of "May Affect". However, no further coordination with USFWS is anticipated for the tricolored bat considering the species is currently not listed and there is no winter habitat for hibernating bats within the project study area. The USFWS species list is included in **Appendix B**.

On November 30, 2022, the National Oceanic and Atmospheric Administration (NOAA) Endangered Species Act (ESA) Section 7 Mapper and Essential Fish Habitat (EFH) Mapper were used to determine if ESA-listed species, critical habitat, or essential fish habitat is located within the project study area. Based on the Section 7 and EFH Mapper, no ESA-listed species, critical habitat, or essential fish habitat were identified within the project study area. The Section 7 and EFH Mapper results are included in **Appendix B**.

An email requesting information on the presence of rare, threatened, or endangered species within the project study area was sent to the Delaware Department of Natural Resources and Environmental Control (DNREC) on February 21, 2023. A response was received on March 23, 2023, stating that there are currently no records of state-rare or federally listed plans, animals or natural communities within the project study area. At present, the project does not lie within a State Natural Heritage site, nor does it lie within a Delaware National Estuarine Research Reserve. Although there is no bog turtle habitat within the study area, Little Mill Creek connects known bog turtle habitats. Due to the stream being a potential migration corridor between habitats, DNREC requests that heavy machinery be kept a minimum of 100 feet away from stream/wetland habitats between March 1st and November 14th. If these conditions cannot be met, a qualified bog turtle surveyor may be required to monitor construction activities. The division of Fish and Wildlife does not have fish community data for the project study area; however, it is unlikely that habitat occurs in the project site that would support anadromous fish species. No time of year restrictions or other measures are required for these species or for resident gamefish species.

Cultural Resources

A letter requesting review of cultural resources within the project study area was sent to the State Historic Preservation Office (SHPO) on March 15, 2023. SHPO responded in a letter dated September 4, 2024, stating that no historic properties or cultural resources will be affected by the project. There are three known historic properties adjacent to the area of potential effect (APE) that will not be impacted by the project and there is one known archeological site adjacent to the APE, however the site was destroyed by existing residential development. Agency correspondence documents can be found in **Appendix B**.

WETLAND DELINEATION – FIELD INVESTIGATION

Methods

A team of two environmental scientists delineated waters of the U.S., including wetlands, within the project study area, and completed the applicable data form for each delineated feature. Each delineated feature was given a unique identifier and photographed. Boundary points were identified for each wetland feature, marked with pink flagging, and numbered consecutively. Wetland boundary point positions were located in the field using a sub-meter GPS unit, and all waterway boundaries were delineated using traditional field survey.

Wetlands were delineated in accordance with the *U.S. Army Corps of Engineers Wetlands Delineation Manual, Y-87-I* (Environmental Laboratory, 1987), U. S. Army Corps of Engineers. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Piedmont Plateau Region Version 2.0,* ed. J.F. Berkowitz, J.S. Wakeley, R.W. Lichvar, C.V. Noble. ERDC/EL TR-12-9. Vicksburg, MS: U.S. Army Engineer Research and Development Center. Routine wetland determination methods with onsite inspection were used to determine the presence of wetlands in the project study area.

Waters of the U.S., other than wetlands, were delineated using the limits defined in 33 C.F.R. § 328 at the time of delineation. The boundaries of non-tidal waters of the U.S. other than wetlands were set at the ordinary high-water mark (OHW). The OHW was determined in the field using physical characteristics established by the fluctuations of water (e.g., change in plant community, changes in the soil character, shelving) in accordance with U.S. Army Corps of Engineers Regulatory Guidance Letter No. 05-05.

Results

RK&K conducted a wetland and waterway delineation within the project study area on November 17th and December 13th, 2022. Seven waterways and one palustrine emergent wetland were identified within the project study area. Summary information on each delineated feature is included in **Tables 2** and **3**. Datasheets and photographs of each delineated feature are included in **Appendices C** and **D**, respectively, and the locations of the delineated features are displayed on the FSD Plans in **Appendix F**.

Table 2. Waterway Features within the Project Study Area

Feature ID	Hydrologic Class	Upstream Connectivity	Downstream Connectivity	Length (LF)	Area (SF)	NRI Plan Map #
WUS-A	Perennial	Outside of Study Area	Outside of Study Area	10,697	95,584	1 - 5
WUS-B	Perennial	Outside of Study Area	WUS-A	941	3,354	3
WUS-C	Intermittent	Outside of Study Area	WUS-A	509	1,059	3 - 4
WUS-D	Perennial	Outside of Study Area	WUS-A	365	925	4
WUS-F	Perennial	Outside of Study Area	WUS-A	1,690	4,928	4
WUS-I	Intermittent	Culvert Outfall	WUS-A	142	113	5
WUS-M	Perennial	Outside of Study Area	WUS-A	2,018	13,076	1-2

Table 3. Wetlands within the Project Study Area

Feature ID	NWI Classification	Hydrologic Connectivity	Area (SF)	NRI Plan Map #
WET-E	PEM	WUS - D	1,094	4

FOREST STAND CHARACTERIZATION & TREE INVENTORY – FIELD INVESTIGATION

Methods

RK&K conducted a walkthrough forest stand characterization within the project study area. Forest stands were identified and delineated in accordance with the New Castle County Code Chapter 40 Amendment, January 26, 2021 that defines a forest as "*An area covered by canopy of trees, covering a continuous land area of at least 1.0 acre or greater in size. Forests do not include trees planted and grown for commercial purposes, and do not include canopy cover over existing structures.*" Forest stands were characterized based on community type, successional stage, and overall condition. Stands were visually assessed, and data collected for each forest stand included size class, dominant canopy species, common understory and herbaceous species, presence and abundance of invasive species, and overall condition.

A tree inventory was conducted within the project study area in accordance with the New Castle County Code Chapter 40 Amendment, January 26, 2021. All individual or groups of trees with a DBH (diameter at breast height) equal to or greater than 16 inches (including specimen trees) located outside forested areas were inventoried. The County Code defines Specimen trees as "Trees listed in the State Big Trees Program, or trees in good health that are not in woodland but have diameters in excess of twenty-four (24) inches DBH. The tree species, DBH, and condition were recorded for each of the inventoried trees. The condition of the tree was assessed by an ocular estimation of growth form, visible signs of decay, live crown ratio, and indications of disease or insect infestation. Each inventoried tree was numbered consecutively. Data obtained from the field reconnaissance was collected with an iPad and the tree locations were inventoried with a GPS unit with sub-meter accuracy.

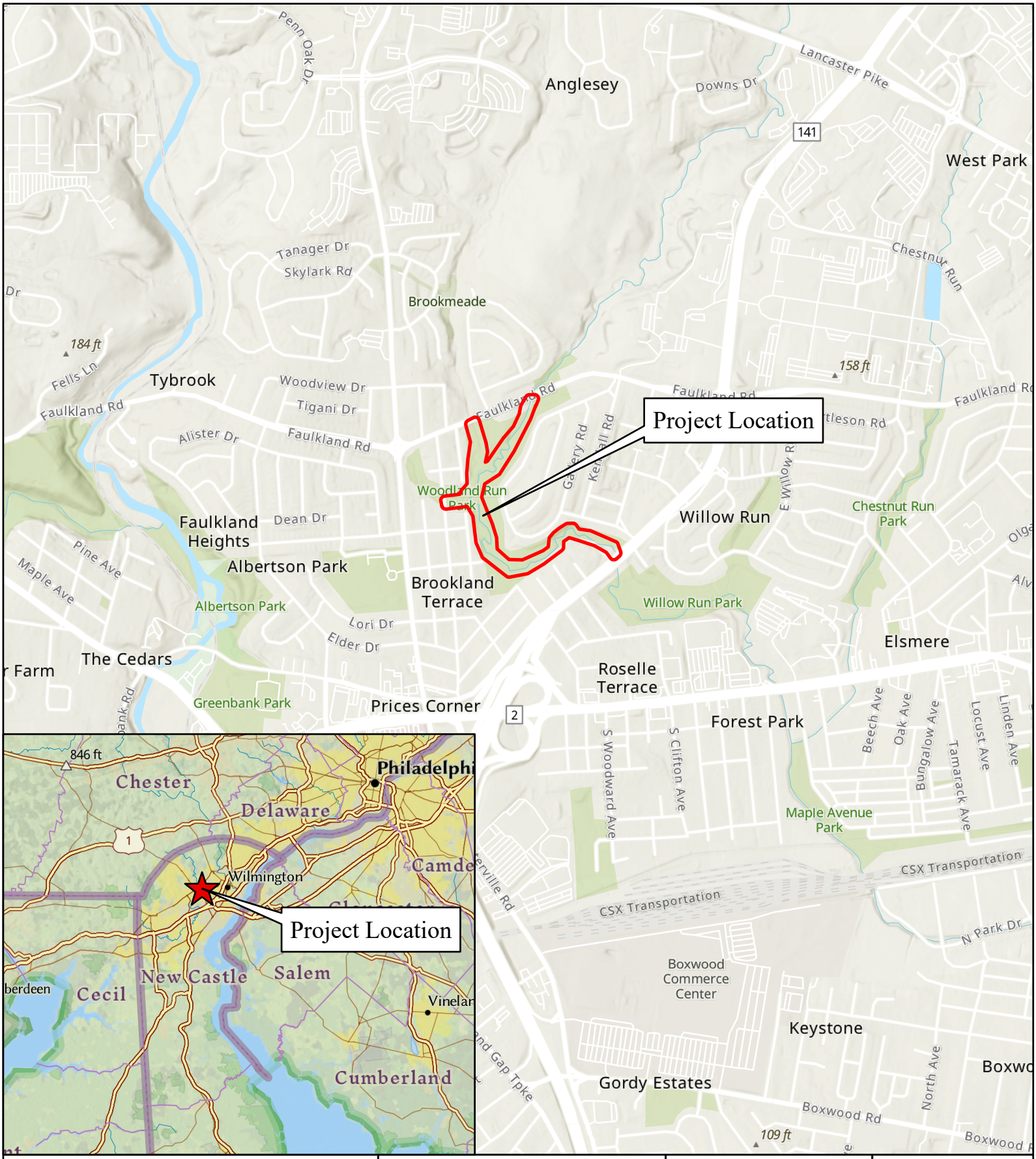
Results

RK&K conducted a walkthrough forest stand characterization and tree inventory within the project study area on December 1st and 13th, 2022. Six forest stands, nine stand-alone trees, and twenty-two specimen trees were identified within or directly adjacent to the project study area and are shown on the NRI Plans in **Appendix F.** Forest stand characterization results are summarized in **Table 4** on the following page. Photographs of each forest stand are included in **Appendix D** and a Tree Inventory Table is included in **Appendix E**.

Table 4. Forest Stands within the Project Study Area

Stand ID	Forest Association	Size Class (DBH)	Dominant Canopy Species	Common Understory Species	Common Herbaceous Species	Invasive Cover	Condition	Acreage in Study Area	NRI Plan Sheet #
FS1	Sycamore-Green Ash-Box Elder-Silver Maple	20-30	Green ash, red maple	Wineberry, spicebush, bush honeysuckle, multi-flora rose	Tall fescue, ground ivy, wild onion, English ivy, calico aster	High	Fair/Poor	5.40	1 – 3
FS2	Beech-Sugar Maple	20-30	American beech, green ash, black cherry	American holly, multi-flora rose, burning bush, spicebush	English ivy, Japanese honeysuckle, wild onion	High	Fair	0.45	4
FS3	Northern Red Oak	12-20	Northern red oak, tulip poplar	American beech, sweet cherry, burning bush, bush honeysuckle	English ivy, Christmas fern, Pachysandra	High	Fair	0.73	4 - 5
FS4	Silver maple-Sycamore	20-30	Silver maple, black walnut	Paper mulberry, privet, multi-flora rose, green briar, bush honeysuckle	English ivy, tall fescue, Japanese knotweed, ground ivy	High	Fair/Poor	0.82	5
FS5	Red Maple	20-30	Red maple, American sycamore, silver maple, green ash	Multi-flora rose, wineberry	Tall fescue, wild onion, English ivy, poison ivy, Japanese honeysuckle	High	Fair/Poor	2.49	1 - 2
FS6	Sycamore-Green Ash-Box Elder-Silver Maple	20-30	Green ash	Wineberry, bush honeysuckle, multi-flora rose	Tall fescue, ground ivy, wild onion, English ivy	High	Poor	4.16	3 - 5

Appendix A – Figures



Little Mill Creek Restoration at Woodland Park

Figure 1. Vicinity Map

Wilmington, DE

Legend

Project Study Area

N

W E

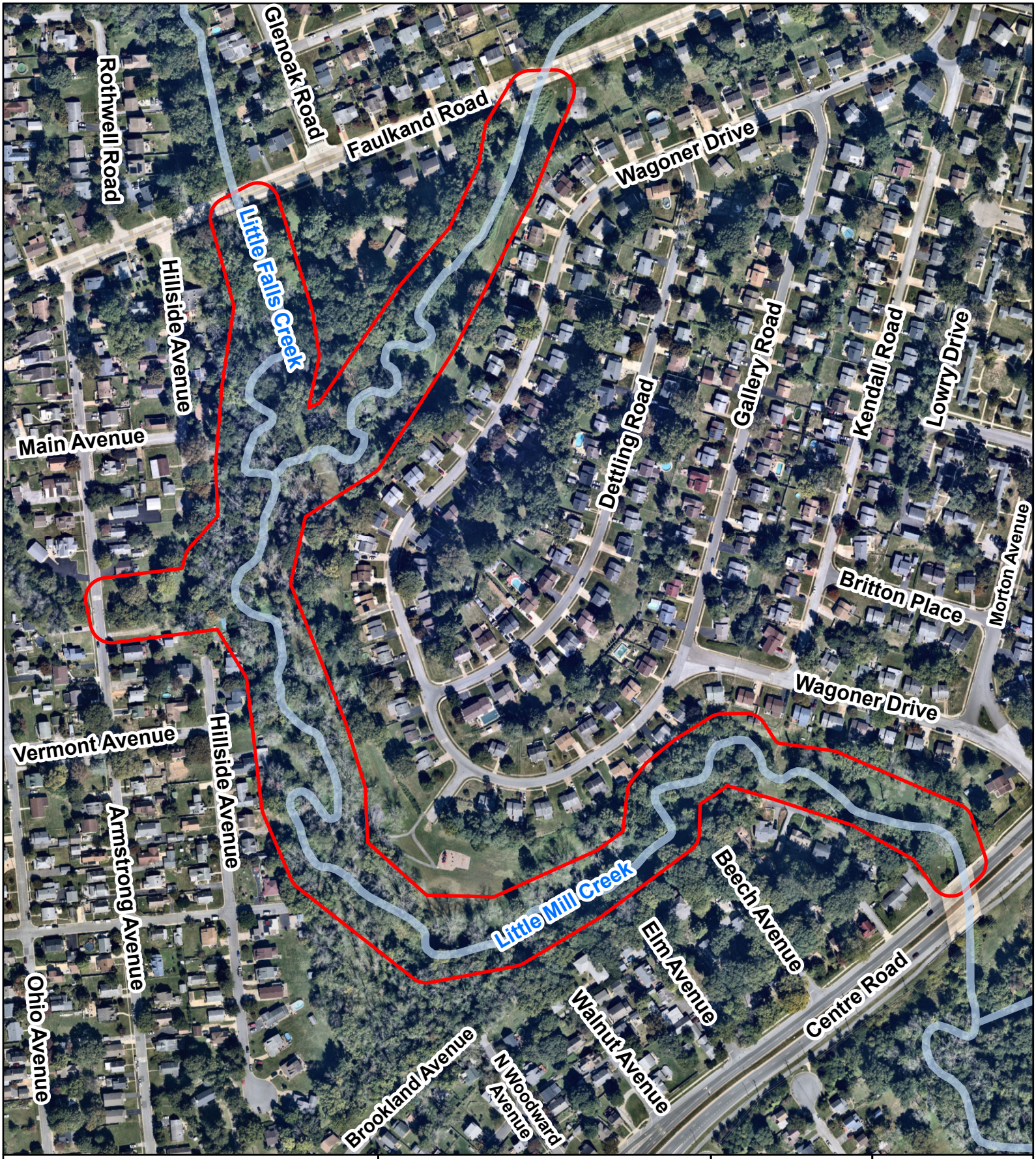
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1 inch = 1,500 feet

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Figure 2. Location Map

Wilmington, DE

Legend

Project Study Area

Streams

N

W E

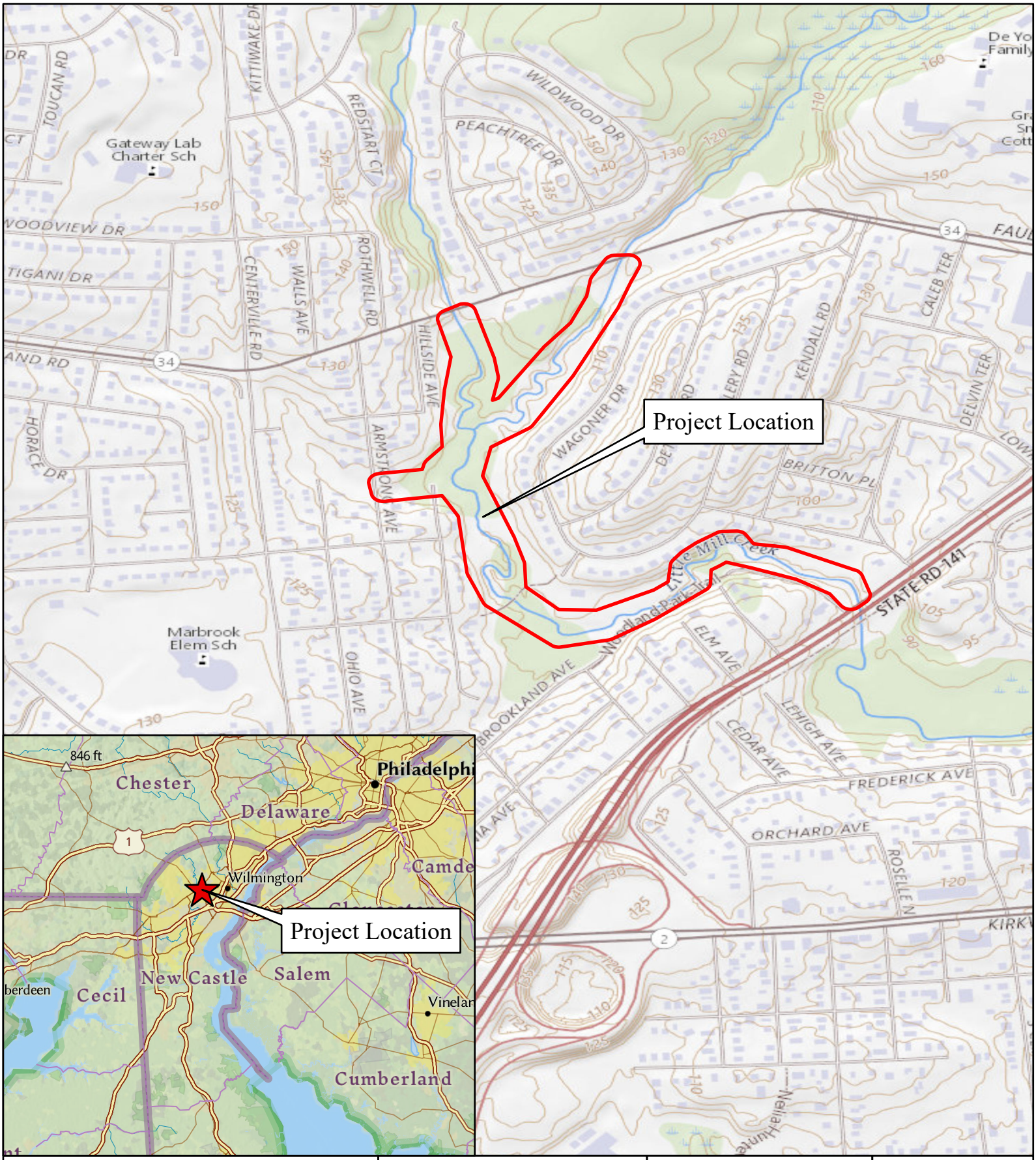
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1 inch = 300 feet

New Castle County 1673 Delaware

RK&K



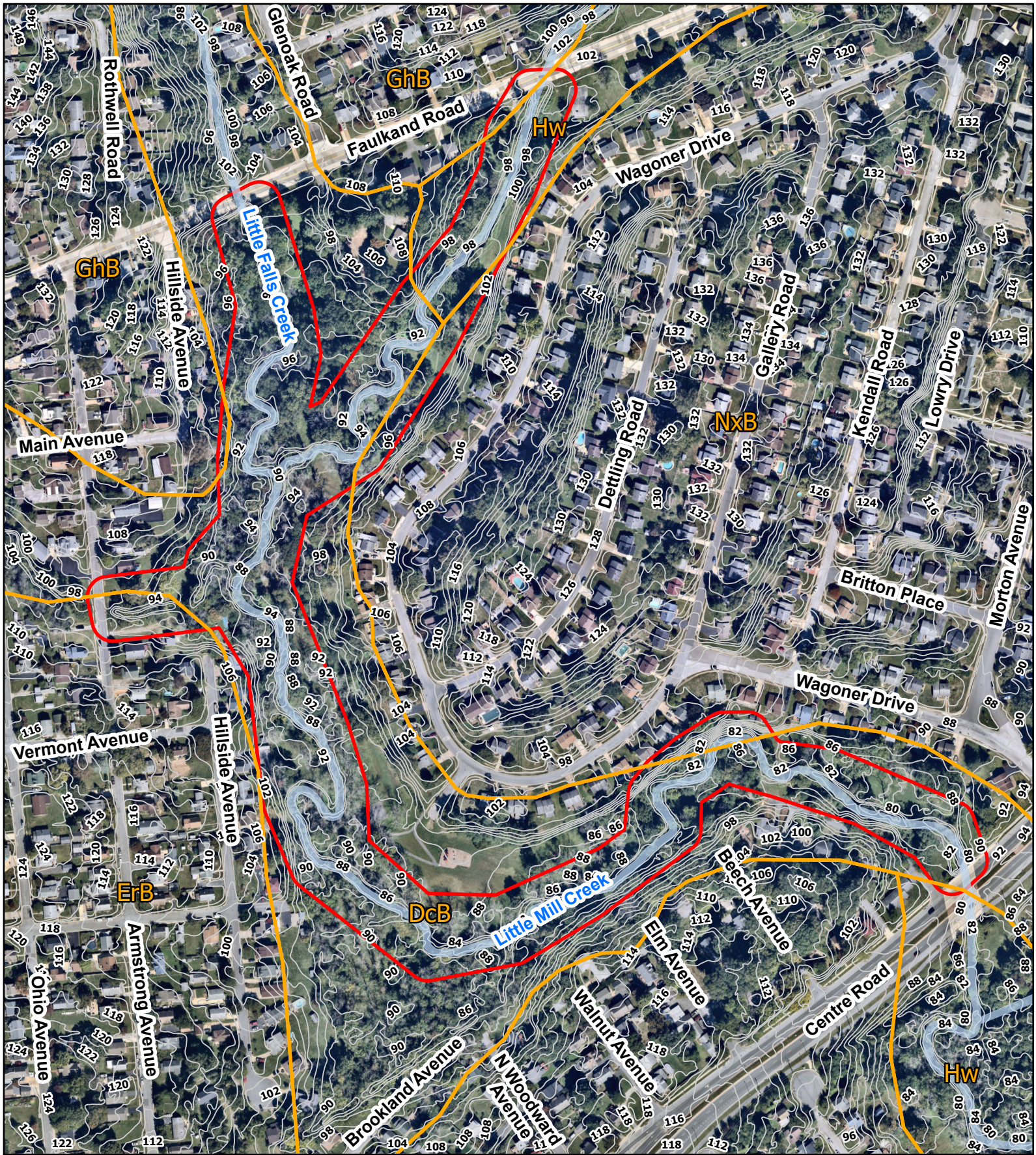
Little Mill Creek Restoration at Woodland Park

Figure 3. USGS Topo Map

Wilmington, DE

Legend

Project Study Area



Little Mill Creek Restoration at Woodland Park

Figure 4. Soils and Topography Map

Wilmington, DE

Legend

- Project Study Area
- Streams
- 2 ft Contours
- Soil Boundaries

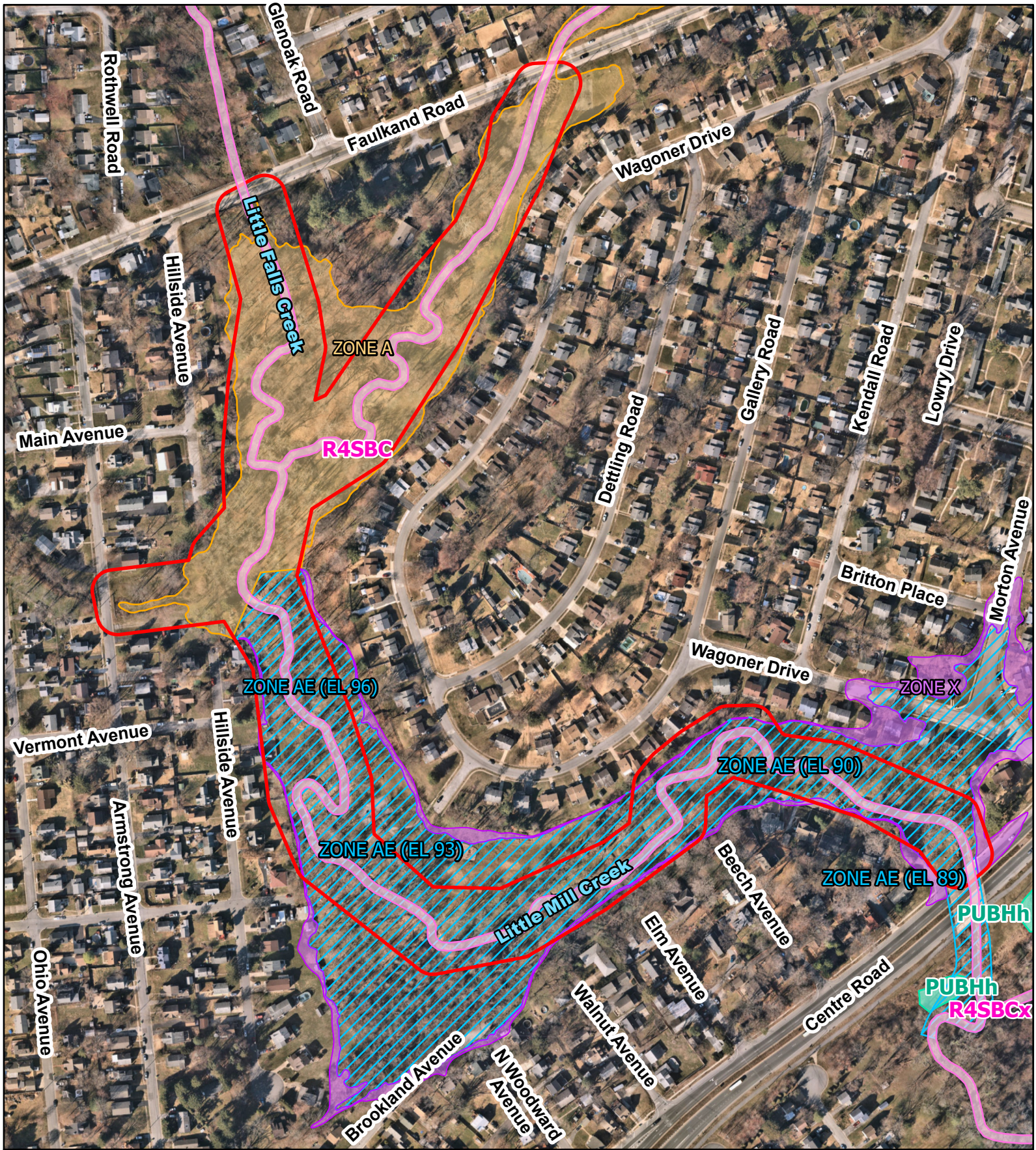
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1 inch = 300 feet

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Figure 5. Environmental Features Map

Wilmington, DE

Legend

- Project Study Area
- DNREC Wetlands and Waters
- NWI Wetlands and Waters
- FEMA Flood Zone AE
- FEMA Flood Zone A
- FEMA Flood Zone X

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0 150 300

1 inch = 300 feet

New Castle County 1673 Delaware

RK&K

Appendix B – Agency Correspondence

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF FISH & WILDLIFE
RICHARDSON & ROBBINS BUILDING
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

DIRECTOR'S OFFICE

PHONE
(302) 739-9910

March 23, 2023

Christina Kundrat
700 East Pratt Street
Suite 500
Baltimore, MD 21202

Re: RK&K 2023 Little Mill Creek Restoration, Tax Parcel # 0703510042

Dear Christina:

Thank you for contacting the Species Conservation and Research Program (SCRP) about information on rare, threatened and endangered species, unique natural communities, and other significant natural resources as they relate to the above referenced project.

State Natural Heritage Site
A review of our database indicates that there are currently no records of state-rare or federally listed plants, animals or natural communities at this project site. As a result, at present, this project does not lie within a State Natural Heritage Site, nor does it lie within a Delaware National Estuarine Research Reserve which are two criteria used to identify "Designated Critical Resource Waters" in the Army Corps of Engineers (ACOE) Nationwide Permit General Condition No. 22. A copy of this letter shall be included in any permit application or pre-construction notification submitted to the Army Corps of Engineers for activities on this property.

Bog Turtle
The following comments have been developed in coordination with the U.S. Fish and Wildlife Service:

A review of our database and GIS revealed that there is no habitat within the project limits that would support the federally-listed threatened bog turtle (*Glyptemys muhlenbergii*).

Although there is no bog turtle habitat at this project site, Little Mill Creek connects known bog turtle habitats. Because this stream is a potential migration corridor between habitats, we request that heavy machinery is kept a minimum 100 ft away from stream/wetland habitats between March 1st and November 14th (please note that this time restriction is standard for the bog turtle activity season when work is proposed near known bog turtle populations). As long as these

conditions are met, we determine that there will be no impact to bog turtles. If these conditions cannot be met, a qualified bog turtle surveyor may be required to monitor construction activities.

Please contact Nate Nazdrowicz at Nathan.Nazdrowicz@delaware.gov or (302) 735-8688 for further guidance.

Fisheries
The Division of Fish and Wildlife does not have fish community data for the project location. However, it is unlikely that habitat occurs in the project site that would support anadromous fish species. No time of year restrictions or other measures are requested for these species or for resident gamefish species.

We are continually updating our records on Delaware's rare, threatened and endangered species, unique natural communities and other significant natural resources. If the start of the project is delayed more than a year past the date of this letter, please contact us again for the latest information.

Please feel free to contact me with any questions or if you require additional information.

Sincerely,



Danielle Ellis
Environmental Review Coordinator
Phone: (302) 223-2446
6180 Hay Point Landing Road
Smyrna, DE 19977

(See invoice on next page)

INVOICE - PAYMENT DUE

It is our policy to charge a fee for this environmental review service. This letter constitutes an invoice for $35.00 ($35.00/hour for a minimum of one hour). Please make your check payable to "Delaware Division of Fish and Wildlife" and submit to:

DE Division of Fish and Wildlife
97 Commerce Way
Suite 106
Dover, DE 19901
ATTN: DFW Fiscal

In order for us to properly process your payment, you must reference "RK&K 2023 Little Mill Creek Restoration**" on your check.**

cc: Division of Fish and Wildlife Fiscal (dnrec_dfw_payroll@delaware.gov); Code to 72900
Kathleen Cullen, USFWS (Kathleen_Cullen@fws.gov)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127

In Reply Refer To: 01/15/2025 16:04:08 UTC
Project Code: 2025-0042488
Project Name: Little Mill Creek Restoration at Woodland Park

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
(410) 573-4599

PROJECT SUMMARY

Project Code: 2025-0042488

Project Name: Little Mill Creek Restoration at Woodland Park

Project Type: Restoration / Enhancement of Waterbody

Project Description: New Castle County (NCC) identified the restoration of Little Mill Creek and tributaries within Woodland Park as a project to provide ecological enhancement, support the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, and help meet pollutant load reductions associated with the Christina River Total Maximum Daily Load (TMDL). The project includes Little Mill Creek and its tributaries beginning at Faulkland Road and extending downstream to Centre Road (SR 141). The project entails restoring 4,814 linear feet of Little Mill Creek and 3,085 linear feet of adjacent tributaries within Woodland Run Park. The design consists of an integrated stream and wetland restoration approach that will lower the existing stream banks and adjacent floodplain to create a stream/floodplain system that is highly connected to groundwater as the existing floodplain width, potentially usable land, and property limits allow.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.7448282,-75.62060317328928,14z



Counties: New Castle County, Delaware

ENDANGERED SPECIES ACT SPECIES

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

RIVERINE

- R4SBC

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: George Carney
Address: 700 East Pratt Street, Suite 500
City: Baltimore
State: MD
Zip: 21202
Email gcarney@rkk.com
Phone: 4102947780

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127

In Reply Refer To: 01/15/2025 16:10:29 UTC
Project code: 2025-0042488
Project Name: Little Mill Creek Restoration at Woodland Park

Federal Nexus: yes
Federal Action Agency (if applicable): Army Corps of Engineers

Subject: Technical assistance for 'Little Mill Creek Restoration at Woodland Park'

Dear George Carney:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on January 15, 2025, for 'Little Mill Creek Restoration at Woodland Park' (here forward, Project). This project has been assigned Project Code 2025-0042488 and all future correspondence should clearly reference this number. **Please carefully review this letter. Your Endangered Species Act (Act) requirements are not complete.**

Ensuring Accurate Determinations When Using IPaC

The Service developed the IPaC system and associated species' determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into IPaC must accurately represent the full scope and details of the Project. **Failure to accurately represent or implement the Project as detailed in IPaC or the Northern Long-eared Bat and Tricolored Bat Range-wide Determination Key (Dkey), invalidates this letter.**

Determination for the Northern Long-Eared Bat and Tricolored Bat

Based on your IPaC submission and a standing analysis completed by the Service, you determined the proposed Project will have the following effect determinations:

Species	Listing Status	Determination
Tricolored Bat (*Perimyotis subflavus*)	Proposed Endangered	May affect

Other Species and Critical Habitat that May be Present in the Action Area

The IPaC-assisted determination key for the northern long-eared bat and tricolored bat does not apply to the following ESA-protected species and/or critical habitat that also may occur in your Action area:

- Monarch Butterfly *Danaus plexippus* Proposed Threatened

You may coordinate with our Office to determine whether the Action may cause prohibited take of the species listed above.

Conclusion

Consultation with the Service is not complete. Further consultation or coordination with the Service is necessary for those species or designated critical habitats with a determination of "May Affect." A "May Affect" determination in this key indicates that the project, as entered, is not consistent with the questions in the key. Not all projects that reach a "May Affect" determination are anticipated to result in adverse impacts to listed species. These projects may result in a "No Effect", "May Affect, Not Likely to Adversely Affect", or "May Affect, Likely to Adversely Affect" determination depending on the details of the project. Please contact our Chesapeake Bay Ecological Services Field Office to discuss methods to avoid or minimize potential adverse effects to those species or designated critical habitats.

Federal agencies must consult with U.S. Fish and Wildlife Service under section 7(a)(2) of the Endangered Species Act (ESA) when an action *may affect* a listed species. Tricolored bat is proposed for listing as endangered under the ESA, but not yet listed. For actions that may affect a proposed species, agencies cannot consult, but they can *confer* under the authority of section 7(a)(4) of the ESA. Such conferences can follow the procedures for a consultation and be adopted as such if and when the proposed species is listed. Should the tricolored bat be listed, agencies must review projects that are not yet complete, or projects with ongoing effects within the tricolored bat range that previously received a NE or NLAA determination from the key to confirm that the determination is still accurate. Projects that receive a may affect determination for tricolored bat through the key, should contact the appropriate Ecological Services Field Office if they want to conference on this species.

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

Little Mill Creek Restoration at Woodland Park

2. Description

The following description was provided for the project 'Little Mill Creek Restoration at Woodland Park':

> New Castle County (NCC) identified the restoration of Little Mill Creek and tributaries within Woodland Park as a project to provide ecological enhancement, support the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, and help meet pollutant load reductions associated with the Christina River Total Maximum Daily Load (TMDL). The project includes Little Mill Creek and its tributaries beginning at Faulkland Road and extending downstream to Centre Road (SR 141). The project entails restoring 4,814 linear feet of Little Mill Creek and 3,085 linear feet of adjacent tributaries within Woodland Run Park. The design consists of an integrated stream and wetland restoration approach that will lower the existing stream banks and adjacent floodplain to create a stream/floodplain system that is highly connected to groundwater as the existing floodplain width, potentially usable land, and property limits allow.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.7448282,-75.62060317328928,14z



DETERMINATION KEY RESULT

Based on the answers provided, the proposed Action is consistent with a determination of “may affect” for a least one species covered by this determination key.

QUALIFICATION INTERVIEW

1. Does the proposed project include, or is it reasonably certain to cause, intentional take of listed bats or any other listed species?

   Note: Intentional take is defined as take that is the intended result of a project. Intentional take could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered or proposed species?

   No

2. Is the action area wholly within Zone 2 of the year-round active area for northern long-eared bat and/or tricolored bat?

   Automatically answered
   No

3. Does the action area intersect Zone 1 of the year-round active area for northern long-eared bat and/or tricolored bat?

   Automatically answered
   No

4. Does any component of the action involve leasing, construction or operation of wind turbines? Answer 'yes' if the activities considered are conducted with the intention of gathering survey information to inform the leasing, construction, or operation of wind turbines.

   Note: For federal actions, answer ‘yes’ if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

   No

5. Is the proposed action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   Yes

6. Is the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), or Federal Transit Administration (FTA) funding or authorizing the proposed action, in whole or in part?

   No

7. Are you an employee of the federal action agency or have you been officially designated in writing by the agency as its designated non-federal representative for the purposes of Endangered Species Act Section 7 informal consultation per 50 CFR § 402.08?

   Note: This key may be used for federal actions and for non-federal actions to facilitate section 7 consultation and to help determine whether an incidental take permit may be needed, respectively. This question is for information purposes only.

   No

8. Is the lead federal action agency the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC)? Is the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC) funding or authorizing the proposed action, in whole or in part?

   No

9. Is the lead federal action agency the Federal Energy Regulatory Commission (FERC)?

   No

10. [Semantic] Is the action area located within 0.5 miles of a known bat hibernaculum?

    Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency.

    Automatically answered
    No

11. Does the action area contain any winter roosts or caves (or associated sinkholes, fissures, or other karst features), mines, rocky outcroppings, or tunnels that could provide habitat for hibernating bats?

    No

12. Will the action cause effects to a bridge?

    Note: Covered bridges should be considered as bridges in this question.

    No

13. Will the action result in effects to a culvert or tunnel at any time of year?

    Yes

14. Does the culvert or tunnel equal or exceed 23 feet (7.0 meters) in length?

    Yes

15. Do the interior dimensions of the culvert or tunnel **equal or exceed 3.0 feet (0.9 meters) in height (minimum height for tricolored bat)**?

    No

16. Are trees present within 1000 feet of the action area?

    Note: If there are trees within the action area that are of a sufficient size to be potential roosts for bats answer "Yes". If unsure, additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    Yes

17. Does the action include the intentional exclusion of bats from a building or structure?

    Note: Exclusion is conducted to deny bats' entry or reentry into a building. To be effective and to avoid harming bats, it should be done according to established standards. If your action includes bat exclusion and you are unsure whether northern long-eared bats or tricolored bats are present, answer "Yes." Answer "No" if there are no signs of bat use in the building/structure. If unsure, contact your local Ecological Services Field Office to help assess whether northern long-eared bats or tricolored bats may be present. Contact a Nuisance Wildlife Control Operator (NWCO) for help in how to exclude bats from a structure safely without causing harm to the bats (to find a NWCO certified in bat standards, search the Internet using the search term "National Wildlife Control Operators Association bats"). Also see the White-Nose Syndrome Response Team's guide for bat control in structures.

    No

18. Does the action involve removal, modification, or maintenance of a human-made structure (barn, house, or other building) **known or suspected to contain roosting bats?**

    No

19. Will the action cause construction of one or more new roads open to the public?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

20. Will the action include or cause any construction or other activity that is reasonably certain to increase average daily traffic permanently or temporarily on one or more existing roads?

    Note: For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.). .

    No

21. Will the action include or cause any construction or other activity that is reasonably certain to increase the number of travel lanes on an existing thoroughfare?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

22. Will the proposed Action involve the creation of a new water-borne contaminant source (e.g., leachate pond, pits containing chemicals that are not NSF/ANSI 60 compliant)?

    Note: For information regarding NSF/ANSI 60 please visit https://www.nsf.org/knowledge-library/nsf-ansi-standard-60-drinking-water-treatment-chemicals-health-effects

    No

23. Will the proposed action involve the creation of a new point source discharge from a facility other than a water treatment plant or storm water system?

    No

24. Will the action include drilling or blasting?

    No

25. Will the action involve military training (e.g., smoke operations, obscurant operations, exploding munitions, artillery fire, range use, helicopter or fixed wing aircraft use)?

    No

26. Will the proposed action involve the use of herbicides or other pesticides other than herbicides (e.g., fungicides, insecticides, or rodenticides)?

    No

27. Will the action include or cause activities that are reasonably certain to cause chronic or intense nighttime noise (above current levels of ambient noise in the area) in suitable summer habitat for the northern long-eared bat or tricolored bat during the active season?

    Chronic noise is noise that is continuous or occurs repeatedly again and again for a long time. Sources of chronic or intense noise that could cause adverse effects to bats may include, but are not limited to: road traffic; trains; aircraft; industrial activities; gas compressor stations; loud music; crowds; oil and gas extraction; construction; and mining.

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    No

28. Does the action include, or is it reasonably certain to cause, the use of permanent or temporary artificial lighting within 1000 feet of suitable northern long-eared bat or tricolored bat roosting habitat?

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    No

29. Will the action include tree cutting or other means of knocking down or bringing down trees, tree topping, or tree trimming?

    Yes

30. Will the proposed action occur exclusively in an already established and currently maintained utility right-of-way?

    No

31. Does the action include emergency cutting or trimming of hazard trees in order to remove an imminent threat to human safety or property? See hazard tree note at the bottom of the key for text that will be added to response letters

    Note: A "hazard tree" is a tree that is an immediate threat to lives, public health and safety, or improved property.

    No

32. Does the project intersect with the 0- 9.9% forest density category?

    Automatically answered
    No

33. Does the project intersect with the 10.0- 19.9% forest density category map?

    Automatically answered
    Yes

34. Does the project intersect with the 20.0- 29.9% forest density category map?

    Automatically answered
    No

35. Does the project intersect with the 30.0- 100% forest density category map?

    Automatically answered
    No

36. Will the action cause trees to be cut, knocked down, or otherwise brought down across an area greater than 5 acres in total extent?

    Yes

37. Does the action area intersect the tricolored bat species list area?

    Automatically answered
    Yes

38. [Semantic] Is the action area located within 0.25 miles of a culvert that is known to be occupied by northern long-eared or tricolored bats?

    Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency.

    Automatically answered
    No

39. Has a presence/probable absence bat survey targeting the tricolored bat and following the Service's Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines been conducted within the project area?

    No

40. Is suitable summer habitat for the tricolored bat present within 1000 feet of project activities?
    (If unsure, answer ""Yes."")

    Note: If there are trees within the action area that may provide potential roosts for tricolored bats (e.g., clusters of leaves in live and dead deciduous trees, Spanish moss (Tillandsia usneoides), clusters of dead pine needles of large live pines) answer ""Yes."" For a complete definition of suitable summer habitat for the tricolored bat, please see Appendix A in the Service's Range-wide Indiana Bat and Northern long-eared Bat Survey Guidelines.

    Yes

41. Do you have any documents that you want to include with this submission?

    No

PROJECT QUESTIONNAIRE

Enter the extent of the action area (in acres) from which trees will be removed - round up to the nearest tenth of an acre. For this question, include the entire area where tree removal will take place, even if some live or dead trees will be left standing.

14.81

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: George Carney
Address: 700 East Pratt Street, Suite 500
City: Baltimore
State: MD
Zip: 21202
Email gcarney@rkk.com
Phone: 4102947780

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

NOAA FISHERIES
National Oceanic and Atmospheric Administration

QR code Share link

☰ MENU

Essential Fish Habitat Mapper

New England / Mid-Atlantic

? View Content

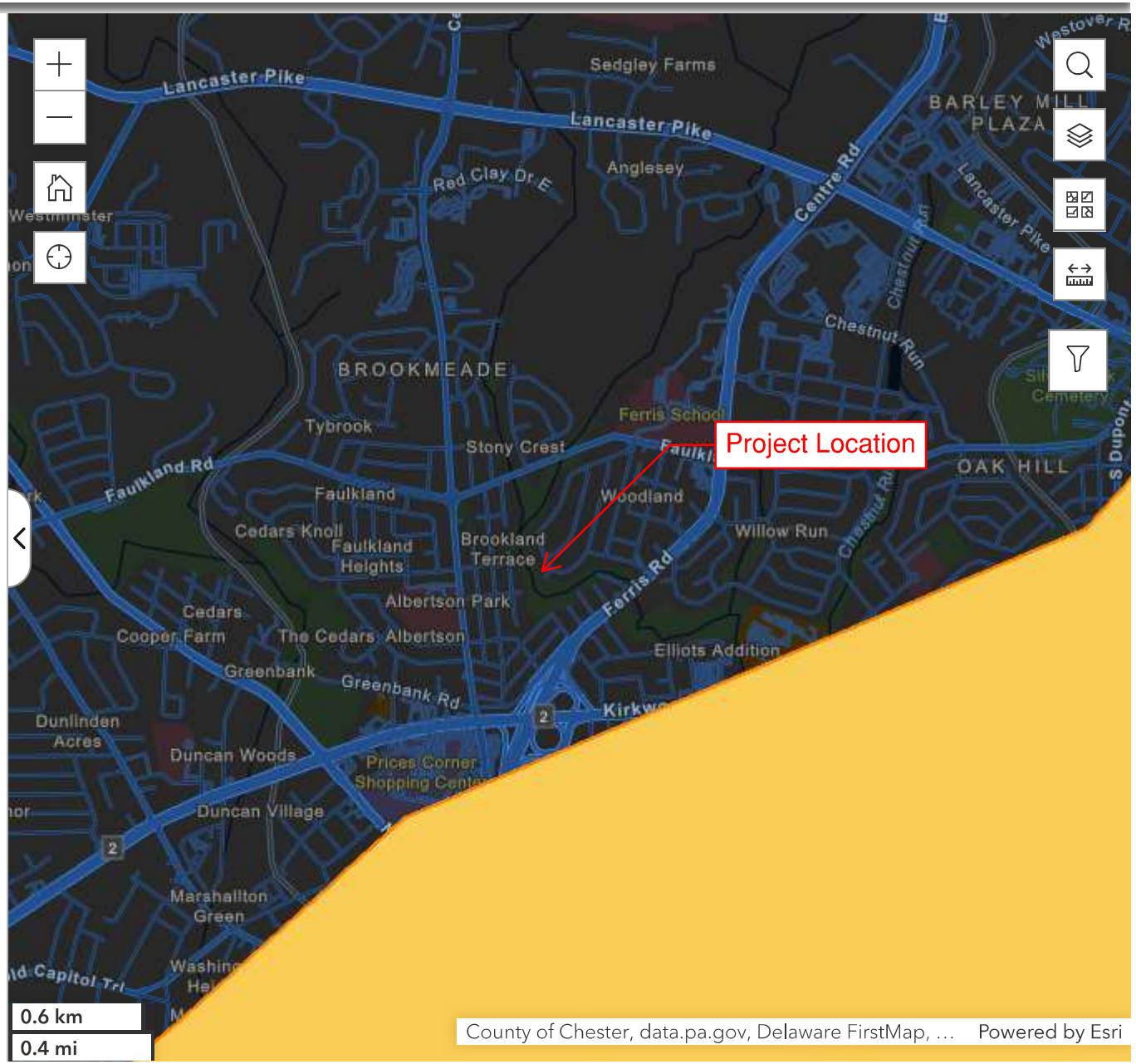
Essential Fish Habitat

New England / Mid-Atlantic EFH Species

Atlantic salmon EFH

Highly Migratory Species EFH

Choose Another Council Generate Report



HCA
DELAWARE HISTORICAL & CULTURAL AFFAIRS

Delaware Division of Historical & Cultural Affairs
29 N. State St., Dover, Delaware 19901
Tel. (302) 736-7400 | Fax. (302) 739-5660
history.delaware.gov

September 4, 2024

Karen Hutchins-Keim
RK&K
110 S. Poplar Street, Suite 102
Wilmington, DE 19801

Subject: **Little Mill Creek Restoration at Woodland Park**
SHPO Project No. 2024.03.15.09

Dear Ms. Hutchins-Keim:

We understand from your letter that the applicant, New Castle County, is seeking a permit from the US Army Corps of Engineers (USACOE) for the proposed undertaking along the Little Mill Creek in Woodland Park. The applicant is proposing to restore 8,4949 linear feet of the stream to minimize erosion. Because of the need for authorization from the USACOE, the project is subject to compliance with Section 106 of the National Historic Preservation Act of 1966 (as amended).

There are three known historic properties within or immediately adjacent to the area of potential effect (APE). Bridge 143 (N13579) was previously determined not eligible for the National Register of Historic Places (NRHP). The remaining two structures are both dwellings (N14246; N14247) that have not been evaluated for their eligibility. Due to the limited nature of the proposed, there is no anticipated impact to these properties. There is one known archaeological site adjacent to the APE. However, the site (N14015) was destroyed by existing residential development. Historic aerials show the APE has been previously disturbed by existing residential development so there is low potential for any intact archaeological sites.

Our Office finds there to be No Historic Properties Affected by the proposed undertaking. Please feel free to contact me if you have any questions at (302) 736-7431 or sarah.carr@delaware.gov.

Sincerely,

Sarah Carr
Cultural Preservation Specialist
cc: Gwen Davis, Deputy SHPO

Appendix C – Datasheets

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** A	**Stream Order:** 1
Date: 11/17/22	**State:** DE	**Photos:** 9249 - 9250	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☐ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Maintain of stream Restoration Little Mill Creek			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity –	Upstream: Outside Study Area	Downstream: Outside Study Area	Adjacent/Abutting: Features B-M

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)			Substrate						Vegetation Cover Type (MBSS)
☒	Natural Channel Shape	Width: 15'-20'	☒	Silts	☒	Sands	☐	Muck	RB: Forest
☐	Artificial (man-made)	Depth: 2"-24"	☒	Cobbles	☒	Gravel	☒	Other:	
☐	Manipulated (man-altered)	Bank Erosion/stability:	☐	Bedrock	☒	Concrete		Rip-Rap	
☐	Other:	Moderate to Severe	Side slope: ☒ ≥1:1 ☐ 2:1 ☐ 3:1 ☐ ≤4:1						LB: Forest
Notes:									

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain		0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought			Normal		Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☒	Sediment deposition	☒	Sediment sorting
☐	No	☐	Changes in the character of soil	☒	Water staining	☒	Scour
		☐	Shelving	☒	Presence of flood litter/debris	☒	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☒	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☒	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** B	**Stream Order:** II
Date: 11/17/22	**State:** DE	**Photos:** 9252 – 9251	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☒ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Flowing during site visit. Deep Pools – 24"			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity –	Upstream: Outfall	Downstream: Waters A	Adjacent/Abutting: None

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)			Substrate						Vegetation Cover Type (MBSS)
☒	Natural Channel Shape	Width: 8'-10'	☒	Silts	☒	Sands	☐	Muck	RB: Forest
☐	Artificial (man-made)	Depth: 2"-24"	☒	Cobbles	☒	Gravel	☒	Other:	
☐	Manipulated (man-altered)	Bank Erosion/stability:	☐	Bedrock	☒	Concrete		Rip-Rap	
☐	Other:	Moderate erosion	Side slope: ☒ ≥1:1 ☐ 2:1 ☐ 3:1 ☐ ≤4:1						LB: Forest
Notes:									

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain	☐	0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☒	Sediment deposition	☒	Sediment sorting
☐	No	☐	Changes in the character of soil	☒	Water staining	☒	Scour
		☐	Shelving	☒	Presence of flood litter/debris	☒	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☐	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☒	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** C	**Stream Order:** II
Date: 11/17/22	**State:** DE	**Photos:** 9255-9256	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☒ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☐ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Standing water in channel Incised – dry portions of VS channel 1-3'			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity – Upstream: Outside Study Area Downstream: Waters A Adjacent/Abutting: Wetland E

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)		Substrate			Vegetation Cover Type (MBSS)
☐ Natural Channel Shape	Width: 1'-3'	☒ Silts	☒ Sands	☐ Muck	RB: Forest & Mowed Lawn
☐ Artificial (man-made)	Depth: 0"-6"	☒ Cobbles	☒ Gravel	☐ Other:	
☒ Manipulated (man-altered)	Bank Erosion/stability:	☐ Bedrock	☐ Concrete		LB: Forest & Mowed Lawn
☐ Other:	Minor erosion	Side slope: ☒ ≥1:1 ☒ 2:1 ☐ 3:1 ☐ ≤4:1			
Notes:					

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain		0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☐	Sediment deposition	☐	Sediment sorting
☐	No	☐	Changes in the character of soil	☒	Water staining	☒	Scour
		☐	Shelving	☒	Presence of flood litter/debris	☐	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☐	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☐	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** D	**Stream Order:** II
Date: 11/17/22	**State:** DE	**Photos:** 9257-9258	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☒ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Shallow Flowing water Drains large seep wetland outside SA. Intercepts groundwater			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity – Upstream: Outside Study Area Downstream: Waters A Adjacent/Abutting: wetland E

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)			Substrate						Vegetation Cover Type (MBSS)
☒	Natural Channel Shape	Width: 2'-3'	☐	Silts	☐	Sands	☒	Muck	RB: Forest
☐	Artificial (man-made)	Depth: 1'-3'	☐	Cobbles	☐	Gravel	☐	Other:	
☐	Manipulated (man-altered)	Bank Erosion/stability:	☐	Bedrock	☐	Concrete			LB: Forest & Mowed Lawn
☐	Other:	Minor erosion	Side slope: ☐ ≥1:1 ☐ 2:1 ☒ 3:1 ☒ ≤4:1						
Notes:									

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain		0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☐	Sediment deposition	☐	Sediment sorting
☐	No	☒	Changes in the character of soil	☒	Water staining	☒	Scour
		☒	Shelving	☐	Presence of flood litter/debris	☒	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☒	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☐	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** F	**Stream Order:** II
Date: 11/17/22	**State:** DE	**Photos:** 9263-9264	
Crew: KJH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☒ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Standing water throughout channel			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity –	Upstream: Outside Study Area	Downstream: Waters A	Adjacent/Abutting: None

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)			Substrate						Vegetation Cover Type (MBSS)
☐	Natural Channel Shape	Width: 3'-6'	☒	Silts	☒	Sands	☒	Muck	RB: Forest & mowed lawn
☐	Artificial (man-made)	Depth: 4"-6"	☒	Cobbles	☒	Gravel	☐	Other:	
☒	Manipulated (man-altered)	Bank Erosion/stability: minor to moderate	☐	Bedrock	☐	Concrete			LB: Forest
☐	Other:		Side slope: ☒ ≥1:1 ☐ 2:1 ☐ 3:1 ☐ ≤4:1						
Notes:									

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain	☐	0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☒	Sediment deposition	☒	Sediment sorting
☐	No	☐	Changes in the character of soil	☒	Water staining	☒	Scour
		☒	Shelving	☒	Presence of flood litter/debris	☒	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☒	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☐	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek		**Feature ID:** I	**Stream Order:**
Date: 12/13/22	**State:** DE	**Photos:** 9359 - 9360	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☐ RPW – Perennial (Flowing year round)	☒ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Water in most of reach. No rain previous night. Few dry areas			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity –	Upstream: Storm drain outlet	Downstream: Waters A	Adjacent/Abutting: None

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)		Substrate				Vegetation Cover Type (MBSS)
☐ Natural Channel Shape	Width: 1'-4'	☒ Silts	☐ Sands	☐ Muck		RB: Mowed Lawn
☐ Artificial (man-made)	Depth: 0-6"	☒ Cobbles	☐ Gravel	☐ Other:		
☒ Manipulated (man-altered)	Bank Erosion/stability:	☐ Bedrock	☐ Concrete			
☐ Other:	Minor erosion	Side slope: ☒ ≥1:1 ☐ 2:1 ☐ 3:1 ☐ ≤4:1				LB: Mowed Lawn
Notes:						

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Dec Year: 2022												
☒	No rain	☐	0-0.5									☒				
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☐	Sediment deposition	☐	Sediment sorting
☐	No	☐	Changes in the character of soil	☐	Water staining	☒	Scour
		☐	Shelving	☒	Presence of flood litter/debris	☐	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☐	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☒	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek		**Feature ID:** M	**Stream Order:** II
Date: 12/13/22	**State:** DE	**Photos:** 9375-9376	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☒ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Little Falls Creek Water throughout channel			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity – Upstream: outside study Area Downstream: Waters A Adjacent/Abutting: None

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)		Substrate			Vegetation Cover Type (MBSS)
☒ Natural Channel Shape	Width: 10-15'	☒ Silts	☒ Sands	☐ Muck	RB: Forest
☐ Artificial (man-made)	Depth: 4"-12"	☒ Cobbles	☒ Gravel	☐ Other:	
☐ Manipulated (man-altered)	Bank Erosion/stability: Minor erosion	☐ Bedrock	☐ Concrete		LB: Forest
☐ Other:		Side slope: ☒ ≥1:1 ☒ 2:1 ☐ 3:1 ☐ ≤4:1			
Notes:					

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Dec Year: 2022												
☒	No rain	☐	0-0.5									☒				
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks	Ordinary High Water Mark			
☒ Yes	☐ Clear, natural line impressed on the bank	☒ Sediment deposition	☒ Sediment sorting	
☐ No	☐ Changes in the character of soil	☒ Water staining	☒ Scour	
	☒ Shelving	☒ Presence of flood litter/debris	☒ Observed/predicted flow events	
	☒ Vegetation matted down, bent, or absent	☐ Destruction of terrestrial veg.	☐ Abrupt change in plant community	
	☒ Leaf litter disturbed	☐ Presence of wrack line	☐ Other:	

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line	Mean High Water Mark indicated by:	Chemical Characteristics
☐ Oil or scum line along shore objects	☐ Survey to available datum	☐ Water is clear
☐ Fine shell or debris deposits (foreshore)	☐ Physical markings	☐ Water is discolored
☐ Physical markings/characteristics	☐ Vegetation lines/changes in types	☐ Oily film
☐ Tidal gauges		☐ Other:
Notes:		

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Little Mill Creek Restoration City/County: New Castle County Sampling Date: 11/17/22

Applicant/Owner: New Castle County State: DE Sampling Point: WET-E

Investigator(s): KUH/AB Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain depression Local relief (concave, convex, none): concave Slope (%):

Subregion (LRR or MLRA): LRR Lat: 39.742361 Long: -75.619509 Datum: NAD83

Soil Map Unit Name: DeB - Delanco-Colonia-Hatboro complex, 0-8% slopes NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** Yes X No ____
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	

Remarks:

Photos 9259 - 9260

Rained previous night 11/16

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1-4 in
Water Table Present?	Yes X	No ____	Depth (inches): 0 in
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0 in

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Rained previous night 11/16

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: WE1-E

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5 x 10 ft)			
1. Persicaria sagittata	60	Y	OBL
2. Persicaria maculosa	10	N	FACW
3. Microstegium vimineum	5	N	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	75 = Total Cover		

50% of total cover: 37.5 20% of total cover: 15

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- X 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Rained previous night 11/16

SOIL

Sampling Point: WET-E

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	10 YR 4/2	80	2.5 YR 4/6	20	C	M+PL	Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No _____

Remarks:

Rained previous night 11/11

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Little Mill Creek Restoration City/County: New Castle County Sampling Date: 11/17/22

Applicant/Owner: New Castle County State: DE Sampling Point: UPL-1

Investigator(s): KJH/AB Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain depression Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR Lat: 39.743558 Long: -75.620406 Datum: NAD83

Soil Map Unit Name: DcB - Delanco-Woodstown-Hatboro complex, 0-8 % slopes NWI classification: upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

Photos 9253 + 9254

* Rain night before 11/16 Mowed - disturbed vegetation

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No _____ Depth (inches): 2 in

Water Table Present? Yes X No _____ Depth (inches): 0 in

Saturation Present? (includes capillary fringe) Yes X No _____ Depth (inches): 0 in

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Rained previous night 11/16

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: UPL - 1

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Herb Stratum (Plot size: 5 ft r)			
1. Potentilla simplex	50	Y	FACU
2. Persicaria maculosa	30	Y	FACW
3. Lysimachia nummularia	10	N	FACW
4. Ficaria verna	10	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	
FACW species	40	x 2 =	80
FAC species	10	x 3 =	30
FACU species	50	x 4 =	200
UPL species	0	x 5 =	0
Column Totals:	100 (A)		310 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

rained previous night on 11/16

Vegetation has been mowed – maintained lawn

SOIL

Sampling Point: UPL-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	10 YR 3/3	100					Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

Rained night before 11/16/22

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Little Mill Creek Restoration City/County: New Castle County Sampling Date: 11/17/22

Applicant/Owner: New Castle County State: DE Sampling Point: UPL-E

Investigator(s): KJH / AB Section, Township, Range:

Landform (hillslope, terrace, etc.): Stream berm Local relief (concave, convex, none): convex Slope (%): 0-2%

Subregion (LRR or MLRA): LRR Lat: 39.742405 Long: -75.61941 Datum: NAD83

Soil Map Unit Name: DcB - Delanco - Cordrey - Harbor complex, 0-8% slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation X, Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes X	No	

Remarks:

Photo 9201 No hydric soils

Rained previous night 11/16 * vegetation has been mowed + maintained

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	No X	Depth (inches):
Water Table Present?	Yes	No X	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	No X	Depth (inches):

Wetland Hydrology Present? Yes X No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Rained previous night 11/16

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: UPL-E

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Herb Stratum (Plot size: 10 ft r)			
1. Microstegium vimineum	90	Y	FAC
2. Glechoma hederacea	5	N	FACU
3. Dichanthelium clandestinum	2	N	UPL
4. Helianthus occidentalis	2	N	UPL
5. Boehmeria cylindrica	5	N	FACW
6.			
7.			
8.			
9.			
10.			
11.			
	104 = Total Cover		
50% of total cover: 52	20% of total cover: 21		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Rained previous night 11/16

SOIL

Sampling Point: VPL - E

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 3/4	100					Silt Loam	
13-18	10YR 3/4	90	5YR 4/6	10	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

No hydric soils - redox under 12 inches, matrix too brown

Rained previous night 11/16

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Little Mill Creek Restoration City/County: New Castle County Sampling Date: 11/17/22

Applicant/Owner: New Castle County State: DE Sampling Point: UPL-11

Investigator(s): KJH/AB Section, Township, Range:

Landform (hillslope, terrace, etc.): stream berm Local relief (concave, convex, none): convex Slope (%): 0-2

Subregion (LRR or MLRA): LRR Lat: 39.743455 Long: -75.615693 Datum: NAD83

Soil Map Unit Name: DcB - Delanco - Cordova - Hatboro Complex, 0-8% slopes NWI classification: upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____ No _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____ No _____	
Wetland Hydrology Present?	Yes _____ No X	

Remarks:

Rained previous night 11/16 Mowed area - disturbed vegetation Photo 9271

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____ No X	Depth (inches): _____
Water Table Present?	Yes _____ No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____ No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Rained previous night 11/16

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: UPL - H

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5 Ft)			
1. Festuca arundinacea	50	Y	FACW
2. Fragaria vesca	30	Y	FACU
3. Persicaria maculosa	10	N	FACW
4. Glechoma hederacea	10	N	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

50% of total cover: 50 20% of total cover: 20

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species 10	x 2 = 20
FAC species _____	x 3 = _____
FACU species 90	x 4 = 360
UPL species _____	x 5 = _____
Column Totals: 100 (A)	380 (B)

Prevalence Index = B/A = 3.8

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

Mowed area - Disturbed vegetation

Rained previous night 11/16

SOIL

Sampling Point: UPL-H

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 4/2	100					Silt Loam	
13-17	2.5Y 4/2	90	5YR 4/6	10	C	M	Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

Redox under 12 inches - no hydric soils

Rained previous night 11/16

Appendix D – Photographic Record

Waters of the U.S.



WUS-A – Perennial RPW (Little Mill Creek)



WUS-B – Perennial RPW



WUS-C – Intermittent RPW



WUS-D – Perennial RPW



WUS-F – Perennial RPW



WUS-I – Intermittent Non-RPW



WUS-M – Perennial RPW (Little Falls Creek)

Wetlands



WET-E – PEM

Forest Stands



FS1 – Sycamore-Green Ash-Box Elder Silver Maple Forest Association



FS2 – Beech-Sugar Maple Forest Association



FS3 – Northern Red Oak Forest Association



FS4 – Silver Maple-Sycamore Forest Association



FS5 – Red Maple Forest Association



FS6 – Sycamore-Green Ash-Box Elder Silver Maple Forest Association

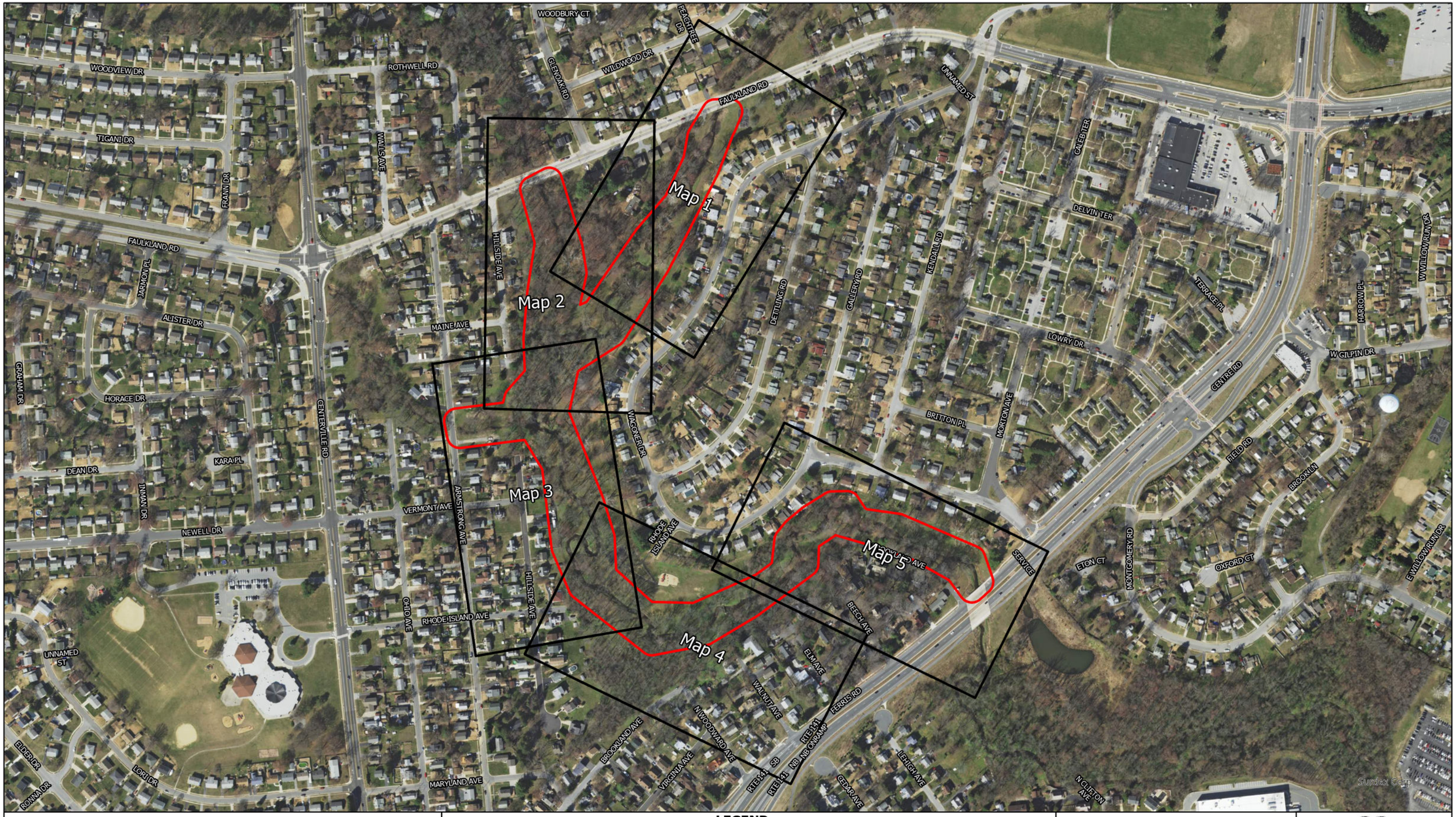
Appendix E – Tree Inventory Table

Little Mill Creek Restoration at Woodland Park - Tree Inventory Table

Tree ID	Scientific Name	Common Name	DBH	Condition	Comments
T1*	*Acer rubrum*	Red maple	34	Good/Fair	Included bark. Exposed roots. Splits above DBH. Trunk cavity.
T2*	*Quercus palustris*	Pin oak	34	Good/Fair	Dead wood.
T3	*Salix nigra*	Black willow	16	Fair/Poor	Severe lean. Extensive deadwood. Moderate vines.
T4*	*Acer saccharinum*	Silver maple	41	Fair	Included bark. Dead wood. Base decay.
T5	*Fraxinus pennsylvanica*	Green ash	21	Good/Fair	Dead wood.
T6*	*Fraxinus pennsylvanica*	Green ash	25	Good/Fair	Dead wood.
T7*	*Fraxinus pennsylvanica*	Green ash	24	Good/Fair	Dead wood. Lean. Moderate vines.
T8*	*Fraxinus pennsylvanica*	Green ash	30	Good/Fair	Vines. Dead wood.
T9*	*Fraxinus pennsylvanica*	Green ash	29	Fair/Poor	Extensive dead wood.
T10*	*Fraxinus pennsylvanica*	Green ash	34	Poor	Moderate vines. Broken leader. Dead wood.
T11*	*Acer saccharinum*	Silver maple	50	Good/Fair	Included bark. Growing against fence. Multi-stem. Dead wood.
T12*	*Acer saccharinum*	Silver maple	49	Good	Included bark. Multi-stem. Growing into fence.
T13	*Fraxinus pennsylvanica*	Green ash	18	Good/Fair	Heavy vines. Dead wood.
T14	*Fraxinus pennsylvanica*	Green ash	19	Fair/Poor	Extensive deadwood.
T15	*Fraxinus pennsylvanica*	Green ash	19	Good/Fair	Dead wood.
T16*	*Juglans nigra*	Black walnut	31	Fair	Dead wood. Broken leader.
T17*	*Quercus palustris*	Pin oak	36	Good	Dead wood.
T18*	*Quercus palustris*	Pin oak	35	Good	Minor vines. Dead wood.
T19	*Quercus palustris*	Pin oak	22	Good/Fair	Heavy vines. Sparse canopy.
T20*	*Quercus palustris*	Pin oak	29	Good	Dead wood.
T21*	*Quercus palustris*	Pin oak	34	Good	Dead wood.
T22*	*Quercus palustris*	Pin oak	34	Good	Vines. Dead wood.
T23	*Fraxinus pennsylvanica*	Green ash	19	Good/Fair	Dead wood. Growing into power lines.
T24*	*Liriodendron tulipifera*	Tulip poplar	25	Good	Included bark.
T25	*Juglans nigra*	Black walnut	22	Fair	Utility pruning. Exposed roots. Trunk wound.
T26*	*Quercus palustris*	Pin oak	42	Good/Fair	Pruned. Exposed roots.
T27	*Acer saccharinum*	Silver maple	16	Fair/Poor	Twin trunk 14in. Broken leaders. Lean. Exposed roots.
T28*	*Liriodendron tulipifera*	Tulip poplar	27	Good/Fair	Water sprouts.
T29*	*Acer rubrum*	Red maple	33	Good/Fair	Included bark. Trunk wound.
T30*	*Acer rubrum*	Red maple	28	Fair	Large trunk cavity. Broken branches.
T31*	*Fraxinus pennsylvanica*	Green ash	36	Fair	Vines. Dead wood. Large broken branches.

* Specimen Tree ($\geq$24.01 " DBH)

Appendix F – Natural Resources Inventory (NRI) Plan



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Key Map

LEGEND

Project Study Area

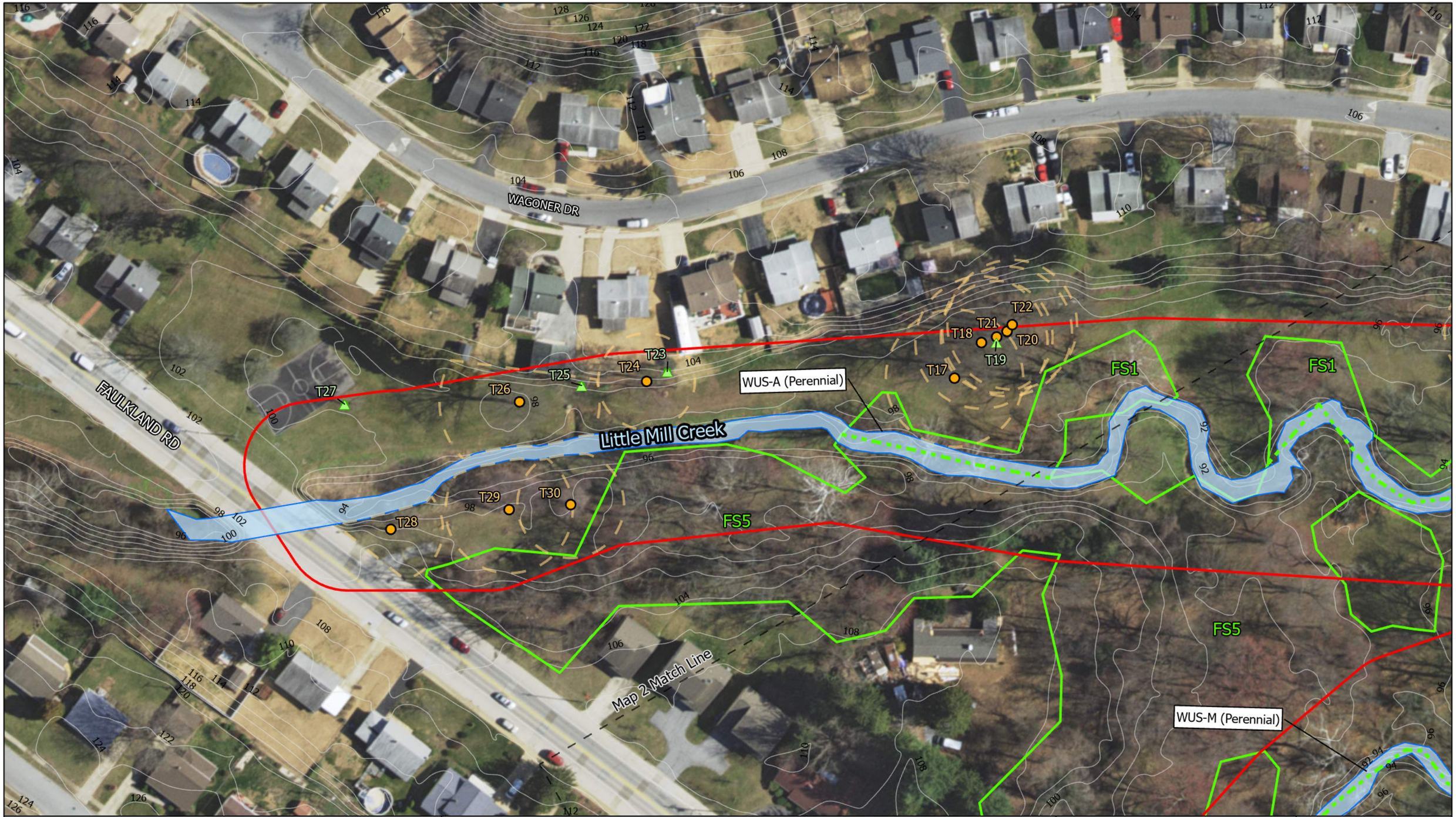
0 175 350 Feet

1 inch = 350 feet

N

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 1 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
- Critical Root Zones
- Stand Alone Trees
- Forest Stand Breaks
- Forest Stand Boundary
- 2' Contours

0 35 70 Feet

1 inch = 70 feet

N

New Castle County 1673 Delaware

RK&K

Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 2 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
- Critical Root Zones
- Stand Alone Trees
- Forest Stand Breaks
- Forest Stand Boundary
- 2' Contours

0 35 70 Feet

1 inch = 70 feet

RK&K



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 3 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
- Critical Root Zones
- Stand Alone Trees
- Forest Stand Breaks
- Forest Stand Boundary
- 2' Contours

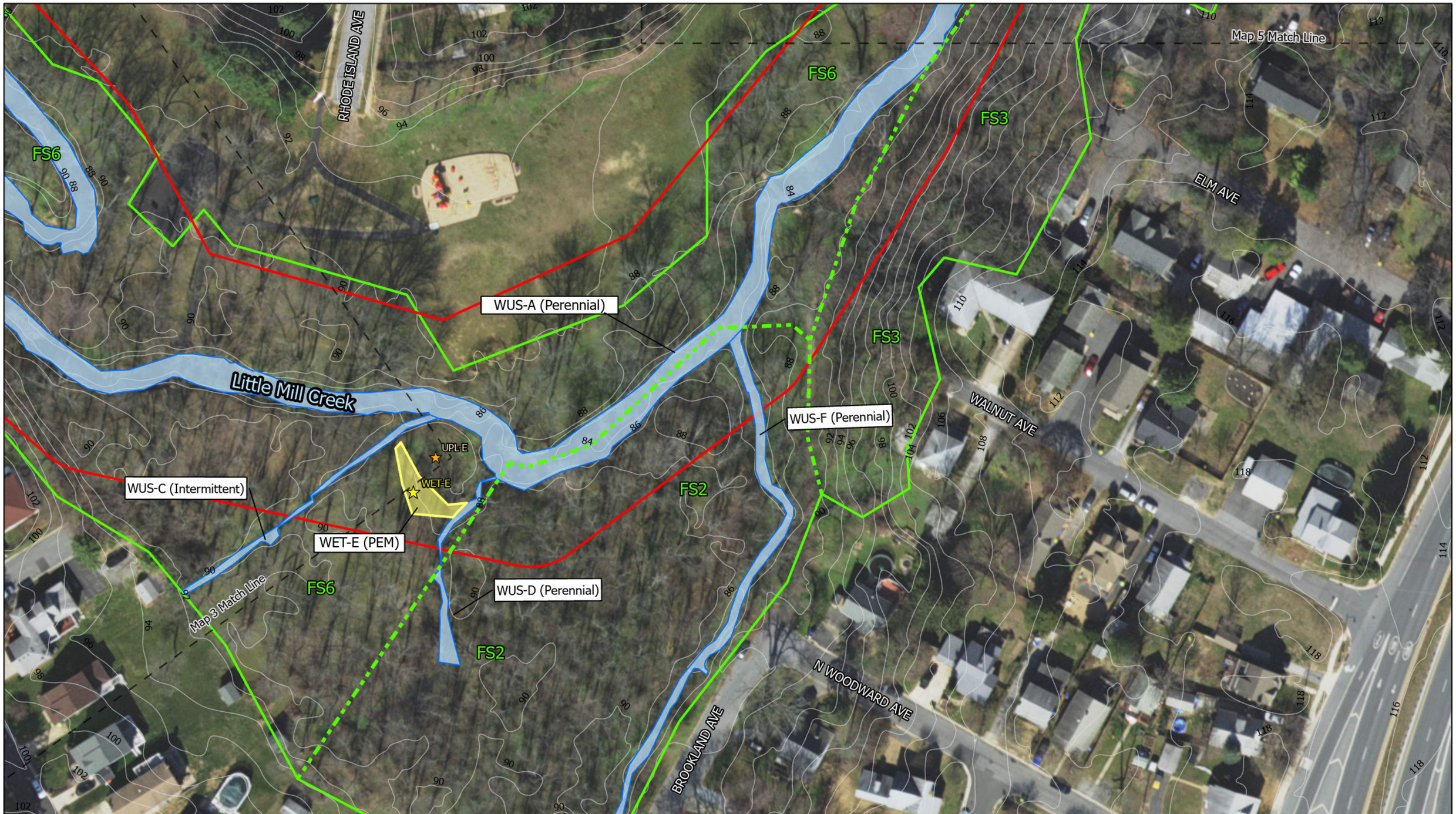
0 35 70 Feet

1 inch = 70 feet

N

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 4 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
- Critical Root Zones
- Stand Alone Trees
- Forest Stand Breaks
- Forest Stand Boundary
- 2' Contours

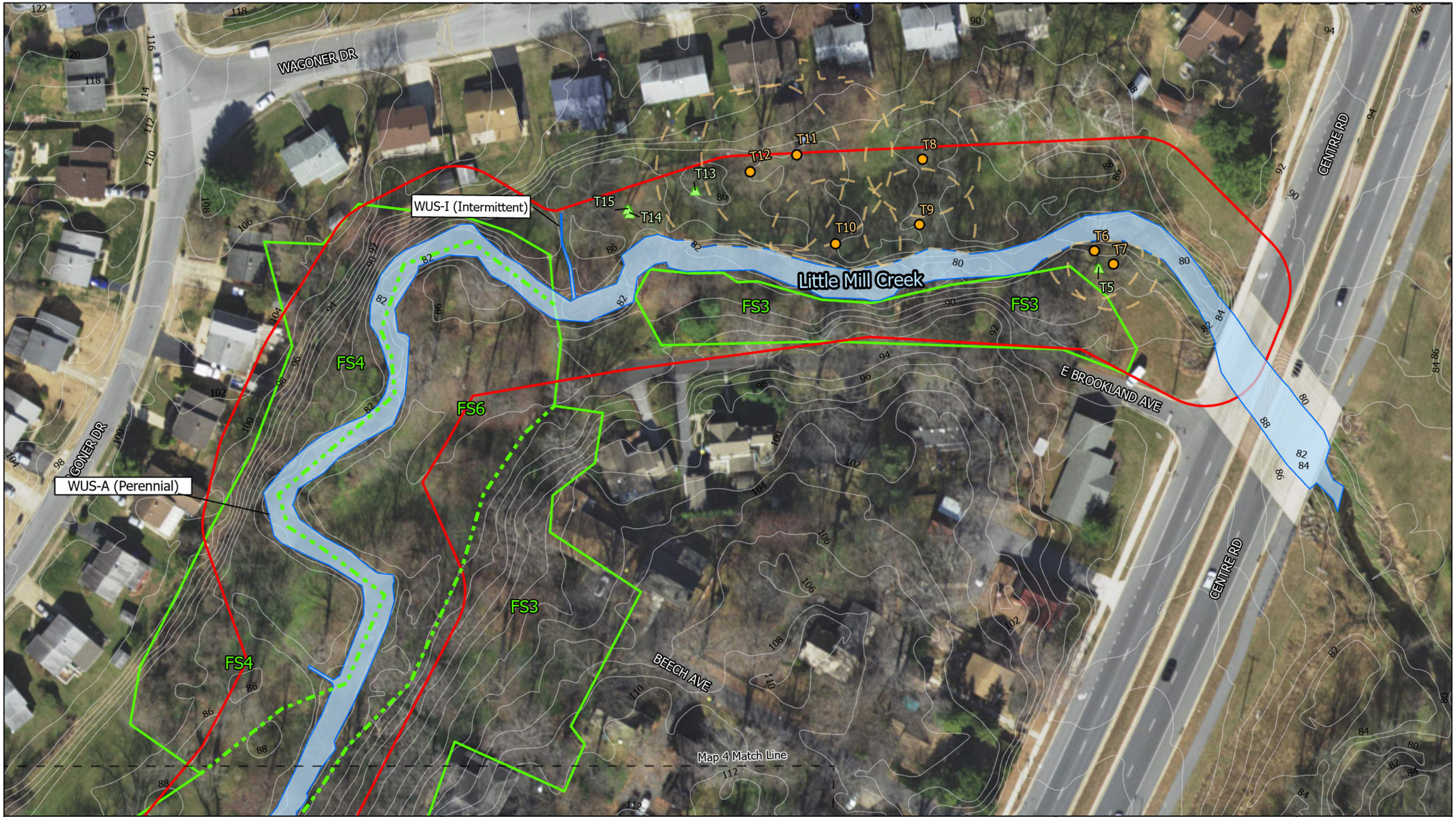
0 35 70 Feet

1 inch = 70 feet

N

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 5 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
- Critical Root Zones
- Stand Alone Trees
- Forest Stand Breaks
- Forest Stand Boundary
- 2' Contours

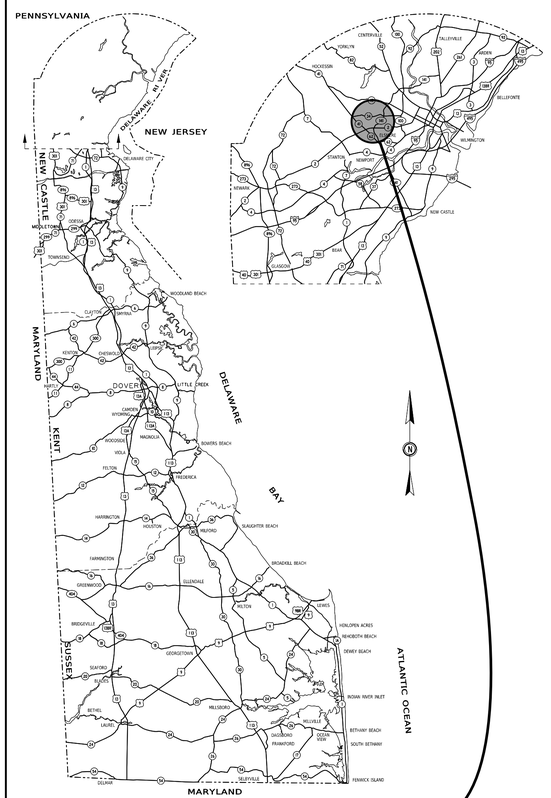
0 35 70 Feet

1 inch = 70 feet

N

New Castle County 1673 Delaware

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GENERAL LOCATION OF CONTRACT

PREPARED BY		
RK&K		
THIS SEAL APPLIES TO ALL SHEETS BEARING THE "RKK" SECTION DESIGNATION.	DATE	SEAL

U.S. CUSTOMARY UNITS

FINAL PLANS

CONSTRUCTION PLANS FOR:

LITTLE MILL CREEK STREAM RESTORATION

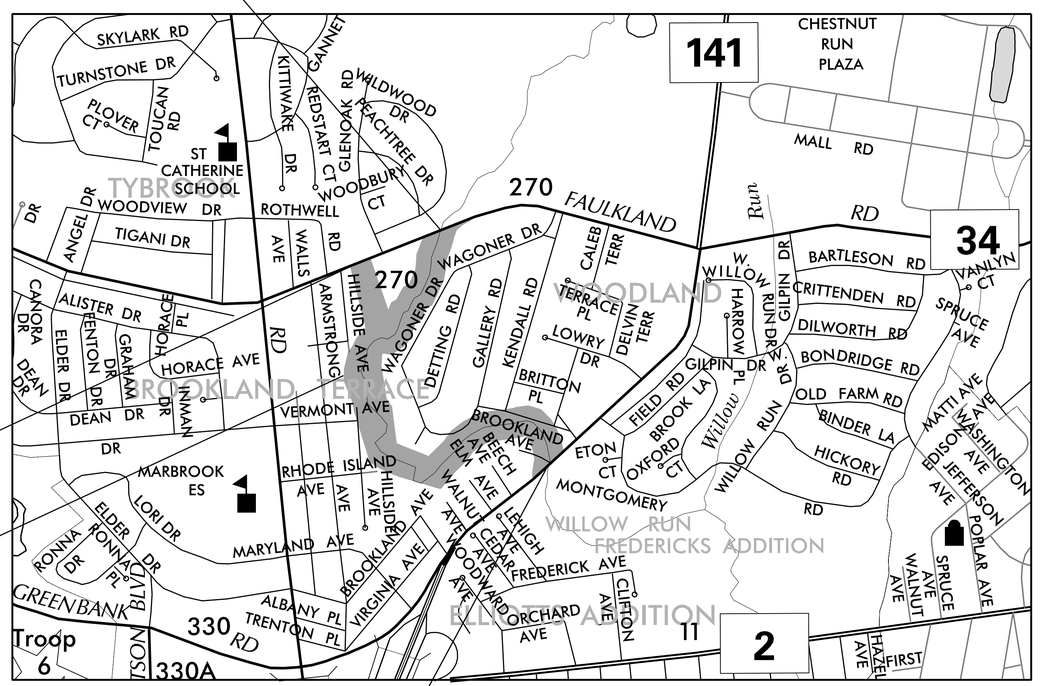
CONTRACT NUMBER: 20230414279
FEDERAL AID PROJECT NUMBER: N/A

BEGIN CONTRACT STATION 102+50

BEGIN CONTRACT STATION 201+33

BEGIN CONTRACT STATION 300+96

END CONTRACT STATION 140+90



LOCATION MAP
SCALE: NTS

DESIGN DESIGNATION

MRD #: N/A	ROAD NAME: N/A		
FUNCTIONAL CLASS: N/A		D.H.V. PROJECTED: N/A	YEAR: N/A
TYPE OF CONSTRUCTION: STREAM RESTORATION		DESIGN SPEED: N/A M.P.H.	
A.A.D.T. CURRENT: N/A	YEAR: N/A	TRUCKS: N/A%	
A.A.D.T. PROJECTED: N/A	YEAR: N/A	DIRECTION OF DISTRIBUTION: N/A%	

APPROVED DESIGN EXCEPTIONS

DESIGN PARAMETER	REQUIRED	PROVIDED	DATE

ADDENDA / REVISIONS

ASSOCIATED CONTRACTS

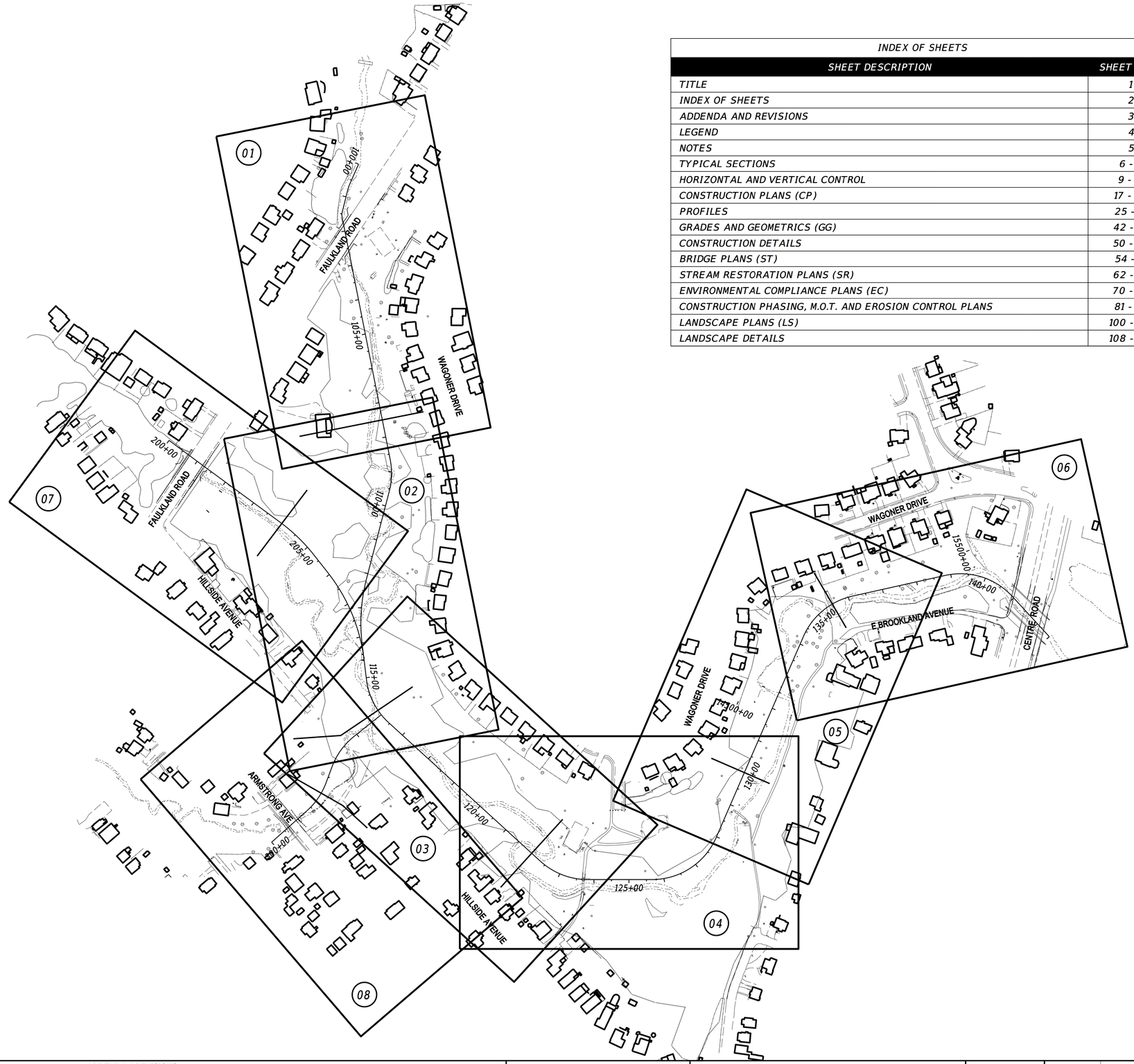
CONTRACT NO.	CONTRACT NAME
NCC 2021-06	NCC PROJECT NO. 221704, LITTLE MILL - MANHOLE IMPROVEMENTS IN FLOODPLAIN

APPROVED FOR ADVERTISEMENT

CHIEF OF PROJECT MANAGEMENT — DATE

LAST REVISED: 11/26/2018
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INDEX OF SHEETS	
SHEET DESCRIPTION	**SHEET NO(S)**
TITLE	1
INDEX OF SHEETS	2
ADDENDA AND REVISIONS	3
LEGEND	4
NOTES	5
TYPICAL SECTIONS	6 - 8
HORIZONTAL AND VERTICAL CONTROL	9 - 16
CONSTRUCTION PLANS (CP)	17 - 24
PROFILES	25 - 41
GRADES AND GEOMETRICS (GG)	42 - 49
CONSTRUCTION DETAILS	50 - 53
BRIDGE PLANS (ST)	54 - 61
STREAM RESTORATION PLANS (SR)	62 - 69
ENVIRONMENTAL COMPLIANCE PLANS (EC)	70 - 80
CONSTRUCTION PHASING, M.O.T. AND EROSION CONTROL PLANS	81 - 99
LANDSCAPE PLANS (LS)	100 - 107
LANDSCAPE DETAILS	108 - 109



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ADDENDA / REVISIONS		SCALE 0 150 300 450 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	INDEX OF SHEETS	SECTION RKK
					DESIGNED BY: N. RILEY		SHEET NO. 2
					CHECKED BY: T. CUTILLO		

ADDENDUM PREPARED BY
RK&K
XXXXXXXXXXXXXXXXXXXX

THIS SEAL APPLIES TO THE FOLLOWING SHEETS CHANGED UNDER ADDENDUM #X:
XX, XX-XX, XX

DATE

SEAL

REVISION PREPARED BY
RK&K
XXXXXXXXXXXXXXXXXXXX

THIS SEAL APPLIES TO THE FOLLOWING SHEETS CHANGED UNDER REVISION #X:
XX, XX-XX, XX

DATE

SEAL

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ADDENDA / REVISIONS		NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	ADDENDA AND REVISIONS	SECTION RKK
					DESIGNED BY: N. RILEY		SHEET NO. 3
					CHECKED BY: T. CUTILLO		

MANMADE ROADSIDE FEATURES

FEATURE DESCRIPTION	EXISTING	PROPOSED	ID
BOLLARD - STEEL POLE			BO XXX
BOLLARD - WOOD POST			
CURB, TYPE 1 AND TYPE 3	CURB, TYPE "X"		
CURB, TYPE 2			
CURB & GUTTER, TYPE 1	C&G, TYPE "X"		C XXX
CURB & GUTTER, TYPE 2			
CURB & GUTTER, TYPE 3			
CURB OPENING - SUMP / ON GRADE			C O
CURB OPENING WITH SIDEWALK			CO SW
FENCE - CHAINLINK OR STRANDED			F XXX
FENCE - STOCKADE OR SPLIT RAIL			
FLAG POLE	F.P.		
GUARDRAIL - STEEL BEAM, TYPE 1			
GUARDRAIL - STEEL BEAM, TYPE 2			
GUARDRAIL - STEEL BEAM, TYPE 3			
GUARDRAIL - WIRE ROPE			
GUARDRAIL - END ANCHORAGE			GR XXX
GUARDRAIL - END TREATMENT, TYPE 1			
GUARDRAIL - END TREATMENT, TYPE 2			
GUARDRAIL - END TREATMENT, TYPE 3			
GUARDRAIL - IMPACT ATTENUATOR			
LAMP AND POST - RESIDENTIAL	LAMP		
MAILBOX	MB	MB	
PARKING METER AND POST	P.M.		
PAVEMENT - FLEXIBLE			
PAVEMENT - RIGID			
PILE - BRIDGE			
PILLAR OR MISCELLANEOUS POST			
TRAFFIC SIGN AND POST			
WALL - BRICK OR BLOCK			
WALL - STONE			

DRAINAGE FEATURES

FEATURE DESCRIPTION	EXISTING	PROPOSED	ID
BIOFILTRATION SWALE		BFS	
DITCH OR STREAM CENTERLINE			
DIRECTIONAL STREAM FLOW ARROW			
DRAINAGE INLET	C.B. / D.I.		DI XXX
DRAINAGE JUNCTION BOX	J.B.		JB XXX
DRAINAGE MANHOLE	Ⓓ		MH XXX
DRAINAGE PIPE AND FLOW ARROW	SIZE/TYPE LABEL		P XXX
DRAINAGE PIPE HEADWALL			
FLARED END SECTION			FES XXX
RIPRAP - AREA FEATURE			RR XXX
RIPRAP - LINEAR FEATURE			
SAFETY END SECTION			SES XXX
UNDERDRAIN			UD XXX
UNDERDRAIN OUTLET			UDO XXX

UTILITY FEATURES

FEATURE DESCRIPTION	EXISTING	PROPOSED
CABLE TV DISTRIBUTION BOX	TV	
COMMUNICATIONS - UNDERGROUND	COMM(A)	COMM
ELECTRIC - UNDERGROUND	E(A)	E
ELECTRIC MANHOLE	Ⓔ	
ELECTRIC METER	EM	
ELECTRIC TRANSFORMER	E	
GAS - UNDERGROUND	G(A)	G
GAS MANHOLE	Ⓖ	
GAS METER	G.M.	
GAS VALVE	G.V.	
GAS PUMP - SERVICE STATION	G.P.	
IRRIGATION - UNDERGROUND	IR(A)	IR
ITMS - UNDERGROUND	ITMS(A)	ITMS
LIGHTING - UNDERGROUND	LI(A)	LI
LUMINAIRE - POLE MOUNTED		
MANHOLE - UNDETERMINED OWNER	?	
RAILROAD TRACKS		
SANITARY - UNDERGROUND	S(A)	S
SANITARY SEWER MANHOLE	Ⓢ	
SANITARY SEWER VALVE	S.V.	
SANITARY SEWER CLEANOUT OR VENT	S.C.O.	
SEPTIC DRAIN FIELD	S.D.F.	
SIGNALIZATION - UNDERGROUND	SIG(A)	SIG
SOIL BORING LOCATION		
TELEPHONE BOOTH	B	
TELEPHONE MANHOLE	Ⓣ	
TELEPHONE TEST POINT	T	
TRAFFIC - CONDUIT JUNCTION WELL	J.W.	
TRAFFIC - LIGHT POLE AND BASE	◎	
TRAFFIC - PEDESTRIAN POLE & BASE		
TRAFFIC - SIGNAL CABINET & BASE		
TRAFFIC - SIGNAL POLE AND BASE	⊗	⊙
UTILITY BOX	U	
UTILITY POLE GUY WIRE ANCHOR		
UTILITY POLE		
UTILITY TEST HOLE LOCATION		
WATER - UNDERGROUND	W(A)	W
WATER - FIRE HYDRANT	F.H.	F.H.
WATER METER	W.M.	
WATER VALVE	W.V.	W.V.
WELL HEAD	WELL	

PAVEMENT SECTION(S)

2" SUPERPAVE HOT MIX, TYPE C 8" GRADED AGGREGATE BASE COURSE	

NATURAL ROADSIDE FEATURES

FEATURE DESCRIPTION	EXISTING	PROPOSED
HEDGEROW OR THICKET		
MARSH BOUNDARY LINE		
TREE - CONIFEROUS		
TREE - DECIDUOUS		
TREE STUMP		
SHRUBBERY		
WETLAND BOUNDARY - DELINEATED	WL	
WOODS LINE BOUNDARY		
EX. 100-YR FLOODPLAIN	100-YR	
WATERS OF THE US	OHW	
TAX DITCH		

RIGHT-OF-WAY FEATURES

FEATURE DESCRIPTION	EXISTING	PROPOSED
DENIAL OF ACCESS	DA	DA
EASEMENT - OTHERS	EASEMENT TYPE	
PERMANENT EASEMENT	PE	PE
PROPERTY LINE		
PROPERTY MARKER - CONCRETE	C.M.	
PROPERTY MARKER - IRON PIPE	I.P.	
RIGHT-OF-WAY BASELINE	100+00	100+00
RIGHT-OF-WAY LINE		R/W
RIGHT-OF-WAY & DENIAL OF ACCESS	R/W-DA	R/W-DA
RIGHT-TO-ENTER		RTE
TEMPORARY CONSTRUCTION EASEMENT		TCE

SURVEY CONTROL & MONUMENTATION

FEATURE DESCRIPTION	EXISTING
POINT OF CURVATURE OR TANGENCY	
POINT OF INTERSECTING TANGENTS	
SURVEY BENCHMARK LOCATION	B.M.
SURVEY NGS POINT LOCATION	
SURVEY TIE POINT LOCATION	T.P.
SURVEY TRAVERSE POINT	

MISCELLANEOUS FEATURES

FEATURE DESCRIPTION	PROPOSED
BARRIER, DOUBLE-FACED, PERMANENT	
BARRIER, SINGLE-FACED, PERMANENT, TEST LEVEL 4 / TEST LEVEL 5	
BRICK PATTERNED SURFACE	
BUTT JOINT	
CLEAR ZONE	CZ
CONSTRUCTION BASELINE	100+00
LATERAL OFFSET	LO
LIMIT OF CONSTRUCTION	LOC
PAVEMENT PATCH	
PAVEMENT REMOVAL - TOPSOIL, SEED AND MULCH	
P.C.C. SIDEWALK - 4"	
P.C.C. SIDEWALK - 6" (USE 8" DEPTH FOR CHANNELIZATION ISLANDS.)	

IDENTIFIERS

FEATURE DESCRIPTION	ID
ABANDON BY CONTRACTOR	AB C
ABANDON BY OTHERS	AB O
ADJUST BY CONTRACTOR	A C
ADJUST BY OTHERS	A O
BEST MANAGEMENT PRACTICE	BMP XXXX
BUS STOP PAD / TYPE	BSP X
BUS STOP WITH SHELTER PAD / TYPE	BSSP X
CONCRETE SAFETY BARRIER	B XXX
CONVERT TO JUNCTION BOX	CJB XXX
CONVERT TO DRAINAGE MANHOLE	CMH XXX
DO NOT DISTURB	DND
ENERGY DISSIPATOR	ED XXX
FILL WITH FLOWABLE FILL	FF C
LANDSCAPE PLANTINGS	LS XXX
PEDESTRIAN CONNECTION / TYPE	PC XX
PEDESTRIAN CONNECTION / TYPE WITHOUT DETECTABLE WARNING SYSTEM	PC-W XXX
RELOCATE BY CONTRACTOR	RL C
RELOCATE BY OTHERS	RL O
RELOCATE BY PROPERTY OWNER	RL PO
REMOVE BY CONTRACTOR	RM C
REMOVE BY OTHERS	RM O
REMOVE BY TRAFFIC CONTRACTOR	RM TC
RIGHT-OF-WAY MONUMENT	R XXX

MISCELLANEOUS SYMBOLS

FEATURE DESCRIPTION	ID
BURIED LOGS	BL X
WALL	W X
WOODY DEBRIS	WD X
WORKING POINT	WP X

STREAM RESTORATION FEATURES

FEATURE DESCRIPTION	PROPOSED
CONTOUR - MAJOR	15
CONTOUR - MINOR	
PROPOSED BURIED FLOODPLAIN LOG	
PROPOSED STRAIGHT CHANNEL BURIED LOG	
PROPOSED BURIED V-SHAPED CHANNEL LOG	
PROPOSED ORDINARY HIGH WATER/WETLAND	POHW/WL
PROPOSED STREAM CHANNEL	
WOODY DEBRIS PLACEMENT/MICRO-TOPOGRAPHY	
R-5 RIPRAP UNDERLAYMENT - 22" THICKNESS	
CLAY CHANNEL BARRIER	
IMBRICATED STONE	
RIFFLE GRADE CONTROL	

LAST REVISED: 04/29/2020
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ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

LEGEND

SECTION RKK

SHEET NO. 4

GENERAL NOTES

1. THIS PROJECT IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE DELAWARE DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS", DATED JANUARY 2025 AND THE DELAWARE DEPARTMENT OF TRANSPORTATION "STANDARD CONSTRUCTION DETAILS", INCLUDING ALL REVISIONS UP TO THE DATE OF ADVERTISEMENT. SEE NEW CASTLE COUNTY GENERAL NOTES FOR ADDITIONAL PROJECT REQUIREMENTS.

2. ELECTRONIC DESIGN DATA FILES THAT WILL BE MADE AVAILABLE TO THE AWARDED CONTRACTOR, INCLUDE:

( )	NONE
(X)	ASCII DATA FILES WITH COORDINATES AND ELEVATIONS FOR PROPOSED POINTS AS SELECTED BY THE ENGINEER.
(X)	EXISTING DIGITAL TERRAIN MODEL, IN .DTM FILE FORMAT, COMPATIBLE WITH SOFTWARE CURRENTLY USED BY DELDOT.
(X)	PROPOSED DIGITAL TERRAIN MODEL, IN .DTM FILE FORMAT, COMPATIBLE WITH SOFTWARE CURRENTLY USED BY DELDOT.
( )	DESIGN FILE, IN .DGN FILE FORMAT, THAT CONTAINS 3D FEATURE LINES FOR THE PROPOSED DESIGN. 3D FEATURE LINES ARE FOR THE PROPOSED TOP SURFACE ELEVATION ONLY.

NOTE: THE DOCUMENT ENTITLED "RELEASE FOR DELIVERY OF DOCUMENTS IN ELECTRONIC FORM TO A CONTRACTOR" MUST BE SIGNED BY ALL PARTIES PRIOR TO THE DELIVERY OF ANY ELECTRONIC PROJECT FILES.

NOTE: THERE MAY BE SOME AREAS OF THE PROJECT NOT INCLUDED IN THE ELECTRONIC DESIGN DATA FILE(S). IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW THE DESIGN DATA FILE AND DETERMINE THE LIMITS OF THE PROJECT INCLUDED.

3. PROJECT FILES THAT WILL BE MADE AVAILABLE TO THE CONTRACTOR, INCLUDE:

( )	CROSS SECTIONS
( )	RIGHT-OF-WAY PLANS (WILL BE MADE AVAILABLE TO THE AWARDED CONTRACTOR)

PROJECT NOTES

SECTION 100

1. ANY DAMAGE TO ITEMS NOTED TO BE RELOCATED OR RESET BY THE CONTRACTOR, AT THE DISCRETION OF THE ENGINEER, SHALL BE REPAIRED AND/OR REPLACED IN KIND AT THE CONTRACTOR'S EXPENSE.

2. THE CONTRACTOR WILL CONTACT THE DELAWARE TMC AT 302-659-4600 PRIOR TO ANY UNMANNED AERIAL VEHICLE (UAV) FLIGHTS. THE CONTRACTOR WILL BE REQUIRED TO PROVIDE THE FOLLOWING INFORMATION: THE REGISTRATION NUMBER OF THE UAV, THE FLIGHT TIME, LOCATION OF THE FLIGHT, THE PILOT'S NAME AND THE PILOT'S CONTACT NUMBER DURING THE FLIGHT.

3. NIGHT WORK IS NOT PERMITTED ON THIS PROJECT UNLESS THE CONTRACTOR OBTAINS: APPROVAL FROM THE ENGINEER, ACCEPTABLE RESPONSES ON NIGHT WORK SURVEYS, AND ACCEPTANCE FROM THE MUNICIPALITY. METHOD AND FORMAT OF NIGHT WORK SURVEYS WILL BE PROVIDED BY THE ENGINEER UPON REQUEST. NIGHT WORK, SURVEYS, AND COORDINATION WITH MUNICIPALITIES IS NOT COMPENSABLE AND THE TIME TO COMPLETE THE SURVEYS IS NOT EXCUSABLE.

SECTION 200

4. ITEMS TO BE REMOVED UNDER ITEM 211000 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:
   a. EXISTING PEDESTRIAN BRIDGES AND ASSOCIATED BRIDGE FOUNDATIONS.
   b. HEADWALLS

5. REMOVAL OF EXISTING STORM DRAIN PIPE SHALL BE PAID UNDER ITEM 202000 UNLESS NOTED WITH A FLOWABLE FILL IDENTIFIER. DISPOSAL OR PLACEMENT OF BITUMINOUS MATERIAL WITHIN AN EXCAVATION AREA WILL BE PAID UNDER ITEM 202000 – EXCAVATION AND EMBANKMENT.

6. EXISTING TREES LOCATED WITHIN THE LIMIT OF CONSTRUCTION SHALL NOT BE DISTURBED UNLESS DESIGNATED TO BE REMOVED BY THE CONTRACTOR. PRIOR TO TREE REMOVAL THE CONTRACTOR SHALL CONDUCT A WALKTHROUGH OF THE TRAIL ALIGNMENTS WITH THE ENGINEER TO CONFIRM ALL TREE REMOVALS. REMOVAL OF TREES AND SHRUBS SHALL BE PAID FOR UNDER 201000. ALL EXISTING TREES TO REMAIN THAT ARE DISTURBED DURING CONSTRUCTION SHALL HAVE THE DAMAGE CORRECTED BY AN I.S.A. CERTIFIED ARBORIST AT THE CONTRACTOR'S EXPENSE.

7. ONLY EXISTING FEATURES WITHIN THE LOC IDENTIFIED WITH REMOVE BY CONTRACTOR OR BY OTHER METHODS ARE TO BE REMOVED OR DISTURBED.

SECTION 600

8. STATION AND ELEVATION DATA GIVEN FOR DRAINAGE STRUCTURES ARE TO BE APPLIED TO THE CENTER OF THE GRATE FOR INLETS AND TO THE CENTER OF THE STRUCTURE FOR JUNCTION BOXES AND MANHOLES.

9. IF PRECASTING, CONTRACTOR SHALL FIELD DETERMINE EXISTING PIPE INVERTS AT PROPOSED MANHOLES PRIOR TO ORDERING MANHOLES FOR FABRICATION.

SECTION 700

10. WHERE PROPOSED CONCRETE SIDEWALK IS CONSTRUCTED TO MEET EXISTING SIDEWALK, THE EXISTING SIDEWALK SHALL BE SAWCUT AT THE TIE-IN POINT OR MEET THE NEAREST EXISTING SIDEWALK JOINT. ALL SAW CUTTING SHALL BE FULL DEPTH, UNLESS OTHERWISE NOTED ON THE PLANS OR DIRECTED BY THE ENGINEER AND SHALL BE PAID FOR UNDER ITEM 762001 - SAWCUTTING, CONCRETE, FULL DEPTH.

11. ALL PAVED AREAS TO BE RECONSTRUCTED OR WIDENED SHALL BE SAWCUT AT THE POINT WHERE THE NEW PAVEMENT IS TO TIE INTO THE EXISTING PAVEMENT.

12. DELDOT STANDARD CONSTRUCTION DETAIL M-5 (2020) SHALL BE USED IN ALL LOCATIONS ITEM 727002 IS DENOTED ON THE PLANS. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL A METHOD TO OVERLAP THE WOODEN FENCE RAILS WITH THE PEDESTRIAN BRIDGE RAILING TO PROTECT AGAINST VERTICAL DROPS AT THE ABUTMENTS.

SECTION 900

13. THIS PROJECT IS COVERED UNDER AN NPDES GENERAL PERMIT FOR CONSTRUCTION. UNDER THE GENERAL PERMIT, COMPLIANCE WITH NEW CASTLE COUNTY'S APPROVED SEDIMENT AND STORMWATER MANAGEMENT PLANS WILL CONSTITUTE COMPLIANCE WITH THE NPDES INDUSTRIAL PERMITTING REQUIREMENTS FOR THIS CONSTRUCTION PROJECT. A COPY OF THE NPDES GENERAL PERMIT AND NOI IS KEPT ON FILE IN EACH OF THE CONSTRUCTION OFFICES AND NEW CASTLE COUNTY'S STORMWATER SECTION. A COPY OF THE GENERAL PERMIT OR THE NOI CAN BE OBTAINED UPON REQUEST FROM EITHER NEW CASTLE COUNTY'S STORMWATER ENGINEER OR THE APPROPRIATE CONSTRUCTION ENGINEER.

MISCELLANEOUS

14. THE CONTRACTOR SHALL PRUNE ALL TREES ALONG THE PROPOSED TRAILS TO WITHIN 84" OF THE PROPOSED GROUND ELEVATIONS. COSTS ASSOCIATED WITH THIS WORK SHALL BE PAID FOR UNDER ITEM 201000 - CLEARING AND GRUBBING.

NEW CASTLE COUNTY GENERAL NOTES

15. IN ADDITION TO THE SPECIFIED DELDOT STANDARDS AND SPECIFICATIONS, THIS PROJECT SHALL BE CONSTRUCTED IN ACCORDANCE WITH NEW CASTLE COUNTY, DELAWARE, STANDARD SPECIFICATIONS FOR CONSTRUCTION, DATED MARCH 1975, AND ALL CURRENT SUPPLEMENTAL ISSUES, SUPPLEMENTAL SPECIFICATIONS, AND SPECIAL PROVISIONS.

16. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS AND FIELD CONDITIONS PRIOR TO BEGINNING WORK.

17. CONSTRUCTION DEBRIS SHALL BE LAWFULLY DISPOSED OF OFF SITE.

18. WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, COUNTY, FEDERAL, AND ENVIRONMENTAL REQUIREMENTS.

19. THE CONTRACTOR SHALL BE RESPONSIBLE TO REPAIR ANY DAMAGE CAUSED BY HIS OPERATIONS AT NO COST TO NEW CASTLE COUNTY.

20. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN THE APPROVAL AND THE ACCEPTANCE OF THE COMPLETED PROJECT BY NEW CASTLE COUNTY UPON COMPLETION OF CONSTRUCTION.

21. EXISTING UTILITIES ARE IN ACCORDANCE WITH THE BEST AVAILABLE INFORMATION. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY UTILITY LOCATIONS IN THE FIELD BEFORE BEGINNING WORK. THE CONTRACTOR IS RESPONSIBLE FOR RESOLVING ANY AND ALL CONFLICTS WITH UTILITIES.

22. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT THE EXISTING UTILITIES AND MAINTAIN UNINTERRUPTED SERVICE. ANY DAMAGE DONE TO UTILITIES DUE TO CONTRACTOR'S NEGLIGENCE SHALL BE IMMEDIATELY AND COMPLETELY REPAIRED AT CONTRACTOR'S EXPENSE.

23. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACEMENT OF DAMAGED OR DESTROYED LANDSCAPING.

24. PLAN LOCATIONS AND DIMENSIONS SHALL BE STRICTLY ADHERED TO UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

25. NO CONSTRUCTION SHALL DEVIATE FROM THE APPROVED PLANS AND SPECIFICATIONS WITHOUT WRITTEN PERMISSION FROM NEW CASTLE COUNTY.

26. THESE DRAWINGS DO NOT INCLUDE THE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY. ALL CONSTRUCTION MUST BE DONE IN COMPLIANCE WITH THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970, AND ALL RULES AND REGULATIONS THERETO AND APPURTENANT.

27. CONTRACTOR SHALL SAW CUT AND REMOVE EXISTING PAVEMENT AS REQUIRED. DISPOSAL OFF SITE SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

28. FABRICATION AND INSTALLATION OF ALL MATERIALS, EQUIPMENT, ETC., SHALL BE IN ACCORDANCE WITH THE STANDARD INDUSTRY PRACTICE, BUILDING CODES AND MANUFACTURERS RECOMMENDATIONS. ALL EXISTING CONDITIONS AND DIMENSIONS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO ORDERING AND/OR FABRICATION OF ANY MATERIALS.

29. ANY EXISTING LATERALS TO SANITARY SEWER SHALL BE RECONNECTED. SEWER SERVICE SHOULD REMAIN UNINTERRUPTED.

30. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MEANS, METHODS, TECHNIQUES AND SEQUENCE OF CONSTRUCTION INCLUDING ANY BYPASS PUMPING AND/OR DEWATERING IN CONJUNCTION WITH THE WORK.

31. MISS UTILITY SHALL BE NOTIFIED THREE (3) CONSECUTIVE WORKING DAYS PRIOR TO EXCAVATION, AT 1-800-282-8555.

32. THE LIMIT OF DISTURBANCE FOR THIS CONSTRUCTION ACTIVITY IS BASED ON THE CONFIGURATION SHOWN ON THE CONSTRUCTION PLANS.

33. THE CONTRACTOR SHALL PROVIDE A CERTIFIED CONSTRUCTION REVIEWER TO MONITOR SEDIMENT AND STORMWATER MANAGEMENT PRACTICES ACCORDING TO NEW CASTLE COUNTY CODE SECTION 12.05.001.

34. UPON COMPLETION OF THE INSTALLATION OF THE PROJECT THE CONTRACTOR SHALL PROVIDE A REPRODUCIBLE SET OF CLEARLY READABLE 'AS-BUILT' CONTRACT DRAWINGS REFLECTING ALL CHANGES MADE DURING THE CONSTRUCTION PERIOD. 'AS-BUILT' DRAWINGS SHALL BE PREPARED BY, SIGNED, AND SEALED BY A PROFESSIONAL ENGINEER OR LAND SURVEYOR REGISTERED IN THE STATE OF DELAWARE.

35. THE CONTRACTOR MUST RESTRICT ALL CONSTRUCTION ACTIVITY TO "WITHIN" THE "LIMITS OF CONSTRUCTION". LAND DISTURBING ACTIVITY MAY NOT OCCUR BEYOND THE LIMIT OF CONSTRUCTION UNLESS THE CONTRACTOR OBTAINS PRIOR, WRITTEN APPROVAL FROM AN AUTHORIZED REPRESENTATIVE OF THE PROPERTY OWNER(S).

36. PARKING FOR CONTRACTOR'S VEHICLES OR CONTRACTOR'S EMPLOYEES' VEHICLES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

37. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SECURITY OF HIS MATERIALS AND EQUIPMENT.

38. THE CONTRACTOR SHALL PERFORM THE VARIOUS ITEMS OF WORK UNDER THE CONTRACT IN A SEQUENCE OF HIS CHOOSING TO MEET HIS PROGRESS SCHEDULE BUT IN KEEPING WITH THE REQUIREMENTS OF THE CONTRACT SPECIFICATIONS AND DRAWINGS.

39. THE CONTRACTOR SHALL PROVIDE BY-PASS PUMPING AND SUCCESSFULLY BY-PASS ALL STREAM FLOWS THROUGH THE WORK AREAS.

40. THE CONTRACTOR SHALL MAINTAIN ONE SET OF ALL CONTRACT DOCUMENTS (CONSTRUCTION DRAWINGS, SPECIFICATIONS, REFERENCE DOCUMENTS AND TECHNICAL DOCUMENTS) AT THE PROJECT LOCATION SO AS TO BE ACCESSIBLE FOR INSPECTION AND REGULATORY REVIEW.

41. TRAFFIC CONTROLS FOR WORK IN THE STATE OF DELAWARE RIGHT-OF-WAY SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND ESTABLISHED ACCORDING TO THE DELAWARE DEPARTMENT OF TRANSPORTATION'S MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) FOR STREETS AND HIGHWAYS, CASE 2 (TWO-LANE, TWO-WAY TRAFFIC SHOULDER CLOSURE - WITHIN TEN FEET OF TRAVELWAY).

EARTHWORK SUMMARY

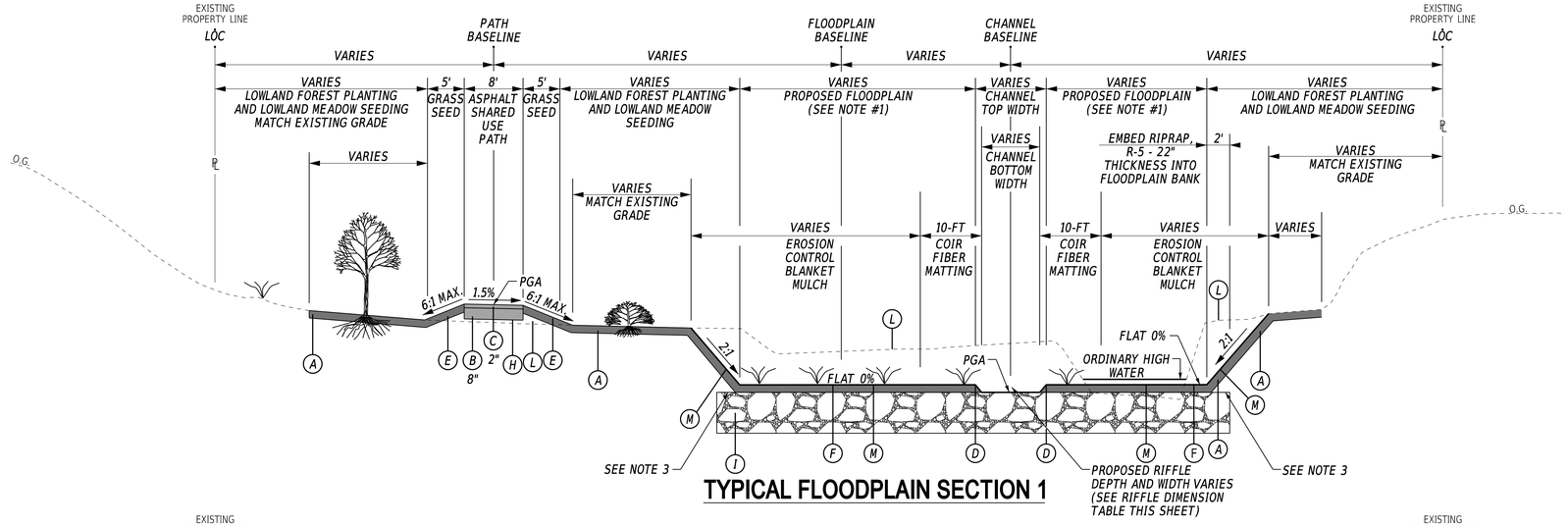
EXCAVATION	
EXCAVATION FROM CROSS SECTIONS	21,149 C.Y.
ROCK EXCAVATION FOR ROADWAY AND TRENCHES	0 C.Y.
EXCAVATION FOR STRUCTURES	145 C.Y.
CHANNEL EXCAVATION	4,709 C.Y.
TOPSOIL STRIPPING	4,043 C.Y.
TOTAL EXCAVATION	30,046 C.Y.
EXCAVATION AVAILABLE FOR EMBANKMENT	
EXCAVATION MEETING BORROW TYPE 'A'	0 C.Y.
EXCAVATION MEETING BORROW TYPE 'F'	19,035 C.Y.
EXCAVATION MEETING CHANNEL BED FILL	2,354 C.Y.
EXCAVATION MEETING TOPSOIL	2,021 C.Y.
EMBANKMENT REQUIREMENTS	
BORROW TYPE 'A' REQUIRED (INCLUDING UNDERCUT)	0 C.Y.
BORROW TYPE 'F' REQUIRED	8,429 C.Y.
CHANNEL BED FILL REQUIRED	2,225 C.Y.
TOPSOIL REQUIRED	14,401 C.Y.
MATERIAL BALANCE ("+"= EXCESS, "-"= NEED)	
BORROW TYPE 'A'	0 C.Y.
BORROW TYPE 'F'	10,605 C.Y.
CHANNEL BED FILL	130 C.Y.
TOPSOIL	-12,380 C.Y.
UNSUITABLE MATERIAL	-312 C.Y.

NOTES:
1) THE VALUES LISTED IN THE EARTHWORK SUMMARY ARE APPROXIMATE AND ARE NOT TO BE USED AS A BASIS OF PAYMENT. THE EARTHWORK SUMMARY IS CONSIDERED FOR INFORMATIONAL PURPOSES ONLY.

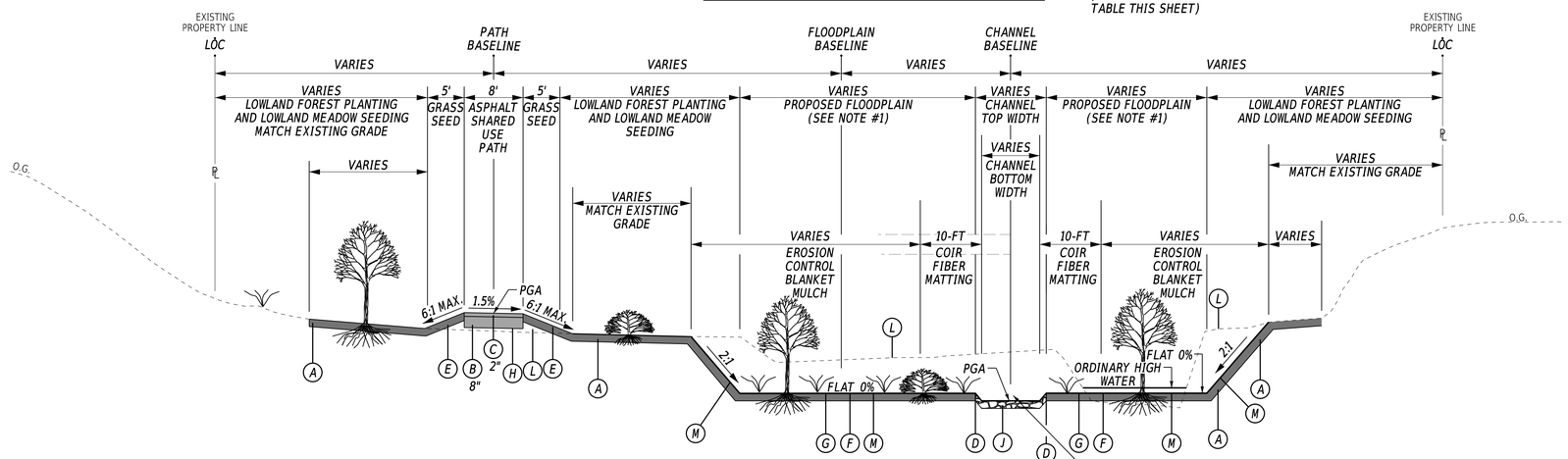
2) OTHER SOURCES OF EXCAVATION MAY INCLUDE PIPE TRENCH EXCAVATION, STRUCTURE EXCAVATION, UNDERCUT EXCAVATION, STORMWATER MANAGEMENT POND EXCAVATION, ENVIRONMENTAL SITE EXCAVATION, MAINTENANCE OF TRAFFIC EXCAVATION, ETC.

3) UNSUITABLE MATERIALS INCLUDE UNDERCUT SOILS, BITUMINOUS PAVEMENT, ETC.

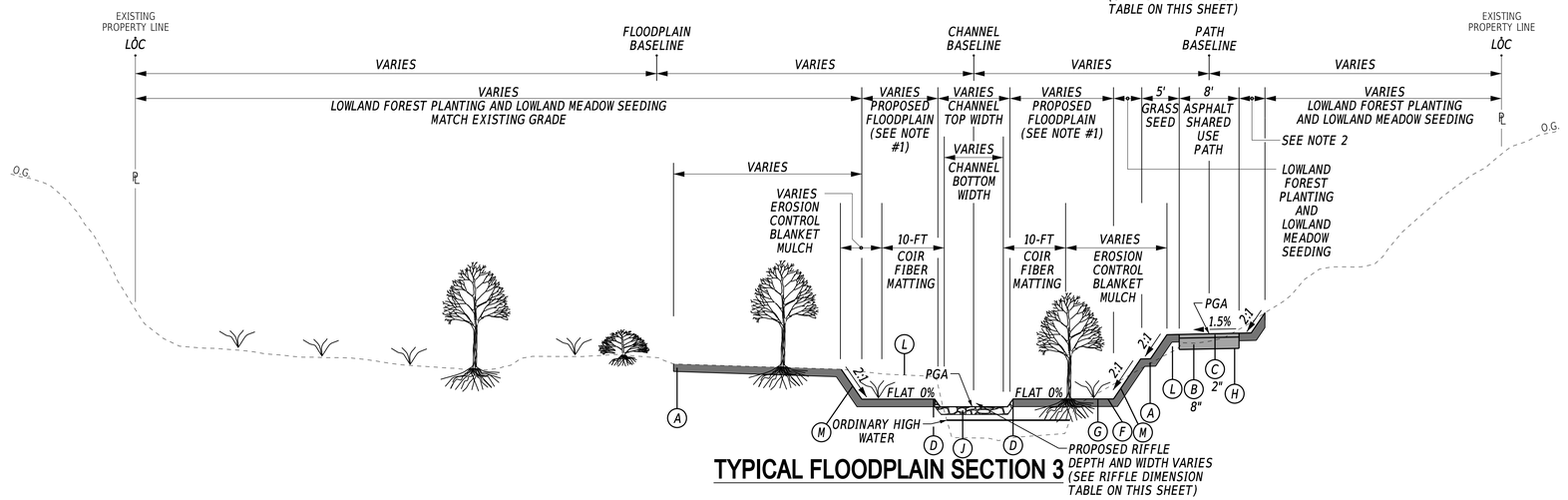
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TYPICAL FLOODPLAIN SECTION 1



TYPICAL FLOODPLAIN SECTION 2



TYPICAL FLOODPLAIN SECTION 3

LEGEND

- (A) ITEM 908003 - TOPSOIL, 4" DEPTH
- (B) ITEM 301001 - GABC
- (C) ITEM 401005 - SUPERPAVE TYPE C, 9.5 MM, PG 64-22, (CARBONATE STONE)
- (D) ITEM 908504 - COIR FIBER MATTING
- (E) ITEM 908016 - PERMANENT GRASS SEEDING, SUBDIVISION
- (F) FLOODPLAIN MEADOW SEEDING
- (G) FLOODPLAIN FOREST PLANTING
- (H) ITEM 708002 - GEOTEXTILES, SEPARATION
- (I) ITEM 707011 - RIPRAP, R-5
- (J) SALVAGED STREAMBED MATERIAL - 12" THICKNESS
- (K) ITEM 727002 - WOOD POST AND RAIL FENCE
- (L) ITEM 202000- SUITABLE PROJECT EXCAVATION MEETING BORROW, TYPE F
- (M) ITEM 908020 - EROSION CONTROL BLANKET MULCH (SSM-II)

NOTES:

1. CREATE SURFACE ROUGHNESS WITHIN THE PROPOSED FLOODPLAIN AREA EXTENDING FROM THE CHANNEL BANKS TO THE TO THE FLOODPLAIN BANKS WITH HIGH AND LOW POINTS IN THE TOPOGRAPHY RANGING IN ELEVATION FROM PLUS OR MINUS TWO TENTHS (0.2) OF A FOOT OF THE PROPOSED FINISHED GRADE.
2. ITEM 908016 - PERMANENT GRASS SEEDING, SUBDIVISION TO BE PLACED WHEN DISTURBANCE FROM EDGE OF ASPHALT PATH IS 5-FT OR LESS. WHEN DISTURBANCE EXCEEDS 5-FT FROM EDGE OF ASPHALT PATH PLACE LOWLAND MEADOW SEEDING AND LOWLAND FOREST PLANTING BEYOND 5-FT OF PERMANENT GRASS SEEDING, SUBDIVISION.
3. CONTRACTOR SHALL OVEREXCAVATE A MINIMUM OF 2-FT INTO 2:1 FLOODPLAIN SIDE SLOPE FOR PLACEMENT OF ITEM 707022 - RIPRAP, R-5 - 22" THICKNESS.
4. IN LOCATIONS WHERE TOE OF PROPOSED CHANNEL IS LESS THAN 10-FT FROM THE TOE OF 2:1 SIDE SLOPE GRADING FOR THE FLOODPLAIN, THE COIR FIBER MATTER SHALL EXTEND AT A MINIMUM FROM THE TOE OF THE PROPOSED CHANNEL AND UP THE 2:1 SIDE SLOPE GRADING FOR THE FLOODPLAIN. EROSION CONTROL BLANKET MULCH SHALL BE USED FOR THE REMAINDER OF THE SIDE SLOPE.
5. SEE THIS SHEET FOR POOL TYPICAL SECTION. POOLS SHALL BE CONSTRUCTED ACCORDING TO THE POOL TYPICAL SECTION, PLANS, AND PROFILE AS APPLICABLE FOR EACH FLOODPLAIN TYPICAL SECTION. POOL DEPTHS AND TOP WIDTH VARY AS SHOWN ON SHEETS 33-39 AND ON THE STREAM RESTORATION PLANS.
6. SUITABLE PROJECT EXCAVATION MEETING BORROW, TYPE F SHALL BE USED TO FILL THE EXISTING CHANNEL AND/OR PROPOSED FLOODPLAIN AS NEEDED TO MEET FINAL PROPOSED GRADES. THE TOP 12" OF FILL WITHIN THE PROPOSED CHANNEL SHALL BE SALVAGED STREAMBED MATERIAL - 12" THICKNESS.

FLOODPLAIN TYPICAL SECTION TABLE

TYPICAL SECTION	START STATION	STOP STATION
1	103+01	104+23
2	104+23	123+53
1	123+53	123+85
2	123+85	128+70
1	128+70	129+00
3	129+00	140+33
4	201+74	202+15
5	202+15	207+71
4	301+11	301+54
5	301+54	303+30
4	303+30	303+75

NOTES:
1. SEE SHEET NO. 7 FOR TYPICAL SECTIONS 4-5

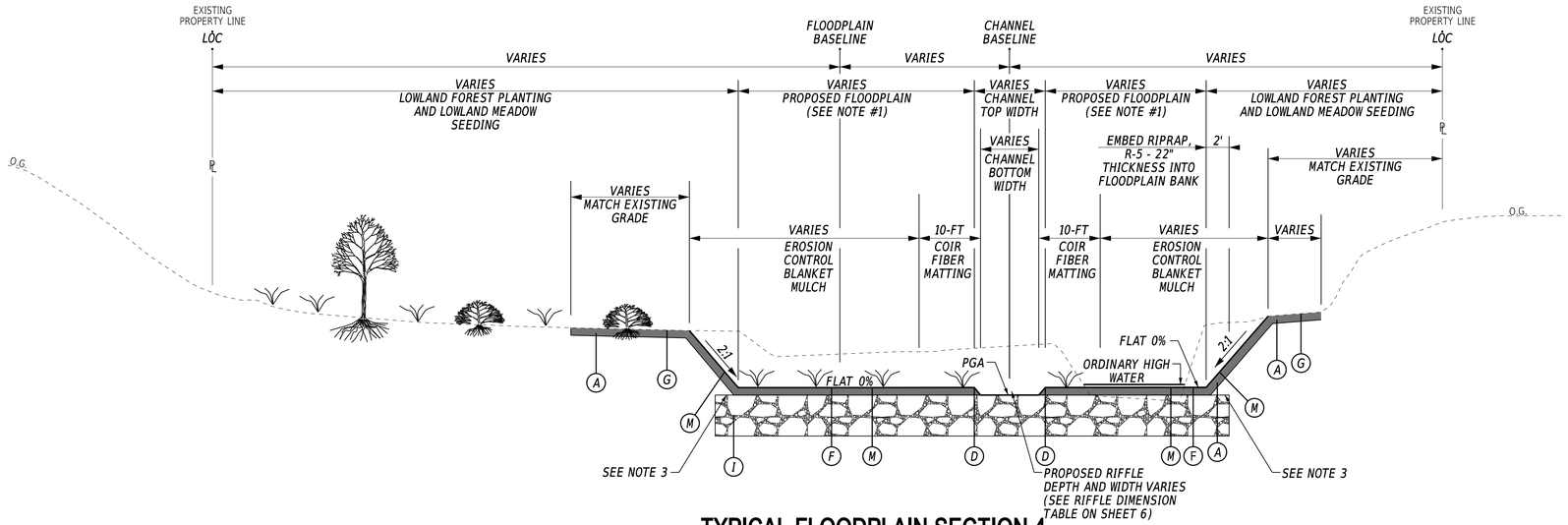
RIFFLE DIMENSION TABLE

REACH	START STATION	STOP STATION	TOP WIDTH (FT)	DEPTH (FT)[1]	SIDE SLOPE
LITTLE MILL CREEK	5+78.8	18+18.0	11.0	0.50	2:1
LITTLE MILL CREEK	18+18.0	20+36.4	12.0	0.56	2:1
LITTLE MILL CREEK	20+36.4	29+62.3	12.0	0.56	2:1
LITTLE MILL CREEK	29+62.3	33+55.4	12.0	0.56	2:1
LITTLE MILL CREEK	33+55.4	37+93.2	13.8	0.64	2:1
LITTLE MILL CREEK	37+93.2	42+68.7	12.0	0.56	2:1
LITTLE MILL CREEK	42+68.7	47+43.3	11.5	0.45	2:1
TRIBUTARY 1	60+71.8	64+83.6	4.7	0.35	2:1
TRIBUTARY 1	64+83.6	67+45.3	4.7	0.40	2:1
TRIBUTARY 1	67+45.3	67+83.4	5.3	0.45	2:1
TRIBUTARY 2	80+58.4	83+18.7	2.5	0.30	2:1
TRIBUTARY 2	83+18.7	83+45.0	2.7	0.40	2:1
TRIBUTARY 2	83+45.0	83+54.3	2.7	0.56	2:1

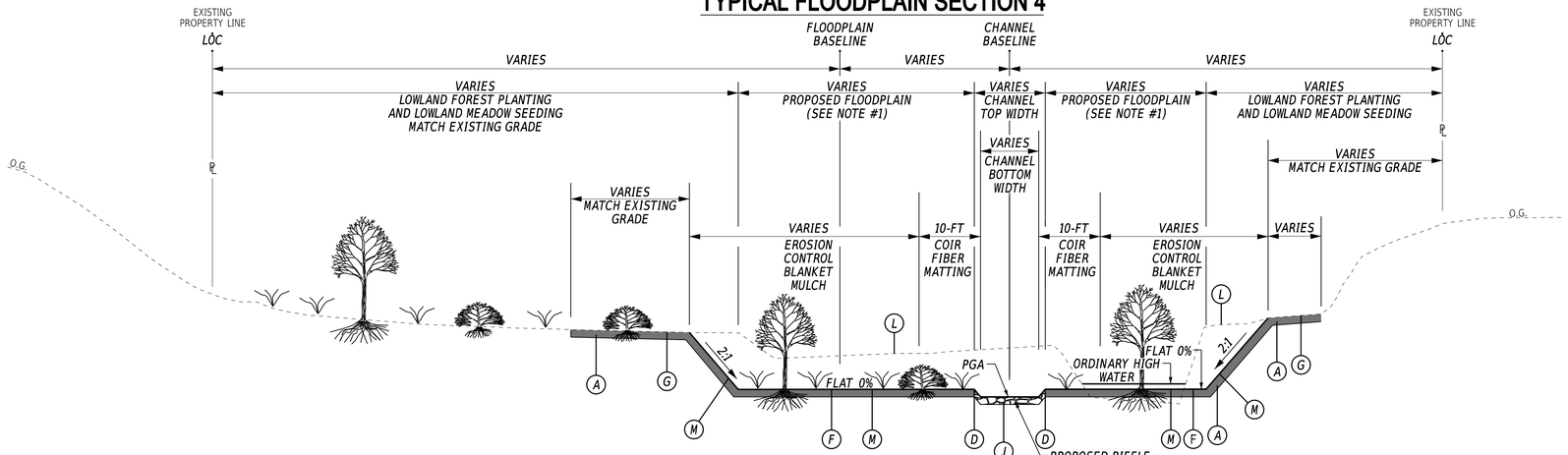
NOTES:
1. RIFFLE DEPTH GIVEN AT CREST OF RIFFLE
2. PROPOSED RIFFLES LISTED ON SHEET 50 WITHIN THE LIMITS OF RIPRAP, R-5 SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE RIFFLE GRADE CONTROL STRUCTURE DETAIL ON SHEET 50

ADDENDA / REVISIONS		NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	TYPICAL SECTIONS	SECTION RKK
					DESIGNED BY: N. RILEY		SHEET NO. 6
					CHECKED BY: T. CUTILLO		

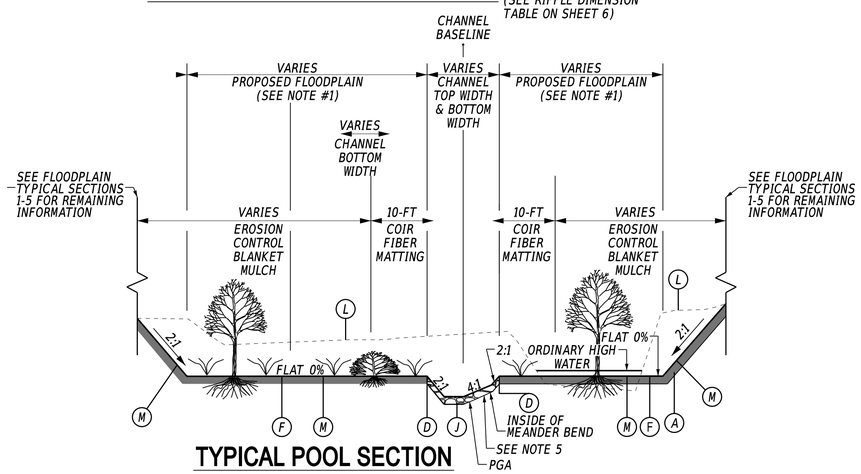
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TYPICAL FLOODPLAIN SECTION 4



TYPICAL FLOODPLAIN SECTION 5



TYPICAL POOL SECTION

LEGEND

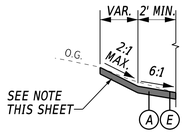
- (A) ITEM 908003 - TOPSOIL, 4" DEPTH
- (B) ITEM 301001 - GABC
- (C) ITEM 401005 - SUPERPAVE TYPE C, 9.5 MM, PG 64-22, (CARBONATE STONE)
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- (J) SALVAGED STREAMBED MATERIAL - 12" THICKNESS
- (K) ITEM 727002 - WOOD POST AND RAIL FENCE
- (L) ITEM 202000- SUITABLE PROJECT EXCAVATION MEETING BORROW, TYPE F
- (M) ITEM 908020 - EROSION CONTROL BLANKET MULCH (SSM-II)

NOTES:

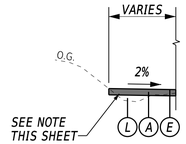
1. CREATE SURFACE ROUGHNESS WITHIN THE PROPOSED FLOODPLAIN AREA EXTENDING FROM THE CHANNEL BANKS TO THE TO THE FLOODPLAIN BANKS WITH HIGH AND LOW POINTS IN THE TOPOGRAPHY RANGING IN ELEVATION FROM PLUS OR MINUS TWO TENTHS (0.2) OF A FOOT OF THE PROPOSED FINISHED GRADE.
2. SEE FLOODPLAIN TYPICAL SECTION TABLE ON SHEET 6 FOR FLOODPLAIN TYPICAL SECTION 4 AND FLOODPLAIN TYPICAL SECTION 5 START AND STOP STATIONING.
3. CONTRACTOR SHALL OVEREXCAVATE A MINIMUM OF 2-FT INTO 2:1 FLOODPLAIN SIDE SLOPE FOR PLACEMENT OF ITEM 707022 - RIPRAP, R-5 - 22" THICKNESS.
4. IN LOCATIONS WHERE TOE OF PROPOSED CHANNEL IS LESS THAN 10-FT FROM THE TOE OF 2:1 SIDE SLOPE GRADING FOR THE FLOODPLAIN, THE COIR FIBER MATTER SHALL EXTEND AT A MINIMUM FROM THE TOE OF THE PROPOSED CHANNEL AND UP THE 2:1 SIDE SLOPE GRADING FOR THE FLOODPLAIN. EROSION CONTROL BLANKET MULCH SHALL BE USED FOR THE REMAINDER OF THE SIDE SLOPE.
5. SEE SHEET 7 FOR POOL TYPICAL SECTION. POOLS SHALL BE CONSTRUCTED ACCORDING TO THE POOL TYPICAL SECTION, PLANS, AND PROFILE AS APPLICABLE FOR EACH FLOODPLAIN TYPICAL SECTION. POOL DEPTHS AND TOP WIDTH VARY AS SHOWN ON SHEETS 33-39 AND ON THE STREAM RESTORATION PLANS.
6. SUITABLE PROJECT EXCAVATION MEETING BORROW, TYPE F SHALL BE USED TO FILL THE EXISTING CHANNEL AND/OR PROPOSED FLOODPLAIN AS NEEDED TO MEET FINAL PROPOSED GRADES. THE TOP 12" OF FILL WITHIN THE PROPOSED CHANNEL SHALL BE SALVAGED STREAMBED MATERIAL - 12" THICKNESS.

ADDENDA / REVISIONS	NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION	CONTRACT 20230414279	TYPICAL SECTIONS	SECTION RKK
			DESIGNED BY: N. RILEY		SHEET NO. 7
			CHECKED BY: T. CUTILLO		

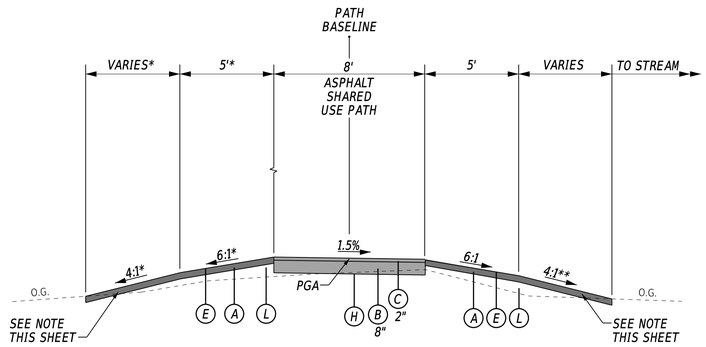
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LEFT END CONDITION IN CUT
PATH 1000, PATH 7000



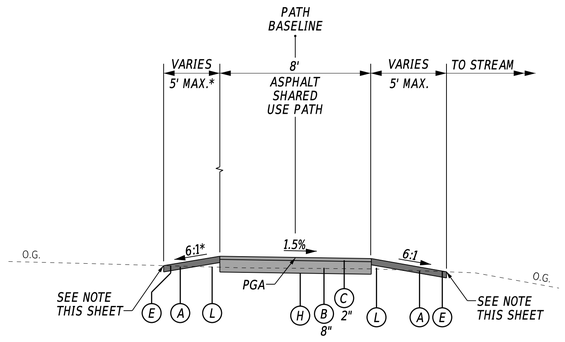
LEFT END CONDITION - PATH 1000
STA. 1001+42 TO STA. 1002+10



*OR PER LEFT END CONDITION THIS SHEET

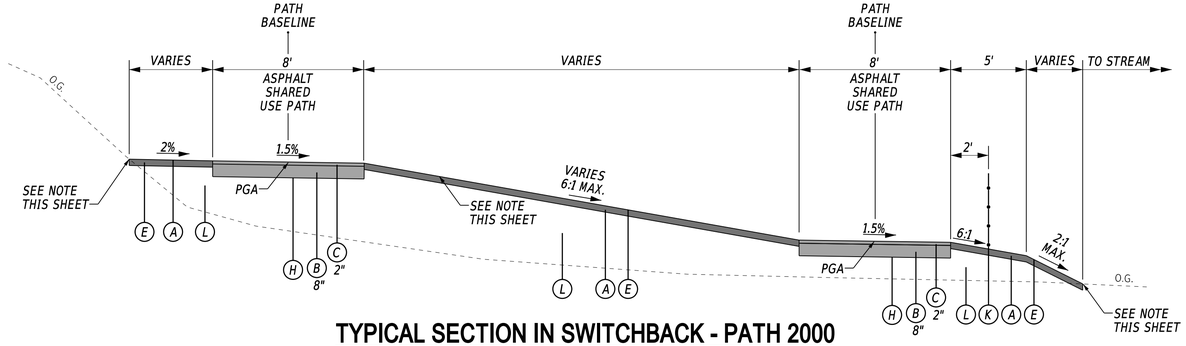
**2:1 MAXIMUM PERMISSABLE FOR FLOODPLAIN TIE-IN

TYPICAL SECTION IN HIGH FILL
PATH 1000, PATH 2000, PATH 5000

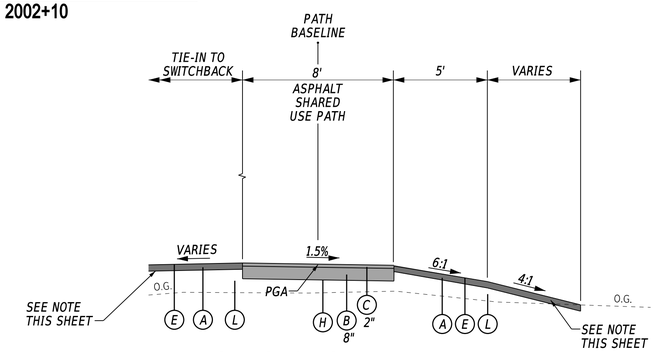


*OR PER LEFT END CONDITION THIS SHEET

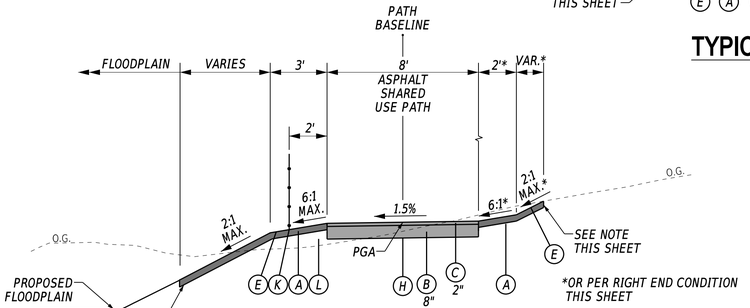
TYPICAL SECTION
PATH 1000, PATH 2000, PATH 5000, PATH 6000, PATH 7000



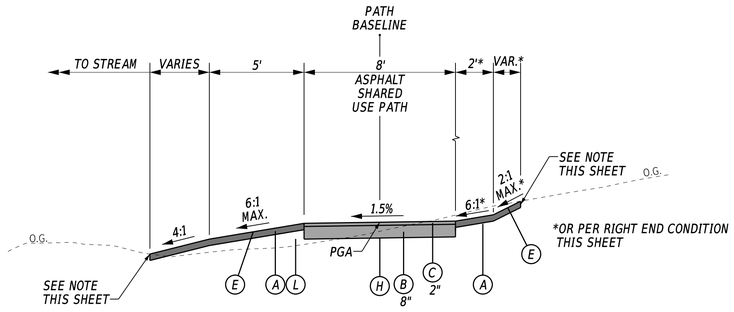
TYPICAL SECTION IN SWITCHBACK - PATH 2000
STA. 2000+00 TO STA. 2002+10



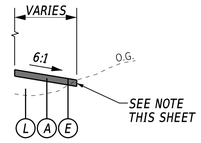
TYPICAL SECTION - PATH 4000



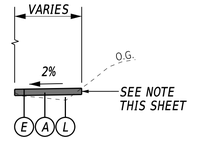
TYPICAL SECTION WITH WOOD RAIL FENCE
PATH 3000
STA. 3000+40 TO STA. 3001+10
STA. 3002+85 TO STA. 3007+15
STA. 3009+75 TO STA. 3013+50



TYPICAL SECTION - PATH 3000



RIGHT END CONDITION IN FILL - PATH 3000
STA. 3000+00 TO STA. 3000+35
STA. 3006+95 TO STA. 3009+55
STA. 3012+90 TO STA. 3014+57



RIGHT END CONDITION IN FILL - PATH 3000
STA. 3000+35 TO STA. 3003+50
STA. 3003+80 TO STA. 3004+08
STA. 3004+32 TO STA. 3006+95
STA. 3009+55 TO STA. 3010+35
STA. 3011+30 TO STA. 3011+60
STA. 3011+80 TO STA. 3012+20

LEGEND

- (A) ITEM 908003 - TOPSOIL, 4" DEPTH
- (B) ITEM 301001 - GABC
- (C) ITEM 401005 - SUPERPAVE TYPE C, 9.5 MM, PG 64-22, (CARBONATE STONE)
- (D) ITEM 908504 - COIR FIBER MATTING
- (E) ITEM 908016 - PERMANENT GRASS SEEDING, SUBDIVISION
- (F) FLOODPLAIN MEADOW SEEDING
- (G) FLOODPLAIN FOREST PLANTING
- (H) ITEM 708002 - GEOTEXTILES, SEPARATION
- (I) ITEM 707011 - RIPRAP, R-5
- (J) SALVAGED STREAMBED MATERIAL - 12" THICKNESS
- (K) ITEM 727002 - WOOD POST AND RAIL FENCE
- (L) ITEM 202000- SUITABLE PROJECT EXCAVATION MEETING BORROW, TYPE F
- (M) ITEM 908020 - EROSION CONTROL BLANKET MULCH (SSM-II)

NOTE:

1. ITEM 908016 - PERMANENT GRASS SEEDING, SUBDIVISION TO BE PLACED WHEN DISTURBANCE FROM EDGE OF ASPHALT PATH IS 5-FT OR LESS. WHEN DISTURBANCE EXCEEDS 5-FT FROM EDGE OF ASPHALT PATH PLACE LOWLAND MEADOW SEEDING AND LOWLAND FOREST PLANTING BEYOND 5-FT OF PERMANENT GRASS SEEDING, SUBDIVISION.

MATERIAL	LIFT THICKNESS	
	MINIMUM	MAXIMUM
BITUMINOUS CONCRETE, TYPE 'C'	1.25"	2"
BITUMINOUS CONCRETE, TYPE 'B'	2.25"	4"
BITUMINOUS CONCRETE BASE COURSE	3"	6"
GRADED AGGREGATE BASE COURSE	4"	8"

ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK
STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: C. HALL
CHECKED BY: C. WEBB

TYPICAL SECTIONS

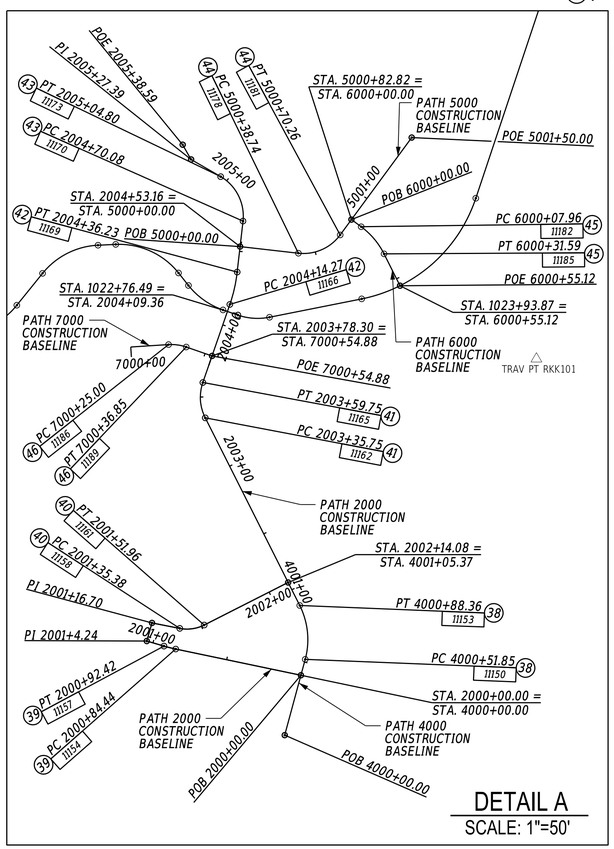
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SHEET NO. 8

01-MAY-2025
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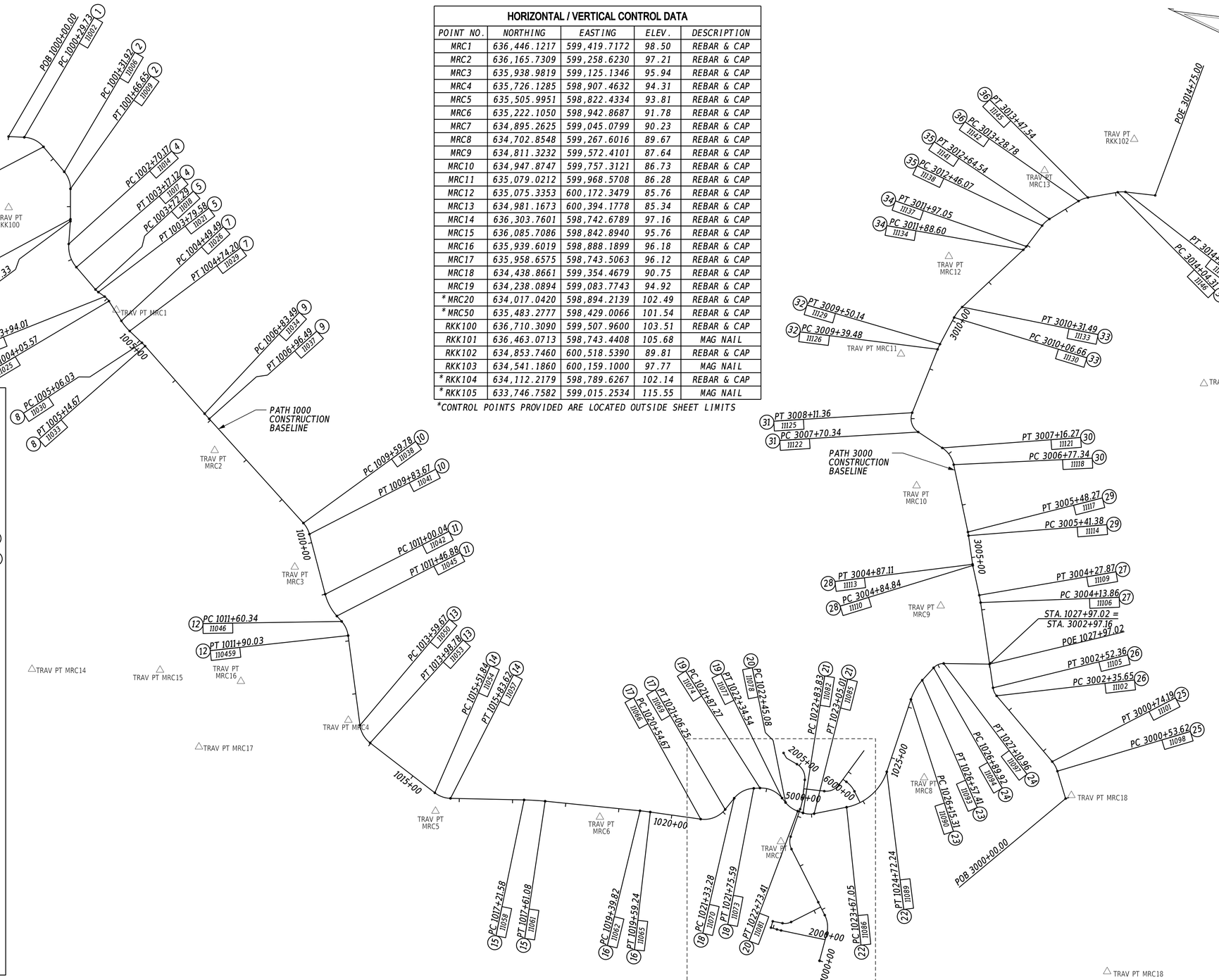
HORIZONTAL / VERTICAL CONTROL DATA

POINT NO.	NORTHING	EASTING	ELEV.	DESCRIPTION
MRC1	636,446.1217	599,419.7172	98.50	REBAR & CAP
MRC2	636,165.7309	599,258.6230	97.21	REBAR & CAP
MRC3	635,938.9819	599,125.1346	95.94	REBAR & CAP
MRC4	635,726.1285	598,907.4632	94.31	REBAR & CAP
MRC5	635,505.9951	598,822.4334	93.81	REBAR & CAP
MRC6	635,222.1050	598,942.8687	91.78	REBAR & CAP
MRC7	634,895.2625	599,045.0799	90.23	REBAR & CAP
MRC8	634,702.8548	599,267.6016	89.67	REBAR & CAP
MRC9	634,811.3232	599,572.4101	87.64	REBAR & CAP
MRC10	634,947.8747	599,757.3121	86.73	REBAR & CAP
MRC11	635,079.0212	599,968.5708	86.28	REBAR & CAP
MRC12	635,075.3353	600,172.3479	85.76	REBAR & CAP
MRC13	634,981.1673	600,394.1778	85.34	REBAR & CAP
MRC14	636,303.7601	598,742.6789	97.16	REBAR & CAP
MRC15	636,085.7086	598,842.8940	95.76	REBAR & CAP
MRC16	635,939.6019	598,888.1899	96.18	REBAR & CAP
MRC17	635,958.6575	598,743.5063	96.12	REBAR & CAP
MRC18	634,438.8661	599,354.4679	90.75	REBAR & CAP
MRC19	634,238.0894	599,083.7743	94.92	REBAR & CAP
*MRC20	634,017.0420	598,894.2139	102.49	REBAR & CAP
*MRC50	635,483.2777	598,429.0066	101.54	REBAR & CAP
RKK100	636,710.3090	599,507.9600	103.51	REBAR & CAP
RKK101	636,463.0713	598,743.4408	105.68	MAG NAIL
RKK102	634,853.7460	600,518.5390	89.81	REBAR & CAP
RKK103	634,541.1860	600,159.1000	97.77	MAG NAIL
*RKK104	634,112.2179	598,789.6267	102.14	REBAR & CAP
*RKK105	633,746.7582	599,015.2534	115.55	MAG NAIL

*CONTROL POINTS PROVIDED ARE LOCATED OUTSIDE SHEET LIMITS



DETAIL A
SCALE: 1"=50'



DATUM REFERENCE:

HORIZONTAL - THIS PROJECT IS REFERENCED TO THE DELAWARE STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD 83 / 2011 / EPOCH 2010.00).

VERTICAL - THIS PROJECT IS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88 BASED ON MODELED GEOID 12A).

ADDENDA / REVISIONS

SCALE
0 100 200 300
FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	C. HALL
CHECKED BY:	C. WEBB

HORIZONTAL AND VERTICAL CONTROL SHARED USE PATHS

SECTION
RKK
SHEET NO.
9

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SHARED USE PATH - BASELINE 1000

CIRCULAR CURVE ①

Element: Circular	STATION	NORTHING	EASTING
PC (11002)	1000+29.73	636739.6484	599639.7396
HPI (11003)	1000+51.67	636719.3497	599648.0521
CC (11004)		636720.7004	599593.4690
PT (11005)	1000+71.07	636699.4869	599638.7458
Radius:	50.00		
Delta:	47°22'25.53" Right		
Degree of Curvature:	114°35'29.61"		
Length:	41.34		
Tangent:	21.93		
Chord:	40.17		
Middle Ordinate:	4.21		
External:	4.60		
Tangent Direction:	S 22°16'09.77" E		
Radial Direction:	S 67°43'50.23" W		
Chord Direction:	S 1°25'03.00" W		
Radial Direction:	N 64°53'44.24" W		
Tangent Direction:	S 25°06'15.76" W		

CIRCULAR CURVE ②

Element: Circular	STATION	NORTHING	EASTING
PC (11006)	1001+31.92	636644.3921	599612.9324
HPI (11007)	1001+50.02	636628.0027	599605.2535
CC (11008)		636665.6055	599567.6556
PT (11009)	1001+66.65	636620.3260	599588.8632
Radius:	50.00		
Delta:	39°47'55.09" Right		
Degree of Curvature:	114°35'29.61"		
Length:	34.7309		
Tangent:	18.0991		
Chord:	34.0368		
Middle Ordinate:	2.9854		
External:	3.1750		
Tangent Direction:	S 25°06'15.76" W		
Radial Direction:	N 64°53'44.24" W		
Chord Direction:	S 45°00'13.31" W		
Radial Direction:	N 25°05'49.15" W		
Tangent Direction:	S 64°54'10.85" W		

CIRCULAR CURVE ③

Element: Circular	STATION	NORTHING	EASTING
PC (11010)	1002+23.67	636596.1379	599537.2201
HPI (11011)	1002+25.51	636595.3613	599535.5621
CC (11012)		636641.4174	599516.0125
PT (11013)	1002+27.33	636594.7081	599533.8517
Radius:	50.00		
Delta:	4°11'38.75" Right		
Degree of Curvature:	114°35'29.61"		
Length:	3.66		
Tangent:	1.83		
Chord:	3.66		
Middle Ordinate:	0.03		
External:	0.03		
Tangent Direction:	S 64°54'10.85" W		
Radial Direction:	N 25°05'49.15" W		
Chord Direction:	S 67°00'00.23" W		
Radial Direction:	N 20°54'10.40" W		
Tangent Direction:	S 69°05'49.60" W		

CIRCULAR CURVE ④

Element: Circular	STATION	NORTHING	EASTING
PC (11014)	1002+70.17	636579.4238	599493.8322
HPI (11015)	1002+94.92	636570.5932	599470.7105
CC (11016)		636523.3726	599515.2393
PT (11017)	1003+17.12	636548.0289	599460.5395
Radius:	60.00		
Delta:	44°49'59.96" Left		
Degree of Curvature:	95°29'34.68"		
Length:	46.95		
Tangent:	24.75		
Chord:	45.76		
Middle Ordinate:	4.53		
External:	4.90		
Tangent Direction:	S 69°05'49.60" W		
Radial Direction:	N 20°54'10.40" W		
Chord Direction:	S 46°40'49.62" W		
Radial Direction:	N 65°44'10.35" W		
Tangent Direction:	S 24°15'49.65" W		

CIRCULAR CURVE ⑤

Element: Circular	STATION	NORTHING	EASTING
PC (11018)	1003+72.29	636497.7390	599437.8710
HPI (11019)	1003+75.95	636494.3980	599436.3650
CC (11020)		636485.4109	599465.2209
PT (11021)	1003+79.58	636490.7927	599435.7075
Radius:	30.00		
Delta:	13°55'45.65" Left		
Degree of Curvature:	190°59'09.35"		
Length:	7.29		
Tangent:	3.66		
Chord:	7.28		
Middle Ordinate:	0.22		
External:	0.22		
Tangent Direction:	S 24°15'49.65" W		
Radial Direction:	N 65°44'10.35" W		
Chord Direction:	S 17°17'56.82" W		
Radial Direction:	N 79°39'56.00" W		
Tangent Direction:	S 10°20'04.00" W		

CIRCULAR CURVE ⑥

Element: Circular	STATION	NORTHING	EASTING
PC (11022)	1003+94.01	636476.5993	599433.1194
HPI (11023)	1003+99.96	636470.7462	599432.0520
CC (11024)		636481.9811	599403.6060
PT (11025)	1004+05.75	636465.7434	599428.8318
Radius:	30.00		
Delta:	22°26'05.26" Right		
Degree of Curvature:	190°59'09.35"		
Length:	11.75		
Tangent:	5.95		
Chord:	11.67		
Middle Ordinate:	0.57		
External:	0.58		
Tangent Direction:	S 10°20'04.00" W		
Radial Direction:	N 79°39'56.00" W		
Chord Direction:	S 21°33'06.63" W		
Radial Direction:	N 57°13'50.74" W		
Tangent Direction:	S 32°46'09.26" W		

CIRCULAR CURVE ⑦

Element: Circular	STATION	NORTHING	EASTING
PC (11026)	1004+49.49	636428.9659	599405.1582
HPI (11027)	1004+61.91	636418.5264	599398.4384
CC (11028)		636374.8402	599489.2439
PT (11029)	1004+74.20	636406.7607	599394.4754
Radius:	100.00		
Delta:	14°09'15.67" Left		
Degree of Curvature:	57°17'44.81"		
Length:	24.70		
Tangent:	12.42		
Chord:	24.64		
Middle Ordinate:	0.76		
External:	0.77		
Tangent Direction:	S 32°46'09.26" W		
Radial Direction:	N 57°13'50.74" W		
Chord Direction:	S 25°41'31.42" W		
Radial Direction:	N 71°23'06.41" W		
Tangent Direction:	S 18°36'53.59" W		

CIRCULAR CURVE ⑧

Element: Circular	STATION	NORTHING	EASTING
PC (11030)	1005+06.03	636376.5875	599384.3122
HPI (11031)	1005+10.36	636372.4927	599382.9330
CC (11032)		636408.5080	599289.5437
PT (11033)	1005+14.67	636368.5321	599381.2057
Radius:	100.00		
Delta:	4°56'53.62" Right		
Degree of Curvature:	57°17'44.81"		
Length:	8.64		
Tangent:	4.32		
Chord:	8.63		
Middle Ordinate:	0.09		
External:	0.09		
Tangent Direction:	S 18°36'53.59" W		
Radial Direction:	N 71°23'06.41" W		
Chord Direction:	S 21°05'20.40" W		
Radial Direction:	N 66°26'12.79" W		
Tangent Direction:	S 23°33'47.21" W		

CIRCULAR CURVE ⑨

Element: Circular	STATION	NORTHING	EASTING
PC (11034)	1006+83.49	636213.7892	599313.7188
HPI (11035)	1006+89.99	636207.8310	599311.1203
CC (11036)		635814.0302	600230.3391
PT (11037)	1006+96.49	636201.8395	599308.5994
Radius:	1000.00		
Delta:	0°44'41.49" Left		
Degree of Curvature:	5°43'46.48"		
Length:	13.00		
Tangent:	6.50		
Chord:	13.00		
Middle Ordinate:	0.02		
External:	0.02		
Tangent Direction:	S 23°33'47.21" W		
Radial Direction:	N 66°26'12.79" W		
Chord Direction:	S 23°11'26.47" W		
Radial Direction:	N 67°10'54.28" W		
Tangent Direction:	S 22°49'05.72" W		

CIRCULAR CURVE ⑩

Element: Circular	STATION	NORTHING	EASTING
PC (11038)	1009+59.78	635959.1507	599206.4914
HPI (11039)	1009+71.96	635947.9300	599201.7705
CC (11040)		635978.5411	599160.4044
PT (11041)	1009+83.67	635940.1353	599192.4200
Radius:	50.00		
Delta:	27°22'00.31" Right		
Degree of Curvature:	114°35'29.61"		
Length:	23.88		
Tangent:	12.17		
Chord:	23.66		
Middle Ordinate:	1.42		
External:	1.46		
Tangent Direction:	S 22°49'05.72" W		
Radial Direction:	N 67°10'54.28" W		
Chord Direction:	S 36°30'05.88" W		
Radial Direction:	N 39°48'53.97" W		
Tangent Direction:	S 50°11'06.03" W		

CIRCULAR CURVE ⑪

Element: Circular	STATION	NORTHING	EASTING
PC (11042)	1011+00.04	635865.6203	599103.0318
HPI (11043)	1011+23.90	635850.3440	599084.7064
CC (11044)		635788.8087	599167.0629
PT (11045)	1011+46.88	635828.4400	599075.2513
Radius:	100.00		
Delta:	26°50'13.67" Left		
Degree of Curvature:	57°17'44.81"		
Length:	46.84		
Tangent:	23.86		
Chord:	46.41		
Middle Ordinate:	2.73		
External:	2.81		
Tangent Direction:	S 50°11'06.03" W		
Radial Direction:	N 39°48'53.97" W		
Chord Direction:	S 36°45'59.20" W		
Radial Direction:	N 66°39'07.64" W		
Tangent Direction:	S 23°20'52.36" W		

CIRCULAR CURVE ⑫

Element: Circular	STATION	NORTHING	EASTING
PC (11046)	1011+60.34	635816.0828	599069.9173
HPI (11047)	1011+75.64	635802.0358	599063.8537
CC (11048)		635835.8985	599024.0115
PT (11049)	1011+90.03	635793.7873	599050.9678
Radius:	50.00		
Delta:	34°01'40.49" Right		
Degree of Curvature:	114°35'29.61"		
Length:	29.70		
Tangent:	15.30		
Chord:	29.26		
Middle Ordinate:	2.19		
External:	2.29		
Tangent Direction:	S 23°20'52.36" W		
Radial Direction:	N 66°39'07.64" W		
Chord Direction:	S 40°21'42.61" W		
Radial Direction:	N 32°37'27.15" W		
Tangent Direction:	S 57°22'32.85" W		

CIRCULAR CURVE ⑬

Element: Circular	STATION	NORTHING	EASTING
PC (11050)	1013+59.67	635702.3304	598908.0938
HPI (11051)	1013+80.29	635691.2162	598890.7311
CC (11052)		635660.2192	598935.0502
PT (11053)	1013+98.78	635671.0945	598886.2472
Radius:	50.00		
Delta:	44°48'47.70" Left		
Degree of Curvature:	114°35'29.61"		
Length:	39.11		
Tangent:	20.62		
Chord:	38.12		
Middle Ordinate:	3.77		
External:	4.08		
Tangent Direction:	S 57°22'32.85" W		
Radial Direction:	N 32°37'27.15" W		
Chord Direction:	S 34°58'09.00" W		
Radial Direction:	N 77°26'14.85" W		
Tangent Direction:	S 12°33'45.15" W		

CIRCULAR CURVE ⑭

Element: Circular	STATION	NORTHING	EASTING
PC (11054)	1015+51.84	635521.6960	598852.9552
HPI (11055)	1015+68.29	635505.6461	598849.3787
CC (11056)		635510.8208	598901.7582
PT (11057)	1015+83.62	635490.6062	598856.0267
Radius:	50.00		
Delta:	36°24'33.15" Left		
Degree of Curvature:	114°35'29.61"		
Length:	31.77		
Tangent:	16.44		
Chord:	31.24		
Middle Ordinate:	2.50		
External:	2.63		
Tangent Direction:	S 12°33'45.15" W		
Radial Direction:	N 77°26'14.85" W		
Chord Direction:	S 5°38'31.43" E		
Radial Direction:	S 66°09'11.99" W		
Tangent Direction:	S 23°50'48.01" E		

CIRCULAR CURVE ⑮

Element: Circular	STATION	NORTHING	EASTING
PC (11058)	1017+21.58	635364.4225	598911.8032
HPI (11059)	1017+41.34	635346.3463	598919.7933
CC (11060)		635162.2773	598454.4878
PT (11061)	1017+61.08	635327.6958	598926.3318
Radius:	500.00		
Delta:	4°31'37.47" Right		
Degree of Curvature:	11°27'32.96"		
Length:	39.51		
Tangent:	19.76		
Chord:	39.50		
Middle Ordinate:	0.39		
External:	0.39		
Tangent Direction:	S 23°50'48.01" E		
Radial Direction:	S 66°09'11.99" W		
Chord Direction:	S 21°34'59.27" E		
Radial Direction:	S 70°40'49.47" W		
Tangent Direction:	S 19°19'10.53" E		

CIRCULAR CURVE ⑯

Element: Circular	STATION	NORTHING	EASTING
PC (11062)	1019+39.82	635159.0199	598985.4660
HPI (11063)	1019+49.53	635149.8566	598988.6785
CC (11064)		634993.6014	598513.6220
PT (11065)	1019+59.24	635140.5754	598991.5327
Radius:	500.00		
Delta:	2°13'30.47" Right		
Degree of Curvature:	11°27'32.96"		
Length:	19.42		
Tangent:	9.71		
Chord:	19.42		
Middle Ordinate:	0.09		
External:	0.09		
Tangent Direction:	S 19°19'10.53" E		
Radial Direction:	S 70°40'49.47" W		
Chord Direction:	S 18°12'25.30" E		
Radial Direction:	S 72°54'19.93" W		
Tangent Direction:	S 17°05'40.07" E		

CIRCULAR CURVE ⑰

Element: Circular	STATION	NORTHING	EASTING
PC (11066)	1020+54.67	635049.3673	599019.5824
HPI (11067)	1020+83.02	635022.2687	599027.9161
CC (11068)		635064.0647	599067.3734
PT (11069)	1021+06.25	635015.5074	599055.4492
Radius:	50.00		
Delta:	59°06'30.38" Left		
Degree of Curvature:	114°35'29.61"		
Length:	51.58		
Tangent:	28.35		
Chord:	49.32		
Middle Ordinate:	6.51		
External:	7.48		
Tangent Direction:	S 17°05'40.07" E		
Radial Direction:	S 72°54'19.93" W		
Chord Direction:	S 46°38'55.26" E		
Radial Direction:	S 13°47'49.55" W		
Tangent Direction:	S 76°12'10.45" E		

CIRCULAR CURVE ⑱

Element: Circular	STATION	NORTHING	EASTING
PC (11070)	1021+33.28	635009.0612	599081.6991
HPI (11071)	1021+55.79	635003.6914	599103.5658
CC (11072)		634960.5039	599069.7749
PT (11073)	1021+75.59	634983.7585	599114.0380
Radius:	50.00		
Delta:	48°29'12.16" Right		
Degree of Curvature:	114°35'29.61"		
Length:	42.31		
Tangent:	22.52		
Chord:	41.06		
Middle Ordinate:	4.41		
External:	4.84		
Tangent Direction:	S 76°12'10.45" E		
Radial Direction:	S 13°47'49.55" W		
Chord Direction:	S 51°57'34.37" E		
Radial Direction:	S 62°17'01.71" W		
Tangent Direction:	S 27°42'58.29" E		

CIRCULAR CURVE ⑲

Element: Circular	STATION	NORTHING	EASTING
PC (11074)	1021+87.27	634973.4164	599119.4715
HPI (11075)	1022+12.84	634950.7820	599131.3630
CC (11076)		634950.1618	599075.2084
PT (11077)	1022+34.54	634927.8905	599119.9743
Radius:	50.00		
Delta:	54°10'00.32" Right		
Degree of Curvature:	114°35'29.61"		
Length:	47.27		
Tangent:	25.57		
Chord:	45.53		
Middle Ordinate:	5.48		
External:	6.16		
Tangent Direction:	S 27°42'58.29" E		
Radial Direction:	S 62°17'01.71" W		
Chord Direction:	S 0°37'58.13" E		
Radial Direction:	N 63°32'57.97" W		
Tangent Direction:	S 26°27'02.03" W		

CIRCULAR CURVE ⑳

Element: Circular	STATION	NORTHING	EASTING
PC (11078)	1022+45.08	634918.4546	599115.2799
HPI (11079)	1022+59.64	634905.4217	599108.7960
CC (11080)		634896.1833	599160.0459
PT (11081)	1022+73.41	634890.9451	599110.3210
Radius:	50.00		
Delta:	32°27'51.08" Left		
Degree of Curvature:	114°35'29.61"		
Length:	28.33		
Tangent:	14.56		
Chord:	27.95		
Middle Ordinate:	1.99		
External:	2.08		
Tangent Direction:	S 26°27'02.03" W		
Radial Direction:	N 63°32'57.97" W		
Chord Direction:	S 10°13'06.49" W		
Radial Direction:	S 83°59'10.95" W		
Tangent Direction:	S 6°00'49.05" E		

ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	C. HALL
CHECKED BY:	C. WEBB

HORIZONTAL AND VERTICAL CONTROL SHARED USE PATHS

SECTION
RKK
SHEET NO.
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SHARED USE PATH - BASELINE 1000

CIRCULAR CURVE (21)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11082)	1022+83.83	634880.6167	599111.4091
HPI (11091)	1022+94.67	634869.8303	599112.5454
CC (11084)		634884.8073	599151.1890
PT (11085)	1023+05.01	634861.0954	599118.9749
Radius:	40.00		
Delta:	30°20'31.51" Left		
Degree of Curvature:	143°14'22.02"		
Length:	21.18		
Tangent:	10.85		
Chord:	20.94		
Middle Ordinate:	1.39		
External:	1.44		
Tangent Direction:	S 6°00'49.05" E		
Radial Direction:	S 83°59'10.95" W		
Chord Direction:	S 21°11'04.80" E		
Radial Direction:	S 53°38'39.44" W		
Tangent Direction:	S 36°21'20.56" E		

CIRCULAR CURVE (22)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11086)	1023+67.05	634811.1325	599155.7511
HPI (11087)	1024+25.10	634764.3807	599190.1638
CC (11088)		634870.4121	599236.2864
PT (11089)	1024+72.24	634771.0803	599247.8272
Radius:	100.00		
Delta:	60°16'17.32" Left		
Degree of Curvature:	57°17'44.81"		
Length:	105.19		
Tangent:	58.05		
Chord:	100.41		
Middle Ordinate:	13.52		
External:	15.63		
Tangent Direction:	S 36°21'20.56" E		
Radial Direction:	S 53°38'39.44" W		
Chord Direction:	S 66°29'29.22" E		
Radial Direction:	S 6°37'37.88" E		
Tangent Direction:	N 83°22'22.12" E		

CIRCULAR CURVE (23)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11090)	1026+15.31	634787.5914	599389.9375
HPI (11091)	1026+36.68	634790.0575	599411.1633
CC (11092)		634688.2596	599401.4784
PT (11093)	1026+57.41	634783.6330	599431.5433
Radius:	100.00		
Delta:	24°07'25.67" Right		
Degree of Curvature:	57°17'44.81"		
Length:	42.10		
Tangent:	21.37		
Chord:	41.79		
Middle Ordinate:	2.21		
External:	2.26		
Tangent Direction:	N 83°22'22.12" E		
Radial Direction:	S 6°37'37.88" E		
Chord Direction:	S 84°33'55.05" E		
Radial Direction:	S 17°29'47.78" W		
Tangent Direction:	S 72°30'12.22" E		

CIRCULAR CURVE (24)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11094)	1026+89.92	634774.1491	599461.6288
HPI (11095)	1027+01.11	634770.7856	599472.2984
CC (11096)		634750.3057	599454.1125
PT (11097)	1027+10.96	634760.5885	599476.8999
Radius:	25.00		
Delta:	48°12'58.08" Right		
Degree of Curvature:	229°10'59.22"		
Length:	21.04		
Tangent:	11.19		
Chord:	20.42		
Middle Ordinate:	2.18		
External:	2.39		
Tangent Direction:	S 72°30'12.22" E		
Radial Direction:	S 17°29'47.78" W		
Chord Direction:	S 48°23'43.17" E		
Radial Direction:	S 65°42'45.87" W		
Tangent Direction:	S 24°17'14.13" E		

SHARED USE PATH - BASELINE 3000

CIRCULAR CURVE (25)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11098)	3000+53.62	634481.8887	599384.4767
HPI (11099)	3000+64.05	634488.8287	599392.2593
CC (11100)		634519.2063	599351.1991
PT (11101)	3000+74.19	634498.3010	599396.6190
Radius:	50.00		
Delta:	23°33'36.97" Left		
Degree of Curvature:	114°35'29.61"		
Length:	20.56		
Tangent:	10.43		
Chord:	20.42		
Middle Ordinate:	1.05		
External:	1.08		
Tangent Direction:	N 48°16'31.27" E		
Radial Direction:	S 41°43'28.73" E		
Chord Direction:	N 36°29'42.79" E		
Radial Direction:	S 65°17'05.69" E		
Tangent Direction:	N 24°42'54.31" E		

CIRCULAR CURVE (26)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11102)	3002+35.65	634644.9747	599464.1282
HPI (11103)	3002+44.23	634652.7652	599467.7139
CC (11104)		634632.4315	599491.3802
PT (11105)	3002+52.36	634657.4834	599474.8755
Radius:	30.00		
Delta:	31°54'25.85" Right		
Degree of Curvature:	190°59'08.72"		
Length:	16.71		
Tangent:	8.58		
Chord:	16.49		
Middle Ordinate:	1.16		
External:	1.20		
Tangent Direction:	N 24°42'54.31" E		
Radial Direction:	S 65°17'05.64" E		
Chord Direction:	N 40°40'07.28" E		
Radial Direction:	S 33°22'39.79" E		
Tangent Direction:	N 56°37'20.26" E		

CIRCULAR CURVE (27)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11106)	3004+13.86	634746.3346	599609.7395
HPI (11107)	3004+20.87	634750.1910	599615.5931
CC (11108)		634913.3470	599499.7084
PT (11109)	3004+27.87	634754.4479	599621.1624
Radius:	200.00		
Delta:	4°00'52.82" Left		
Degree of Curvature:	28°38'52.40"		
Length:	14.01		
Tangent:	7.01		
Chord:	14.01		
Middle Ordinate:	0.12		
External:	0.12		
Tangent Direction:	N 56°37'20.26" E		
Radial Direction:	S 33°22'39.74" E		
Chord Direction:	N 54°36'53.85" E		
Radial Direction:	S 37°23'32.56" E		
Tangent Direction:	N 52°36'27.44" E		

CIRCULAR CURVE (28)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11110)	3004+84.84	634789.0443	599666.4251
HPI (11111)	3004+85.98	634789.7345	599667.3281
CC (11112)		634765.2094	599684.6432
PT (11113)	3004+87.11	634790.3544	599668.2807
Radius:	30.00		
Delta:	4°20'21.82" Right		
Degree of Curvature:	190°59'09.35"		
Length:	2.27		
Tangent:	1.14		
Chord:	2.27		
Middle Ordinate:	0.02		
External:	0.02		
Tangent Direction:	N 52°36'27.44" E		
Radial Direction:	S 37°23'32.56" E		
Chord Direction:	N 54°46'38.35" E		
Radial Direction:	S 33°03'10.74" E		
Tangent Direction:	N 56°56'49.20" E		

CIRCULAR CURVE (29)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11114)	3005+41.38	634819.9510	599713.7632
HPI (11115)	3005+44.83	634821.8319	599716.6538
CC (11116)		634903.7676	599659.2218
PT (11117)	3005+48.27	634823.9075	599719.4079
Radius:	100.0000		
Delta:	3°57'01.03" Left		
Degree of Curvature:	57°17'44.81"		
Length:	6.8946		
Tangent:	3.4486		
Chord:	6.8932		
Middle Ordinate:	0.0594		
External:	0.0594		
Tangent Direction:	N 56°56'49.20" E		
Radial Direction:	S 33°03'10.80" E		
Chord Direction:	N 54°58'18.68" E		
Radial Direction:	S 37°00'11.83" E		
Tangent Direction:	N 52°59'48.17" E		

CIRCULAR CURVE (30)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11118)	3006+77.34	634901.5873	599822.4801
HPI (11119)	3006+97.85	634913.9340	599838.8628
CC (11120)		634941.5173	599792.3871
PT (11121)	3007+16.27	634934.2292	599841.8530
Radius:	50.0000		
Delta:	44°36'54.84" Left		
Degree of Curvature:	114°35'29.61"		
Length:	38.9341		
Tangent:	20.5143		
Chord:	37.9579		
Middle Ordinate:	3.7420		
External:	4.0447		
Tangent Direction:	N 52°59'48.17" E		
Radial Direction:	S 37°00'11.83" E		
Chord Direction:	N 30°41'20.74" E		
Radial Direction:	S 81°37'06.68" E		
Tangent Direction:	N 8°22'53.32" E		

CIRCULAR CURVE (31)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11122)	3007+70.34	634987.7153	599849.7335
HPI (11123)	3007+94.78	635011.9019	599853.2971
CC (11124)		634983.3424	599879.4131
PT (11125)	3008+11.36	635013.2937	599877.7052
Radius:	30.0000		
Delta:	78°21'17.28" Right		
Degree of Curvature:	190°59'09.35"		
Length:	41.0265		
Tangent:	24.4477		
Chord:	37.9034		
Middle Ordinate:	6.7442		
External:	8.7000		
Tangent Direction:	N 8°22'53.32" E		
Radial Direction:	S 81°37'06.68" E		
Chord Direction:	N 47°33'31.96" E		
Radial Direction:	S 3°15'49.39" E		
Tangent Direction:	N 86°44'10.61" E		

CIRCULAR CURVE (32)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11126)	3009+39.48	635020.5875	600005.6108
HPI (11127)	3009+44.82	635020.8914	600010.9413
CC (11128)		634920.7497	600011.3040
PT (11129)	3009+50.14	635020.6261	600016.2739
Radius:	100.0000		
Delta:	6°06'44.75" Right		
Degree of Curvature:	57°17'44.81"		
Length:	10.6682		
Tangent:	5.3392		
Chord:	10.6631		
Middle Ordinate:	0.1422		
External:	0.1424		
Tangent Direction:	N 86°44'10.61" E		
Radial Direction:	S 3°15'49.39" E		
Chord Direction:	N 89°47'32.98" E		
Radial Direction:	S 2°50'55.36" W		
Tangent Direction:	S 87°09'04.64" E		

CIRCULAR CURVE (33)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11130)	3010+06.66	635017.8171	600072.7236
HPI (11131)	3010+19.19	635017.1946	600085.2338
CC (11132)		634942.9098	600068.9962
PT (11133)	3010+31.49	635012.5407	600096.8627
Radius:	75.00		
Delta:	18°57'45.91" Right		
Degree of Curvature:	76°23'39.74"		
Length:	24.82		
Tangent:	12.53		
Chord:	24.71		
Middle Ordinate:	1.02		
External:	1.04		
Tangent Direction:	S 87°09'04.64" E		
Radial Direction:	S 2°50'55.36" W		
Chord Direction:	S 77°40'11.68" E		
Radial Direction:	S 21°48'41.27" W		
Tangent Direction:	S 68°11'18.73" E		

CIRCULAR CURVE (34)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11134)	3011+88.60	634954.1647	600242.7284
HPI (11135)	3011+92.84	634952.5908	600246.6611
CC (11136)		635000.5853	600261.3061
PT (11137)	3011+97.05	634951.7010	600250.8025
Radius:	50.00		
Delta:	9°41'05.73" Left		
Degree of Curvature:	114°35'29.61"		
Length:	8.45		
Tangent:	4.24		
Chord:	8.44		
Middle Ordinate:	0.18		
External:	0.18		
Tangent Direction:	S 68°11'18.73" E		
Radial Direction:	S 21°48'41.27" W		
Chord Direction:	S 73°01'51.59" E		
Radial Direction:	S 12°07'35.54" W		
Tangent Direction:	S 77°52'24.46" E		

CIRCULAR CURVE (35)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11138)	3012+46.07	634941.4039	600298.7259
HPI (11139)	3012+55.41	634939.4417	600307.8579
CC (11140)		634892.5196	600288.2224
PT (11141)	3012+64.54	634934.3151	600315.6656
Radius:	50.00		
Delta:	21°09'45.56" Right		
Degree of Curvature:	114°35'29.61"		
Length:	18.47		
Tangent:	9.34		
Chord:	18.36		
Middle Ordinate:	0.85		
External:	0.86		
Tangent Direction:	S 77°52'24.46" E		
Radial Direction:	S 12°07'35.54" W		
Chord Direction:	S 67°17'31.68" E		
Radial Direction:	S 33°17'21.10" W		
Tangent Direction:	S 56°42'38.90" E		

CIRCULAR CURVE (36)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11142)	3013+28.78	634899.0549	600369.3662
HPI (11143)	3013+38.27	634893.8440	600377.3024
CC (11144)		634857.2593	600341.9229
PT (11145)	3013+47.54	634886.0868	600382.7761
Radius:	50.00		
Delta:	21°30'09.67" Right		
Degree of Curvature:	114°35'29.38"		
Length:	18.76		
Tangent:	9.49		
Chord:	18.65		
Middle Ordinate:	0.88		
External:	0.89		
Tangent Direction:	S 56°42'38.90" E		
Radial Direction:	S 33°17'21.12" W		
Chord Direction:	S 45°57'34.04" E		
Radial Direction:	S 54°47'30.79" W		
Tangent Direction:	S 35°12'29.18" E		

SHARED USE PATH - BASELINE 4000

CIRCULAR CURVE (38)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11150)	4000+51.85	634744.04	598924.50
HPI (11151)	4000+70.96	634747.35	598943.32
CC (11152)		634793.28	598915.83
PT (11153)	4000+88.36	634762.37	598955.13
Radius:	50.00		
Delta:	41°49'58.50" Left		
Degree of Curvature:	114°35'29.61"		
Length:	36.51		
Tangent:	19.11		
Chord:	35.70		
Middle Ordinate:	3.29		
External:	3.53		
Tangent Direction:	N 80°01'05.86" E		
Radial Direction:	S 9°58'54.14" E		
Chord Direction:	N 59°06'06.61" E		
Radial Direction:	S 51°48'52.64" E		
Tangent Direction:	N 38°11'07.36" E		

SHARED USE PATH - BASELINE 2000

CIRCULAR CURVE (39)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11154)	2000+84.44	634824.3375	598894.3946
HPI (11155)	2000+88.43	634828.2218	598893.4787
CC (11156)		634847.2890	598991.7252
PT (11157)	2000+92.42	634832.1667	598892.8752
Radius:	100.00		
Delta:	4°34'14.47" Right		
Degree of Curvature:	57°17'44.81"		
Length:	7.98		
Tangent:	3.99		
Chord:	7.98		
Middle Ordinate:	0.08		
External:	0.08		
Tangent Direction:	N 13°16'06.59" W		
Radial Direction:	N 76°43'53.41" E		
Chord Direction:	N 10°58'59.36" W		
Radial Direction:	N 81°18'07.88" E		
Tangent Direction:	N 8°41'52.12" W		

CIRCULAR CURVE (40)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11158)	2001+35.38	634827.7010	598907.8839
HPI (11159)	2001+43.99	634819.3417	598909.9571
CC (11160)		634833.7190	598932.1487
PT (11161)	2001+51.96	634814.0330	598916.7390
Radius:	25.00		
Delta:	38°01'04.54" Left		
Degree of Curvature:	229°10'59.22"		
Length:	16.59		
Tangent:	8.61		
Chord:	16.29		
Middle Ordinate:	1.36		
External:	1.44		
Tangent Direction:	S 13°55'45.14" E		
Radial Direction:	S 76°04'14.86" W		
Chord Direction:	S 32°56'17.40" E		
Radial Direction:	S 38°03'10.33" W		
Tangent Direction:	S 51°56'49.67" E		

ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	C. HALL
CHECKED BY:	C. WEBB

HORIZONTAL AND VERTICAL CONTROL SHARED USE PATHS

SECTION: RKK

SHEET NO.: 11

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SHARED USE PATH - BASELINE 2000

CIRCULAR CURVE (41)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11162)	2003+35.75	634871.3827	599040.8578
HPI (11163)	2003+48.43	634881.3572	599048.6928
CC (11164)		634852.8511	599064.4498
PT (11165)	2003+59.75	634882.6860	599061.3068
Radius:	30.00		
Delta:	45°50'12.19" Right		
Degree of Curvature:	190°59'09.35"		
Length:	24.00		
Tangent:	12.68		
Chord:	23.37		
Middle Ordinate:	2.37		
External:	2.57		
Tangent Direction:	N 38°08'58.76" E		
Radial Direction:	S 51°51'01.24" E		
Chord Direction:	N 61°04'04.85" E		
Radial Direction:	S 6°00'49.05" E		
Tangent Direction:	N 83°59'10.95" E		

CIRCULAR CURVE (42)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11166)	2004+14.27	634888.3984	599115.5323
HPI (11167)	2004+25.30	634889.5532	599126.4945
CC (11168)		634987.8481	599105.0558
PT (11169)	2004+36.23	634893.0680	599136.9420
Radius:	100.00		
Delta:	12°34'49.81" Left		
Degree of Curvature:	57°17'44.81"		
Length:	21.96		
Tangent:	11.02		
Chord:	21.91		
Middle Ordinate:	0.60		
External:	0.61		
Tangent Direction:	N 83°59'10.95" E		
Radial Direction:	S 6°00'49.05" E		
Chord Direction:	N 77°41'46.04" E		
Radial Direction:	S 18°35'38.86" E		
Tangent Direction:	N 71°24'21.14" E		

CIRCULAR CURVE (43)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11170)	2004+70.08	634903.8616	599169.0255
HPI (11171)	2004+89.68	634910.1098	599187.5980
CC (11172)		634932.2957	599159.4597
PT (11173)	2005+04.80	634929.6275	599189.3408
Radius:	30.00		
Delta:	66°18'11.79" Left		
Degree of Curvature:	190°59'09.35"		
Length:	34.77		
Tangent:	19.60		
Chord:	32.81		
Middle Ordinate:	4.88		
External:	5.83		
Tangent Direction:	N 71°24'21.14" E		
Radial Direction:	S 18°35'38.86" E		
Chord Direction:	N 38°15'15.24" E		
Radial Direction:	S 84°53'50.65" E		
Tangent Direction:	N 5°06'09.35" E		

SHARED USE PATH - BASELINE 5000 CIRCULAR CURVE (44)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11178)	5000+38.74	634861.7485	599165.3360
HPI (11179)	5000+56.13	634845.2646	599170.8816
CC (11180)		634871.3144	599193.7700
PT (11181)	5000+70.26	634841.8859	599187.9419
Radius:	30.00		
Delta:	60°12'13.57" Left		
Degree of Curvature:	190°59'09.35"		
Length:	31.52		
Tangent:	17.39		
Chord:	30.09		
Middle Ordinate:	4.05		
External:	4.68		
Tangent Direction:	S 18°35'38.86" E		
Radial Direction:	S 71°24'21.14" W		
Chord Direction:	S 48°41'45.64" E		
Radial Direction:	S 11°12'07.57" W		
Tangent Direction:	S 78°47'52.43" E		

SHARED USE PATH - BASELINE 6000 CIRCULAR CURVE (45)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11182)	6000+07.96	634831.6348	599198.7136
HPI (11183)	6000+20.00	634819.8273	599196.3753
CC (11184)		634841.3483	599149.6662
PT (11185)	6000+31.59	634810.3777	599188.9195
Radius:	50.00		
Delta:	27°04'16.07" Right		
Degree of Curvature:	114°35'29.61"		
Length:	23.62		
Tangent:	12.04		
Chord:	23.40		
Middle Ordinate:	1.39		
External:	1.43		
Tangent Direction:	S 11°12'07.57" W		
Radial Direction:	N 78°47'52.43" W		
Chord Direction:	S 24°44'15.61" W		
Radial Direction:	N 51°43'36.36" W		
Tangent Direction:	S 38°16'23.64" W		

SHARED USE PATH - BASELINE 7000 CIRCULAR CURVE (46)

	STATION	NORTHING	EASTING
Element: Circular			
PC (11186)	7000+25.00	634913.7965	599074.3652
HPI (11187)	7000+31.01	634908.5291	599077.2418
CC (11188)		634899.4174	599048.0357
PT (11189)	7000+36.85	634902.5604	599077.8706
Radius:	30.00		
Delta:	22°37'34.72" Right		
Degree of Curvature:	190°59'09.35"		
Length:	11.85		
Tangent:	6.00		
Chord:	11.77		
Middle Ordinate:	0.58		
External:	0.59		
Tangent Direction:	S 28°38'23.77" E		
Radial Direction:	S 61°21'36.23" W		
Chord Direction:	S 17°19'36.41" E		
Radial Direction:	S 83°59'10.95" W		
Tangent Direction:	S 6°00'49.05" E		

PATH 1000

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	1000+00.00	636766.9867	599628.5445	S22°16'09.77"E 29.73
PC	1000+29.73	636739.6484	599639.7396	CURVE 1
PT	1000+71.07	636699.4869	599638.7458	S25°06'15.76"W 60.84
PC	1001+31.92	636644.3921	599612.9324	CURVE 2
PT	1001+66.65	636620.3260	599588.8632	S64°54'10.85"W 57.03
PC	1002+23.67	636596.1379	599537.2201	CURVE 3
PT	1002+27.33	636594.7081	599533.8517	S69°05'49.60"W 42.84
PC	1002+70.17	636579.4238	599493.8322	CURVE 4
PT	1003+17.12	636548.0289	599460.5395	S24°15'49.65"W 55.16
PC	1003+72.29	636497.7390	599437.8710	CURVE 5
PT	1003+79.58	636490.7927	599435.7075	S10°20'04.00"W 14.43
PC	1003+94.01	636476.5993	599433.1194	CURVE 6
PT	1004+05.75	636465.7434	599428.8318	S32°46'09.26"W 43.74
PC	1004+49.49	636428.9659	599405.1582	CURVE 7
PT	1004+74.20	636406.7607	599394.4754	S18°36'53.59"W 31.84
PC	1005+06.03	636376.5875	599384.3122	CURVE 8
PT	1005+14.67	636368.5321	599381.2057	S23°33'47.21"W 168.82
PC	1006+83.49	636213.7892	599313.7188	CURVE 9
PT	1006+96.49	636201.8395	599308.5994	S22°49'05.72"W 263.29
PC	1009+59.78	635959.1507	599206.4914	CURVE 10
PT	1009+83.67	635940.1353	599192.4200	S50°11'06.03"W 116.37
PC	1011+00.04	635865.6203	599103.0318	CURVE 11
PT	1011+46.88	635828.4400	599075.2513	S23°20'52.36"W 13.46
PC	1011+60.34	635816.0828	599069.9173	CURVE 12
PT	1011+90.03	635793.7873	599050.9678	S57°22'32.85"W 169.64
PC	1013+59.67	635702.3304	598908.0938	CURVE 13
PT	1013+98.78	635671.0945	598886.2472	S12°33'45.15"W 153.06
PC	1015+51.84	635521.6960	598852.9552	CURVE 14
PT	1015+83.62	635490.6062	598856.0267	S23°50'48.01"E 137.96
PC	1017+21.58	635364.4225	598911.8032	CURVE 15
PT	1017+61.08	635327.6958	598926.3318	S19°19'10.53"E 178.74
PC	1019+39.82	635159.0199	598985.4660	CURVE 16
PT	1019+59.24	635140.5754	598991.5327	S17°05'40.07"E 95.42
PC	1020+54.67	635049.3673	599019.5824	CURVE 17
PT	1021+06.25	635015.5074	599055.4492	S76°12'10.45"E 27.03
PC	1021+33.28	635009.0612	599081.6991	CURVE 18
PT	1021+75.59	634983.7585	599114.0380	S27°42'58.29"E 11.68
PC	1021+87.27	634973.4164	599119.4715	CURVE 19
PT	1022+34.54	634927.8905	599119.9743	S26°27'02.03"W 10.54
PC	1022+45.08	634918.4546	599115.2799	CURVE 20
PT	1022+73.41	634890.9451	599110.3210	S06°00'49.05"E 10.42
PC	1022+83.83	634880.5869	599111.4122	CURVE 21
PT	1023+05.01	634861.0954	599118.9749	S36°21'20.56"E 62.04
PC	1023+67.05	634811.1325	599155.7511	CURVE 22
PT	1024+72.24	634771.0803	599247.8272	N83°22'22.12"E 143.07
PC	1026+15.31	634787.5914	599389.9375	CURVE 23
PT	1026+57.41	634783.9222	599430.6259	S72°30'12.22"E 32.51
PC	1026+89.92	634774.1491	599461.6288	CURVE 24
PT	1027+10.96	634760.5885	599476.8999	S24°17'14.13"E 96.06
POE	1027+97.02	634682.1394	599512.3000	

PATH 2000

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	2000+00.00	634742.1530	598913.7745	N13°16'06.59"W 84.44
PC	2000+84.44	634824.3375	598894.3946	CURVE 39
PT	2000+92.42	634832.1667	598892.8752	N08°41'52.12"W 11.83
PI	2001+04.24	634843.8591	598891.0865	N80°55'10.60"E 12.46
PI	2001+16.70	634845.8253	598903.3888	S13°55'45.14"E 18.67
PC	2001+35.38	634827.7010	598907.8839	CURVE 40
PT	2001+51.96	634814.0330	598916.7390	S51°56'49.67"E 62.12
PI	2002+14.08	634775.7446	598965.6528	N38°10'32.87"E 10.21
PI	2002+24.29	634783.7679	598971.9611	N38°11'07.36"E 94.94
PI	2003+19.23	634858.3953	599030.6562	N38°08'58.76"E 16.51
PC	2003+35.75	634871.3827	599040.8578	CURVE 41
PT	2003+59.75	634882.6860	599061.3068	N83°59'10.95"E 54.53
PC	2004+14.27	634888.3984	599115.5323	CURVE 42
PT	2004+36.23	634893.0680	599136.9420	N71°24'21.14"E 33.85
PC	2004+70.08	634903.8616	599169.0255	CURVE 43
PT	2005+04.80	634929.6275	599189.3408	N05°06'09.35"E 22.59
PI	2005+27.39	634952.1277	599191.3499	N35°03'39.40"E 11.20
POE	2005+38.59	634961.2969	599197.7848	

PATH 3000

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	3000+00.00	634446.1985	599344.4536	N48°16'31.27"E 53.62
PC	3000+53.62	634481.8887	599384.4767	CURVE 25
PT	3000+74.19	634498.3010	599396.6190	N24°42'54.31"E 161.46
PC	3002+35.65	634644.9747	599464.1282	CURVE 26
PT	3002+52.36	634657.4834	599474.8755	N56°37'20.26"E 161.50
PC	3004+13.86	634746.3346	599609.7395	CURVE 27
PT	3004+27.87	634754.4479	599621.1624	N52°36'27.44"E 56.97
PC	3004+84.84	634789.0443	599666.4251	CURVE 28
PT	3004+87.11	634790.3544	599668.2807	N56°56'49.20"E 54.26
PC	3005+41.38	634819.9510	599713.7632	CURVE 29
PT	3005+48.27	634823.9075	599719.4079	N52°59'48.17"E 129.07
PC	3006+77.34	634901.5873	599822.4801	CURVE 30
PT	3007+16.27	634934.2292	599841.8530	N08°22'53.32"E 54.06
PC	3007+70.34	634987.7153	599849.7335	CURVE 31
PT	3008+11.36	635013.2937	599877.7052	N86°44'10.61"E 128.11
PC	3009+39.48	635020.5875	600005.6108	CURVE 32
PT	3009+50.14	635020.6261	600016.2739	S87°09'04.64"E 56.52
PC	3010+06.66	635017.8171	600072.7236	CURVE 33
PT	3010+31.49	635012.5407	600096.8626	S68°11'18.73"E 157.11
PC	3011+88.60	634954.1647	600242.7284	CURVE 34
PT	3011+97.05	634951.7010	600250.8025	S77°52'24.46"E 49.02
PC	3012+46.07	634941.4039	600298.7259	CURVE 35
PT	3012+64.54	634934.3151	600315.6656	S56°42'38.90"E 64.24
PC	3013+28.78	634899.0549	600369.3662	CURVE 36
PT	3013+47.54	634886.0867	600382.7761	S35°12'29.18"E 56.76
PC	3014+04.31	634839.7084	600415.5023	CURVE 37
PT	3014+18.88	634826.7547	600422.0625	S18°30'36.93"E 51.37
POE	3014+75.00	634773.5337	600439.8806	

PATH 4000

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	4000+00.00	634735.0530	598873.4328	N80°01'05.86"E 51.85
PC	4000+51.85	634744.0407	598924.5001	CURVE 38
PT	4000+88.36	634762.3734	598955.1341	N38°11'07.36"E 27.22
POE	4001+15.58	634783.7679	598971.9611	

PATH 5000

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	5000+00.00	634898.4648	599152.9838	S18°35'38.86"E 38.74
PC	5000+38.74	634861.7485	599165.3360	CURVE 44
PT	5000+70.26	634841.8859	599187.9419	S78°47'52.43"E 80.60
POE	5001+50.00	634826.3980	599266.1466	

PATH 6000

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	6000+00.00	634839.4463	599200.2607	S11°12'07.57"W 7.96
PC	6000+07.96	634831.6348	599198.7136	CURVE 45
PT	6000+31.58	634810.3777	599188.9195	S38°16'23.64"W 23.53
POE	6000+55.11	634791.9055	599174.3451	

PATH 7000

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	7000+00.00	634935.7417	599062.3804	S28°38'23.77"E 25.00
PC	7000+25.00	634913.7965	599074.3652	CURVE 46
PT	7000+36.85	634902.5604	599077.8706	S06°00'49.05"E 18.03
POE	7000+54.88	634884.6299	599079.7595	

ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279

DESIGNED BY: C. HALL

CHECKED BY: C. WEBB

HORIZONTAL AND VERTICAL CONTROL SHARED USE PATHS

SECTION RKK

SHEET NO. 12

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LITTLE MILL CREEK
PROPOSED FLOODPLAIN BASELINE

POB 100+00.00

50 PC 100+62.25

50 PT 100+79.30

51 PC 101+45.58

51 PT 101+58.81

TRAV PT RKK100

OUTFALL 1
BASELINE

POB 10000+00.00
PI 10000+13.11
PI 10000+15.37
PI 10000+89.37
PI 10000+89.87
PI 10001+28.02
PI 10001+29.96
PI 10002+18.18
PI 10002+55.45
PI 10002+63.03
POE 10002+95.22

STA. 103+75.11 =
STA. 10001+40.75

OUTFALL 2 BASELINE

POB 10500+00.00
PI 10500+60.88
POE 10500+99.87

TRAV PT MRC1

105+00

52 PC 108+66.06

TRAV PT MRC2

52 PT 109+56.16

110+00

59 PT 205+27.14

60 PC 205+92.07

TRAV PT MRC3

POE 11001+00.00
PI 11000+53.24
POB 11000+00.00

OUTFALL 3 BASELINE

53 PC 112+15.15

TRIBUTARY 1
PROPOSED FLOODPLAIN BASELINE

STA. 202+09.63 =
STA. 16500+00.00

TRAV PT RKK101

205+00

TRAV PT MRC14

TRAV PT MRC15

TRAV PT
MRC16

OUTFALL 14 BASELINE

POB 200+00.00

PI 16500+29.07
POE 16500+96.18

59 PC 203+92.36

TRAV PT MRC17

OUTFALL 15 BASELINE

POE 17001+53.87

POB 17000+00.00

53 PT 114+02.92

60 PT 208+65.96

54 PC 115+05.11

TRAV PT MRC4

STA. 114+48.39 =
STA. 208+65.96

115+00

54 PT 116+47.10

TRAV PT MRC5

STA. 116+15.67 =
STA. 304+89.42

62 PT 303+89.65

304+00

POB 17500+00.00

62 PC 302+81.53

61 PT 302+32.61

61 PC 301+35.31

303+00

302+00

301+00

POB 300+00.00

TRIBUTARY 2
PROPOSED FLOODPLAIN BASELINE

PI 17500+50.46
PI 17500+80.60
PI 17500+82.60
POE 17501+36.52

OUTFALL 16 BASELINE

STA. 303+23.07=
STA. 17500+03.48

PI 11500+64.89

TRAV PT MRC6

STA. 119+61.41 =
STA. 11500+00.00

POE 11501+19.76

OUTFALL 4 BASELINE

55 PC 122+33.93

OUTFALL 5 BASELINE

POB 12000+00.00

PI 12000+61.66

55 PT 123+81.93

56 PC 125+65.74

TRAV PT MRC7

POE 12002+00.52

120+00

125+00

TRAV PT MRC8

56 PT 127+98.02

TRAV PT MRC18

POB 12500+00.00
PI 12500+41.68
PI 12501+43.62
PI 12502+23.65
POE 12502+95.33

TRAV PT MRC18

OUTFALL 6 BASELINE

OUTFALL 13 BASELINE

PI 16000+81.41

58 PC 138+84.29

POB 16000+00.00
PI 16000+76.83
PI 16001+29.69
PI 16001+65.86

TRAV PT RKK102

PT 140+93.36 58

POE 142+50.07

TRAV PT
MRC13

140+00

STA. 140+21.25 =
STA. 16002+18.98

57 PT 136+11.69

TRAV PT MRC12

OUTFALL 11 BASELINE

POB 15000+00.00

STA. 135+45.83 =
STA. 15000+94.48

TRAV PT MRC11

135+00

57 PC 134+23.27

TRAV PT RKK103

OUTFALL 10 BASELINE

POE 14500+99.81

153 PT 14500+62.66

TRAV PT MRC10

POB 14500+00.00
PI 14500+25.50
PC 14500+54.94 153

130+00

TRAV PT MRC9

DATUM REFERENCE:

HORIZONTAL - THIS PROJECT IS REFERENCED TO THE DELAWARE STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD 83 / 2011 / EPOCH 2010.00).

VERTICAL - THIS PROJECT IS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88 BASED ON MODELED GEOID 12A).

OUTFALL NOTES:

SEE SHEET 15 FOR OUTFALL 9 AND 12 BASELINES

ADDENDA / REVISIONS	

SCALE
0 100 200 300
FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

HORIZONTAL AND VERTICAL CONTROL FLOODPLAINS

SECTION
RKK
SHEET NO.
13

01-May-2025
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LITTLE MILL CREEK PROPOSED FLOODPLAIN

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	100+00.00	636887.2426	599637.0642	S 58.1477 W 62.2531
PC	100+62.25	636854.3897	599584.1858	CURVE 50
PT	100+79.30	636844.2066	599570.5418	S 48.3813 W 66.2807
PC	101+45.58	636800.1850	599520.9916	CURVE 51
PT	101+58.81	636789.5340	599513.3248	S 23.1132 W 707.2487
PC	108+66.06	636139.0553	599235.6954	CURVE 52
PT	109+56.16	636066.7935	599183.1568	S 48.9256 W 258.9868
PC	112+15.15	635896.6292	598987.9178	CURVE 53
PT	114+02.92	635749.8708	598872.5656	S 27.4091 W 102.1968
PC	115+05.11	635659.1463	598825.5204	CURVE 54
PT	116+47.10	635521.1831	598808.4060	S 13.2662 E 586.8332
PC	122+33.93	634950.0099	598943.0701	CURVE 55
PT	123+81.93	634830.7558	599024.9247	S 55.6643 E 183.8102
PC	125+65.74	634727.0793	599176.7053	CURVE 56
PT	127+98.02	634723.0060	599396.1142	N 57.7914 E 625.2516
PC	134+23.27	635056.2671	599925.1479	CURVE 57
PT	136+11.69	635072.7795	600105.9274	S 68.2292 E 272.5934
PC	138+84.29	634971.6761	600359.0781	CURVE 58
PT	140+93.41	634814.8851	600482.7938	S 8.3211 E 156.6606
POE	142+50.07	634659.8737	600505.4656	

TRIBUTARY 1 PROPOSED FLOODPLAIN

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	200+00.00	636540.9916	598745.0678	S 19.1025 E 136.7106
PC	203+92.36	636170.7035	598874.8105	CURVE 59
PT	205+27.14	636039.1281	598902.0547	S 3.9764 E 64.9386
PC	205+92.07	635974.3459	598906.5579	CURVE 60
POE	208+65.96	635709.5029	598851.6328	

TRIBUTARY 2 PROPOSED FLOODPLAIN

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	300+00.00	635428.1286	598339.688	N 82.6283 E 135.3505
PC	301+35.35	635445.4949	598473.9198	CURVE 61
PT	302+32.61	635480.4843	598563.6463	N 54.7645 E 48.9201
PC	302+81.53	635508.7082	598603.6036	CURVE 62
PT	303+89.65	635544.7975	598704.1262	N 54.7645 E 99.77
POE	304+89.42	635552.2131	598803.6221	

OUTFALL 1

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	1000+000.00	636696.2956	599696.5062	S 58.5931 W 13.1145
PI	1000+013.11	636689.4614	599685.3131	S 58.5931 W 2.2522
PI	1000+015.37	636688.2878	599683.3909	S 53.6919 W 73.0000
PI	1000+088.37	636645.0625	599624.5642	S 53.6919 W 1.5000
PI	1000+089.87	636644.1743	599623.3555	S 53.2967 W 38.1514
PI	1000+128.02	636621.3724	599592.7680	S 74.8907 W 1.9411
PI	1000+129.96	636620.8664	599590.8940	S 78.1407 W 88.2188
PI	1000+218.18	636602.7366	599504.5582	S 80.1764 W 37.2679
PI	1000+255.45	636596.3782	599467.8368	S 81.8058 W 7.5877
PI	1000+263.03	636595.2967	599460.3265	S 81.8058 W 32.1906
POE	1000+295.22	636590.7087	599428.4646	

OUTFALL 2

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	10500+00.00	636455.7557	599490.4058	N 55.5742 W 60.8774
PI	10500+60.88	636490.1721	599440.1905	N 61.5246 W 38.9902
POE	10500+99.87	636508.7619	599405.9173	

OUTFALL 3

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	11000+00.00	635784.7373	599114.4799	N 42.6543 W 53.2383
PI	11000+53.24	635823.8916	599078.4070	N 41.6995 W 46.8375
POE	11001+00.08	635858.8626	599047.2496	

OUTFALL 4

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	11500+00.00	635215.2606	598880.5326	S 69.2099 W 35.2205
PI	11500+35.22	635202.7593	598847.6054	S 71.0721 W 84.5369
POE	11501+19.76	635175.3374	598767.6396	

OUTFALL 5

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	12000+00.00	635172.1521	599108.2090	S 71.5737 W 61.6613
PI	12000+61.66	635152.6619	599049.7090	S 68.0198 W 138.8618
POE	12002+00.52	635100.6878	598920.9407	

OUTFALL 6

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	12500+00.00	634701.5352	599145.3549	S 81.8963 W 41.6825
PI	12500+41.68	634695.6594	599104.0886	S 77.6601 W 101.9355
PI	12501+43.62	634673.8746	599004.5081	S 80.2022 W 80.0274
PI	12502+23.65	634660.2562	598925.6480	S 82.9789 W 71.6863
POE	12502+95.33	634651.4937	598854.4992	

OUTFALL 9

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	14000+00.00	634704.0734	599423.6322	CURVE 146
PT	14000+52.36	634654.2110	599408.1265	S 8.2708 W 59.4568
PC	14001+11.82	634595.3726	599399.5735	CURVE 147
PT	14001+20.13	634587.3549	599397.4366	S 26.2678 W 39.8381
PC	14001+59.97	634551.6307	599379.8055	CURVE 148
PT	14001+74.79	634537.2044	599378.5329	S 16.1853 E 16.1170
PC	14001+90.91	634521.7262	599383.0254	CURVE 149
PT	14002+17.81	634498.6789	599373.5502	S 60.8824 W 41.9027
PC	14002+59.71	634478.2889	599336.9430	CURVE 150
PT	14002+72.08	634470.7066	599327.2304	S 43.1621 W 26.0666
PC	14002+98.15	634451.6930	599309.3991	CURVE 151
PT	14003+20.25	634440.4510	599290.6952	S 74.8218 W 23.1363
PC	14003+43.39	634434.3934	599268.3659	CURVE 152
PT	14003+56.01	634429.2364	599256.9013	S 56.7401 W 85.9584
POE	14004+41.97	634382.0936	599185.0236	

OUTFALL 10

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	14500+00.00	635008.4302	599667.7770	S 31.6959 E 25.4987
PI	14500+25.50	634986.7346	599681.1743	S 81.6958 E 29.4380
PC	14500+54.94	634982.4829	599710.3037	CURVE 153
PT	14500+62.66	634984.2833	599717.6194	N 54.0451 E 41.2133
POE	14500+99.81	635006.0939	599747.6890	

OUTFALL 11

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	15000+00.00	635177.8284	600067.1348	S 15.5080 W 94.4801
POE	15000+94.48	635086.7880	600041.8734	

OUTFALL 12

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	15500+00.00	634992.2006	600456.0588	S 15.3268 W 92.4327
POE	15500+92.43	634903.0553	600431.6265	

OUTFALL 13

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	16000+00.00	635076.7220	600530.8191	S 45.9768 W 76.8290
PI	16000+76.83	635023.3297	600475.5746	S 28.0477 W 4.5843
PI	16000+81.41	635019.2838	600473.4190	S 0.0000 W 48.2792
PI	16001+29.69	634971.0046	600473.4190	S 5.0689 W 36.1716
PI	16001+65.86	634934.9744	600470.2231	S 11.2759 W 53.1205
POE	16002+18.98	634882.8793	600459.8363	

OUTFALL 14

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	16500+00.00	636342.7605	598813.2580	S 70.8458 W 29.0689
PI	16500+29.07	636333.2228	598785.7984	S 75.4400 W 67.1156
POE	16500+96.18	636316.3504	598720.8382	

OUTFALL 15

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	17000+00.00	635967.8848	598861.5648	N 46.1820 W 153.6720
POE	17001+53.67	636074.2827	598750.6840	

OUTFALL 16

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	17500+00.00	635532.4362	598639.2878	S 7.83 E 50.4580
PI	17500+50.46	635482.4488	598646.1632	S 7.83 E 30.1376
PI	17500+80.60	635452.5922	598650.2697	S 20.06 E 2.0000
PI	17500+82.60	635450.7135	598650.9556	S 20.06 E 53.9279
POE	17501+36.52	635400.0561	598669.4501	

ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279

DESIGNED BY: N. RILEY

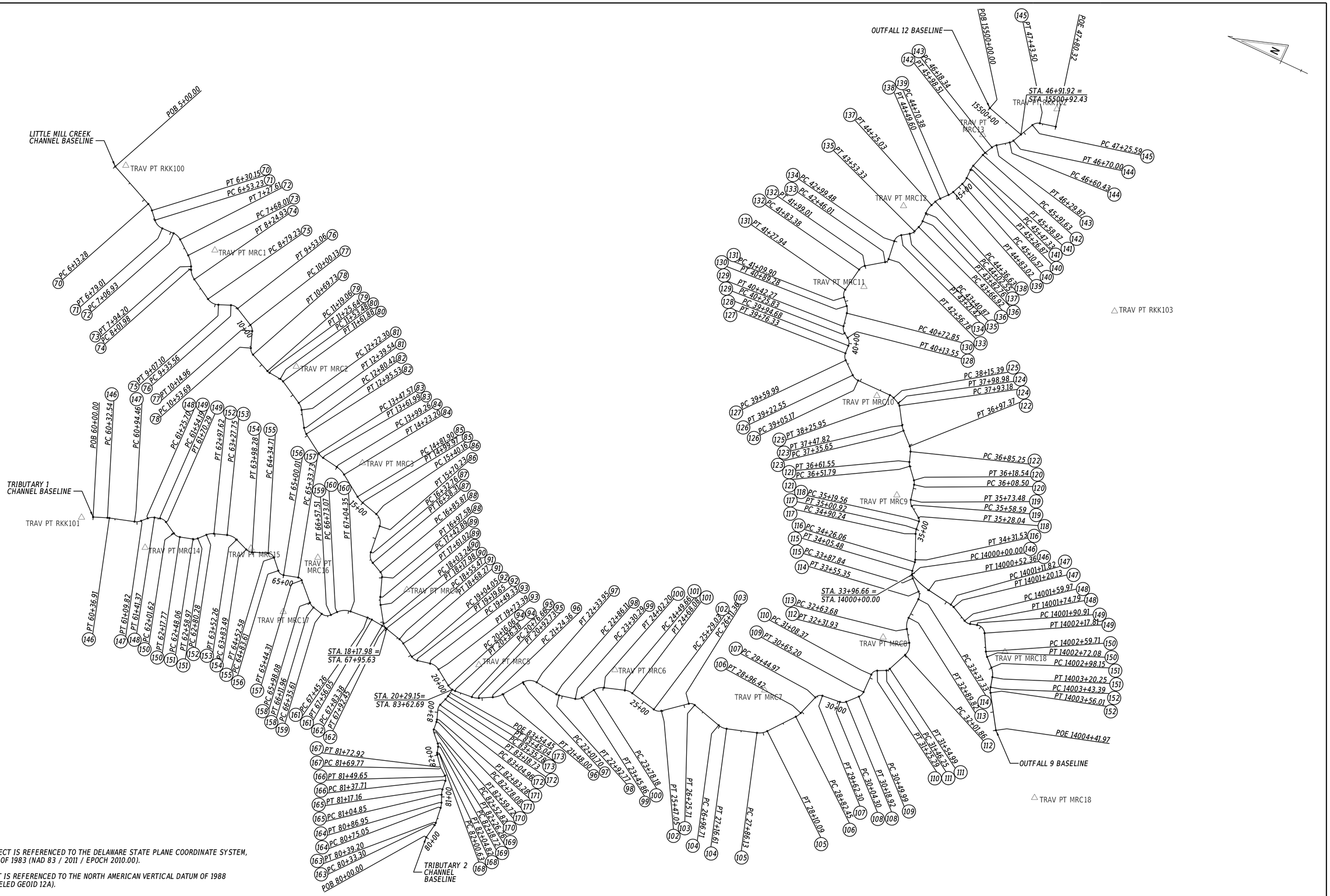
CHECKED BY: T. CUTILLO

HORIZONTAL AND VERTICAL CONTROL FLOODPLAINS AND OUTFALLS

SECTION RKK

SHEET NO. 14

01-MAY-2025
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DATUM REFERENCE:

HORIZONTAL - THIS PROJECT IS REFERENCED TO THE DELAWARE STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD 83 / 2011 / EPOCH 2010.00).

VERTICAL - THIS PROJECT IS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88 BASED ON MODELED GEOID 12A).

ADDENDA / REVISIONS

SCALE 0 100 200 300 FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

HORIZONTAL AND VERTICAL CONTROL STREAM CHANNELS

SECTION
RKK
SHEET NO.
15

01-MAY-2025
13:30
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LITTLE MILL CREEK CHANNEL

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	5+00.00	636730.9864	599495.9370	S 23.5267 W 113.2781
PC	6+13.28	636627.1246	599450.7190	CURVE 70
PT	6+30.15	636613.5084	599440.9667	S 47.6958 W 23.0818
PC	6+53.23	636597.9728	599423.8958	CURVE 71
PT	6+79.01	636574.9856	599414.0984	S 1.5276 E 27.9191
PC	7+06.93	636547.0764	599414.8427	CURVE 72
PT	7+27.61	636527.8167	599408.5014	S 37.9760 W 40.4017
PC	7+68.01	636495.9693	599383.6410	CURVE 73
PT	7+94.20	636479.4354	599363.5974	S 62.9860 W 7.7772
PC	8+01.98	636475.9030	599356.6687	CURVE 74
PT	8+24.93	636460.3337	599340.2345	S 30.1100 W 54.3032
PC	8+79.23	636413.3580	599312.9927	CURVE 75
PT	9+07.10	636386.5344	599311.3515	S 23.1074 E 28.4613
PC	9+35.56	636360.3565	599322.5213	CURVE 76
PT	9+53.06	636343.4206	599321.9424	S 27.0224 W 47.073
PC	10+00.13	636301.4866	599300.5554	CURVE 77
PT	10+14.96	636291.8389	599289.7402	S 69.5084 W 38.7294
PC	10+53.69	636278.2809	599253.4614	CURVE 78
PT	10+69.73	636267.5439	599242.1314	S 23.5702 W 49.3337
PC	11+19.06	636222.3261	599222.4043	CURVE 79
PT	11+25.64	636215.9756	599220.8036	S 4.7234 W 27.8384
PC	11+53.48	636188.2318	599218.5112	CURVE 80
PT	11+61.88	636180.2435	599216.1052	S 28.8003 W 60.4215
PC	12+22.30	636127.2959	599186.9966	CURVE 81
PT	12+39.54	636114.7994	599175.3813	S 57.0138 W 40.8857
PC	12+80.42	636092.5397	599141.0864	CURVE 82
PT	12+95.53	636081.8783	599130.5539	S 32.2889 W 52.0385
PC	13+47.57	636037.8867	599102.7555	CURVE 83
PT	13+61.99	636024.4744	599097.7445	S 8.6837 W 37.278
PC	13+99.26	635987.6237	599092.1163	CURVE 84
PT	14+23.20	635965.4770	599083.5481	S 33.6175 W 58.7012
PC	14+81.90	635916.5935	599051.0485	CURVE 85
PT	14+99.97	635900.1836	599043.6722	S 14.7904 W 40.1882
PC	15+40.16	635861.3269	599033.4128	CURVE 86
PT	15+70.23	635842.8597	599011.9819	S 83.7059 W 62.5319
PC	16+32.76	635836.0042	598949.8270	CURVE 87
PT	16+58.31	635821.7771	598929.9366	S 25.1436 W 27.5505
PC	16+85.87	635796.8372	598918.2307	CURVE 88
PT	16+97.58	635789.1244	598909.8078	S 69.8964 W 45.3075
PC	17+42.89	635773.5514	598867.2608	CURVE 89
PT	17+61.02	635765.3298	598851.1463	S 56.0424 W 42.2163
PC	18+03.24	635741.7487	598816.1299	CURVE 90
PT	18+17.98	635729.9399	598807.8812	S 13.8282 W 37.4906
PC	18+55.47	635693.5359	598798.9205	CURVE 91
PT	18+68.27	635681.7972	598793.9376	S 32.1730 W 35.7742
PC	19+04.05	635651.5163	598774.8886	CURVE 92
PT	19+19.65	635636.5309	598772.2931	S 12.5207 E 29.6801
PC	19+49.33	635607.5567	598778.7275	CURVE 93
PT	19+73.39	635584.5211	598774.4749	S 33.4398 W 42.6712
PC	20+16.06	635548.9134	598750.9605	CURVE 94
PT	20+36.38	635529.5810	598746.1254	S 5.3566 E 40.2813
PC	20+76.66	635489.4756	598749.8858	CURVE 95
PT	20+92.73	635474.1961	598754.5191	S 28.3816 E 31.628
PC	21+24.36	635446.3697	598769.5532	CURVE 96
PT	21+48.00	635428.9477	598785.1980	S 55.4653 E 53.7003
PC	22+01.70	635398.5047	598829.4355	CURVE 97
PT	22+33.95	635370.5823	598842.2562	S 6.1404 W 52.1526
PC	22+86.11	635318.7289	598836.6777	CURVE 98
PT	22+92.77	635312.1069	598837.0718	S 12.9522 E 37.5195
PC	23+30.29	635275.5420	598845.4813	CURVE 99
PT	23+45.86	635263.1445	598854.2460	S 57.5662 E 32.3171
PC	23+78.18	635245.8121	598881.5220	CURVE 100
PT	24+02.20	635227.2329	598895.9899	S 18.2509 E 47.4634
PC	24+49.66	635182.1572	598910.8544	CURVE 101
PT	24+68.08	635163.9765	598911.8624	S 11.9039 W 60.9491
PC	25+29.03	635104.3381	598899.2904	CURVE 102
PT	25+47.05	635087.4338	598903.4753	S 39.7132 E 64.3159
PC	26+11.36	635037.9586	598944.5696	CURVE 103
PT	26+25.71	635024.4733	598947.5146	S 15.0746 W 71.0047
PC	26+96.71	634955.9120	598929.0479	CURVE 104
PT	27+16.61	634936.2863	598929.4629	S 17.4971 E 69.516
PC	27+86.13	634869.9867	598950.3634	CURVE 105
PT	28+10.09	634850.5701	598963.7874	S 51.8202 E 72.3656
PC	28+82.45	634805.8386	599020.6722	CURVE 106
PT	28+96.42	634799.2779	599032.9186	S 71.8219 E 48.5518

LITTLE MILL CREEK CHANNEL CONT.

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
PC	29+44.97	634784.1311	599079.0472	CURVE 107
PT	29+62.30	634771.3449	599089.2959	S 5.6051 E 42.0004
PC	30+04.30	634729.5452	599093.3982	CURVE 108
PT	30+18.92	634716.7568	599099.7868	S 47.4845 E 31.0715
PC	30+49.99	634695.7590	599122.6894	CURVE 109
PT	30+65.20	634690.5042	599136.5708	N 88.9525 E 43.1667
PC	31+08.37	634691.2934	599179.7303	CURVE 110
PT	31+25.29	634682.9670	599193.4394	S 26.4065 E 20.9597
PC	31+46.25	634664.1942	599202.7610	CURVE 111
PT	31+54.99	634658.9197	599209.3755	S 67.4252 E 46.8745
PC	32+01.86	634640.9250	599252.6584	CURVE 112
PT	32+31.93	634644.0098	599281.3221	N 55.1404 E 31.7458
PC	32+63.68	634662.1546	599307.3713	CURVE 113
PT	32+89.82	634669.2919	599332.0337	S 87.4212 E 47.514
PC	33+37.33	634667.1542	599379.4996	CURVE 114
PT	33+55.35	634674.0216	599395.5014	N 40.9663 E 32.4988
PC	33+87.84	634698.5613	599416.8080	CURVE 115
PT	34+05.48	634706.8888	599431.9405	N 81.3848 E 20.5813
PC	34+26.06	634709.9719	599452.2895	CURVE 116
PT	34+31.53	634711.5163	599457.5198	N 65.7128 E 58.7115
PC	34+90.24	634735.6649	599511.0351	CURVE 117
PT	35+00.92	634738.5158	599521.2817	N 83.1916 E 18.6398
PC	35+19.56	634740.7255	599539.7901	CURVE 118
PT	35+28.04	634744.9726	599546.8332	N 34.6275 E 30.549
PC	35+58.59	634770.1103	599564.1923	CURVE 119
PT	35+73.48	634778.2563	599576.2529	N 77.3006 E 35.0195
PC	36+08.50	634785.9548	599610.4158	CURVE 120
PT	36+18.54	634790.4781	599619.2620	N 48.5361 E 33.2484
PC	36+51.79	634812.4934	599644.1775	CURVE 121
PT	36+61.55	634817.3851	599652.5573	N 70.9160 E 23.6956
PC	36+85.25	634825.1325	599674.9506	CURVE 122
PT	36+97.37	634831.6670	599685.0218	N 43.1304 E 38.2725
PC	37+35.65	634859.5982	599711.1872	CURVE 123
PT	37+47.82	634867.3872	599720.5046	N 57.0811 E 45.3556
PC	37+93.18	634892.0358	599758.5779	CURVE 124
PT	37+98.98	634896.3939	599762.2926	N 23.8048 E 16.4101
PC	38+15.39	634911.4079	599768.9161	CURVE 125
PT	38+25.95	634921.6660	599771.0424	N 0.3838 W 79.2253
PC	39+05.17	635000.8895	599770.5116	CURVE 126
PT	39+22.55	635016.9348	599776.2006	N 39.4284 E 37.4488
PC	39+59.99	635045.8610	599799.9849	CURVE 127
PT	39+76.33	635053.1157	599814.1217	N 86.2399 E 18.3464
PC	39+94.68	635054.3188	599832.4286	CURVE 128
PT	40+13.55	635063.6210	599848.0426	N 32.1908 E 12.2786
PC	40+25.83	635074.0121	599854.5839	CURVE 129
PT	40+42.27	635083.0086	599867.7911	N 79.2854 E 30.58
PC	40+72.85	635088.6940	599897.8380	CURVE 130
PT	40+89.28	635095.9145	599912.3764	N 47.8920 E 20.617
PC	41+09.90	635109.7388	599927.6717	CURVE 131
PT	41+27.94	635114.6219	599944.4125	S 80.4151 E 55.4326
PC	41+83.38	635105.3919	599999.0712	CURVE 132
PT	41+99.01	635097.3216	600011.9973	S 35.6283 E 46.9967
PC	42+46.01	635059.1221	600039.3741	CURVE 133
PT	42+56.78	635055.0297	600048.7823	N 82.6452 E 42.7037
PC	42+99.48	635060.4963	600091.1347	CURVE 134
PT	43+21.42	635051.9910	600110.1761	S 34.5069 E 19.4513
PC	43+40.87	635035.9620	600121.1954	CURVE 135
PT	43+53.33	635028.4744	600130.9021	S 70.2009 E 13.5859
PC	43+66.92	635023.8725	600143.6849	CURVE 136
PT	43+82.76	635021.5591	600159.2554	N 87.1031 E 19.7885
PC	44+02.55	635022.5592	600179.0187	CURVE 137
PT	44+25.03	635018.6952	600200.9712	S 67.1381 E 11.5968
PC	44+36.63	635014.1898	600211.6570	CURVE 138
PT	44+49.60	635007.3168	600222.5913	S 48.5574 E 20.7835
PC	44+70.38	634993.5608	600238.1710	CURVE 139
PT	44+83.02	634986.8187	600248.7986	S 66.6604 E 27.5527
PC	45+10.57	634975.9028	600274.0967	CURVE 140
PT	45+26.87	634972.6297	600289.9439	S 90.0000 E 20.461
PC	45+47.33	634972.6297	600310.4050	CURVE 141
PT	45+58.97	634970.9491	600321.8780	S 73.3319 E 32.6636
PC	45+91.63	634961.5803	600353.1692	CURVE 142
PT	45+98.51	634959.0494	600359.5620	S 63.4712 E 19.8253
PC	46+18.34	634950.1945	600377.2999	CURVE 143
PT	46+29.87	634942.8882	600386.0874	S 37.0463 E 30.5573
PC	46+60.43	634918.4989	600404.4969	CURVE 144

LITTLE MILL CREEK CHANNEL CONT.

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
PT	46+70.00	634912.4993	600411.8437	S 64.4811 E 55.5839
PC	47+25.59	634888.5532	600462.0050	CURVE 145
PT	47+43.50	634875.0606	600472.8629	S 13.1683 E 36.8272
POE	47+80.32	634839.2018	600481.2526	

TRIBUTARY 1 CHANNEL

DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	60+00.00	636439.7516	598755.3666	S 21.9445 E 32.5390
PC	60+32.54	636409.5702	598767.5267	CURVE 146
PT	60+36.91	636405.4496	598768.9810	S 16.9356 E 57.5482
PC	60+94.46	636350.3971	598785.7445	CURVE 147
PT	61+09.82	636337.4553	598793.7083	S 46.2769 E 15.8760
PC	61+25.70	636326.4822	598805.1817	CURVE 148
PT	61+41.37	636313.2435	598813.2342	S 16.3436 E 12.8183
PC	61+54.19	636300.9432	598816.8412	CURVE 149
PT	61+70.29	636285.3804	598815.0074	S 29.7845 W 31.3320
PC	62+01.62	636258.1874	598799.4436	CURVE 150
PT	62+17.77	636242.5763	598797.6240	S 16.4880 E 30.2813
PC	62+48.06	636213.5402	598806.2183	CURVE 151
PT	62+58.97	636204.4087	598811.9523	S 47.7648 E 21.3018
PC	62+80.28	636190.0901	598827.7240	CURVE 152
PT	62+97.62	636175.7848	598837.2167	S 19.3700 E 30.1309
PC	63+27.75	636147.3594	598847.2102	CURVE 153
PT	63+52.26	636123.3545	598846.9224	S 20.7436 W 31.2349
PC	63+83.49	636094.1444	598835.8594	CURVE 154
PT	63+98.28	636079.6909	598835.9702	S 21.6224 E 36.4332
PC	64+34.71	636045.8213	598849.3954	CURVE 155
PT	64+52.58	636029.3928	598845.7544	S 46.6147 W 31.0350
PC	64+83.61	636008.0748	598823.1997	CURVE 156
PT	65+00.01	635993.0361	598819.0851	S 16.0114 E 33.7241
PC	65+33.73	635960.6203	598828.3872	CURVE 157
PT	65+44.31	635950.8381	598825.8930	S 44.6194 W 53.7693
PC	65+98.08	635912.5657	598788.1258	CURVE 158
PT	66+11.96	635900.5494	598781.5428	S 12.8114 W 23.6467
PC	66+35.61	635877.4914	598776.2994	CURVE 159
PT	66+57.51	635857.7502	598782.9284	S 49.9352 E 15.5640
PC	66+73.07	635847.7324	598794.8399	CURVE 160
PT	67+04.35	635820.7026	598808.9330	S 5.1391 E 40.9089
PC	67+45.26	635779.9582	598812.5973	CURVE 161
PT	67+56.05	635769.1843	598812.5951	S 5.1631 W 27.3316
PC	67+83.38	635741.9636	598810.1355	CURVE 162
PT	67+92.45	635733.0224	598808.6399	S 13.8282 W
POE	67+95.63	635729.9399	598807.8812	

TRIBUTARY 2 CHANNEL

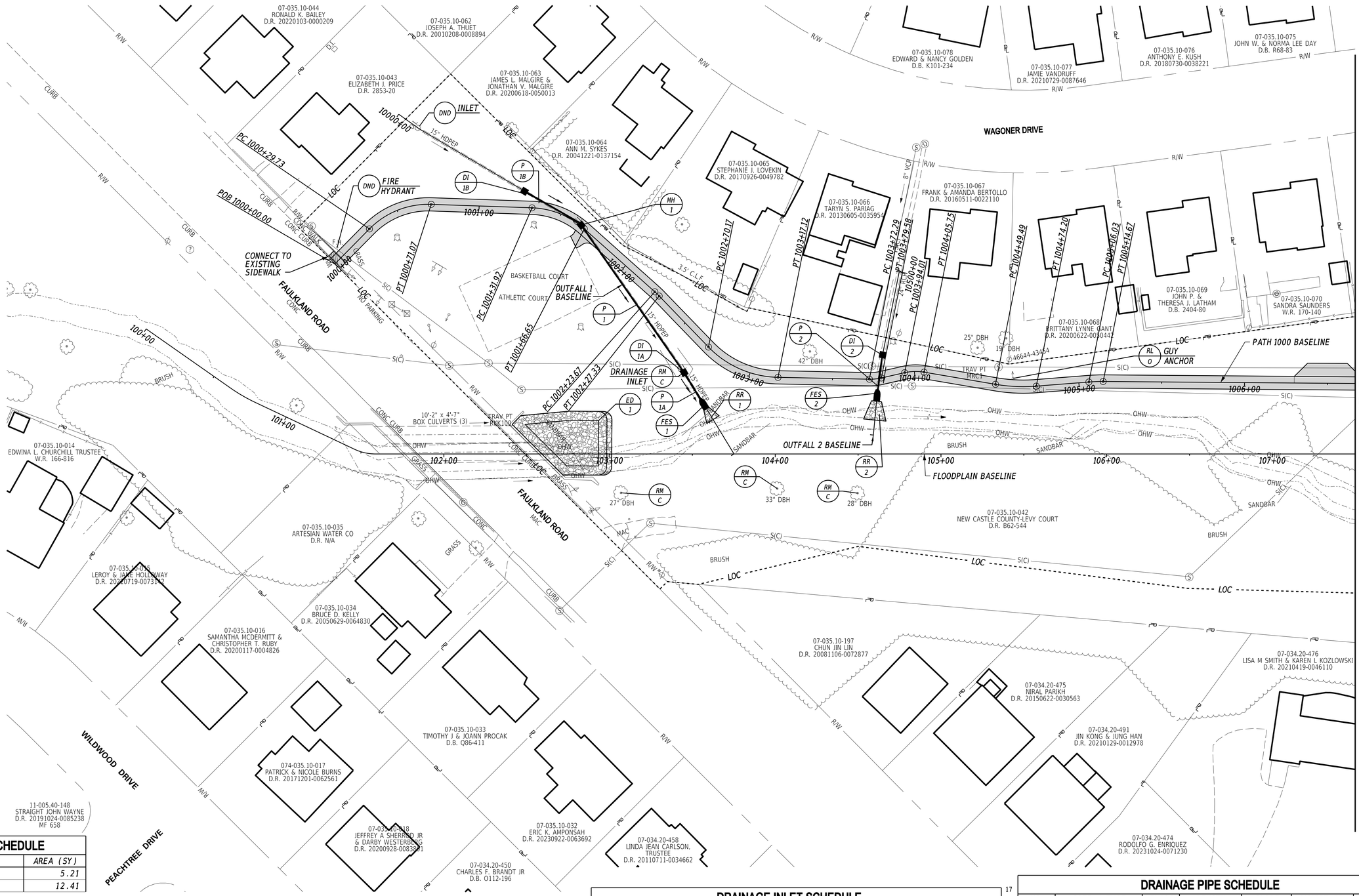
DESCRIPTION	STATION	NORTHING	EASTING	BEARING & DISTANCE OR CURVE NO.
POB	80+00.00	635448.4340	598418.2775	S 80.3235 E 33.3031
PC	80+33.30	635442.8363	598451.1068	CURVE 163
PT	80+39.20	635442.7100	598456.9793	N 82.7879 E 16.8438
PC	80+75.05	635447.2104	598492.5439	CURVE 164
PT	80+86.95	635450.4267	598503.9580	N 65.7389 E 17.8994
PC	81+04.85	635457.7814	598520.2766	CURVE 165
PT	81+17.16	635461.0475	598532.1016	N 83.3808 E 20.5430
PC	81+37.71	635463.4155	598552.5077	CURVE 166
PT	81+49.65	635469.1326	598562.6393	N 37.7483 E 20.1175
PC	81+69.77	635485.0396	598574.9551	CURVE 167
PT	81+72.92	635487.3104	598577.1300	N 49.7808 E 27.7130
PC	82+00.63	635505.2051	598598.2911	CURVE 168
PT	82+04.82	635507.1707	598601.9529	N 73.7681 E 13.9006
PC	82+18.72	635511.0562	598615.2994	CURVE 169
PT	82+26.26	635514.8546	598621.7161	N 44.9841 E 26.5639
PC	82+52.82	635533.6433	598640.4944	CURVE 170
PT	82+59.72	635536.5283	598646.6098	N 84.5050 E 18.3639
PC	82+78.08	635538.2868	598664.8893	CURVE 171
PT	82+83.28	635539.4469	598669.9394	N 69.6189 E 21.6842
PC	83+04.96	635546.9987	598690.2661	CURVE 172
PT	83+18.73	635547.1535	598703.7649	S 70.9327 E 17.0417
PC	83+35.78	635541.5863	598719.8716	CURVE 173
PT	83+45.04	635539.3862	598728.8564	S 81.5479 E 17.6556
POE	83+62.69	635536.7911	598746.3202	

ADDENDA / REVISIONS		NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	HORIZONTAL AND VERTICAL CONTROL STREAM CHANNELS	SECTION RKK
					DESIGNED BY: N. RILEY		SHEET NO. 16
					CHECKED BY: T. CUTILLO		

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NOTES

1. SEE SHEET 52 FOR ED-1 SCHEDULE



RIPRAP SCHEDULE

NO.	TYPE	AREA (SY)
1	R-5	5.21
2	R-5	12.41

FLARED END SECTION SCHEDULE

NO.	SIZE / TYPE	SLOPE	SAFETY GRATE
1	15" RCP	0.0189	NO
2	24" RCP	0.0095	NO

MANHOLE SCHEDULE

NO.	STATION	OFFSET	TYPE/SIZE	T.G. EL.	INVERT EL.
1	102+82.92	138.14	34" x 18"	100.49	96.61

DRAINAGE INLET SCHEDULE

NO.	STATION	OFFSET	BOX SIZE	GRATE	T.G. EL.	INV. EL.
1A	103+44.98	49.11	34" x 18"	1	98.06	95.53
1B	102+48.62	158.57	34" x 18"	1	100.73	96.94
2	104+64.77	59.82	48" x 30"	1	99.23	94.99

DRAINAGE PIPE SCHEDULE

NO.	SIZE / TYPE	CLASS	LENGTH	SLOPE	INVERT EL.	DIS. EL.
1	15" RCP	IV	108.00	0.0081	96.61	95.73
1A	15" RCP	IV	18.00	0.0189	95.53	95.19
1B	15" RCP	IV	39.00	0.0079	96.94	96.63
2	24" RCP	IV	21.00	0.0095	94.99	94.79

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

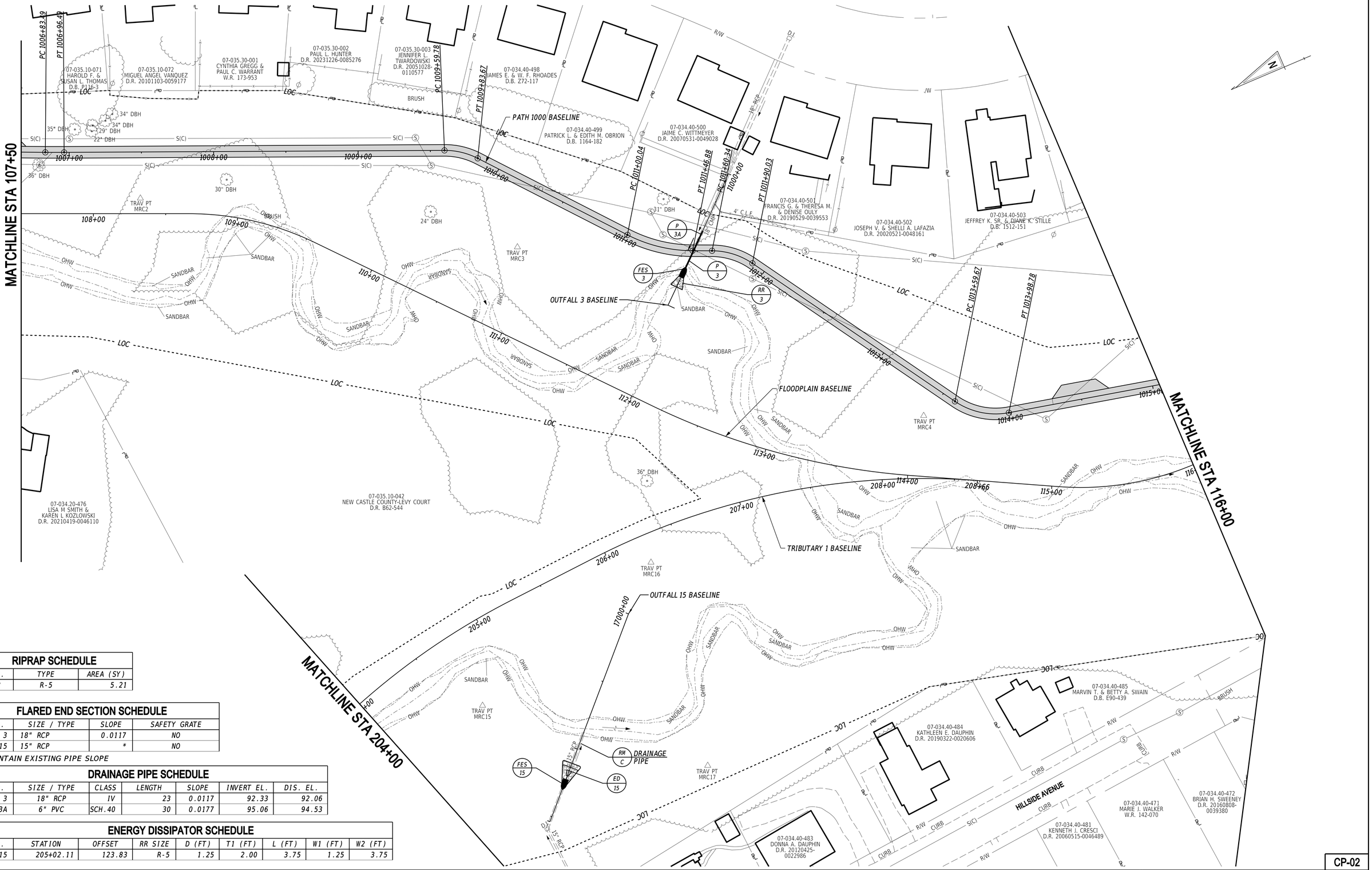
New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	C. HALL
CHECKED BY:	C. WEBB

CONSTRUCTION PLAN

CP-01	
SECTION	
RKK	
SHEET NO.	
17	

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RIPRAP SCHEDULE		
NO.	TYPE	AREA (SY)
3	R-5	5.21

FLARED END SECTION SCHEDULE			
NO.	SIZE / TYPE	SLOPE	SAFETY GRATE
3	18" RCP	0.0117	NO
15	15" RCP	*	NO

*MAINTAIN EXISTING PIPE SLOPE

DRAINAGE PIPE SCHEDULE						
NO.	SIZE / TYPE	CLASS	LENGTH	SLOPE	INVERT EL.	DIS. EL.
3	18" RCP	IV	23	0.0117	92.33	92.06
3A	6" PVC	SCH.40	30	0.0177	95.06	94.53

ENERGY DISSIPATOR SCHEDULE								
NO.	STATION	OFFSET	RR SIZE	D (FT)	T1 (FT)	L (FT)	W1 (FT)	W2 (FT)
15	205+02.11	123.83	R-5	1.25	2.00	3.75	1.25	3.75

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

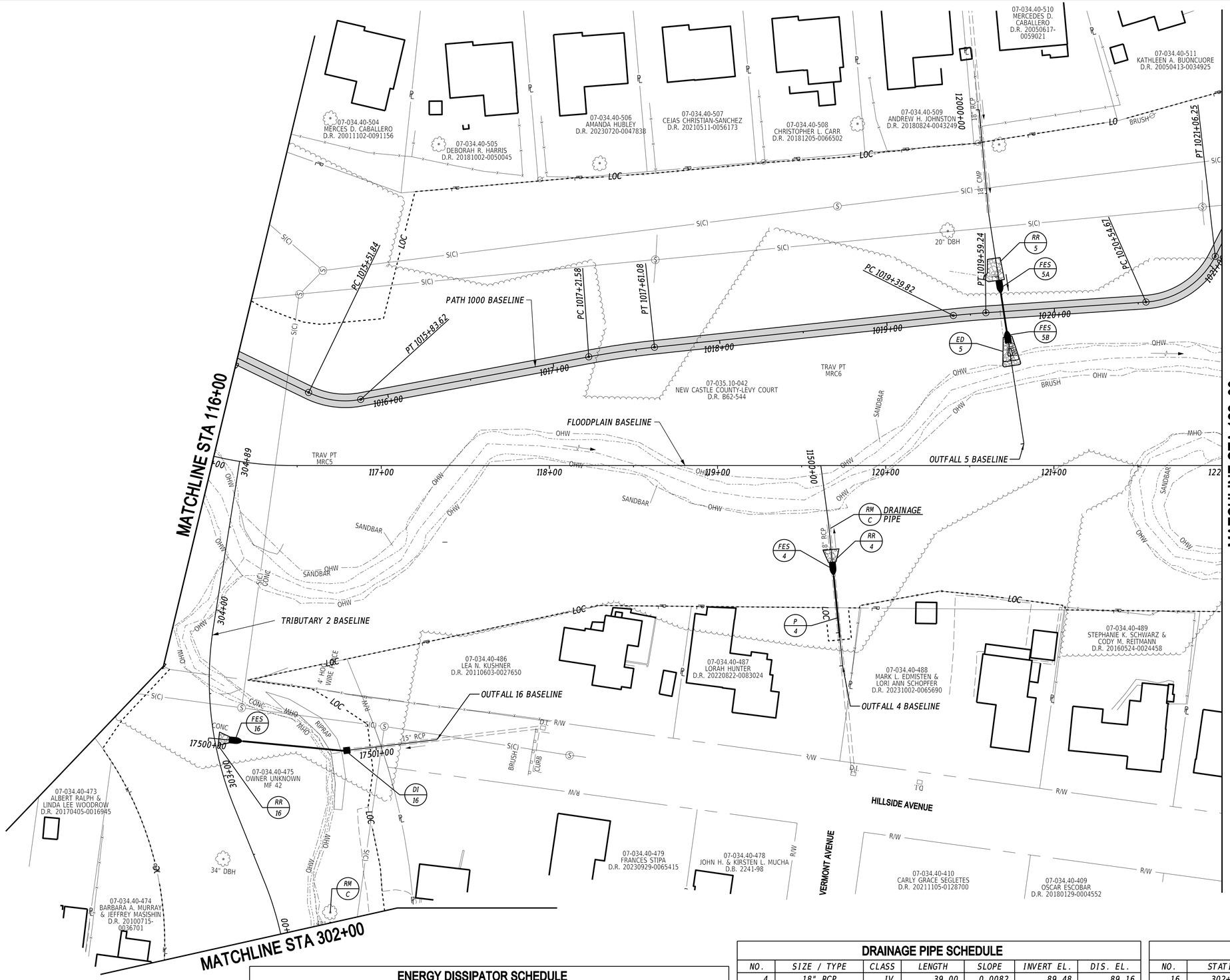
LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: C. HALL
CHECKED BY: C. WEBB

CONSTRUCTION PLAN

CP-02
SECTION
RKK
SHEET NO.
18

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RIPRAP SCHEDULE

NO.	TYPE	AREA (SY)
4	R-5	5.83
5	R-5	13.89
16	R-5	4.05

FLARED END SECTION SCHEDULE

NO.	SIZE / TYPE	SLOPE	SAFETY GRATE
4	18" RCP	0.0082	NO
5A	18" RCP	0.0132	NO
5B	18" RCP	0.0132	NO
16	15" RCP	0.0046	NO

ENERGY DISSIPATOR SCHEDULE

NO.	STATION	OFFSET	RR SIZE	D (FT)	T1 (FT)	L (FT)	W1 (FT)	W2 (FT)
5	120+73.92	67.02	R-5	1.50	2.00	4.50	1.50	3.00

DRAINAGE PIPE SCHEDULE

NO.	SIZE / TYPE	CLASS	LENGTH	SLOPE	INVERT EL.	DIS. EL.
4	18" RCP	IV	39.00	0.0082	89.48	89.16
5	18" RCP	IV	26.00	0.0132	89.15	88.81
16	15" RCP	IV	63.00	0.0046	91.63	91.34

DRAINAGE INLET SCHEDULE

NO.	STATION	OFFSET	BOX SIZE	GRATE	T.G. EL.	INV. EL.
16	302+89.86	74.58	34" x 18"	1	95.14	91.63

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: C. HALL
CHECKED BY: C. WEBB

CONSTRUCTION PLAN

CP-03
SECTION
RKK
SHEET NO.
19

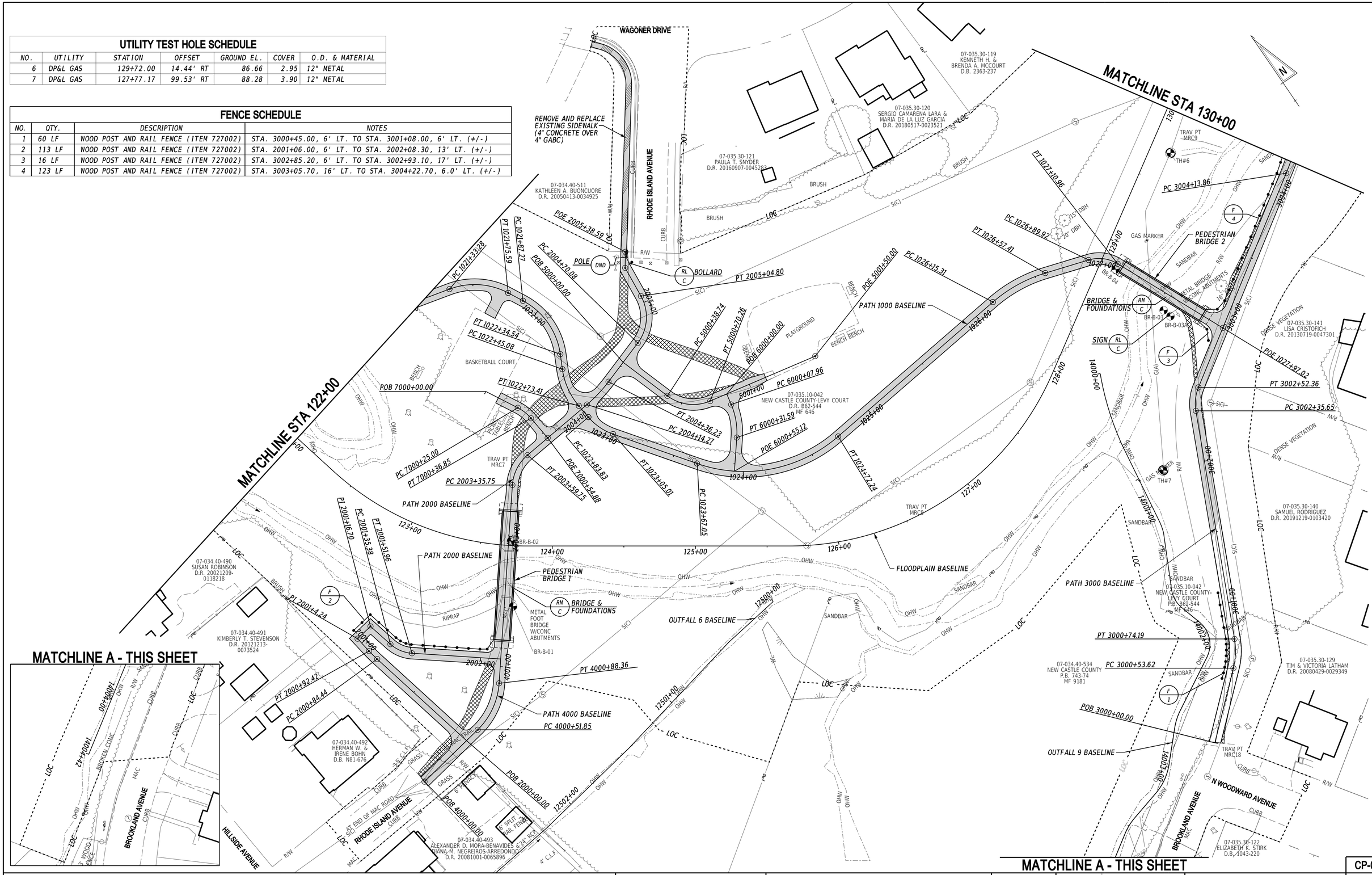
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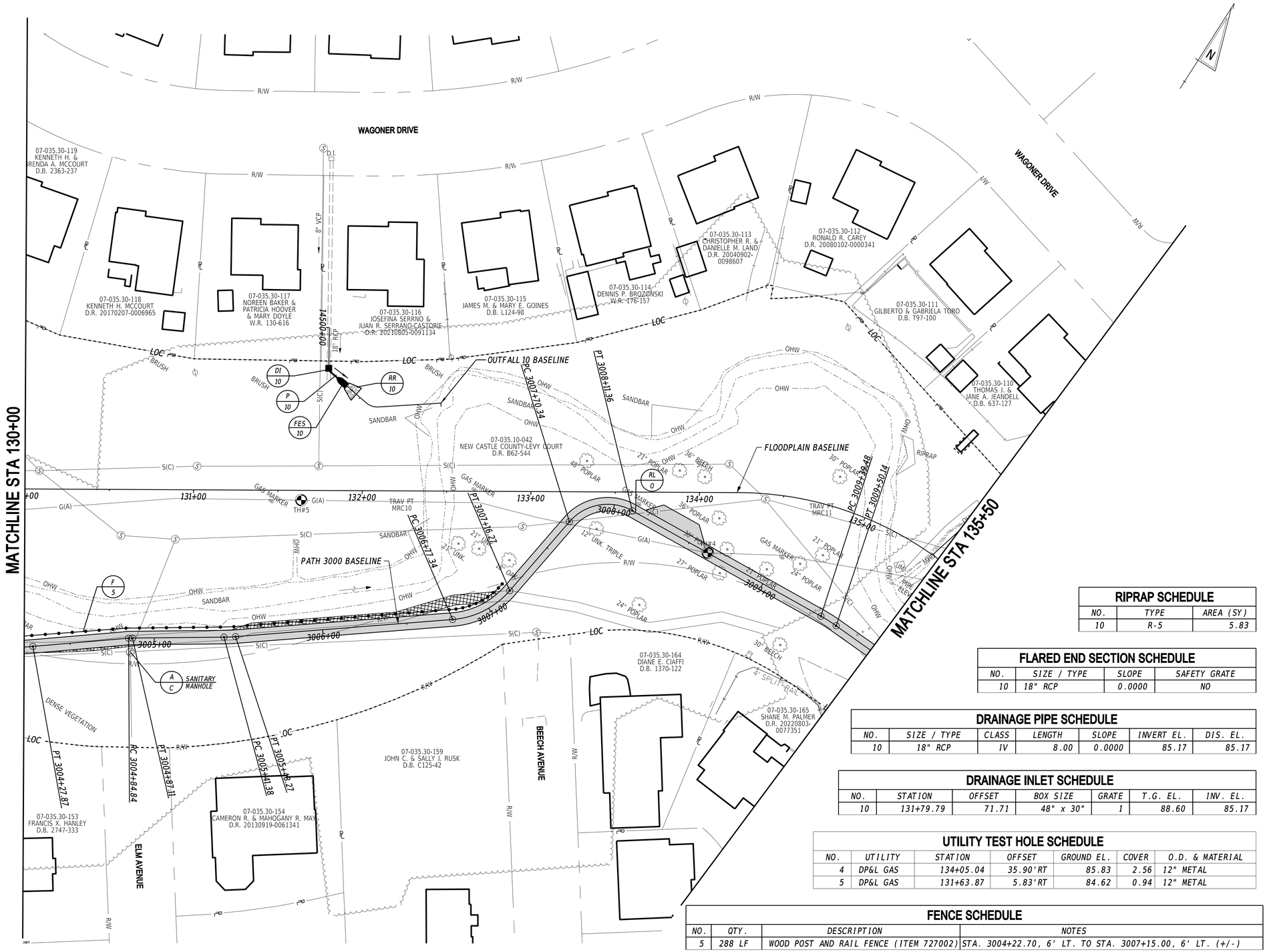
UTILITY TEST HOLE SCHEDULE

NO.	UTILITY	STATION	OFFSET	GROUND EL.	COVER	O.D. & MATERIAL
6	DP&L GAS	129+72.00	14.44' RT	86.66	2.95	12" METAL
7	DP&L GAS	127+77.17	99.53' RT	88.28	3.90	12" METAL

FENCE SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
1	60 LF	WOOD POST AND RAIL FENCE (ITEM 727002)	STA. 3000+45.00, 6' LT. TO STA. 3001+08.00, 6' LT. (+/-)
2	113 LF	WOOD POST AND RAIL FENCE (ITEM 727002)	STA. 2001+06.00, 6' LT. TO STA. 2002+08.30, 13' LT. (+/-)
3	16 LF	WOOD POST AND RAIL FENCE (ITEM 727002)	STA. 3002+85.20, 6' LT. TO STA. 3002+93.10, 17' LT. (+/-)
4	123 LF	WOOD POST AND RAIL FENCE (ITEM 727002)	STA. 3003+05.70, 16' LT. TO STA. 3004+22.70, 6.0' LT. (+/-)


WAGONER DRIVE
RHODE ISLAND AVENUE
MATCHLINE STA 122+00
MATCHLINE STA 130+00
MATCHLINE A - THIS SHEET
REMOVE AND REPLACE EXISTING SIDEWALK (4" CONCRETE OVER 4" GABC)
07-035.30-119 KENNETH H. & BRENDA A. MCCOURT D.B. 2363-237
07-035.30-120 SERGIO CAMARENA LARA & MARIA DE LA LUZ GARCIA D.R. 20180517-0023521
07-035.30-121 PAULA T. SNYDER D.R. 20160907-0045283
07-034.40-511 KATHLEEN A. BUONCUORE D.R. 20050413-0034925
07-034.40-490 SUSAN ROBINSON D.R. 20021209-0118218
07-034.40-491 KIMBERLY T. STEVENSON D.R. 20121213-0073524
07-034.40-492 HERMAN W. & IRENE BOHN D.B. N81-676
07-034.40-493 ALEXANDER D. MORA-BENAVIDES & DIANA M. NEGREIROS-ARREDONDO D.R. 20081001-0065896
07-035.10-042 NEW CASTLE COUNTY-LEVY COURT D.R. B62-544 MF 646
07-035.30-141 LISA CRISTOFICH D.R. 20130719-0047301
07-035.30-140 SAMUEL RODRIGUEZ D.R. 20191219-0103420
07-035.30-129 TIM & VICTORIA LATHAM D.R. 20080429-0029349
07-034.40-534 NEW CASTLE COUNTY P.B. 743-74 MF 9181
07-035.30-122 ELIZABETH K. STIRK D.B. 1043-220
PATH 1000 BASELINE
PATH 2000 BASELINE
PATH 3000 BASELINE
PATH 4000 BASELINE
FLOODPLAIN BASELINE
OUTFALL 6 BASELINE
OUTFALL 9 BASELINE
PEDESTRIAN BRIDGE 1
PEDESTRIAN BRIDGE 2
BRIDGE & FOUNDATIONS
METAL FOOT BRIDGE W/CONC ABUTMENTS
BR-B-01
BR-B-02
BR-B-03
BR-B-04
POB 7000+00.00
POB 5000+00.00
POB 4000+00.00
POB 3000+00.00
POB 2000+00.00
POE 2005+38.59
POE 5001+50.00
POE 7000+54.88
POE 6000+55.12
POE 1027+97.02
PC 1021+33.28
PT 1021+75.59
PC 1021+87.27
PT 1022+34.54
PC 1022+45.08
PT 1022+73.41
PC 1022+93.83
PT 2003+59.75
PC 2003+35.75
PT 2001+16.70
PC 2001+35.38
PT 2001+51.96
PC 2001+74.24
PT 2000+92.42
PC 2000+84.44
PT 4000+88.36
PC 4000+51.85
PC 2004+70.08
PT 2005+04.80
PC 5000+38.74
PT 5000+70.26
PC 6000+07.96
PT 6000+31.59
PC 2004+14.27
PT 2004+36.23
PT 1023+05.01
PC 1023+67.05
PT 1024+72.24
PC 1026+15.31
PT 1026+57.41
PC 1026+89.92
PT 1027+10.96
PC 3004+13.86
PT 3002+52.36
PC 3002+35.65
PT 3000+74.19
PC 3000+53.62
2005+00
2004+00
2003+00
2002+00
2001+00
2000+00
1000+00
1023+00
1024+00
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3350+00



RIPRAP SCHEDULE		
NO.	TYPE	AREA (SY)
10	R-5	5.83

FLARED END SECTION SCHEDULE			
NO.	SIZE / TYPE	SLOPE	SAFETY GRATE
10	18" RCP	0.0000	NO

DRAINAGE PIPE SCHEDULE						
NO.	SIZE / TYPE	CLASS	LENGTH	SLOPE	INVERT EL.	DIS. EL.
10	18" RCP	IV	8.00	0.0000	85.17	85.17

DRAINAGE INLET SCHEDULE						
NO.	STATION	OFFSET	BOX SIZE	GRATE	T.G. EL.	INV. EL.
10	131+79.79	71.71	48" x 30"	1	88.60	85.17

UTILITY TEST HOLE SCHEDULE						
NO.	UTILITY	STATION	OFFSET	GROUND EL.	COVER	O.D. & MATERIAL
4	DP&L GAS	134+05.04	35.90'RT	85.83	2.56	12" METAL
5	DP&L GAS	131+63.87	5.83'RT	84.62	0.94	12" METAL

FENCE SCHEDULE			
NO.	QTY.	DESCRIPTION	NOTES
5	288 LF	WOOD POST AND RAIL FENCE (ITEM 727002)	STA. 3004+22.70, 6' LT. TO STA. 3007+15.00, 6' LT. (+/-)

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

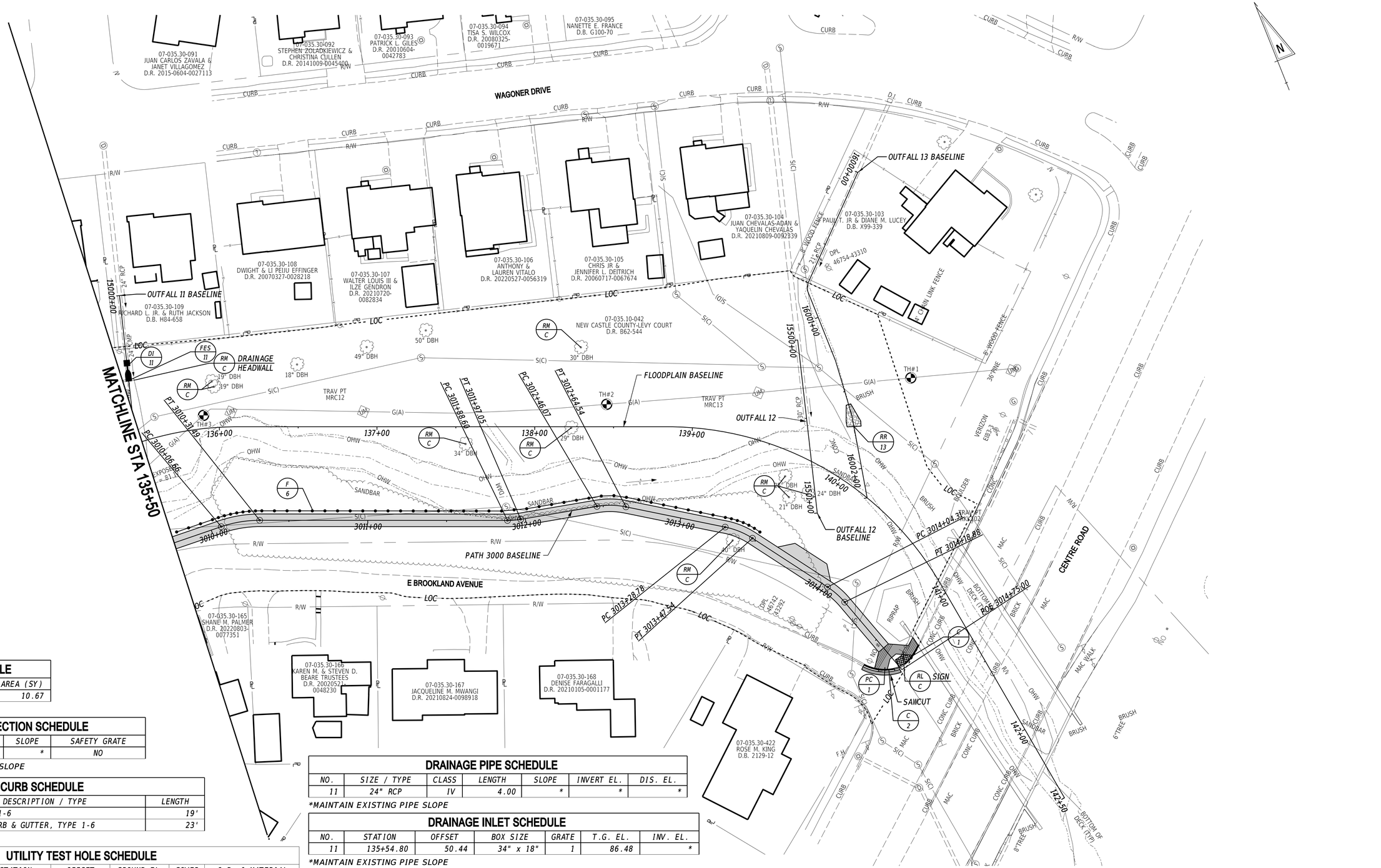
LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: C. HALL
CHECKED BY: C. WEBB

CONSTRUCTION PLAN

CP-05
SECTION
RKK
SHEET NO.
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RIPRAP SCHEDULE

NO.	TYPE	AREA (SY)
13	R-6	10.67

FLARED END SECTION SCHEDULE

NO.	SIZE / TYPE	SLOPE	SAFETY GRATE
11	24" RCP	*	NO

*MAINTAIN EXISTING PIPE SLOPE

CURB SCHEDULE

NO.	ITEM DESCRIPTION / TYPE	LENGTH
1	PCC CURB, TYPE 1-6	19'
2	INTEGRAL PCC CURB & GUTTER, TYPE 1-6	23'

UTILITY TEST HOLE SCHEDULE

NO.	UTILITY	STATION	OFFSET	GROUND EL.	COVER	O.D. & MATERIAL
1	DP&L GAS	140+02.00	71.22'LT	90.56	3.04	12" METAL
2	DP&L GAS	138+45.64	14.24'LT	85.67	3.29	12" METAL
3	DP&L GAS	135+90.85	8.36'LT	86.27	3.09	12" METAL

DRAINAGE PIPE SCHEDULE

NO.	SIZE / TYPE	CLASS	LENGTH	SLOPE	INVERT EL.	DIS. EL.
11	24" RCP	IV	4.00	*	*	*

*MAINTAIN EXISTING PIPE SLOPE

DRAINAGE INLET SCHEDULE

NO.	STATION	OFFSET	BOX SIZE	GRATE	T.G. EL.	INV. EL.
11	135+54.80	50.44	34" x 18"	1	86.48	*

*MAINTAIN EXISTING PIPE SLOPE

FENCE SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
6	374 LF	WOOD POST AND RAIL FENCE (ITEM 727002)	STA. 3009+78.82, 6.0' LT. TO STA. 3013+47.42, 6.0' LT. (+/-)

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: C. HALL
CHECKED BY: C. WEBB

CONSTRUCTION PLAN

CP-06
SECTION
RKK
SHEET NO.
22

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NOTES

1. SEE SHEET 52 FOR ED-2 SCHEDULE



FLARED END SECTION SCHEDULE

NO.	SIZE / TYPE	SLOPE	SAFETY GRATE
14	12" RCP	0.0042	NO

DRAINAGE PIPE SCHEDULE

NO.	SIZE / TYPE	CLASS	LENGTH	SLOPE	INVERT EL.	DIS. EL.
14	12" RCP	IV	12.00	0.0042	95.15	95.10

DRAINAGE INLET SCHEDULE

NO.	STATION	OFFSET	BOX SIZE	GRATE	T.G. EL.	INV. EL.
14	202+04.67	86.58	34" x 18"	1	97.70	95.15

ENERGY DISSIPATOR SCHEDULE

NO.	STATION	OFFSET	RR SIZE	D (FT)	T1 (FT)	L (FT)	W1 (FT)	W2 (FT)
14	202+06.58	64.16	R-5	1.00	2.00	3.00	1.00	3.00

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK
STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: C. HALL
CHECKED BY: C. WEBB

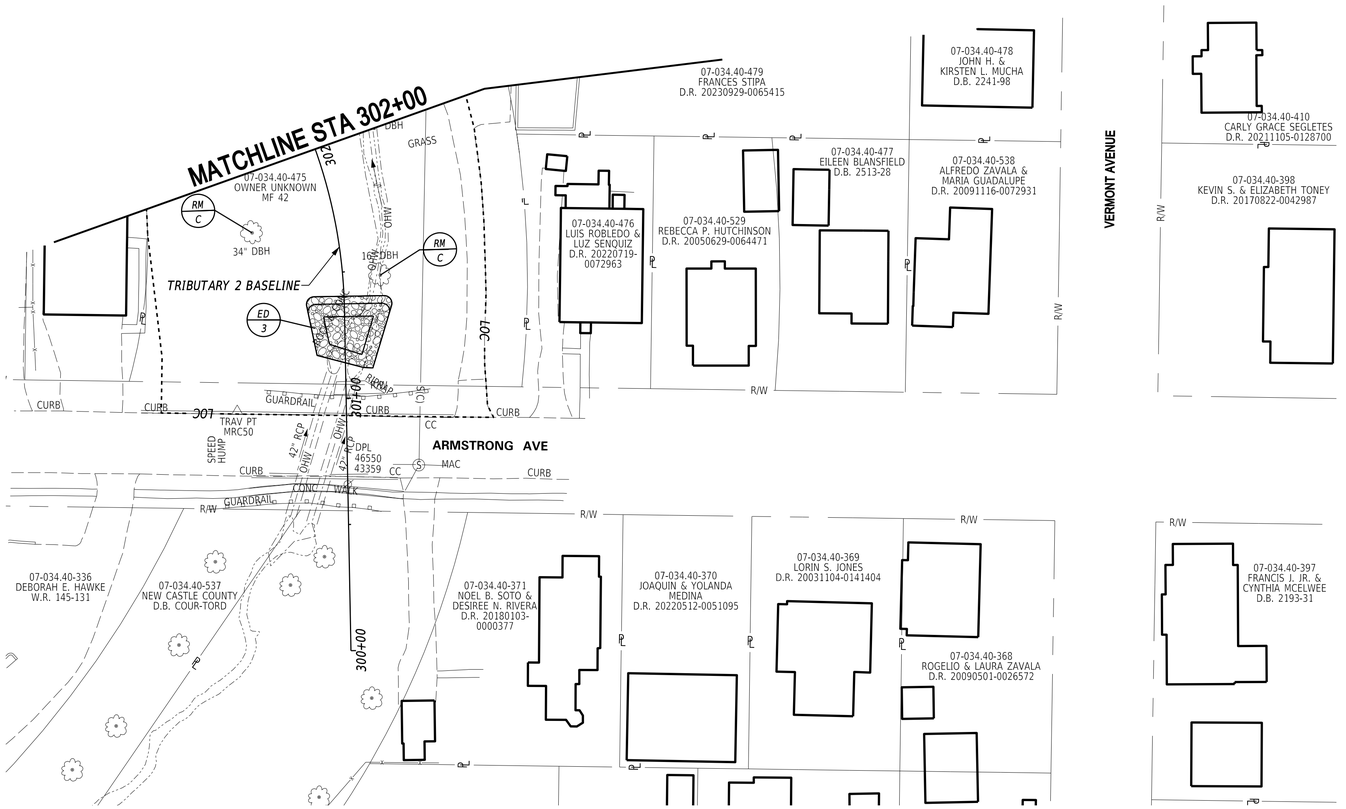
CONSTRUCTION PLAN

CP-07
SECTION
RKK
SHEET NO.
23

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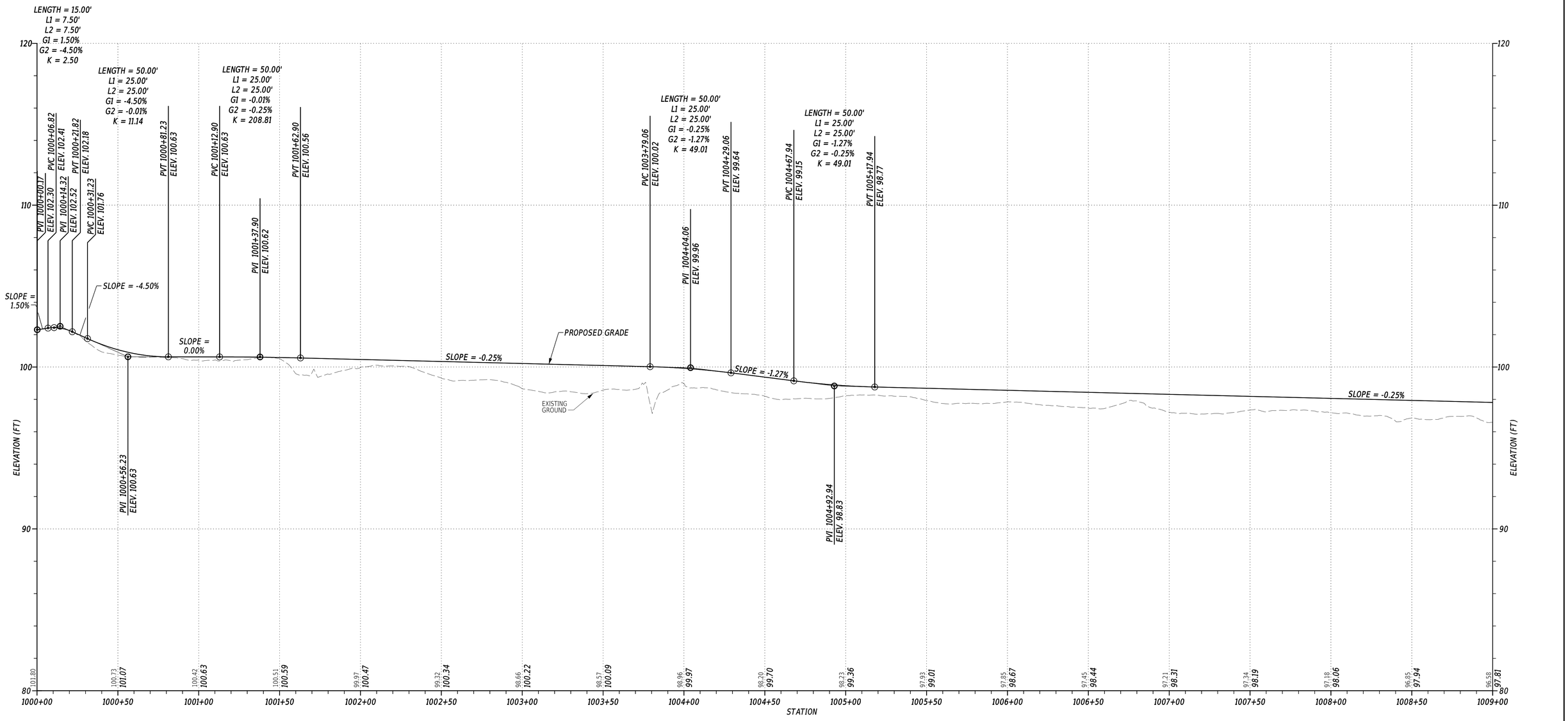
NOTES

1. SEE SHEET 52 FOR ED-3 SCHEDULE



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ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	CONSTRUCTION PLAN	CP-08
					DESIGNED BY: C. HALL		SECTION
					CHECKED BY: C. WEBB		RKK
							SHEET NO.
							24

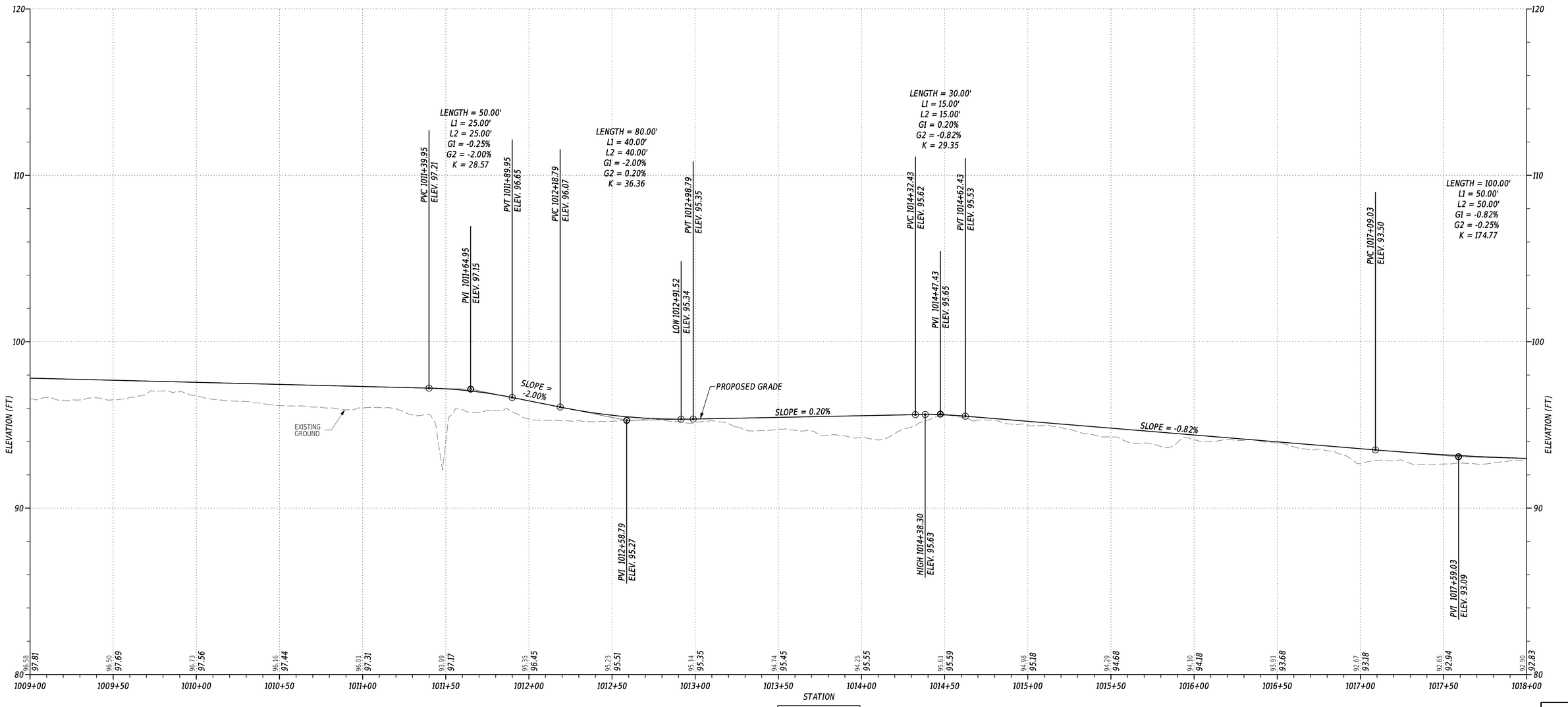


PATH 1000

VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	PROFILES SHARED USE PATH	SECTION RKK
					DESIGNED BY: C. HALL		SHEET NO. 25
					CHECKED BY: C. WEBB		

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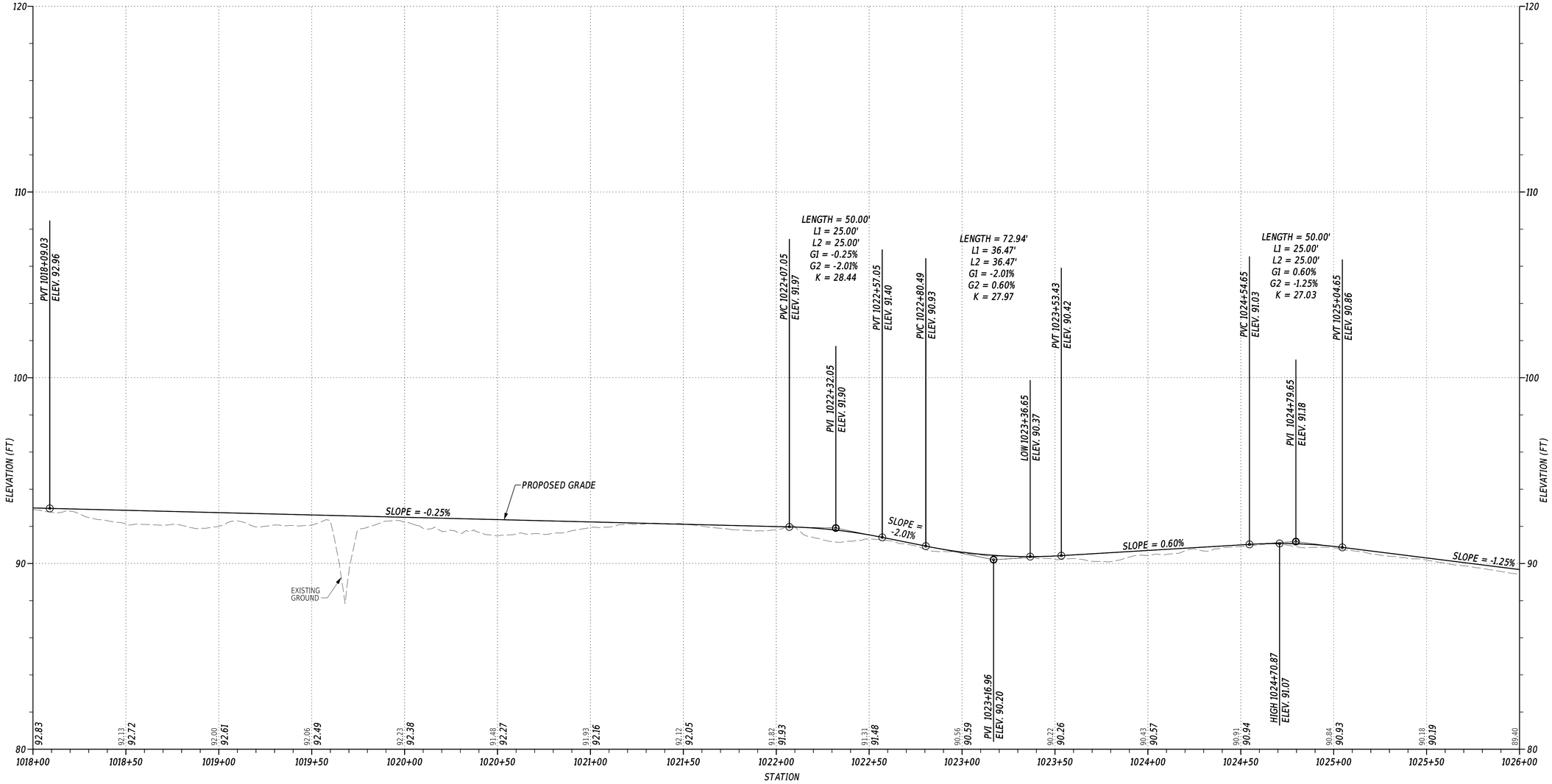


PATH 1000

VERTICAL SCALE FEET
9
6
3
0

ADDENDA / REVISIONS		SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	PROFILES SHARED USE PATH	SECTION RKK
		0 30 60 90 FEET		New Castle County 1673 Delaware	DESIGNED BY: C. HALL		SHEET NO. 26
					CHECKED BY: C. WEBB		

01-MAY-2025
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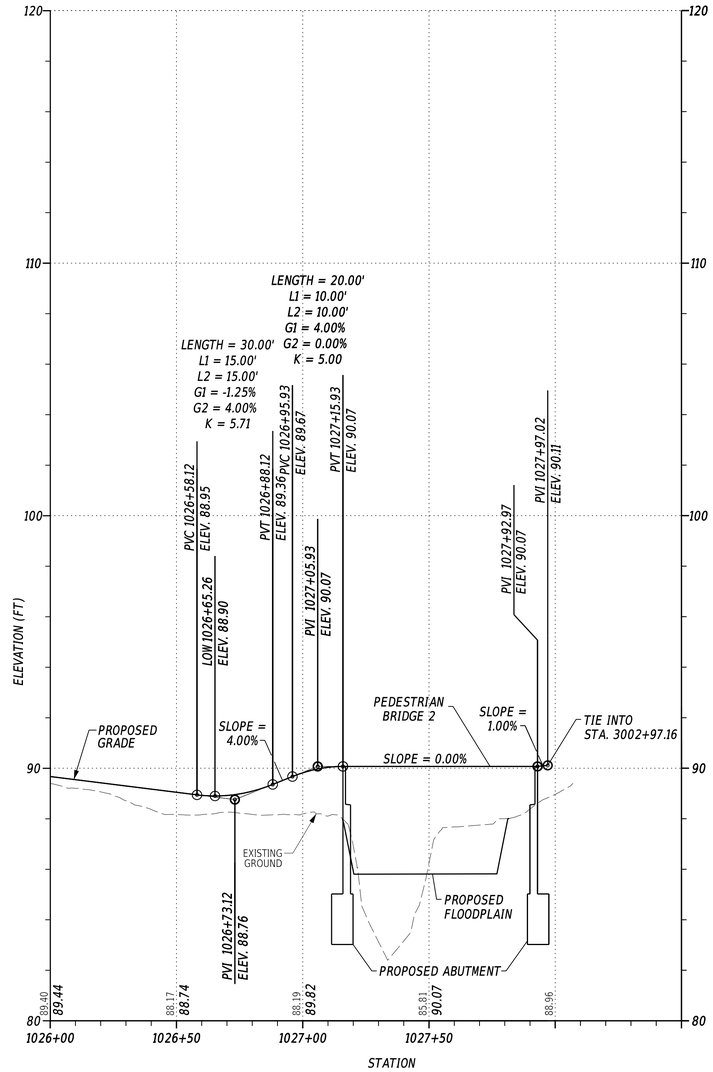


PATH 1000

VERTICAL SCALE FEET
9
6
3
0

ADDENDA / REVISIONS		SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	PROFILES SHARED USE PATH	SECTION RKK
		0 30 60 90 FEET		New Castle County 1673 Delaware	DESIGNED BY: C. HALL		SHEET NO. 27
					CHECKED BY: C. WEBB		

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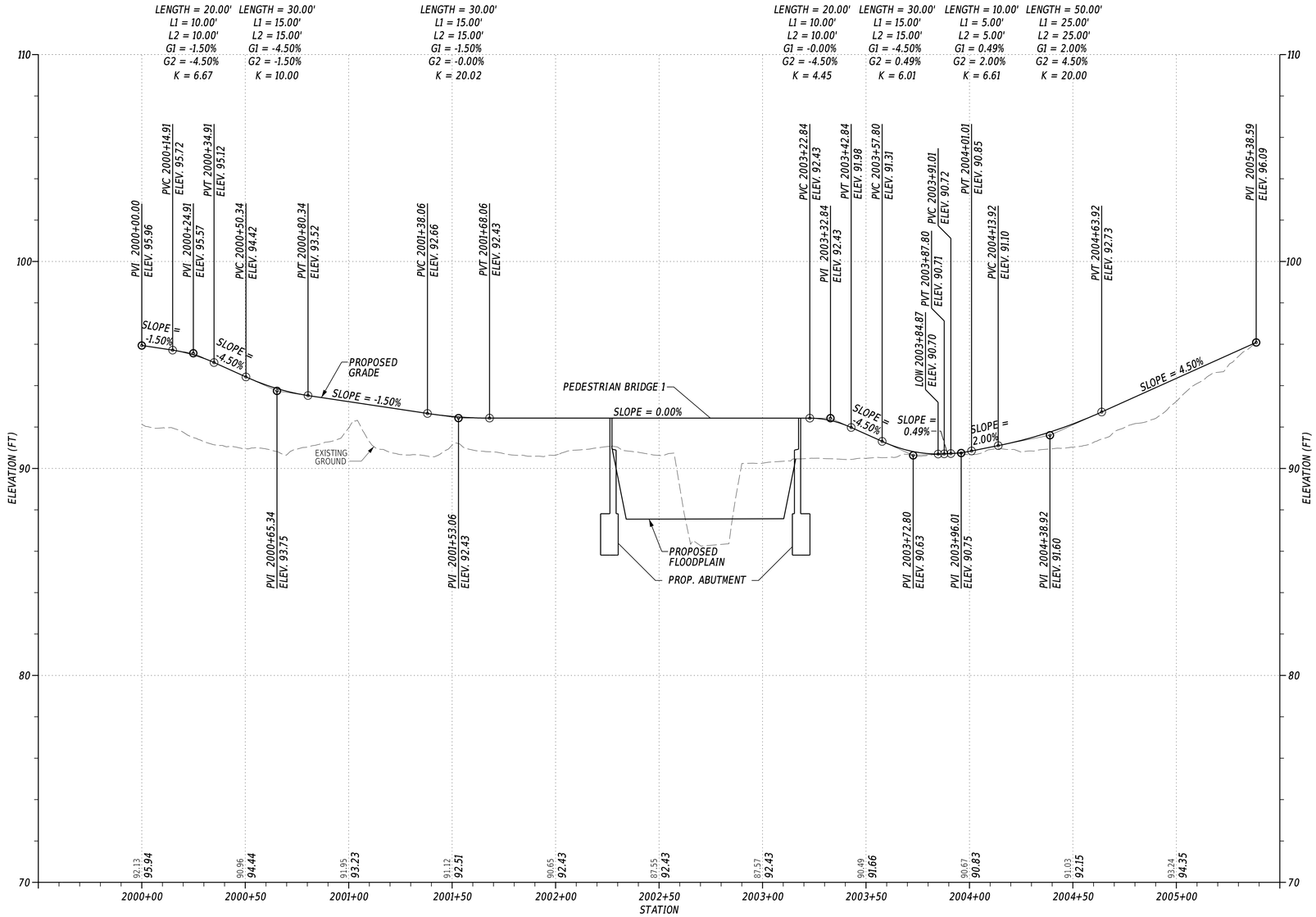


PATH 1000

VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	PROFILES SHARED USE PATH	SECTION RKK
					DESIGNED BY: C. HALL		SHEET NO. 28
					CHECKED BY: C. WEBB		

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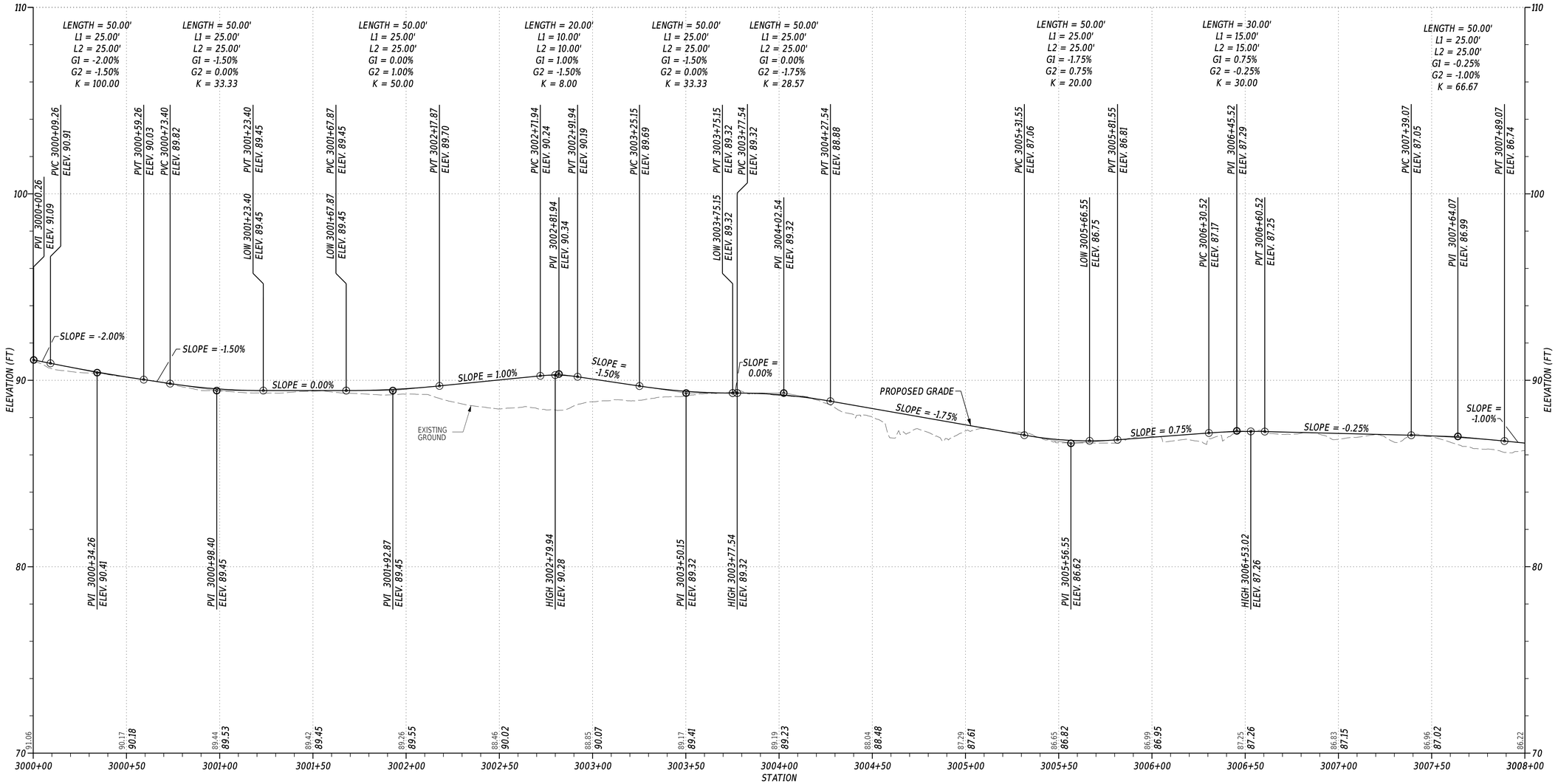


PATH 2000

VERTICAL SCALE FEET 0 3 6 9

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					DESIGNED BY: C. HALL		SHEET NO. 29
					CHECKED BY: C. WEBB		

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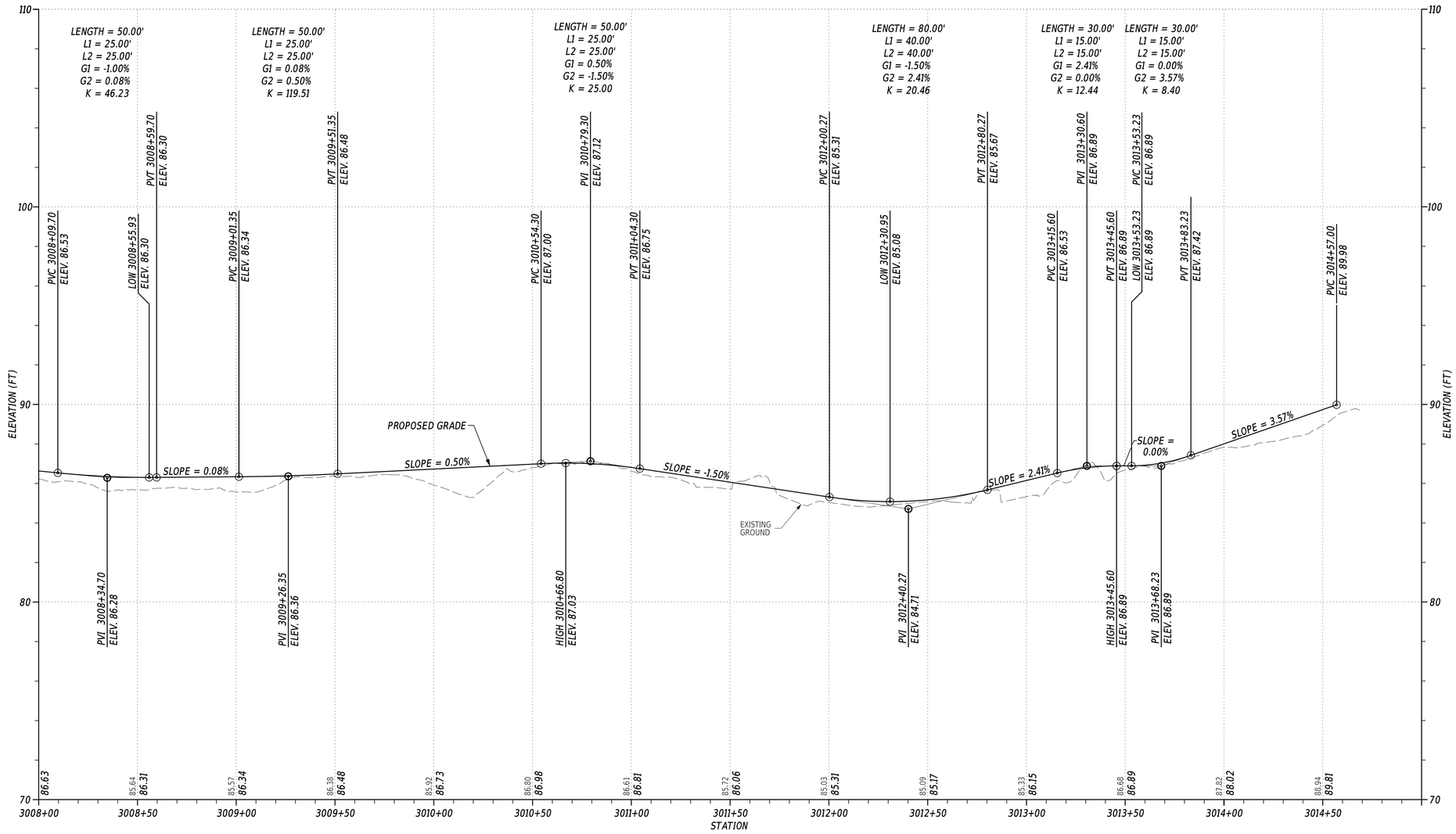


PATH 3000

VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	PROFILES SHARED USE PATH	SECTION RKK
					DESIGNED BY: C. HALL		SHEET NO. 30
					CHECKED BY: C. WEBB		

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PATH 3000

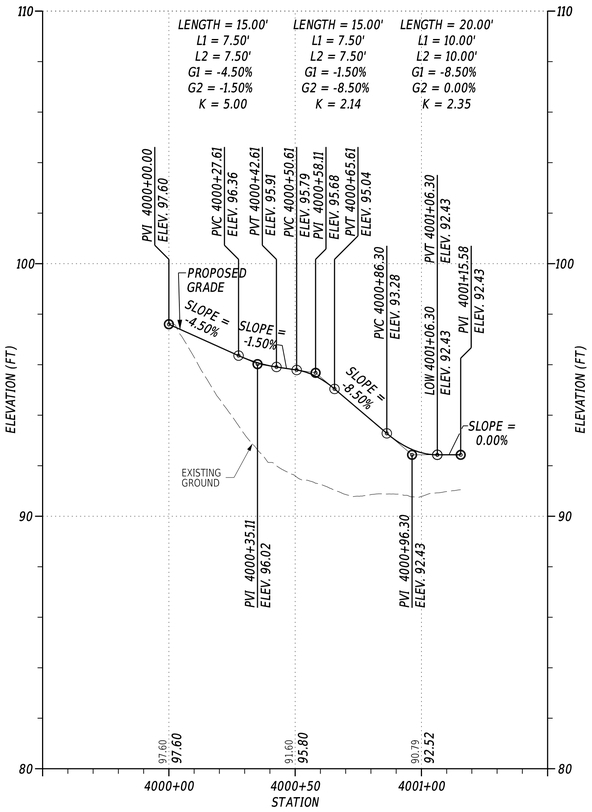
VERTICAL SCALE FEET 9 6 3 0

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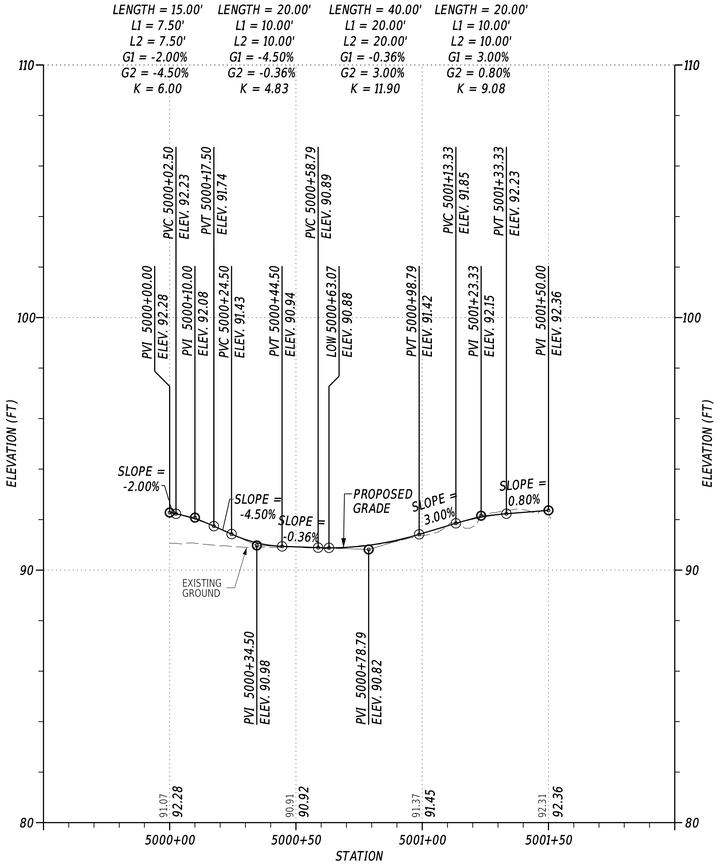
ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	PROFILES SHARED USE PATH	SECTION RKK
				New Castle County 1673 Delaware	DESIGNED BY: C. HALL		SHEET NO. 31
					CHECKED BY: C. WEBB		

SAG CURVE - SYMMETRIC
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L1 = 7.50'
L2 = 7.50'
G1 = -1.50%
G2 = +1.43%
K = 5.11

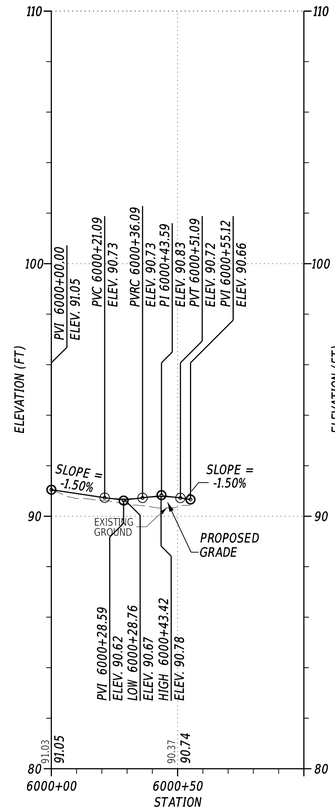
CREST CURVE - SYMMETRIC
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L1 = 7.50'
L2 = 7.50'
G1 = +1.43
G2 = -1.50%
K = 5.11



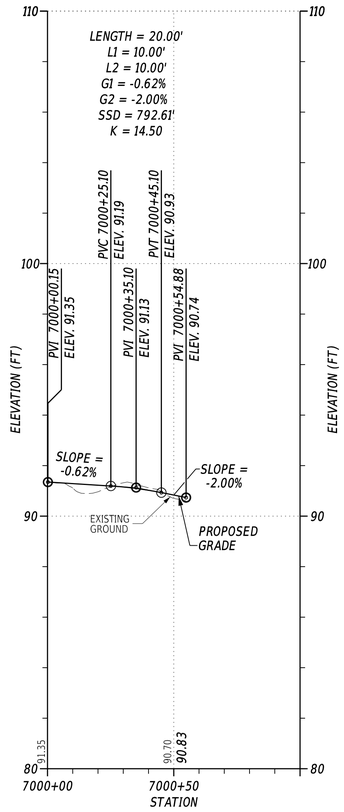
PATH 4000



PATH 5000



PATH 6000



PATH 7000

VERTICAL SCALE FEET
9
6
3
0

ADDENDA / REVISIONS			

SCALE
0 30 60 90
FEET

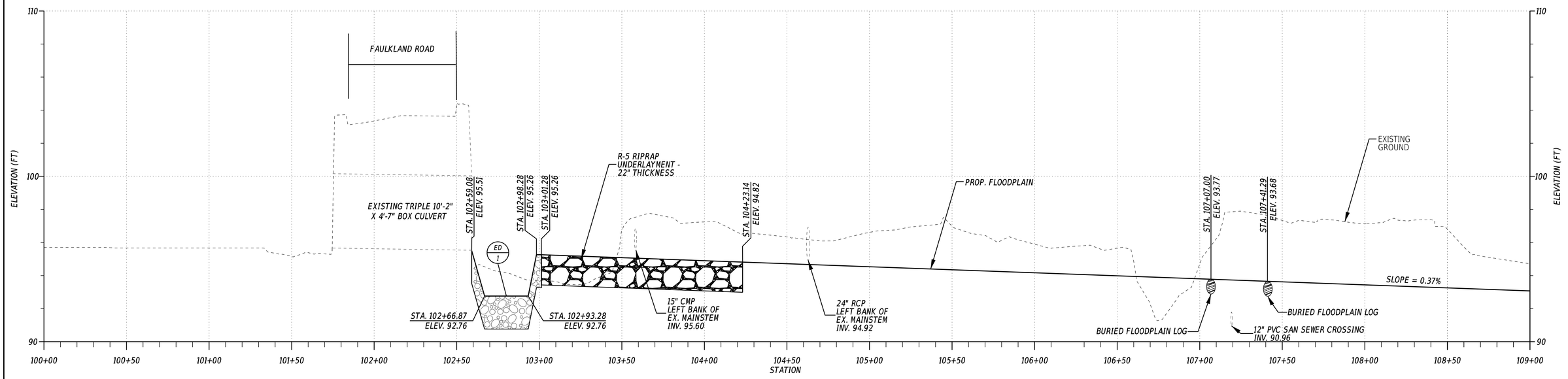
LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	C. HALL
CHECKED BY:	C. WEBB

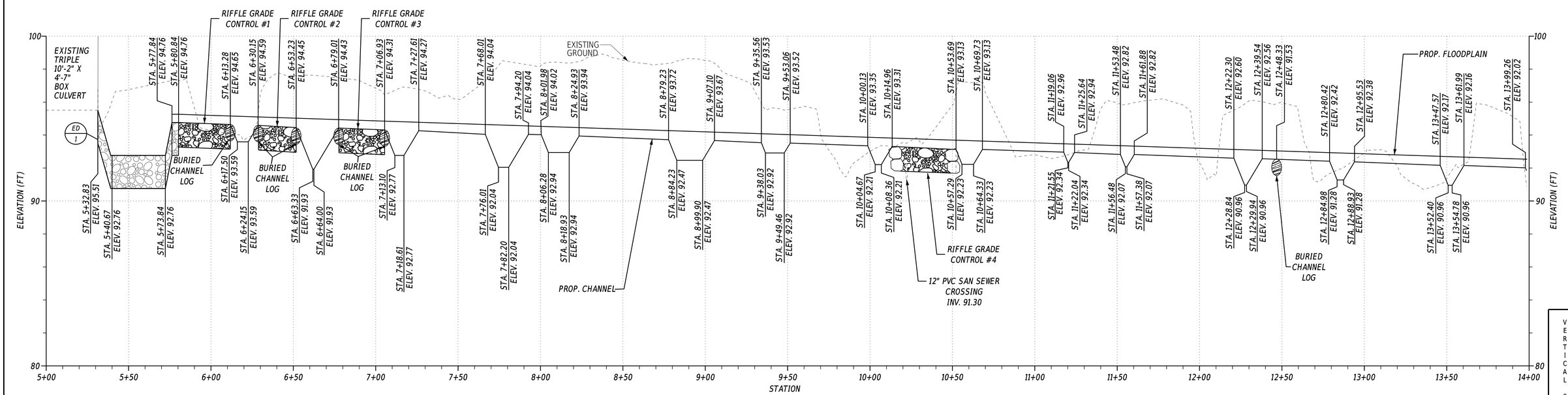
PROFILES SHARED USE PATH

SECTION
RKK
SHEET NO.
32

01-MAY-2025
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LITTLE MILL CREEK FLOODPLAIN



LITTLE MILL CREEK CHANNEL

VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

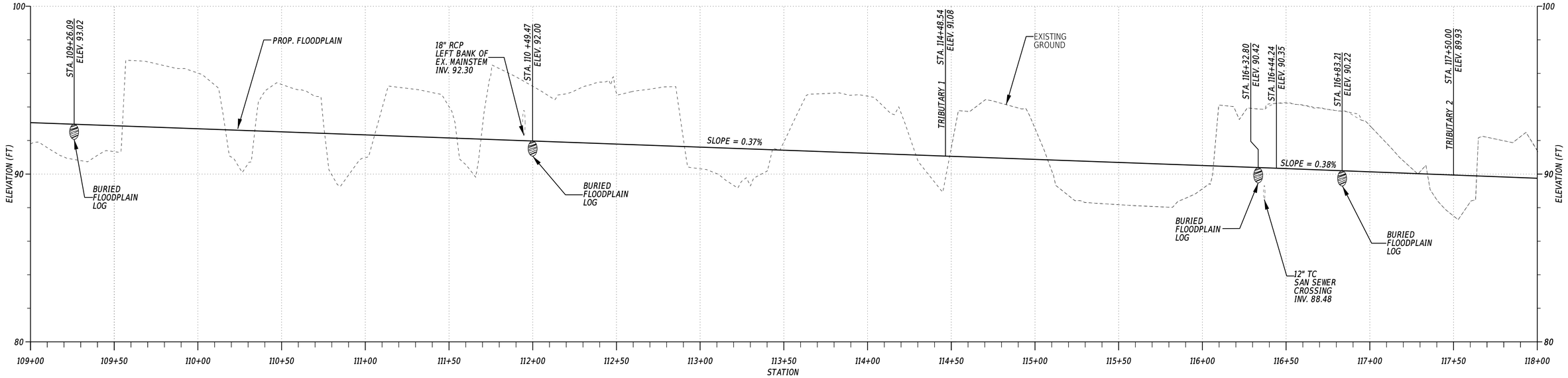
New Castle County 1673 Delaware

CONTRACT NO.	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

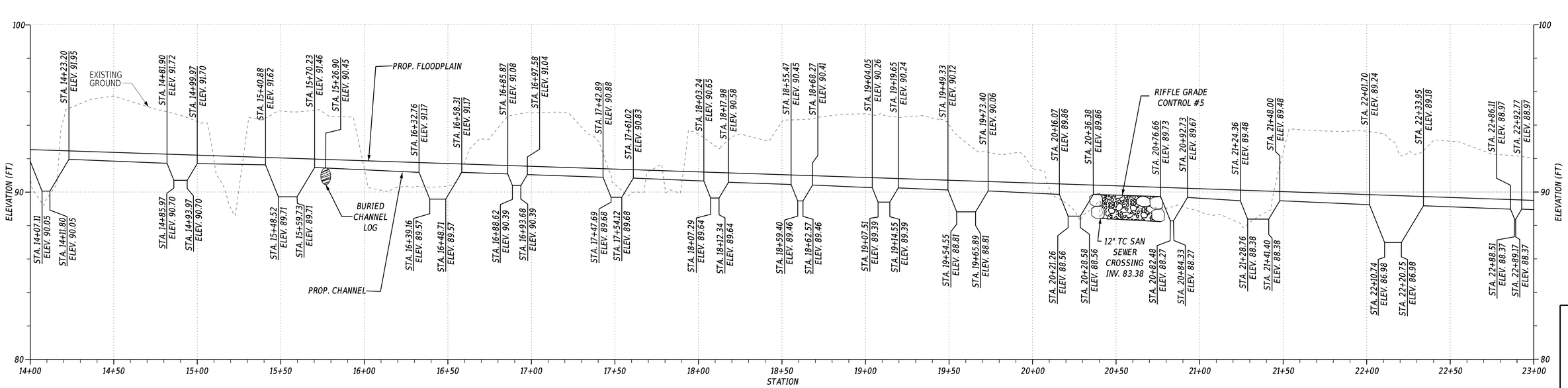
PROFILES STREAM RESTORATION

SECTION	RKK
SHEET NO.	33

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LITTLE MILL CREEK FLOODPLAIN



LITTLE MILL CREEK CHANNEL

VERTICAL SCALE FEET
9
6
3
0

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

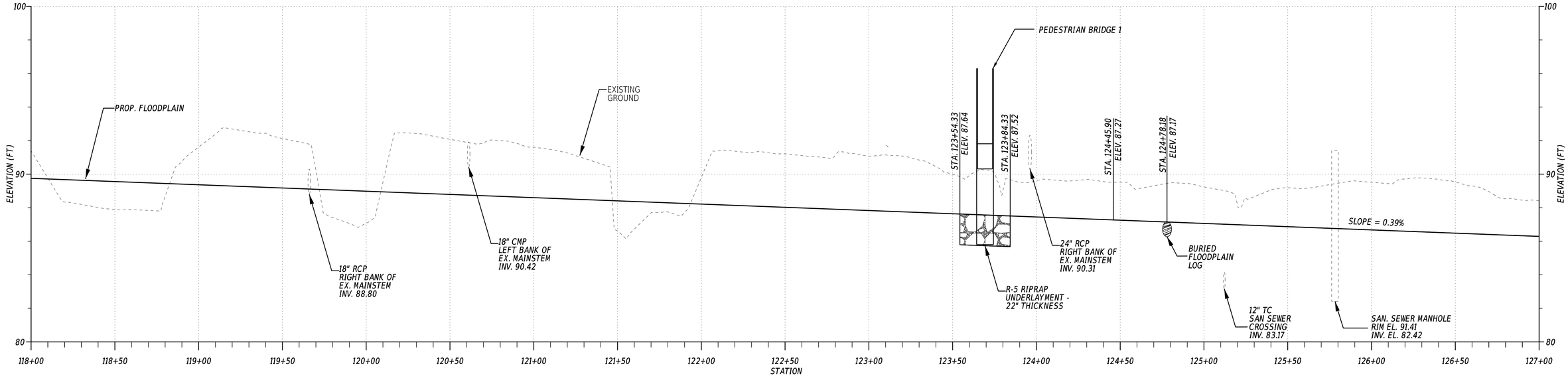
New Castle County 1673 Delaware

CONTRACT NO.	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

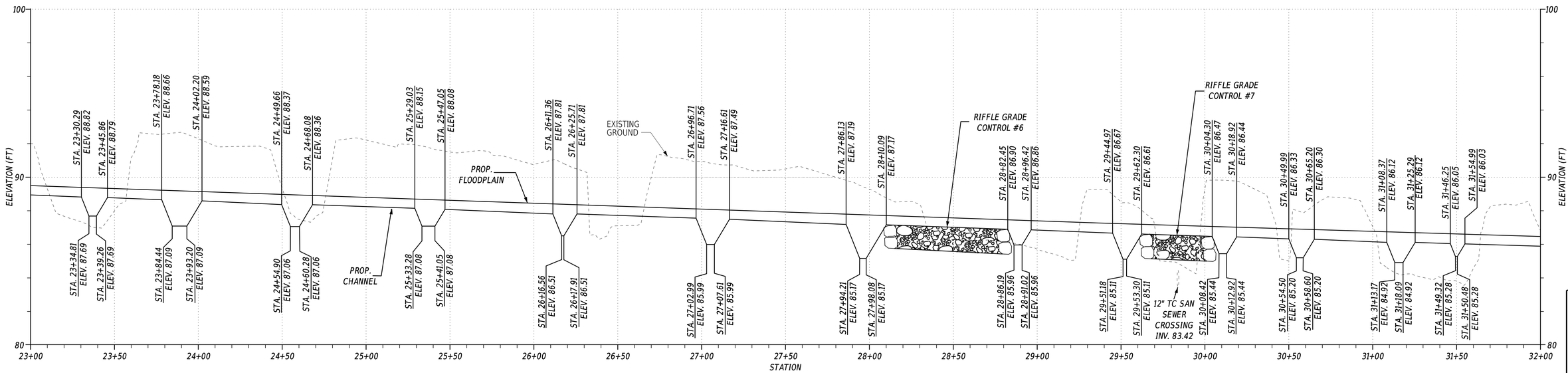
PROFILES STREAM RESTORATION

SECTION
RKK
SHEET NO.
34

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LITTLE MILL CREEK FLOODPLAIN

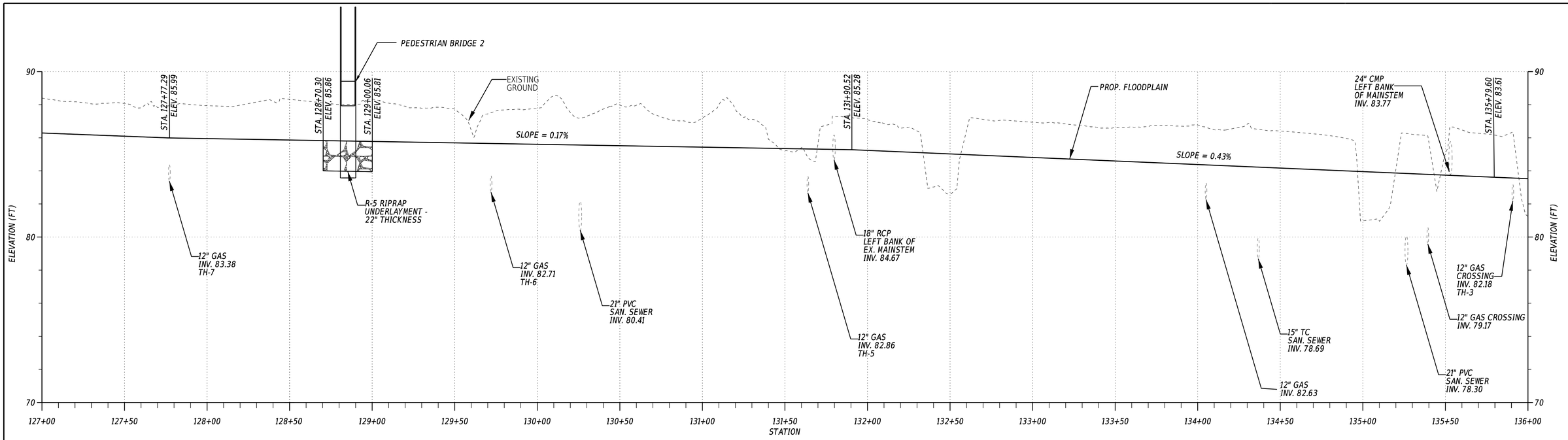


LITTLE MILL CREEK CHANNEL

VERTICAL SCALE FEET
9
6
3
0

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT NO. 20230414279	PROFILES STREAM RESTORATION	SECTION RKK
					DESIGNED BY: N. RILEY		SHEET NO. 35
					CHECKED BY: T. CUTILLO		

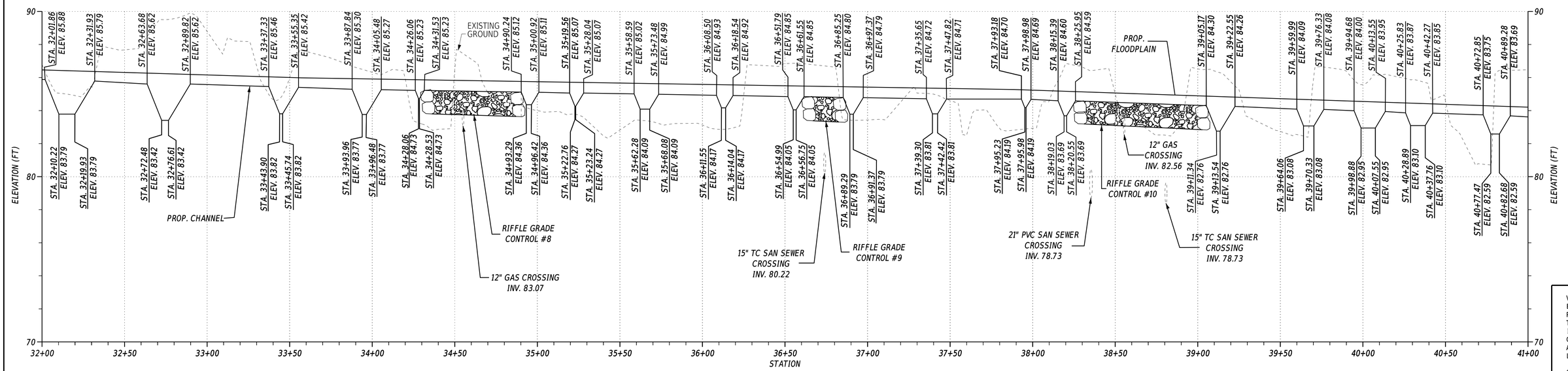
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FLOODPLAIN NOTE:

EXISTING GROUND LINE PROFILE AND UTILITY INFORMATION IS ALONG THE FLOODPLAIN BASELINE. PROPOSED FLOODPLAIN PROFILE MAY BE A PROJECTION AND NOT LOCATED ALONG THE FLOODPLAIN BASELINE, SEE TYPICAL FLOODPLAIN SECTION 3 FOR MORE INFORMATION.

LITTLE MILL CREEK FLOODPLAIN

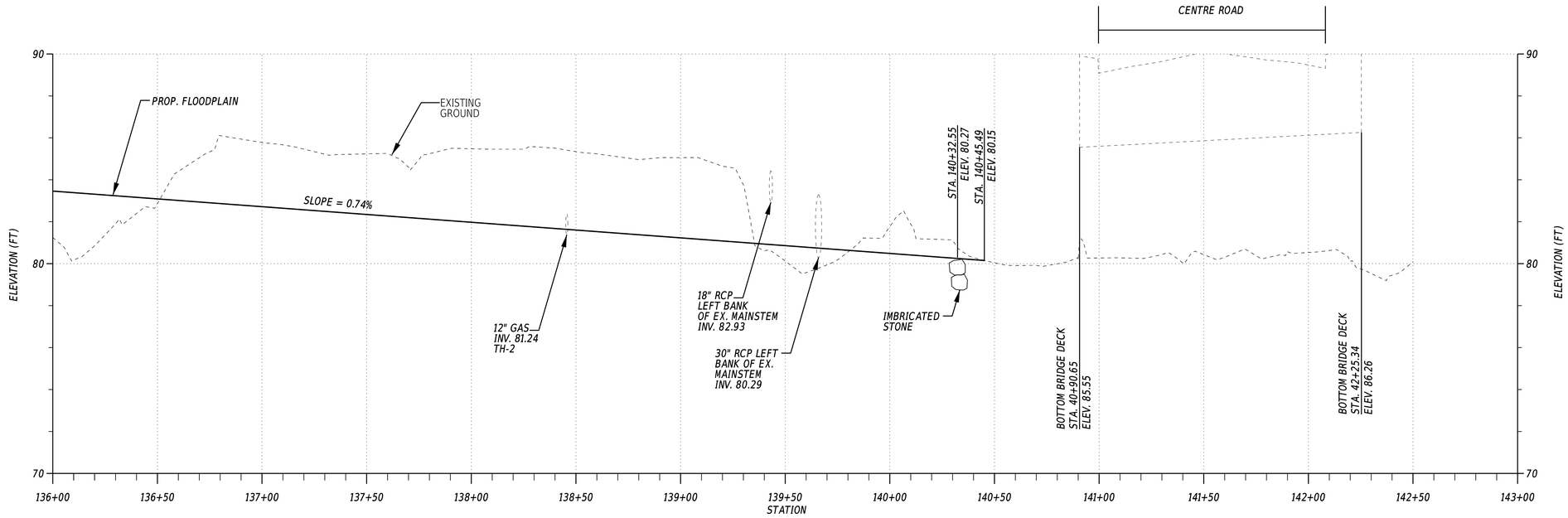


LITTLE MILL CREEK CHANNEL

VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS	SCALE	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT NO. 20230414279	PROFILES STREAM RESTORATION	SECTION RKK
	0 30 60 90 FEET			DESIGNED BY: N. RILEY		SHEET NO. 36
				CHECKED BY: T. CUTILLO		

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FLOODPLAIN NOTE:

EXISTING GROUND LINE PROFILE AND UTILITY INFORMATION IS ALONG THE FLOODPLAIN BASELINE. PROPOSED FLOODPLAIN PROFILE MAY BE A PROJECTION AND NOT LOCATED ALONG THE FLOODPLAIN BASELINE, SEE TYPICAL FLOODPLAIN SECTION 3 FOR MORE INFORMATION.

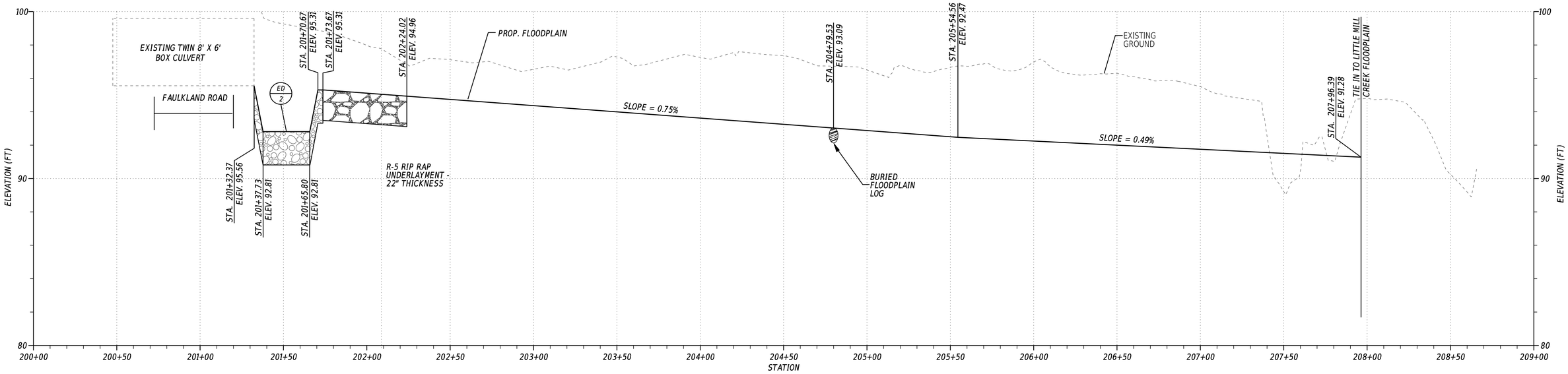
LITTLE MILL CREEK FLOODPLAIN

LITTLE MILL CREEK CHANNEL

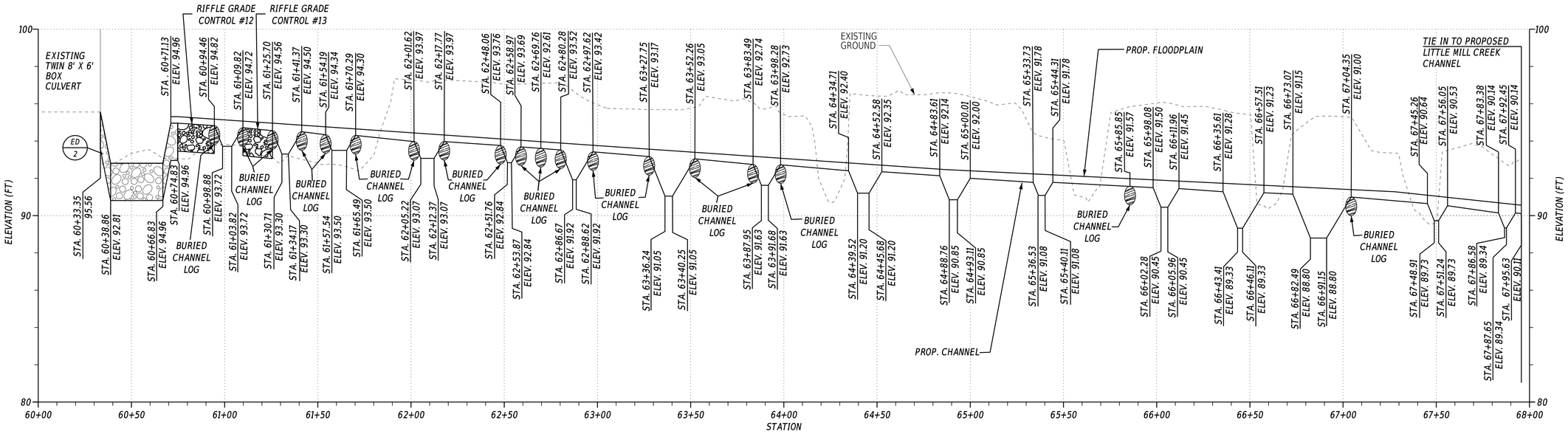
VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT NO. 20230414279	PROFILES STREAM RESTORATION	SECTION RKK
					DESIGNED BY: N. RILEY		SHEET NO. 37
					CHECKED BY: T. CUTILLO		

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TRIBUTARY 1 FLOODPLAIN



TRIBUTARY 1 CHANNEL

VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS			

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

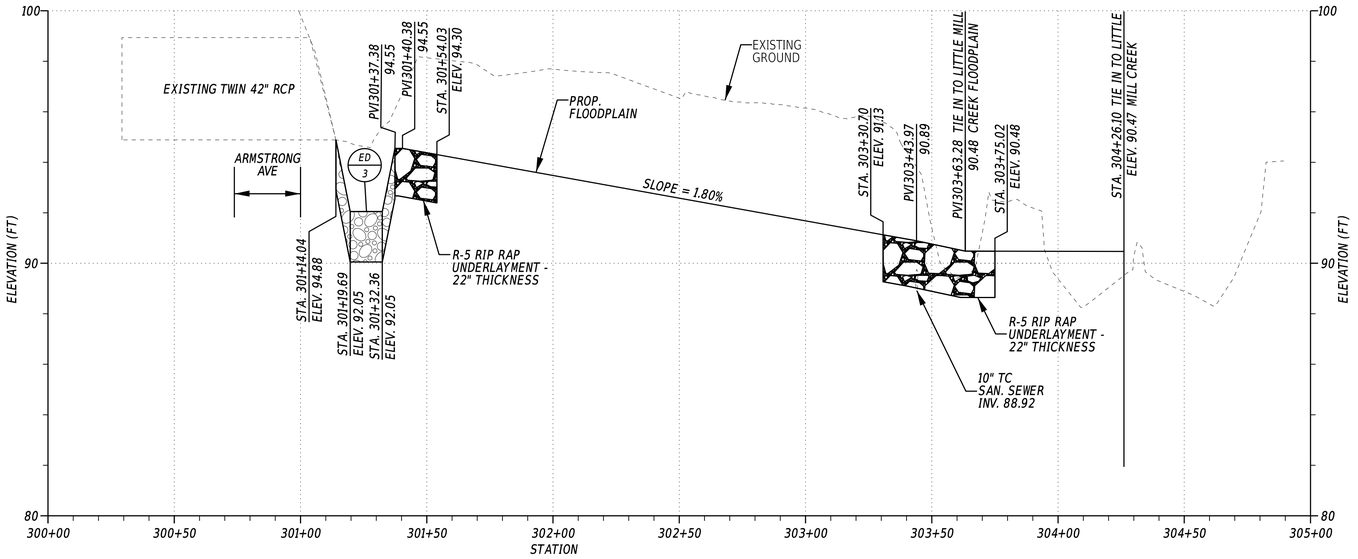
New Castle County 1673 Delaware

CONTRACT NO.	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

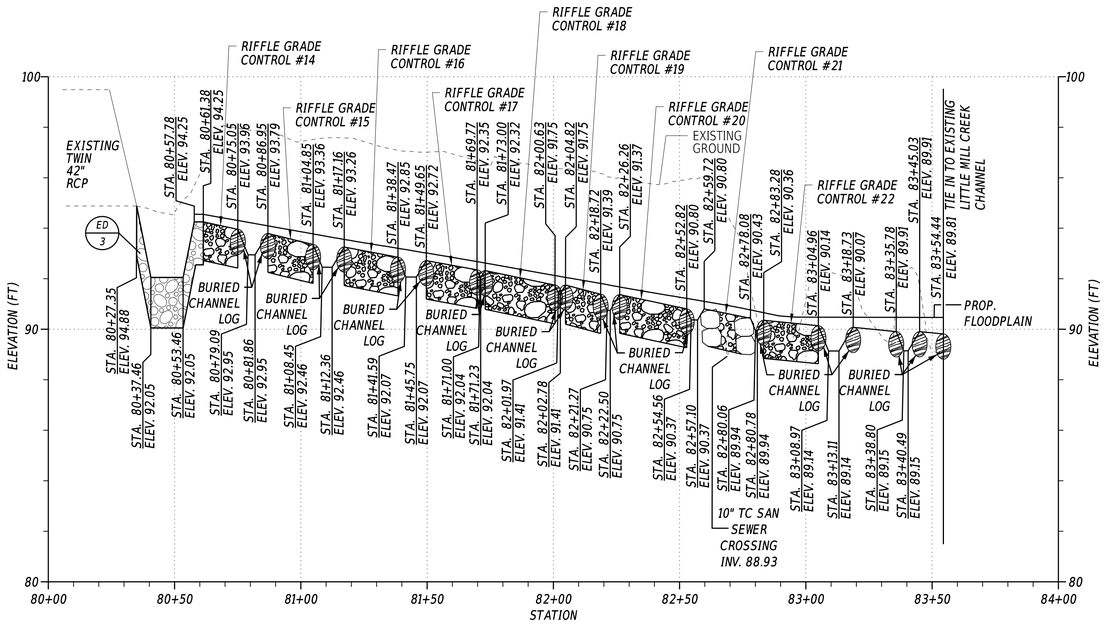
PROFILES STREAM RESTORATION

SECTION
RKK
SHEET NO.
38

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TRIBUTARY 2 FLOODPLAIN



TRIBUTARY 2 CHANNEL

VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS			

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

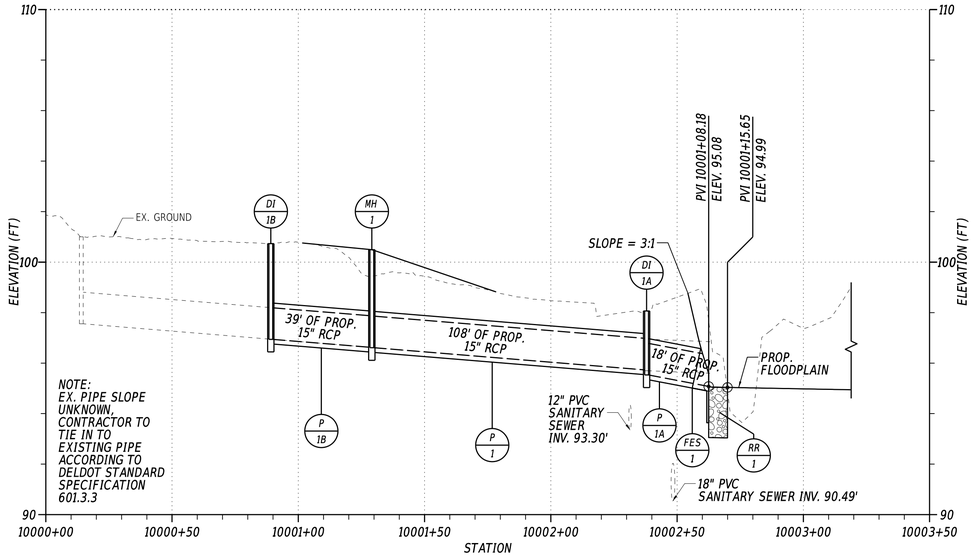
New Castle County 1673 Delaware

CONTRACT NO.	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTTILO

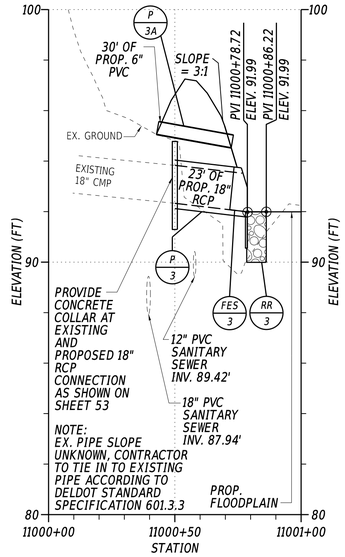
PROFILES STREAM RESTORATION

SECTION
RKK
SHEET NO.
39

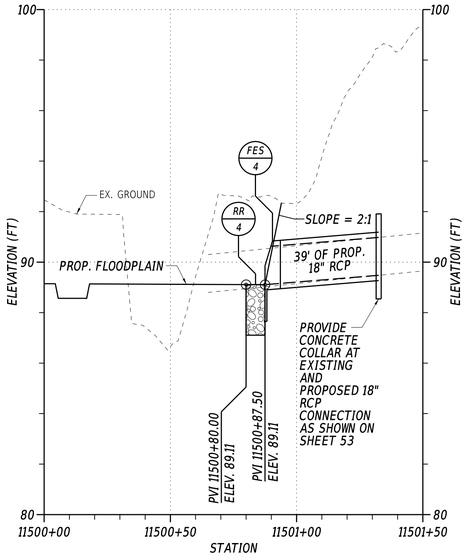
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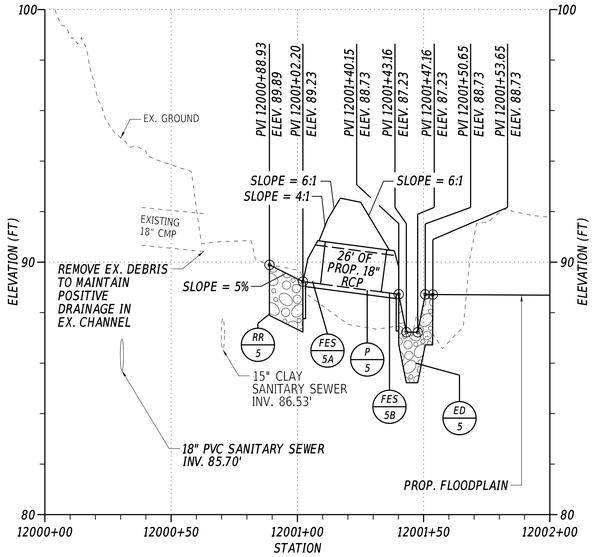
OUTFALL 1



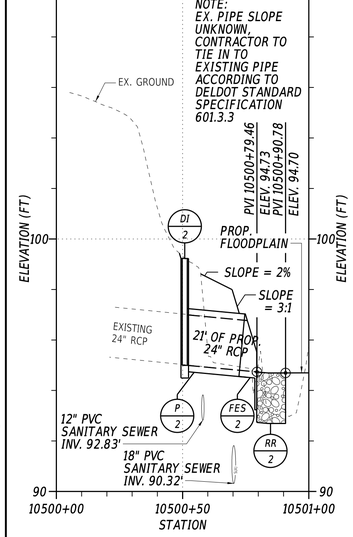
OUTFALL 3



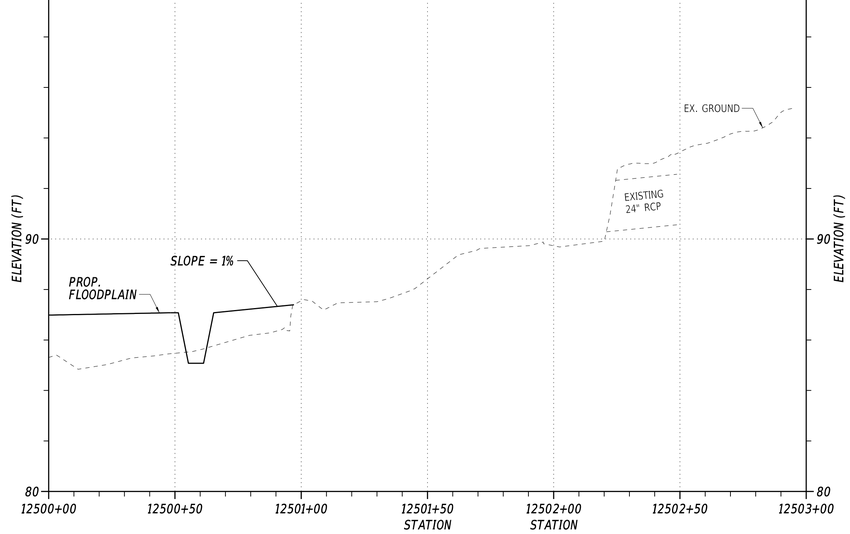
OUTFALL 4



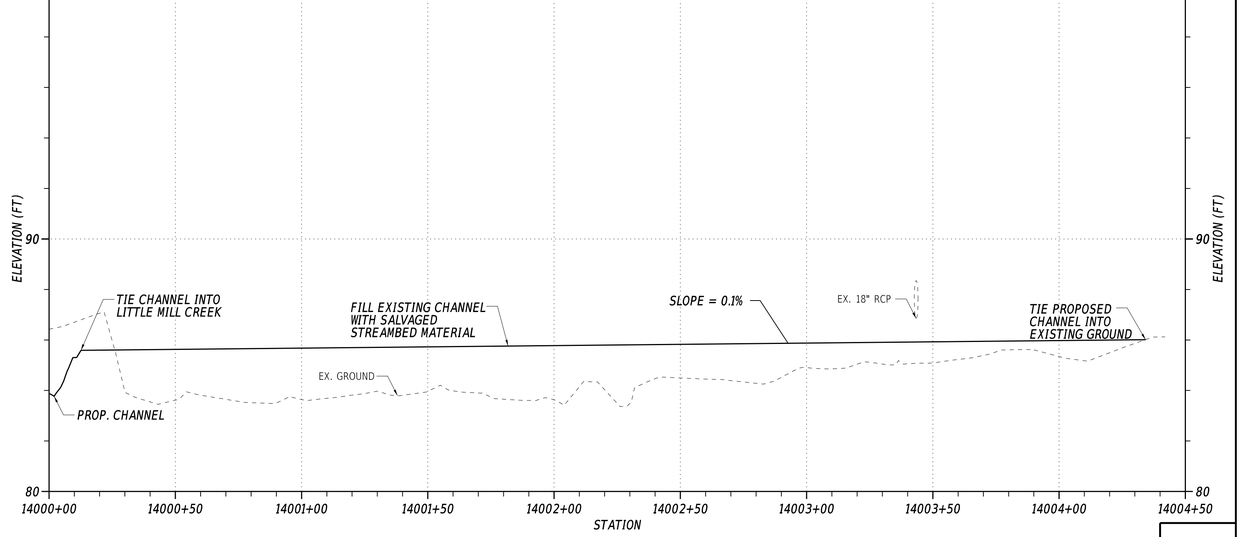
OUTFALL 5



OUTFALL 2



OUTFALL 6

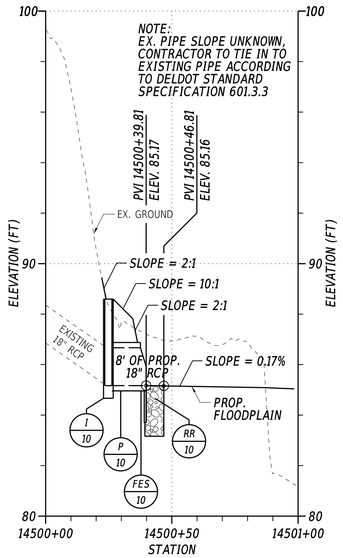


OUTFALL 9

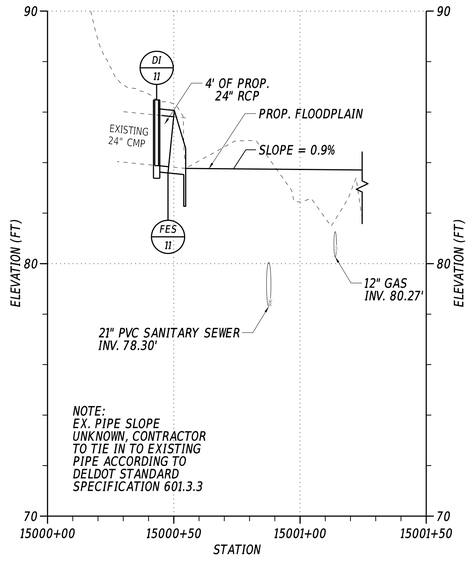
VERTICAL SCALE FEET 0 3 6 9

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT NO. 20230414279	PROFILES STREAM RESTORATION	SECTION RKK
					DESIGNED BY: N. RILEY		SHEET NO. 40
					CHECKED BY: T. CUTILLO		

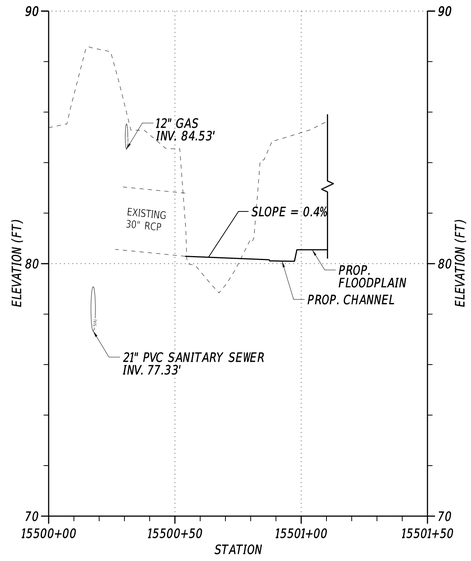
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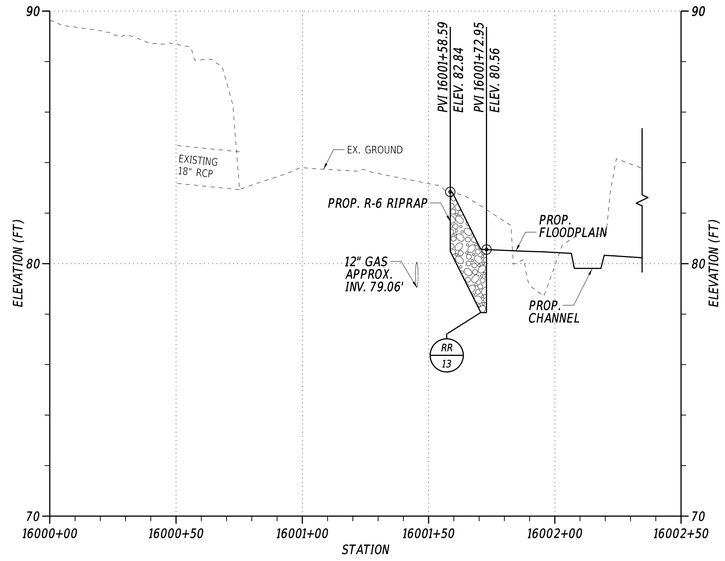
OUTFALL 10



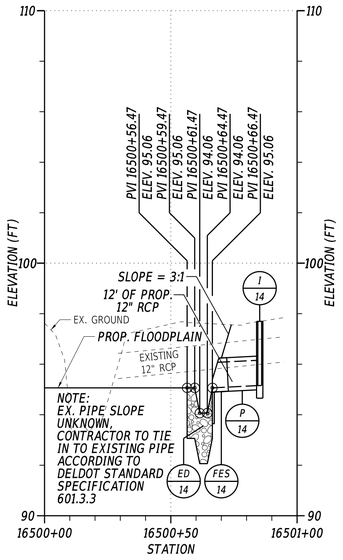
OUTFALL 11



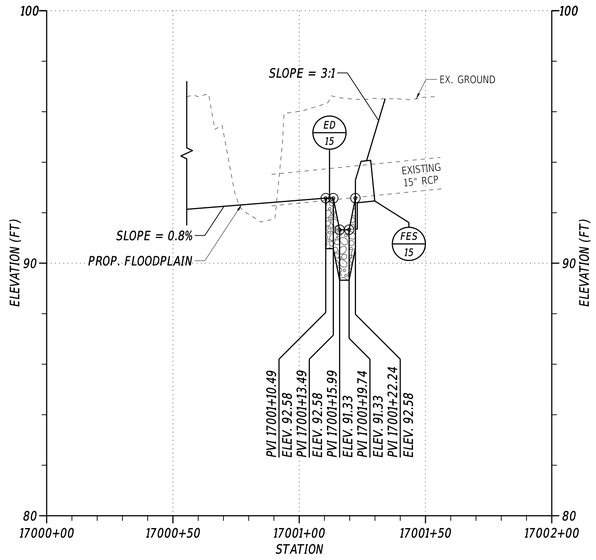
OUTFALL 12



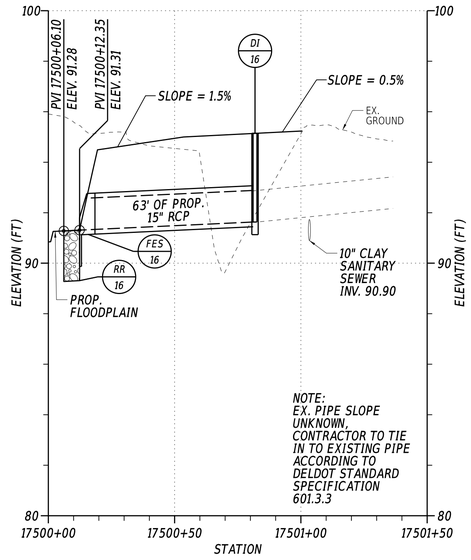
OUTFALL 13



OUTFALL 14



OUTFALL 15



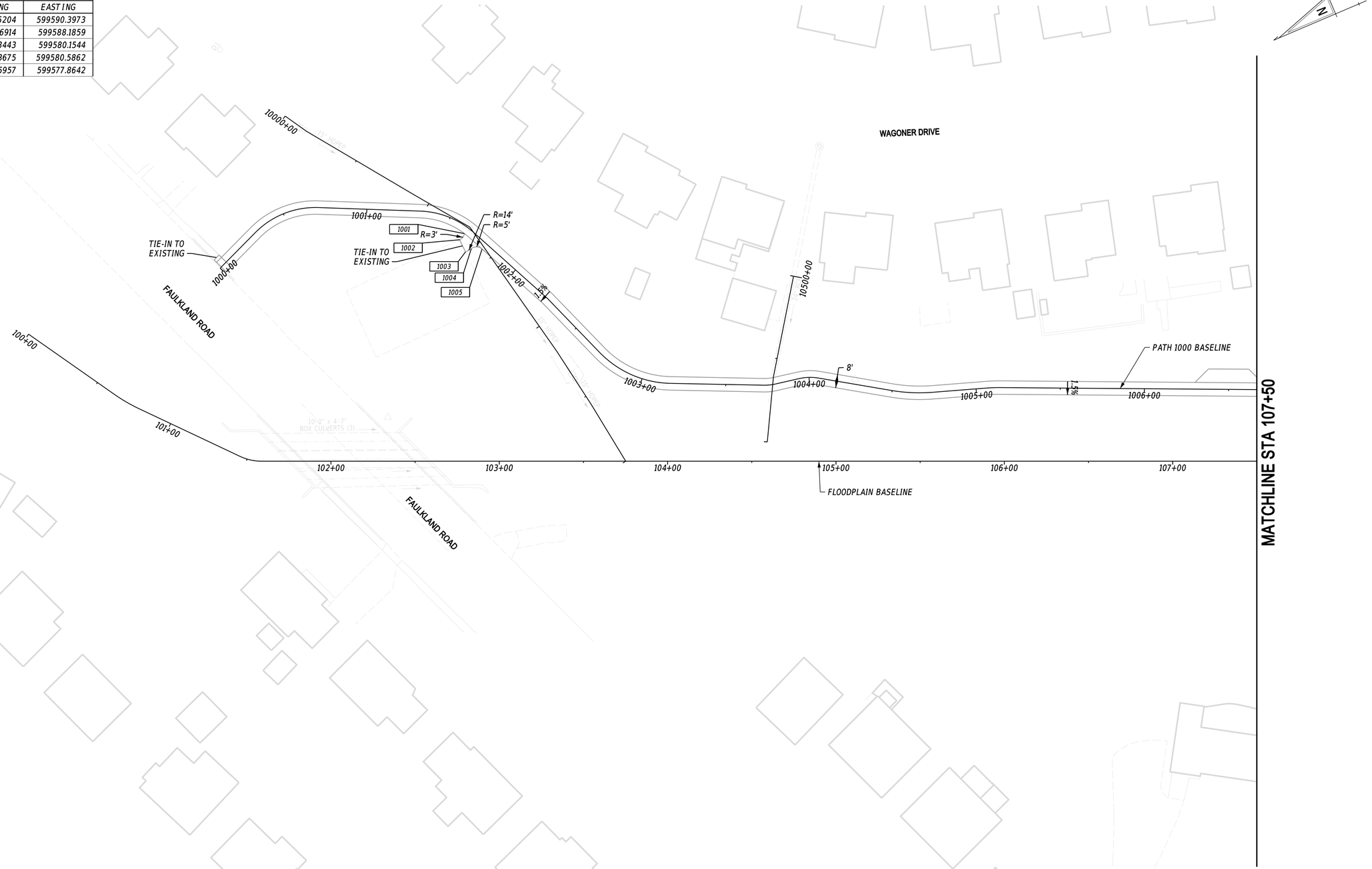
OUTFALL 16

VERTICAL SCALE FEET
9
6
3
0

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT NO. 20230414279	PROFILES STREAM RESTORATION	SECTION RKK
					DESIGNED BY: N. RILEY		SHEET NO. 41
					CHECKED BY: T. CUTILLO		

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COORDINATE LIST				
POINT NO.	STATION	OFFSET	NORTHING	EASTING
1001	1001+62.50	4.00	636625.6204	599590.3973
1002	1001+62.48	8.60	636629.6914	599588.1859
1003	1001+70.52	11.86	636629.3443	599580.1544
1004	1001+71.81	8.07	636625.3675	599580.5862
1005	1001+76.72	4.00	636619.5957	599577.8642

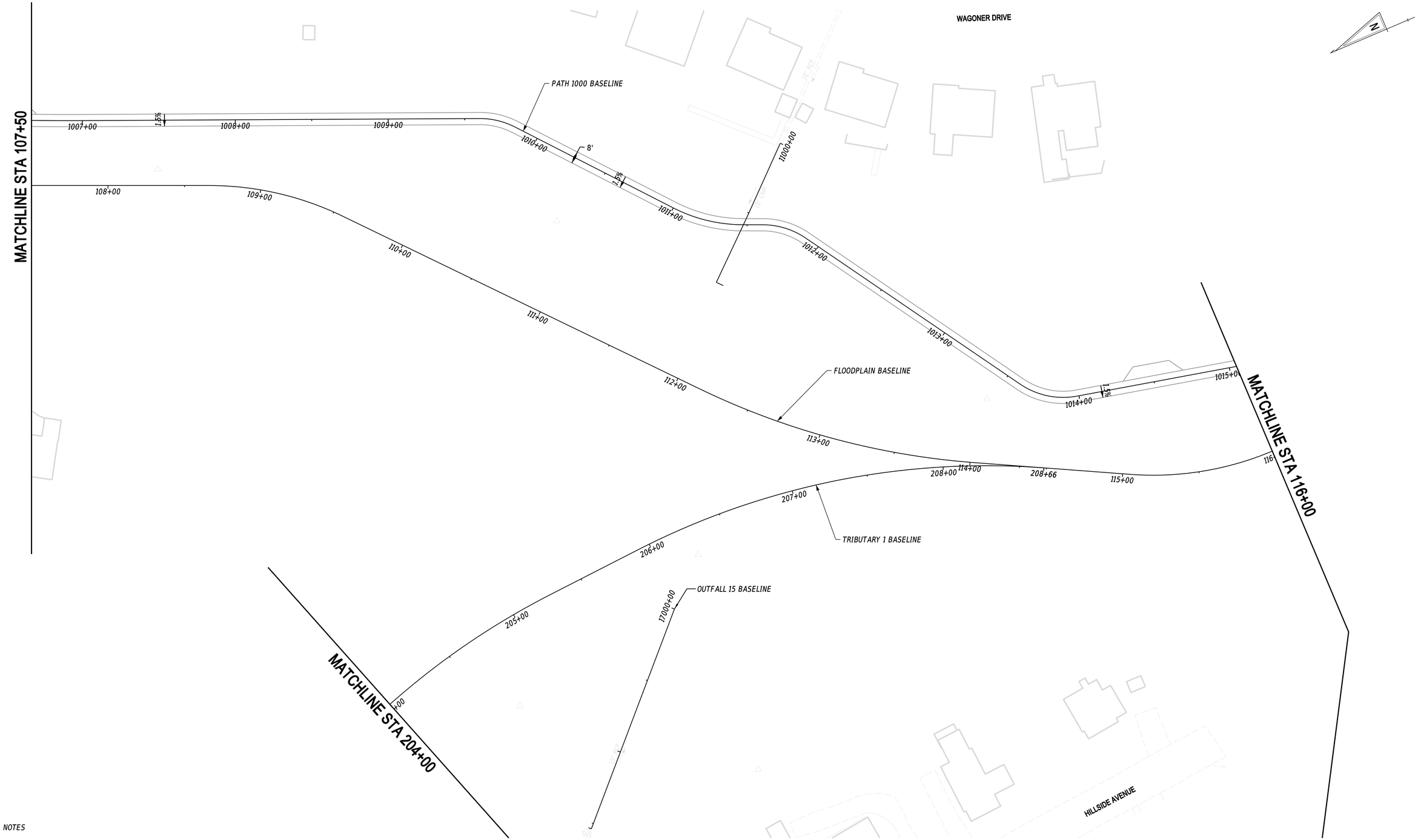


NOTES

1. *SEE CONSTRUCTION DETAILS FOR TRUCK PULL-OFF LOLCATIONS AND DIMENSIONS.*

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	GRADES AND GEOMETRICS	GG-01
					DESIGNED BY: C. HALL		SECTION RKK
					CHECKED BY: C. WEBB		SHEET NO. 42

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NOTES

1. SEE CONSTRUCTION DETAILS FOR TRUCK PULL-OFF LOLCATIONS AND DIMENSIONS.

ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	GRADES AND GEOMETRICS	GG-02
					DESIGNED BY: C. HALL		SECTION RKK
					CHECKED BY: C. WEBB		SHEET NO. 43

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ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673

CONTRACT	20230414279
DESIGNED BY:	C. HALL
CHECKED BY:	C. WEBB

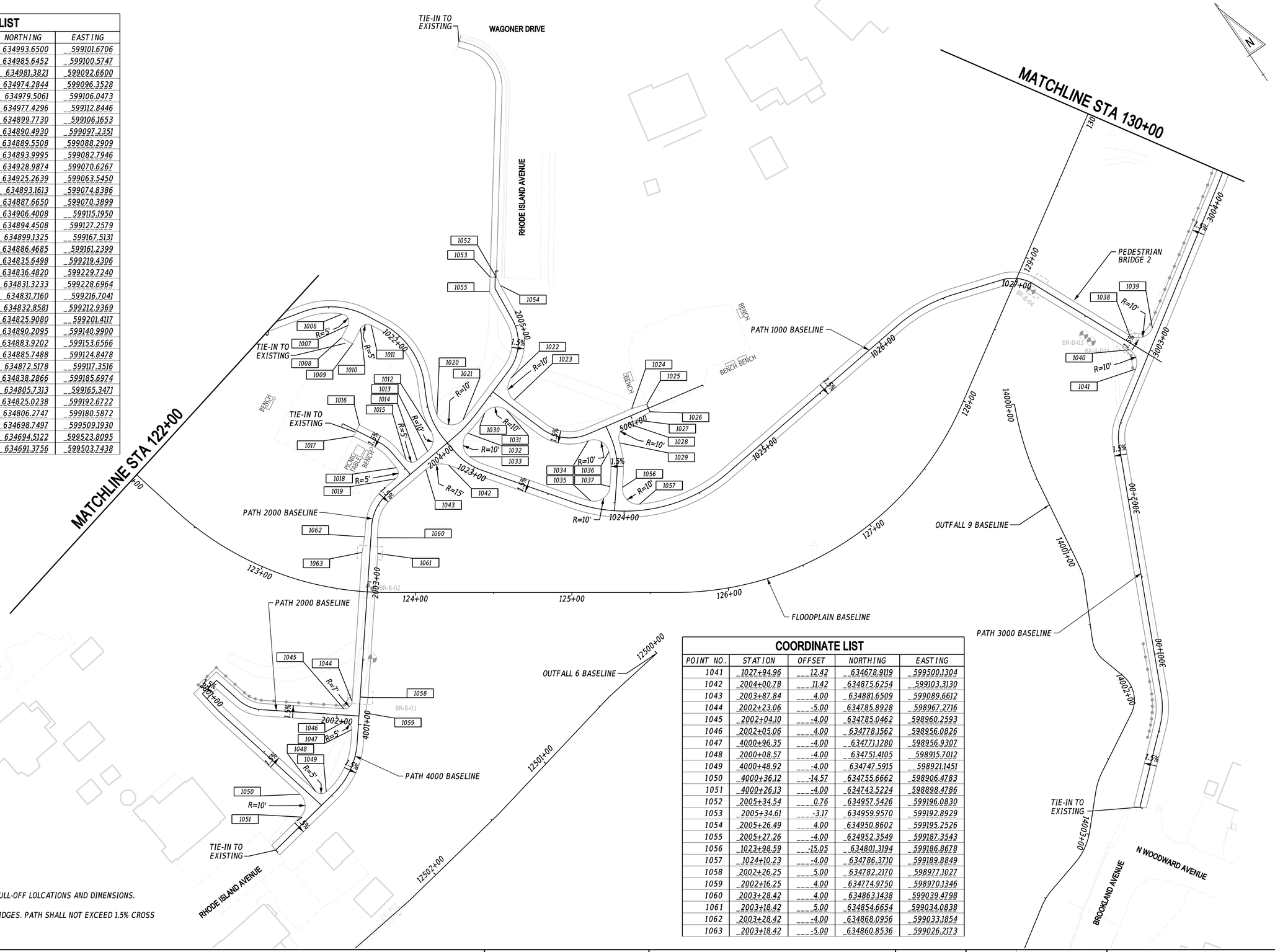
GRADES AND GEOMETRICS

	GG-03
SECTION	RKK
SHEET NO.	44

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COORDINATE LIST

POINT NO.	STATION	OFFSET	NORTHING	EASTING
1006	1021+59.54	4.00	634993.6500	599101.6706
1007	1021+65.55	10.24	634985.6452	599100.5747
1008	1021+66.98	20.90	634981.3821	599092.6600
1009	1021+75.91	21.89	634974.2844	599096.3528
1010	1021+75.65	9.05	634979.5061	599106.0473
1011	1021+80.64	4.00	634977.4296	599112.8446
1012	2004+06.15	-12.29	634899.7730	599106.1653
1013	2003+96.30	-4.00	634890.4930	599097.2351
1014	7000+50.88	-9.00	634889.5508	599088.2909
1015	7000+45.88	-4.00	634893.9995	599082.7946
1016	7000+09.36	-4.00	634928.9874	599070.6267
1017	7000+09.36	4.00	634925.2639	599063.5450
1018	7000+45.88	4.00	634893.1613	599074.8386
1019	7000+50.88	9.00	634887.6650	599070.3899
1020	2004+16.16	-17.92	634906.4008	599115.1950
1021	2004+27.12	-4.00	634894.4508	599127.2579
1022	5000+04.00	-13.98	634899.1325	599167.5131
1023	5000+14.00	-4.00	634886.4685	599161.2399
1024	5001+02.36	-4.00	634835.6498	599219.4306
1025	5001+12.30	-2.82	634836.4820	599229.7240
1026	5001+12.30	2.44	634831.3233	599228.6964
1027	5001+02.41	4.00	634831.7160	599216.7041
1028	5000+96.53	4.00	634832.8581	599212.9369
1029	5000+86.58	13.06	634825.9080	599201.4117
1030	5000+04.00	14.00	634890.2095	599140.9900
1031	5000+14.00	4.00	634883.9202	599153.6566
1032	5000+03.08	30.72	634885.7488	599124.8478
1033	5000+13.23	42.05	634872.5178	599117.3516
1034	6000+03.97	-14.06	634838.2866	599185.6974
1035	6000+49.84	-15.63	634805.7313	599165.3471
1036	6000+16.33	-4.00	634825.0238	599192.6722
1037	6000+39.97	-4.00	634806.2747	599180.5872
1038	1027+80.60	-4.00	634698.7497	599509.1930
1039	1027+90.48	-15.58	634694.5122	599523.8095
1040	1027+85.08	4.00	634691.3756	599503.7438



COORDINATE LIST

POINT NO.	STATION	OFFSET	NORTHING	EASTING
1041	1027+94.96	12.42	634678.9119	599500.1304
1042	2004+00.78	11.42	634875.6254	599103.3130
1043	2003+87.84	4.00	634881.6509	599089.6612
1044	2002+23.06	-5.00	634785.8928	598967.2716
1045	2002+04.10	-4.00	634785.0462	598960.2593
1046	2002+05.06	4.00	634778.1562	598956.0826
1047	4000+96.35	-4.00	634771.1280	598956.9307
1048	2000+08.57	-4.00	634751.4105	598915.7012
1049	4000+48.92	-4.00	634747.5915	598921.1451
1050	4000+36.12	-14.57	634755.6662	598906.4783
1051	4000+26.13	-4.00	634743.5224	598898.4786
1052	2005+34.54	0.76	634957.5426	599196.0830
1053	2005+34.61	-3.17	634959.9570	599192.8929
1054	2005+26.49	4.00	634950.8602	599195.2526
1055	2005+27.26	-4.00	634952.3549	599187.3543
1056	1023+98.59	-15.05	634801.3194	599186.8678
1057	1024+10.23	-4.00	634786.3710	599189.8849
1058	2002+26.25	5.00	634782.2170	598977.1027
1059	2002+16.25	4.00	634774.9750	598970.1346
1060	2003+28.42	4.00	634863.1438	599039.4798
1061	2003+18.42	5.00	634854.6654	599034.0838
1062	2003+28.42	-4.00	634868.0956	599033.1854
1063	2003+18.42	-5.00	634860.8536	599026.2173

NOTES

1. SEE CONSTRUCTION DETAILS FOR TRUCK PULL-OFF LOLCATIONS AND DIMENSIONS.
2. TRANSITION PATH SLOPE AT PROPOSED BRIDGES. PATH SHALL NOT EXCEED 1.5% CROSS SLOPE IN ANY DIRECTION.

ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

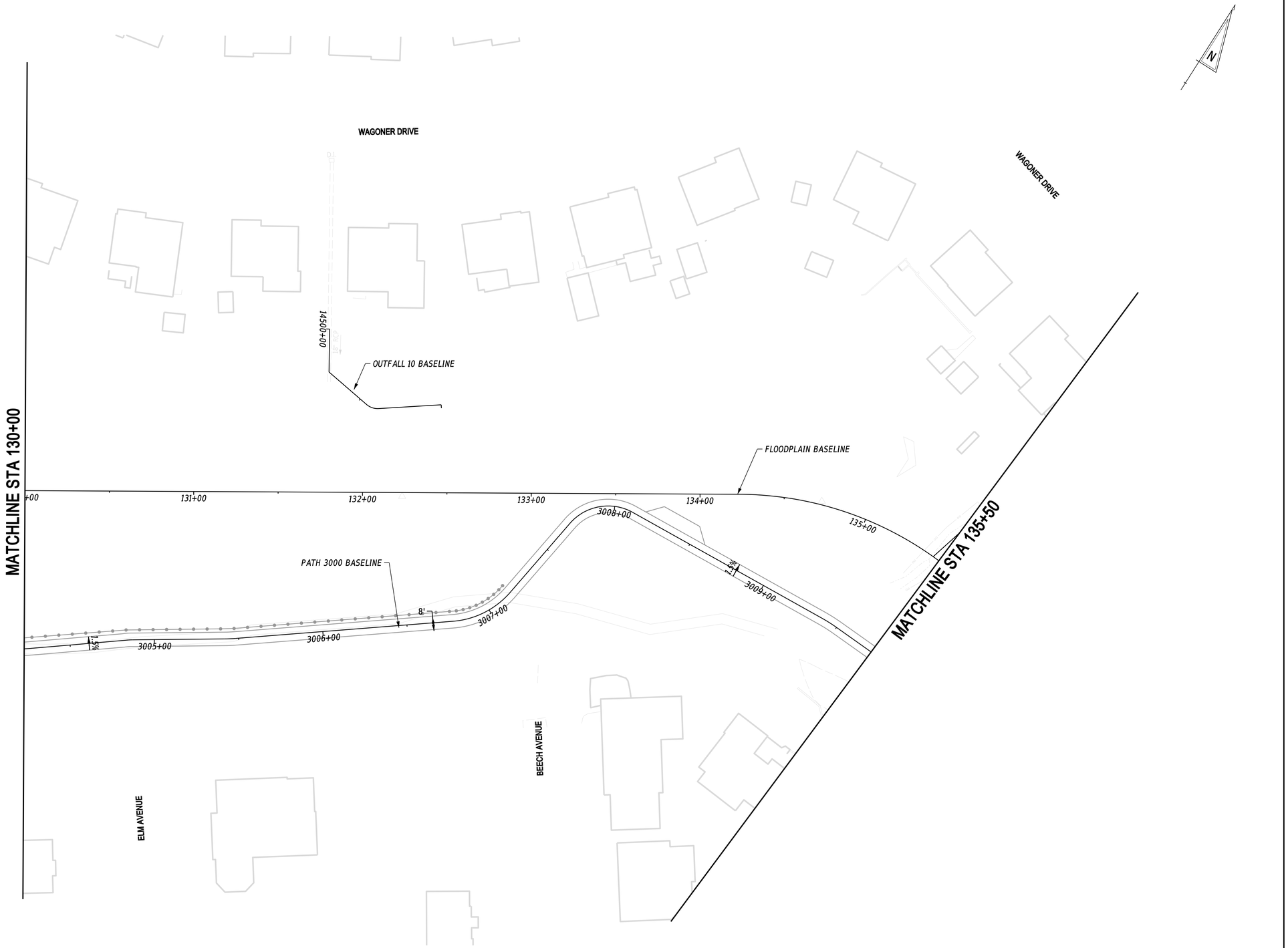
New Castle County 1673 Delaware

CONTRACT 20230414279
DESIGNED BY: C. HALL
CHECKED BY: C. WEBB

GRADES AND GEOMETRICS

GG-04
SECTION
RKK
SHEET NO.
45

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NOTES

1. *SEE CONSTRUCTION DETAILS FOR TRUCK PULL-OFF LOLCATIONS AND DIMENSIONS.*

ADDENDA / REVISIONS	

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

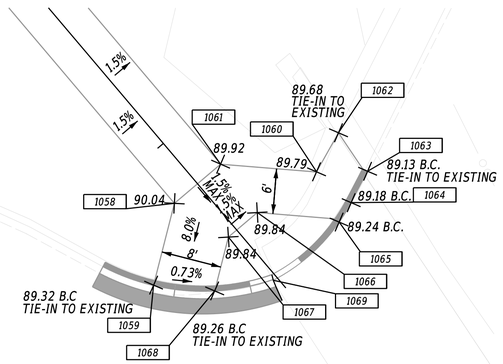
New Castle County 1673 Delaware

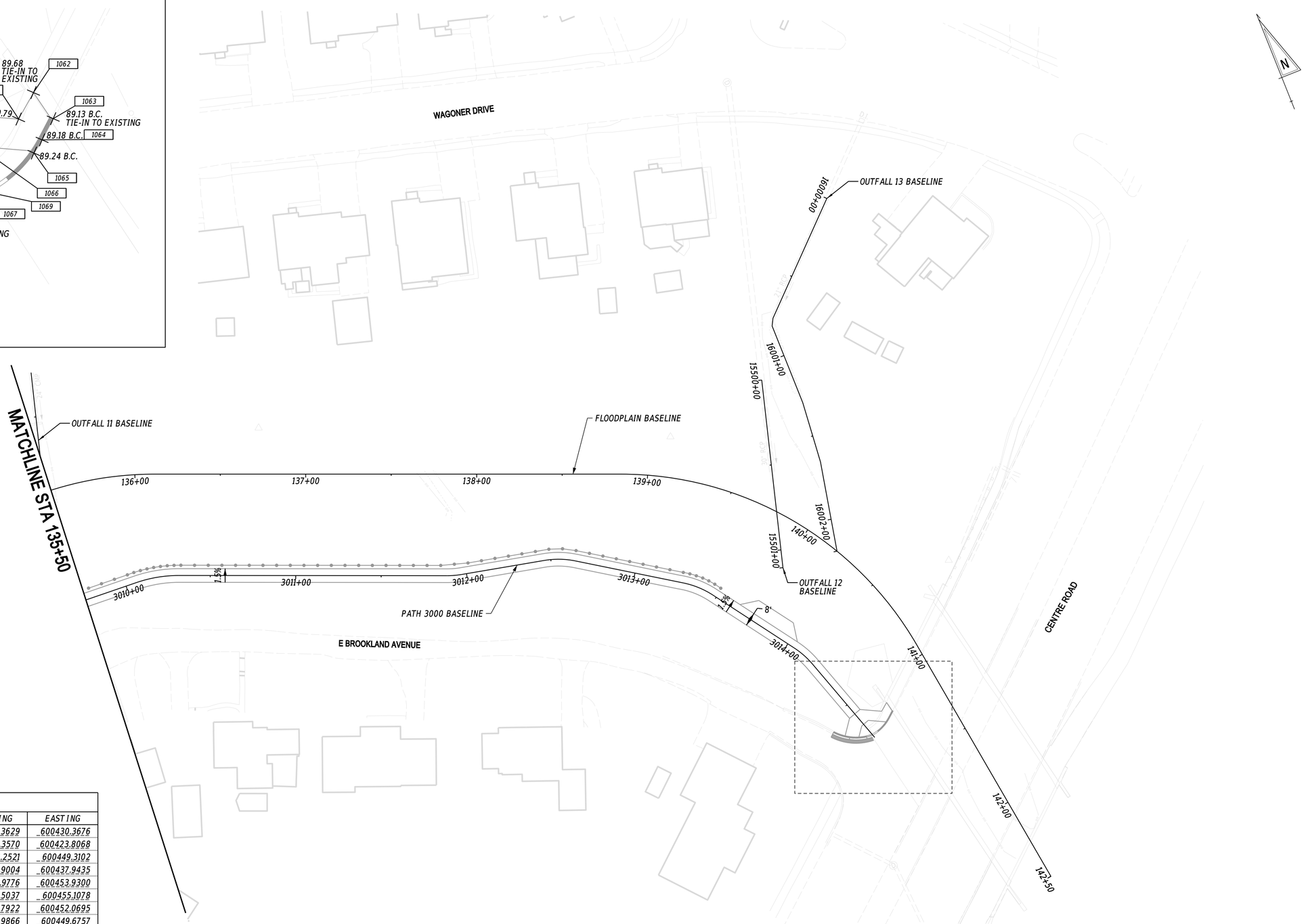
CONTRACT	20230414279
DESIGNED BY:	C. HALL
CHECKED BY:	C. WEBB

GRADES AND GEOMETRICS

GG-05
SECTION
RKK
SHEET NO.
46

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COORDINATE LIST				
POINT NO.	STATION	OFFSET	NORTHING	EASTING
1058	3014+57.00	-4.00	634789.3629	600430.3676
1059	3014+63.43	-13.07	634780.3570	600423.8068
1060	3014+65.93	12.98	634786.2521	600449.3102
1061	3014+57.00	4.00	634791.9004	600437.9435
1062	3014+63.87	18.54	634789.9776	600453.9300
1063	3014+69.47	17.92	634784.5037	600455.1078
1064	3014+71.99	13.86	634780.7922	600452.0695
1065	3014+72.94	11.01	634778.9866	600449.6757
1066	3014+64.97	3.56	634784.1761	600440.0711
1067	3014+64.97	-1.44	634782.5882	600435.3299
1068	3014+69.22	-7.42	634776.6582	600431.0100
1069	3014+73.29	0.61	634775.0853	600438.7245

NOTES

1. SEE CONSTRUCTION DETAILS FOR TRUCK PULL-OFF LOLCATIONS AND DIMENSIONS.

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK
STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: C. HALL
CHECKED BY: C. WEBB

GRADES AND
GEOMETRICS

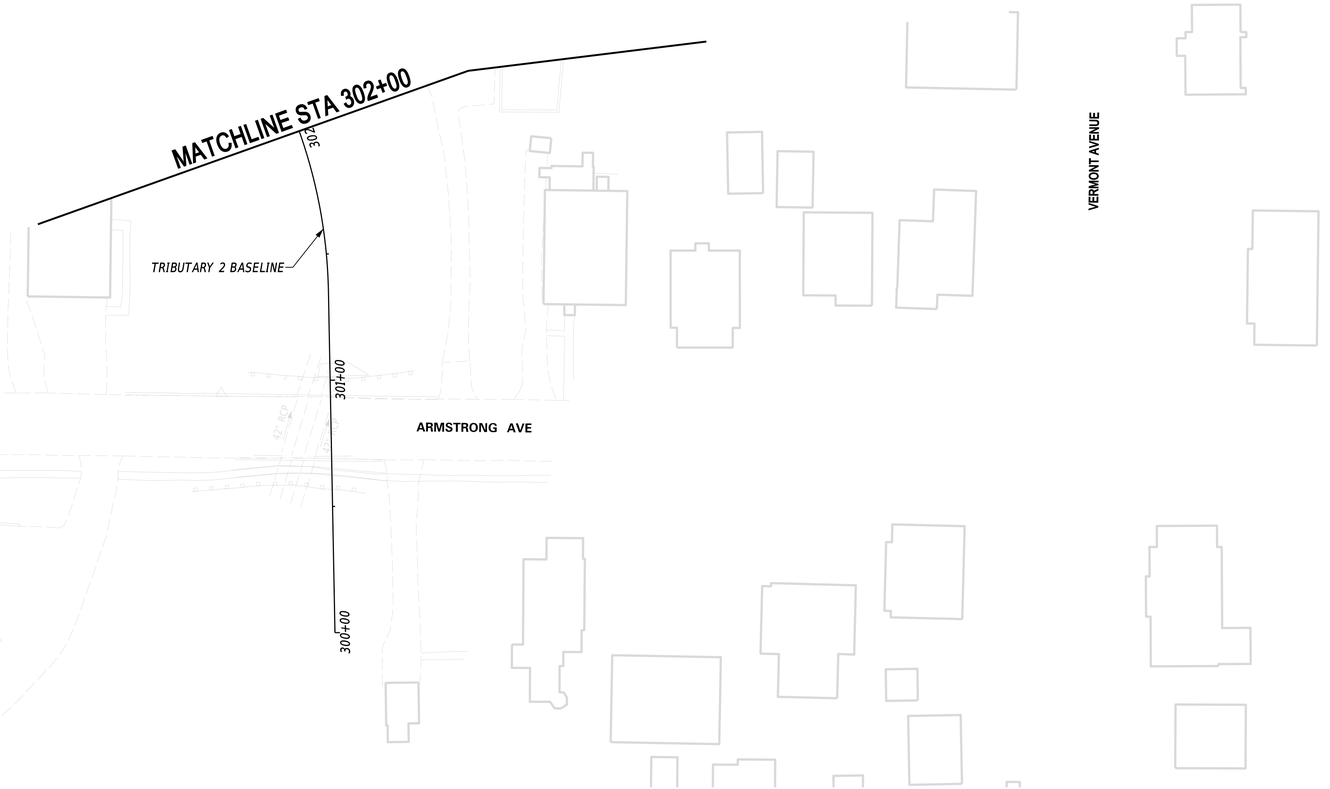
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SECTION
RKK
SHEET NO.
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ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	GRADES AND GEOMETRICS	GG-07
					DESIGNED BY: S. SMITH		SECTION RKK
					CHECKED BY: C. WEBB		SHEET NO. 48

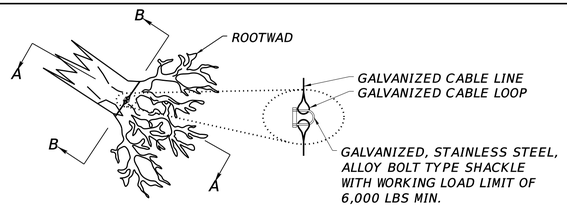
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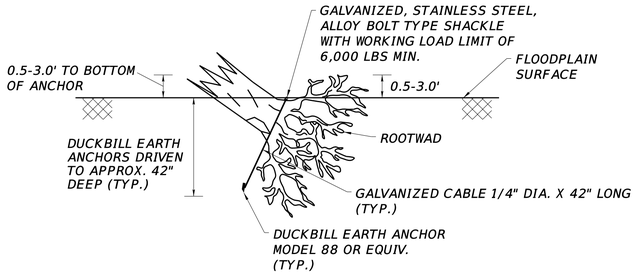
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					DESIGNED BY: S. SMITH		SECTION RKK
					CHECKED BY: C. WEBB		SHEET NO. 49

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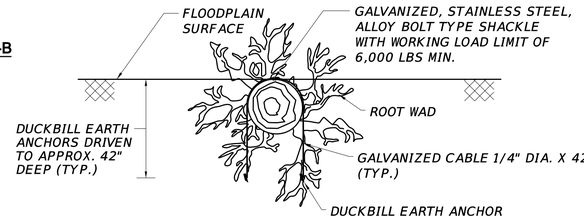
PLAN VIEW



SECTION A-A

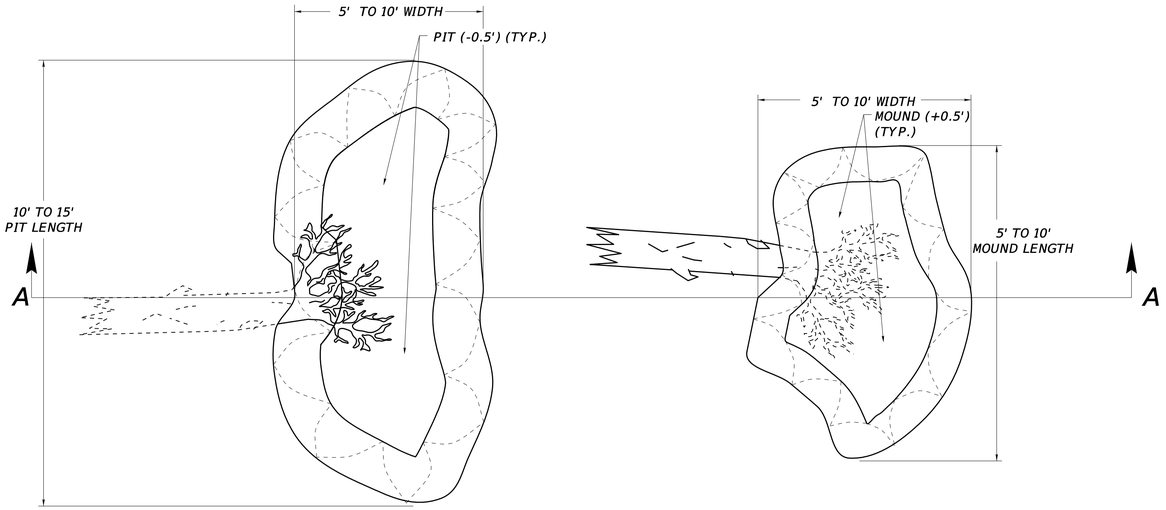


SECTION B-B

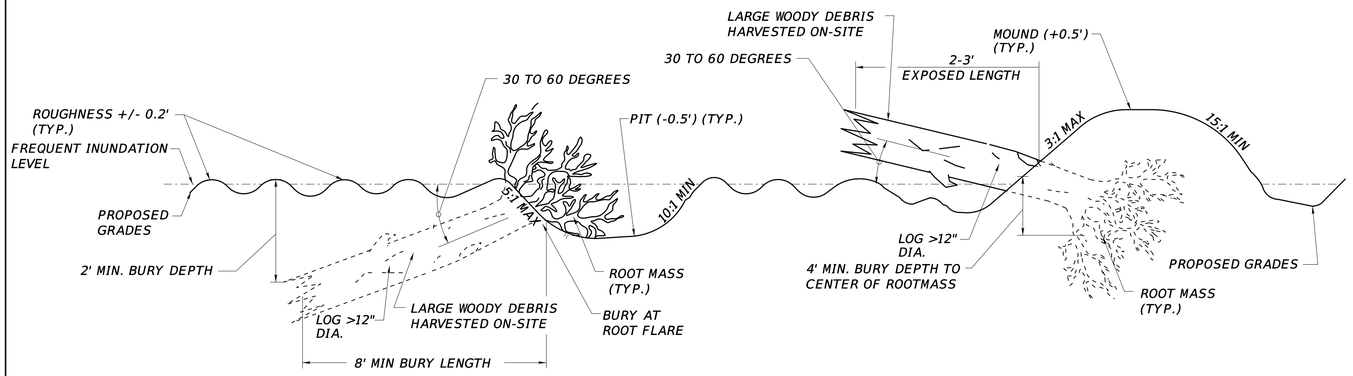


LARGE WOODY DEBRIS (ROOT WAD) ANCHOR DETAIL

NOTE: TREES TO BE REMOVED BY CONTRACTOR SHALL BE USED AS ROOT WADS/WOODY DEBRIS.



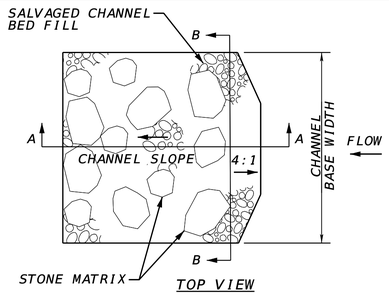
PLAN VIEW



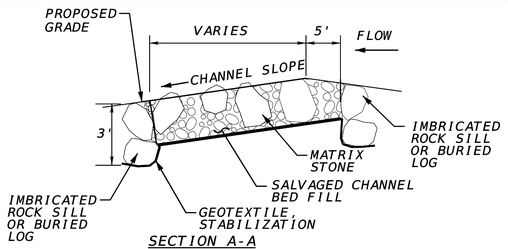
SECTION A-A

WOODY DEBRIS PLACEMENT DETAIL

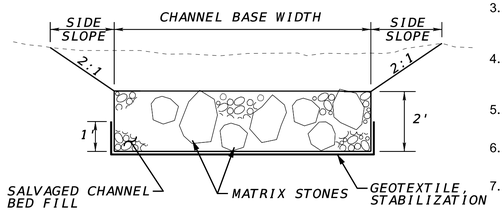
NOTE: TREES TO BE REMOVED BY CONTRACTOR SHALL BE USED AS ROOT WADS/WOODY DEBRIS.



TOP VIEW



SECTION A-A



SECTION B-B

RIFFLE GRADE CONTROL CONSTRUCTION NOTES

1. THE RIFFLE GRADE CONTROL SHALL CONSIST OF 50% MATRIX STONES AND 50% SALVAGED CHANNEL BED MATERIAL.
2. RIFFLE GRADE CONTROLS SHALL BE CONSTRUCTED BY PLACING A LAYER OF MATRIX STONES AND BACKFILLING WITH THE SALVAGED CHANNEL BED MATERIAL.
3. A CONTINUOUS ROW OF IMBRICATED ROCK STONES OR BURIED LOG SHALL BE PLACED AT THE UPSTREAM AND DOWNSTREAM LIMIT OF THE STRUCTURE.
4. THE MATRIX STONE SHALL BE PLACED WITH 1"-2" OF AN ANGULAR PORTION OF THE STONE PROTRUDING ABOVE THE PROPOSED CHANNEL GRADE ELEVATION.
5. THE RIFFLE GRADE CONTROL MATERIAL SHALL EXTEND TO THE ENTIRE WIDTH OF THE THRESHOLD CHANNEL.
6. SEE SPECIAL PROVISION - PROVIDE AND PLACE STONE FOR ROCK SILL SIZING REQUIREMENTS.
7. SEE SPECIAL PROVISION -PROVIDE AND PLACE STONE FOR MATRIX STONE SIZING REQUIREMENTS.
8. IMBRICATED ROCK SILL SHALL BE REPLACED BY BURIED LOGS IN ACCORDANCE WITH THE PLANS. SEE SPECIAL PROVISION -BURIED LOG PLACEMENT FOR LOG REQUIREMENTS.

RIFFLE GRADE CONTROL STRUCTURE

RIFFLE GRADE CONTROL SCHEDULE*

STRUCTURE	START STATION	STOP STATION
1	5+80.8	6+13.3
2	6+30.2	6+53.2
3	6+79.0	7+06.9
4	10+15.0	10+53.7
5	20+36.4	20+76.7
6	28+10.1	28+82.5
7	29+62.3	30+04.3
8	34+31.5	34+90.2

*SEE PROFILES ON SHEETS 33 THROUGH SHEET 39 FOR CREST AND TAIL ELEVATIONS

RIFFLE GRADE CONTROL SCHEDULE CONTINUED*

STRUCTURE	START STATION	STOP STATION
9	36+61.6	36+85.3
10	38+26.0	39+05.2
11	41+99.0	42+46.0
12	60+71.1	60+94.5
13	61+09.8	61+25.7
14	80+61.4	80+75.1
15	80+87.0	81+04.9
16	81+17.2	81+38.5

*SEE PROFILES ON SHEETS 33 THROUGH SHEET 39 FOR CREST AND TAIL ELEVATIONS

RIFFLE GRADE CONTROL SCHEDULE CONTINUED*

STRUCTURE	START STATION	STOP STATION
17	81+49.7	81+69.8
18	81+73.0	82+00.6
19	82+04.8	82+18.7
20	82+26.3	82+52.8
21	82+59.7	82+78.1
22	82+83.3	83+05.0

*SEE PROFILES ON SHEETS 33 THROUGH SHEET 39 FOR CREST AND TAIL ELEVATIONS

ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279

DESIGNED BY: N. RILEY

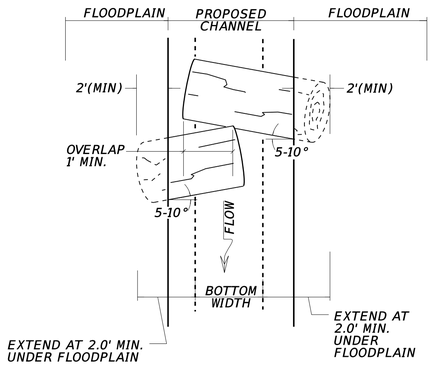
CHECKED BY: T. CUTILLO

CONSTRUCTION DETAILS

SECTION RKK

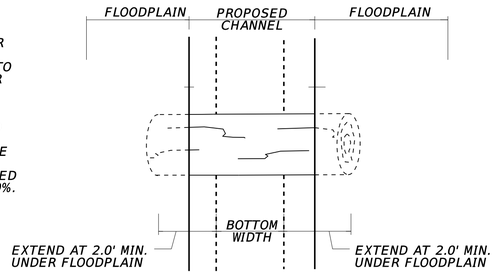
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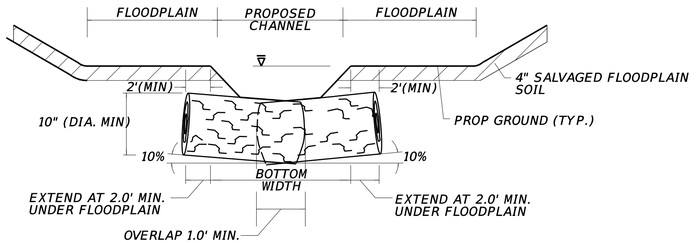


PLAN VIEW

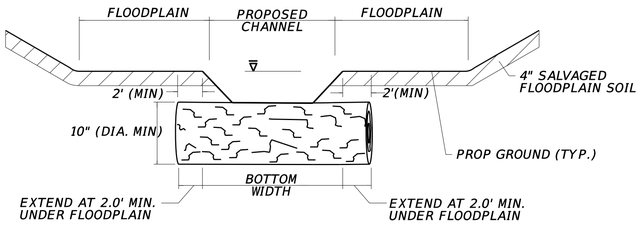
NOTES:
1. LOGS BURIED IN THE CHANNEL SHALL HAVE A MIN. DIAMETER OF 10". LOGS SHALL BE HARVESTED FROM TREES TO BE REMOVED WITHIN THE PERMITTED LIMIT OF DISTURBANCE.
2. BURIED CHANNEL LOGS SHALL BE PLACED IN EITHER A 'V' PATTERN OR PERPENDICULAR TO THE CHANNEL PER PLAN.
3. 'V' PATTERN LOGS SHALL BE ANGLED DOWNSTREAM 5-10°AND SHALL BE ANGLED UPWARDS TOWARDS PROPOSED FLOODPLAIN AT 10%.



PLAN VIEW



SECTION VIEW
'V' SHAPED CHANNEL LOG

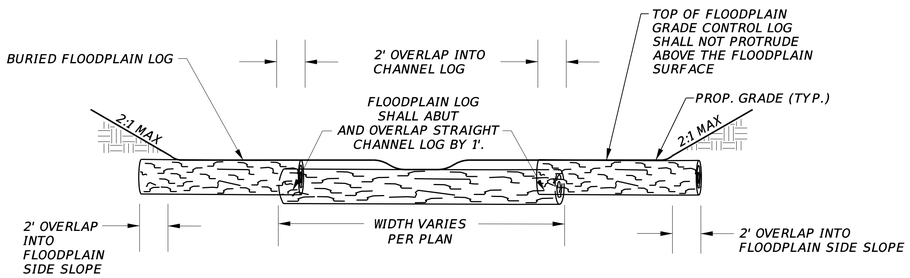


SECTION VIEW
STRAIGHT CHANNEL LOG

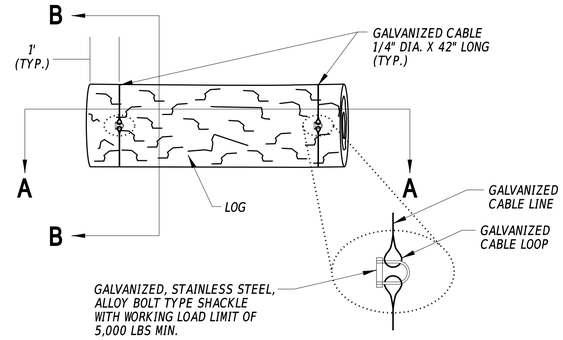
PLAN VIEW

BURIED CHANNEL LOG PLACEMENT DETAILS

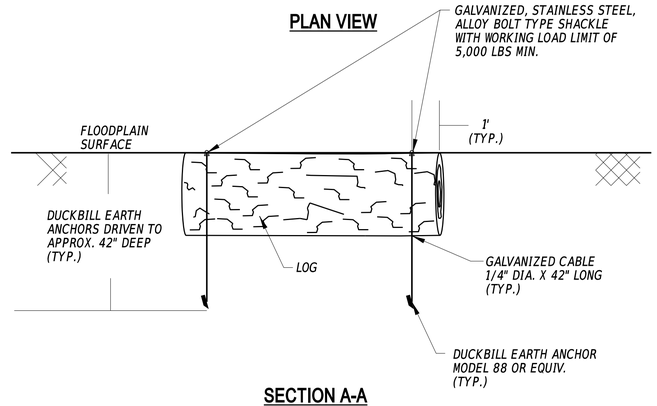
NOTES:
1. LOGS BURIED IN THE FLOODPLAIN AND CHANNEL SHALL HAVE A MINIMUM DIAMETER OF 8". LOGS SHALL BE STACKED VERTICALLY IF MINIMUM DEPTH NOT MET WITH SINGLE LOG.
2. LOGS SHALL BE HARVESTED FROM TREES TO BE REMOVED WITHIN THE PERMITTED LIMIT OF DISTURBANCE.
3. BURIED LOGS SHALL BE ANCHORED PER DETAIL ON THIS SHEET.
4. LOGS SHALL NOT PROTRUDE ABOVE THE FLOODPLAIN SURFACE AND SHALL BE PLACED IN ACCORDANCE WITH THE PLANS AND CHANNEL PROTECTION LOGS TABLE ON THIS SHEET.



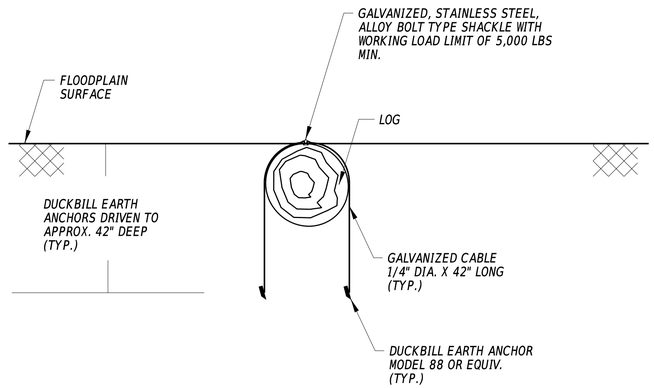
CONTINUOUS LOG SILL PLACEMENT DETAIL



PLAN VIEW



SECTION A-A

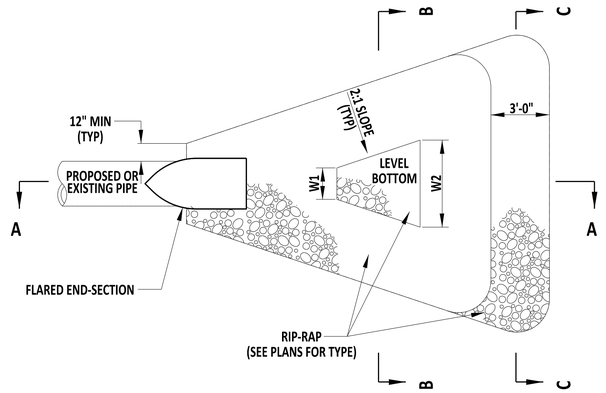


SECTION B-B

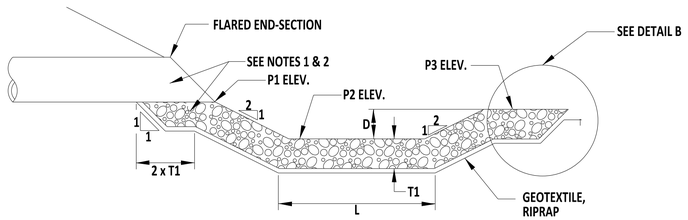
LOG ANCHOR DETAIL

ADDENDA / REVISIONS		NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT	20230414279	CONSTRUCTION DETAILS	SECTION
				New Castle County 1673 Delaware	DESIGNED BY:	N. RILEY		RKK
					CHECKED BY:	T. CUTILLO		SHEET NO. 51

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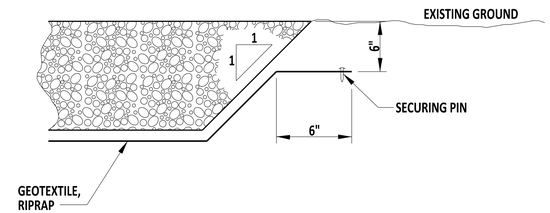
PLAN VIEW



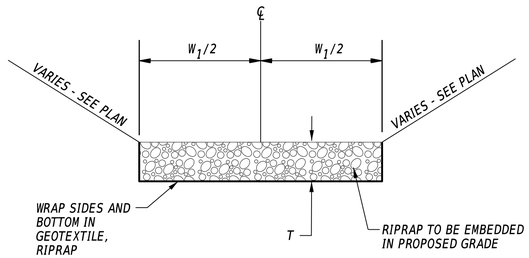
SECTION A-A

NOTES:

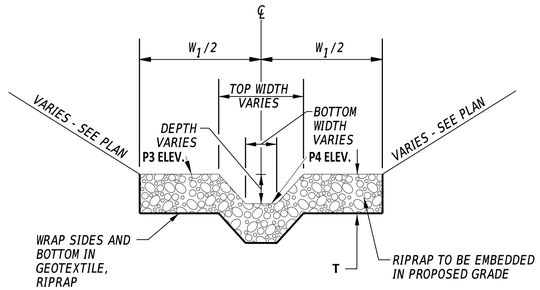
1). PLACE RIPRAP PRIOR TO PLACING PROPOSED FLARED END SECTIONS. GROUND BELOW EXISTING STRUCTURES AND/OR PIPES SHALL NOT BE EXCAVATED FOR RIPRAP PLACEMENT.
2). PLACE DELAWARE NO. 3 STONE UNDER PROPOSED FLARED END SECTIONS. GROUND BELOW EXISTING STRUCTURES AND/OR PIPES SHALL NOT BE EXCAVATED FOR NO. 3 STONE PLACEMENT.
3). REFER TO THE PIPE ENERGY DISSIPATOR SCHEDULE ON THIS SHEET FOR THE VALUE OF DIMENSION VARIABLES.



DETAIL B



SECTION B-B
WITHOUT BASEFLOW CHANNEL



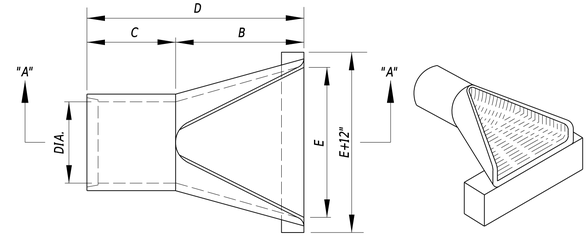
SECTION C-C
WITH BASEFLOW CHANNEL

RIPRAP R-5 ENERGY DISSIPATOR DIMENSION TABLE

	PIPE DIA. (IN)	L (FT)	W1 (FT)	W2 (FT)	T (IN)	D (IN)	P1 ELEV.	P2 ELEV.	P3 ELEV.	P4 ELEV.	BASEFLOW CHANNEL
ED-1*	--	31.8	35.4	27.4	24"	2.5	95.51	92.76	95.26	94.76	YES
ED-2*	--	28.0	9.3	16.8	24"	2.5	95.56	92.81	95.31	94.96	YES
ED-3*	--	12.8	13.5	19.8	24"	2.5	94.88	92.05	94.55	94.25	YES
ED-5	18"	4.5	1.5	3.0	24"	1.5	88.73	87.23	88.73	N/A	NO
ED-14	12"	3.0	1.0	3.0	24"	1.0	95.06	94.06	95.06	N/A	NO
ED-15	15"	3.75	1.25	3.75	24"	1.25	92.58	91.33	92.58	N/A	NO

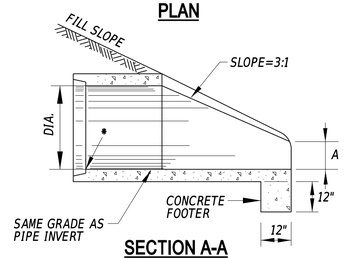
NOTES:
** ED-1 SIZED TO ACCOMMODATE TRIPLE 10'-2" X 4'-7" BOX CULVERTS*
** ED-2 SIZED TO ACCOMMODATE DUAL 8' X 6' BOX CULVERTS*
** ED-3 SIZED TO ACCOMMODATE TWIN 42" RCP*

ENERGY DISSIPATOR DETAIL

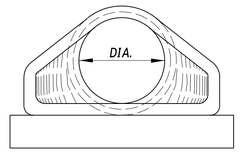


PLAN

ISOMETRIC VIEW



SECTION A-A

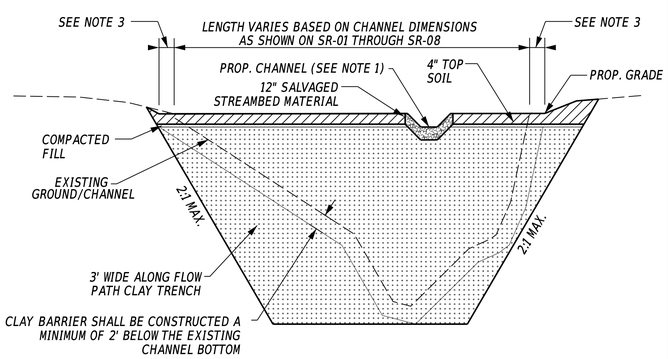


END VIEW

* *INVERT ELEVATION TO BE AT THE PIPE END OF THE STANDARD END SECTION. ELEVATIONS ARE NOTED ON THE CONSTRUCTION PLANS.*

DIAMETER	A	B	C	D	E
12"	4"	2'-0"	4'-0⅞"	6'-0⅞"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
24"	9½"	3'-7½"	2'-6"	6'-1½"	4'-0"
30"	1'-0"	4'-6"	1'-7¾"	6'-1¾"	5'-0"
36"	1'-3"	5'-3"	2'-10¾"	8'-1¾"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"

CONCRETE FLARED END SECTION



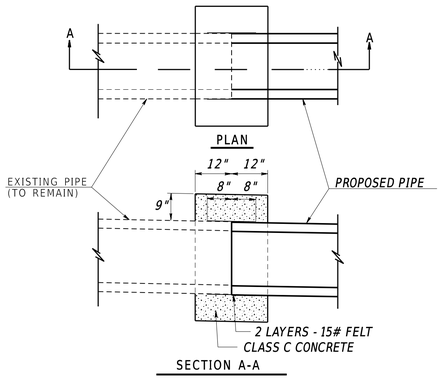
CLAY CHANNEL BARRIERS

NOTE:

1. CONSTRUCTION OF CLAY CHANNEL BARRIER NOT WITHIN THE LIMITS OF THE PROPOSED CHANNEL SHALL MATCH PROPOSED GRADE AS SHOWN ON THE PLANS USING CLAY TRENCH, COMPACTED FILL, AND 4" OF TOP SOIL AS SHOWN ON THIS DETAIL.
2. STATION/OFFSET MEASURED FROM CENTER OF STRUCTURE AS SHOWN ON SR-01 THROUGH SR-08.
3. CLAY CHANNEL BARRIER SHALL EXTEND A MINIMUM OF 2-FT BEYOND THE TOP OF THE EXISTING CHANNEL BANK AND IN ACCORDANCE WITH NOTE 1.
4. IF CLAY CHANNEL BARRIER EXTENDS INTO THE PROPOSED FLOODPLAIN'S 2:1 SLOPE GRADING, CLAY CHANNEL BARRIER SHALL MAINTAIN A CONSTANT ELEVATION AT 4" OF TOP SOIL AS SHOWN ON THIS DETAIL

ADDENDA / REVISIONS		NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT	20230414279	CONSTRUCTION DETAILS	SECTION
				New Castle County 1673 Delaware	DESIGNED BY:	N. RILEY		RKK
					CHECKED BY:	T. CUTILLO		SHEET NO. 52

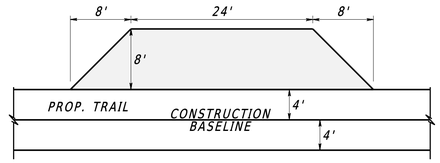
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NOTES

1. PIPE CONNECTION SHALL BE CONSTRUCTED OF PLAIN CONCRETE (MIX NO.2) SIZE, TYPE & DIRECTION OF CONNECTION WILL VARY TO SUIT CONDITIONS.
2. PIPE CONNECTION SHALL BE WRAPPED WITH DOUBLE LAYER OF 15# FELT PRIOR TO PLACEMENT OF CONCRETE COLLAR.

CONCRETE COLLAR DETAIL



PLAN
NTS

PATH	START STA.	END STA.
1000	1006+30.00	1006+70.00
1000	1014+30.00	1014+70.00
3000	3008+18.00	3008+58.00
3000	3013+64.00	3014+04.00

TRUCK PULL-OFF DETAIL

ADDENDA / REVISIONS		NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	CONSTRUCTION DETAILS	SECTION RKK
					DESIGNED BY: J. VAROUNIS		SHEET NO. 53
					CHECKED BY: C. WEBB		

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STRUCTURAL GENERAL NOTES

DESIGN SPECIFICATIONS

1. AASHTO LRFD GUIDE SPECIFICATIONS FOR THE DESIGN OF PEDESTRIAN BRIDGES 2009, INCLUDING 2015 INTERIMS.
2. DELAWARE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION 2025.

DESIGN LOADING

1. PEDESTRIAN LIVE LOAD IS 90 PSF.
2. VECHICAL LIVE LOAD IS H10 FOR BRIDGE 1 AND H5 FOR BRIDGE 2.
3. FOR SIESMIC LOADS, THE PROJECT SITE IS LOCATED WITHIN SEISMIC PERFORMANCE ZONE 1, WITH A SITE CLASS D, ACCELERATION COEFFICIENT OF 0.074 AND IMPORTANCE CATEGORY - OTHER.

STRUCTURAL STEEL

1. STEEL PIPE FOR HANDRAIL SHALL BE ASTM A53, GRADE B, GALVANIZED.
2. STEEL TUBING FOR TRUSS MEMBERS SHALL BE ASTM A847.
3. STEEL FOR MISCELLANEOUS SHAPES, PLATES, AND ASSEMBLIES SHALL BE ASTM A588.
4. ELECTRODES FOR FIELD AND SHOP WELDING SHALL BE E70.
5. ANCHOR BOLTS SHALL BE ASTM F1554, GRADE 55 MIN. NUTS SHALL BE ASTM A563 AND WASHERS SHALL BE ASTM F436. MECHANICALLY GALVANIZE PER SECTION 1039 OF THE DELAWARE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.

CONCRETE AND REINFORCING STEEL

1. ALL SUBSTRUCTURE CONCRETE SHALL BE DELDOT CLASS A (f'c=4500 PSI) CONFORMING TO MIX REQUIREMENTS IN SECTION 1022 OF THE DELAWARE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.
2. ALL DECK CONCRETE SHALL BE DELDOT CLASS D (f'c=4500 PSI) CONFORMING TO MIX REQUIREMENTS IN SECTION 1022 OF THE DELAWARE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.
3. REINFORCING STEEL SHALL CONFORM TO ASTM A615 GRADE 60, EPOXY COATED. ALL REINFORCING SHALL HAVE A CLEAR COVER OF 2" UNLESS SPECIFIED ON THE PLANS.
4. CHAMFER ALL EXPOSED EDGES OF SUBSTRUCTURE CONCRETE 3/4" X 3/4", UNLESS NOTED OTHERWISE
5. ALL BAR BENDS AND LAPS SHALL BE IN ACCORDANCE WITH THE CRSI MANUAL OF STANDARD PRACTICE.

FOUNDATION

1. THE ABUTMENT FOOTINGS FOR BRIDGE 1 SHALL BEAR IN FIRM MATERIAL WITH A FACTORED BEARING RESISTANCE OF 3,000-PSF AND THE ABUTMENT FOOTINGS FOR BRIDGE 2 SHALL BEAR IN FIRM MATERIAL WITH A FACTORED BEARING RESISTANCE OF 2,500-PSF.
2. THE CONTRACTOR SHALL RETAIN AN INDEPENDENT TESTING AGENCY TO TEST AND VERIFY THAT THE FOUNDATION SUBGRADE IS IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. AFTER EXCAVATION TO THE BEARING LEVEL, THE SOIL AT THE BEARING LEVEL SHALL BE DENSIFIED IN SITU. IF SOIL CANNOT BE DENSIFIED TO MEET THE BEARING REQUIREMENTS, THE SUBGRADE SHALL BE UNDERCUT TO THE DEPTH REQUIRED BY THE INDEPENDENT TESTING AGENCY AND SHALL BE BACKFILLED USING COMPACTED GABC, RCA, OR LEAN CONCRETE. THE INDEPENDENT TESTING AGENCY SHALL SUBMIT A REPORT SIGNED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF DELAWARE, STATING THAT THE FOUNDATION SUBGRADE COMPLIES WITH THE REQUIREMENTS OF THE PLANS AND SPECIFICATIONS.
3. THE CONTRACTOR SHALL REMOVE EXISTING SOIL TO THE SPECIFIED DEPTH BELOW THE FOUNDATION AS SHOWN ON THE TYPICAL CROSS SECTIONS AND BACKFILLED WITH GABC, RCA, OR LEAN CONCRETE. ADDITIONAL UNDERCUTTING MAY BE REQUIRED BY THE INDEPENDENT TESTING AGENCY. UNDERCUTTING SHALL EXTEND 9 INCHES LATERALLY FROM THE FOOTING FOR EACH 12 INCHES OF VERTICAL UNDERCUTTING, AND THE ENDS OF THE UNDERCUT SHOULD TRANSITION UP AT A 1(H):1(V) SLOPE.

SCOUR

1. THE STREAM CHANNEL RESTORATION IS DESIGNED TO PREVENT SCOUR OF THE CHANNEL BANKS FOR UP TO THE 100-YEAR STORM EVENT.

2. THE PROPOSED BRIDGES SPAN THE LIMITS OF POTENTIAL SCOUR FOR THE 25-YEAR DESIGN STORM EVENT.

BRIDGE 1

SCOUR DATA	UNITS	DESIGN EVENT	CHECK EVENT
FREQUENCY	YEARS	25	100
DISCHARGE	CFS	1,270	1,800
VELOCITY	FPS	3.33	2.71
DEPTH OF FLOW	FT	4.58	5.39

BRIDGE 2

SCOUR DATA	UNITS	DESIGN EVENT	CHECK EVENT
FREQUENCY	YEARS	25	100
DISCHARGE	CFS	1,420	2,010
VELOCITY	FPS	2.29	1.54
DEPTH OF FLOW	FT	5.59	6.82

HYDRAULIC DATA

DRAINAGE AREA	=	0.44 SQUARE MILES BRIDGE 1
DRAINAGE AREA	=	0.44 SQUARE MILES BRIDGE 2
DESIGN FREQUENCY	=	100 YEARS
25 YEAR FLOOD ELEVATION	=	91.64 FT. BRIDGE 1
25 YEAR FLOOD ELEVATION	=	90.74 FT. BRIDGE 2
100 YEAR FLOOD ELEVATION	=	92.44 FT. BRIDGE 1
100 YEAR FLOOD ELEVATION	=	91.98FT. BRIDGE 2
PROPOSED OPENING	=	287 SF BRIDGE 1
PROPOSED OPENING	=	180 SF BRIDGE 2

ADDENDA / REVISIONS

NOT TO SCALE

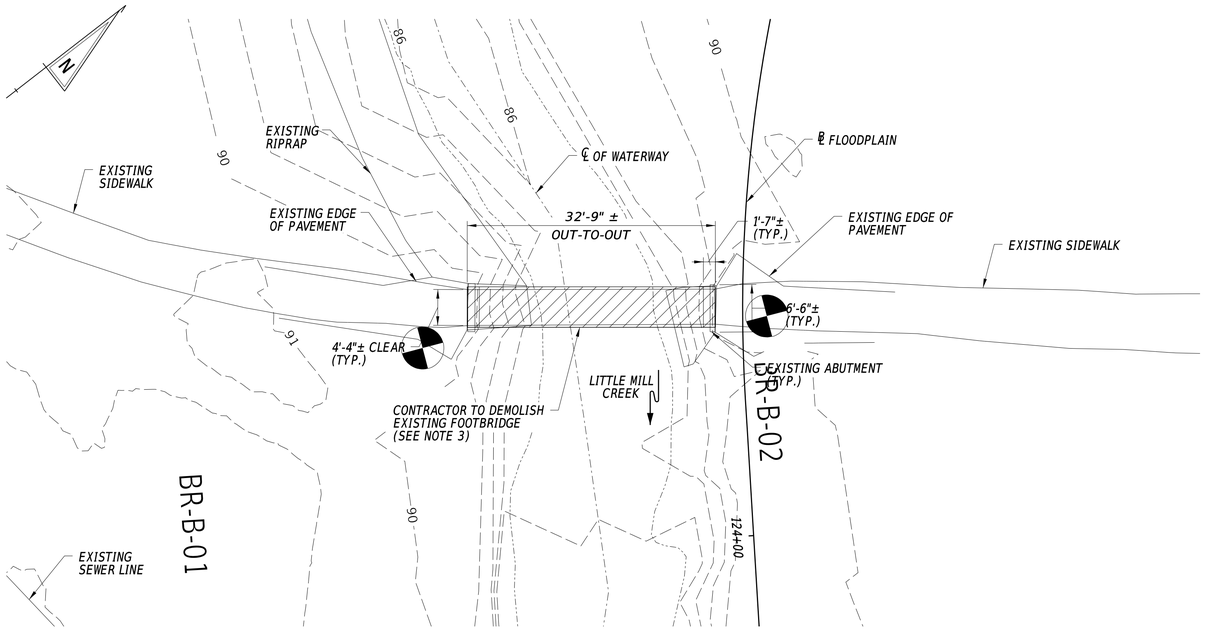
LITTLE MILL CREEK
STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: D. BERNARD
CHECKED BY: P. BARDOFF

BRIDGE GENERAL NOTES

ST-01
SECTION
RKK
SHEET NO.
54

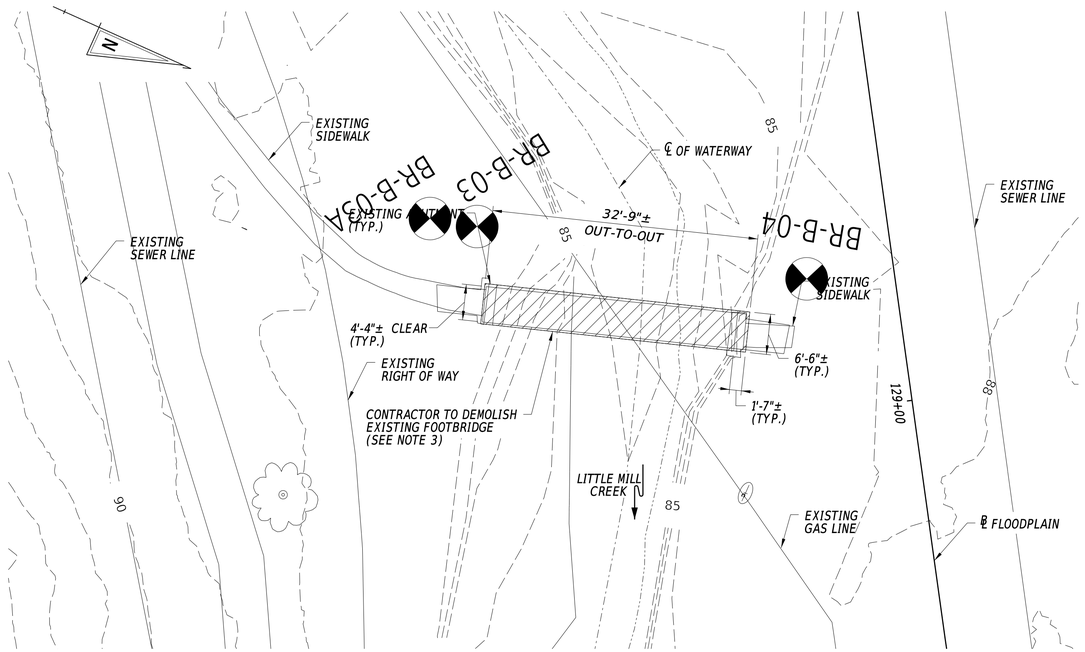
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BRIDGE 1 DEMO - PLAN
SCALE: 1" = 10'-0"



TYPICAL BRIDGE ELEVATION
SCALE: NTS



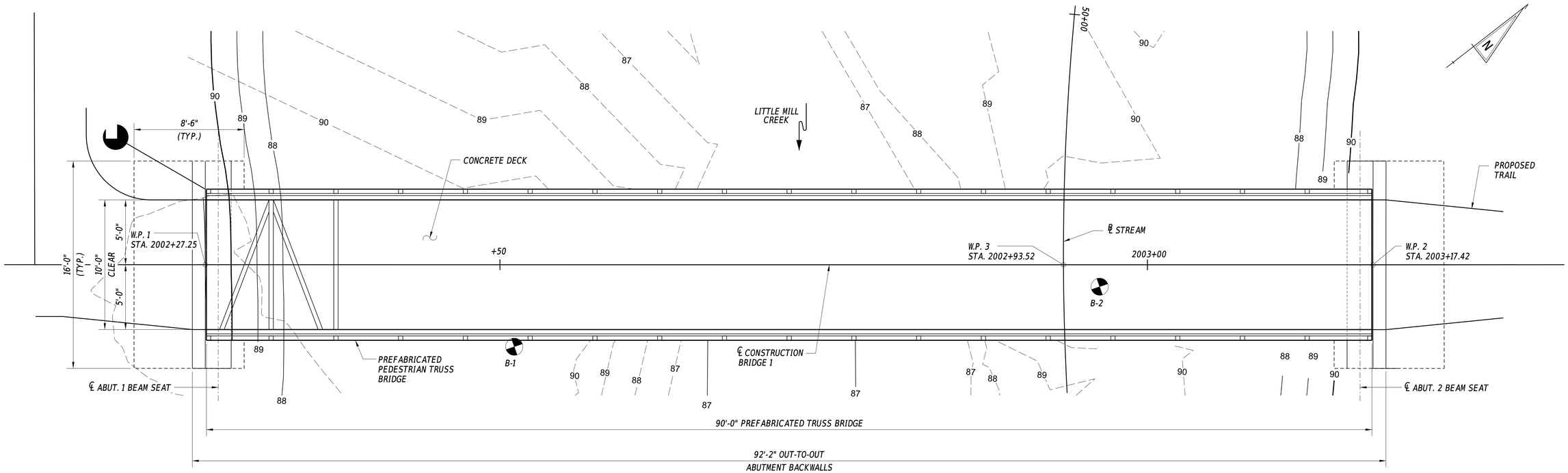
BRIDGE 2 DEMO - PLAN
SCALE: 1" = 10'-0"

NOTES:

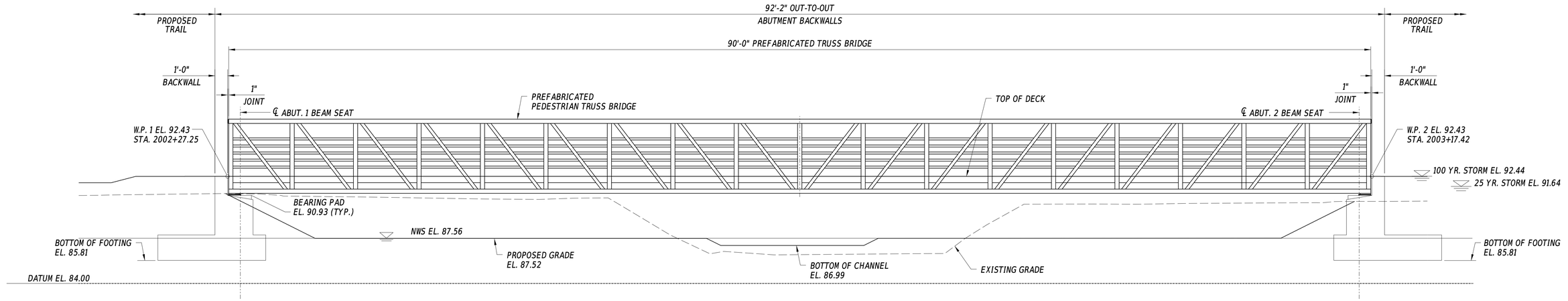
1. *CONTRACTOR TO REMOVE AND REPLACE BOTH EXISTING STRUCTURES IN THEIR ENTIRETY.*
2. *CONTRACTOR TO VERITFY DIMENSIONS OF EXISTING SUPERSTRUCTURE AND ABUTMENTS. DIMENSIONS SHOWN ON THIS SHEET ARE BASED OFF A SITE SURVEY. EXTENTS OF FOOTINGS ARE UNKNOWN.*
3. *THE BOTTOM CHORDS OF THE BRIDGES CONSIST OF (2) 6" DIA. STEEL TUBES WITH 2½" DIA. STEEL TUBE BRACING AND DIAGONALS. THE BRIDGE DECK CONSISTS OF A 2" THICK STEEL GRATING. THE BRIDGE RAILING IS A 3" DIA. STEEL TUBE WITH (5) POSTS SPACED AT 7'-3".*
4. *REFER TO SHEET CP-04 FOR DEMOLITION OF EXISTING SIDEWALKS.*

ADDENDA / REVISIONS		SCALE 0 10 20 30 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	BRIDGE DEMOLITION	ST-02
					DESIGNED BY: D. BERNARD		SECTION RKK
					CHECKED BY: P. BARDOFF		SHEET NO. 55

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PLAN
SCALE: 1" = 4'-0"

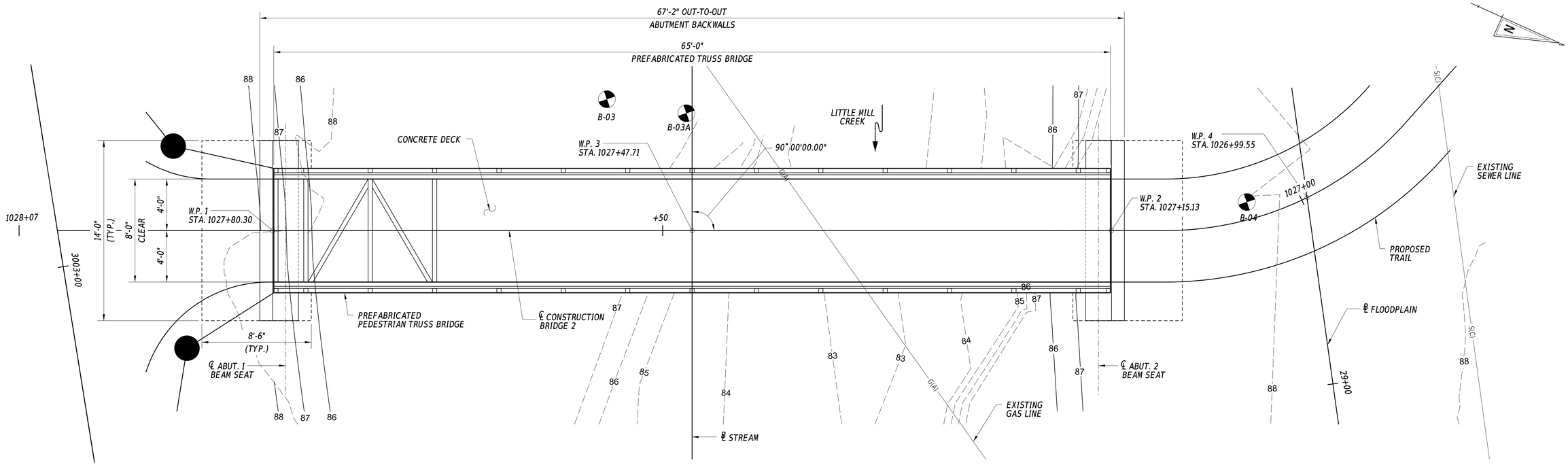


ELEVATION
SCALE: 1" = 4'-0"

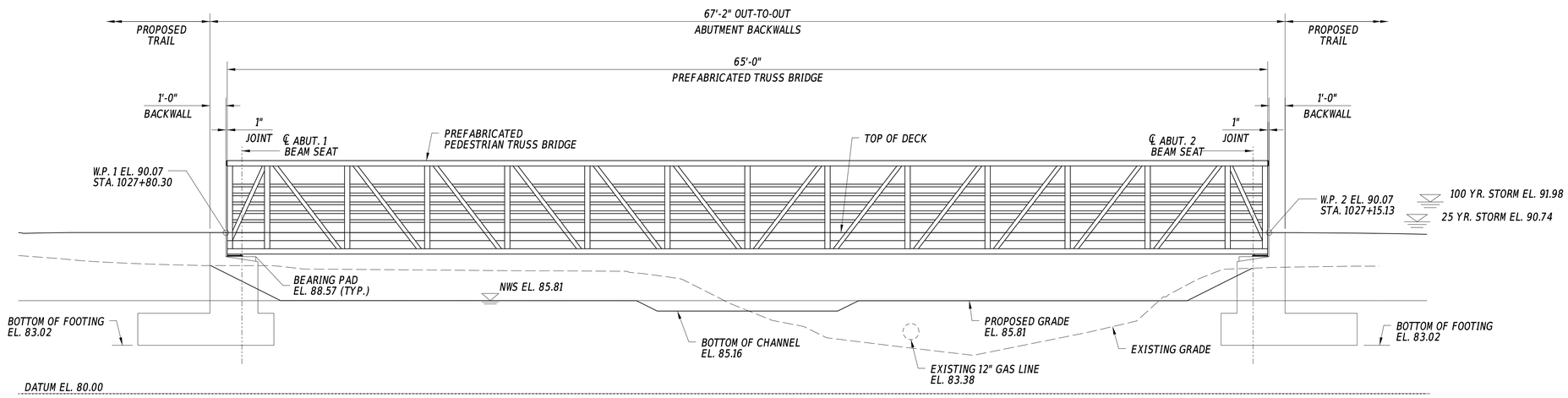
PEDESTRIAN BRIDGE 1

ADDENDA / REVISIONS		SCALE AS NOTED	LITTLE MILL CREEK STREAM RESTORATION	CONTRACT 20230414279	BRIDGE 1 GENERAL PLAN AND ELEVATION	ST-03
				DESIGNED BY: D. BERNARD		SECTION
				CHECKED BY: P. BARDOFF		RKK
						SHEET NO. 56

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PLAN
SCALE: 1" = 4'-0"

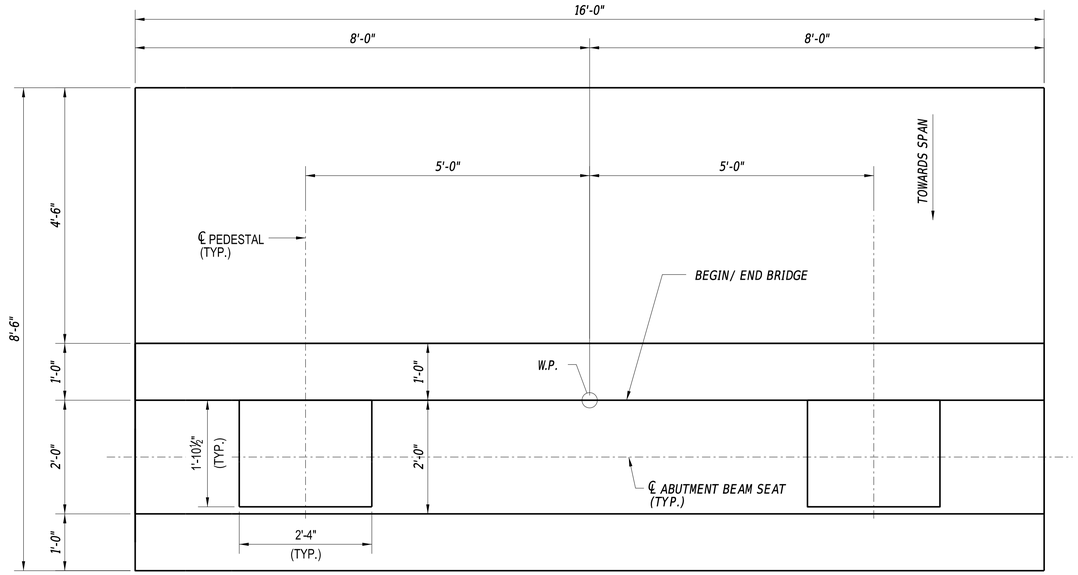


ELEVATION
SCALE: 1" = 4'-0"

PEDESTRIAN BRIDGE 2

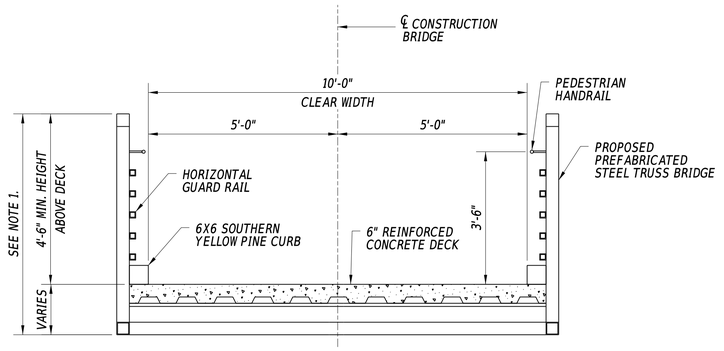
ADDENDA / REVISIONS	SCALE AS NOTED	LITTLE MILL CREEK STREAM RESTORATION	CONTRACT 20230414279	BRIDGE 2 GENERAL PLAN AND ELEVATION	ST-04
			DESIGNED BY: D. BERNARD		SECTION RKK
			CHECKED BY: P. BARDOFF		SHEET NO. 57

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TYPICAL ABUTMENT PLAN - BRIDGE 1

SCALE: ¾" = 1'-0"



TYPICAL SECTION BRIDGE 1

SCALE: ½" = 1'-0"

NOTES:

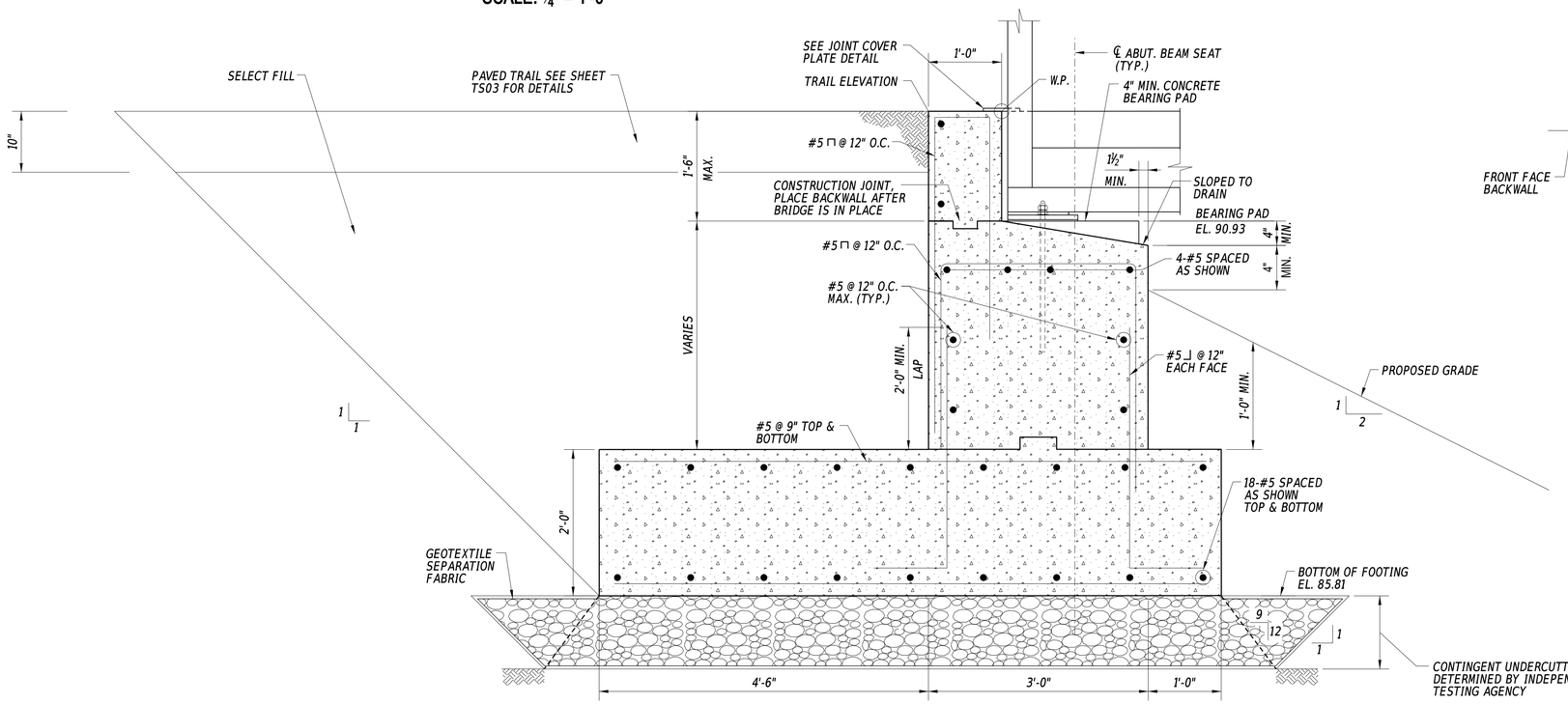
1. BEARING LOCATIONS AND BASE PLATE SIZES SHALL BE VERIFIED PER MANUFACTURER'S RECOMMENDATIONS PRIOR TO ORDERING ANY MATERIALS.
2. SEE ST-03 FOR W.P. LOCATIONS.

BRIDGE 1 WORKING POINT SCHEDULE

NO.	STATION	OFFSET	NORTHING	EASTING
WP-1	2002+27.25	0.00	634786.10	598973.79
WP-2	2003+17.42	0.00	634856.97	599029.54
WP-3	2002+93.52	0.00	634838.18	599014.76

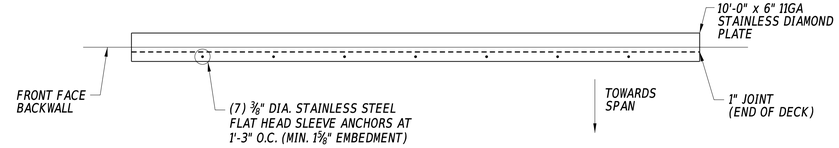
NOTES:

1. OVERALL STRUCTRE DEPTH VARIES BY MANUFACTURER. CONTRACTOR TO COORDINATE TRAIL AND BACKWALL ELEVATIONS AS NEEDED PRIOR TO CONSTRUCTION. THE BEAM SEAT ELEVATIONS SHOWN ON SHEET 56 ARE MINIMUMS.
2. SEE SHEET 20 FOR BRIDGE LOCATIONS.



TYPICAL ABUTMENT - BRIDGE 1

SCALE: 1" = 1'-0"



JOINT COVER PLATE DETAIL PLAN

SCALE: ¾" = 1'-0"

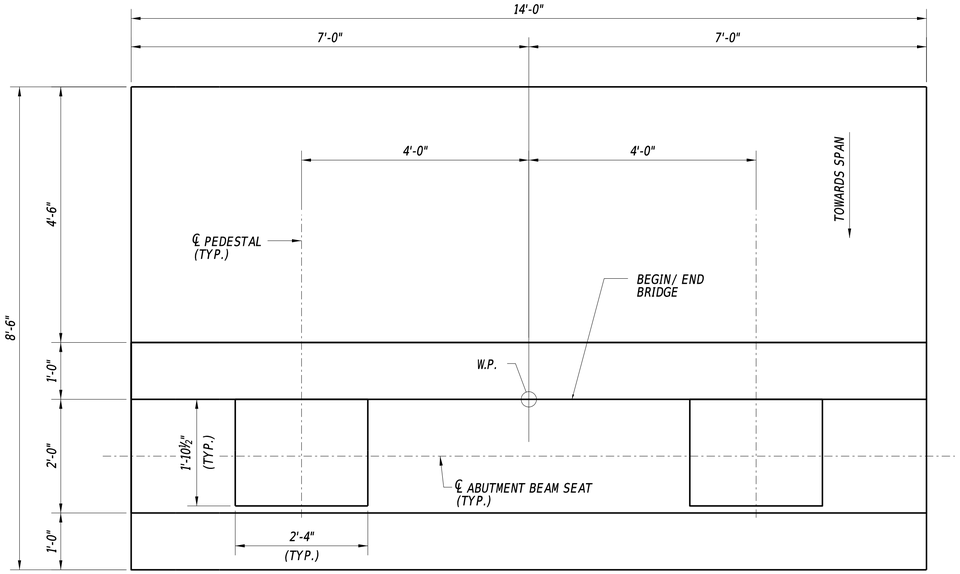
ABUTMENT DESIGN REACTION TABLE

SCOUR DATA	P (kips)	H (kips)	L (kips)
DEAD	24		
UNIFORM LIVE	22		
WIND		13	0
WINDWARD	0		
LEEWARD	0		
THERMAL			5

'P' - VERTICAL LOAD EACH BASE PLATE (4 PER BRIDGE)
'H' - HORIZONTAL LOAD EACH FOOTING (2 PER BRIDGE)
'L' - LONGITUDINAL LOAD EACH BASE PLATE (4 PER BRIDGE)
ALL LOADS ARE SERVICE LOADS

ADDENDA / REVISIONS		SCALE AS NOTED	LITTLE MILL CREEK STREAM RESTORATION	CONTRACT 20230414279	TYPICAL BRIDGE 1 DETAILS	ST-05
				DESIGNED BY: D. BERNARD		SECTION
				CHECKED BY: P. BARDOFF		RKK
						SHEET NO. 58

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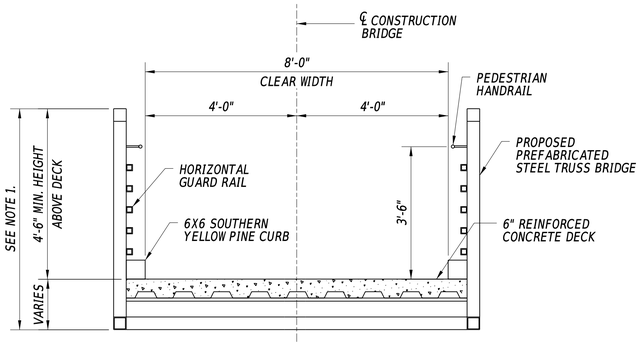
TYPICAL ABUTMENT PLAN - BRIDGE 2

SCALE: ¾" = 1'-0"

NOTES:
1. BEARING LOCATIONS AND BASE PLATE SIZES SHALL BE VERIFIED PER MANUFACTURER'S RECOMMENDATIONS PRIOR TO ORDERING ANY MATERIALS.
2. SEE ST-04 FOR W.P. LOCATIONS.

BRIDGE 2 WORKING POINT SCHEDULE

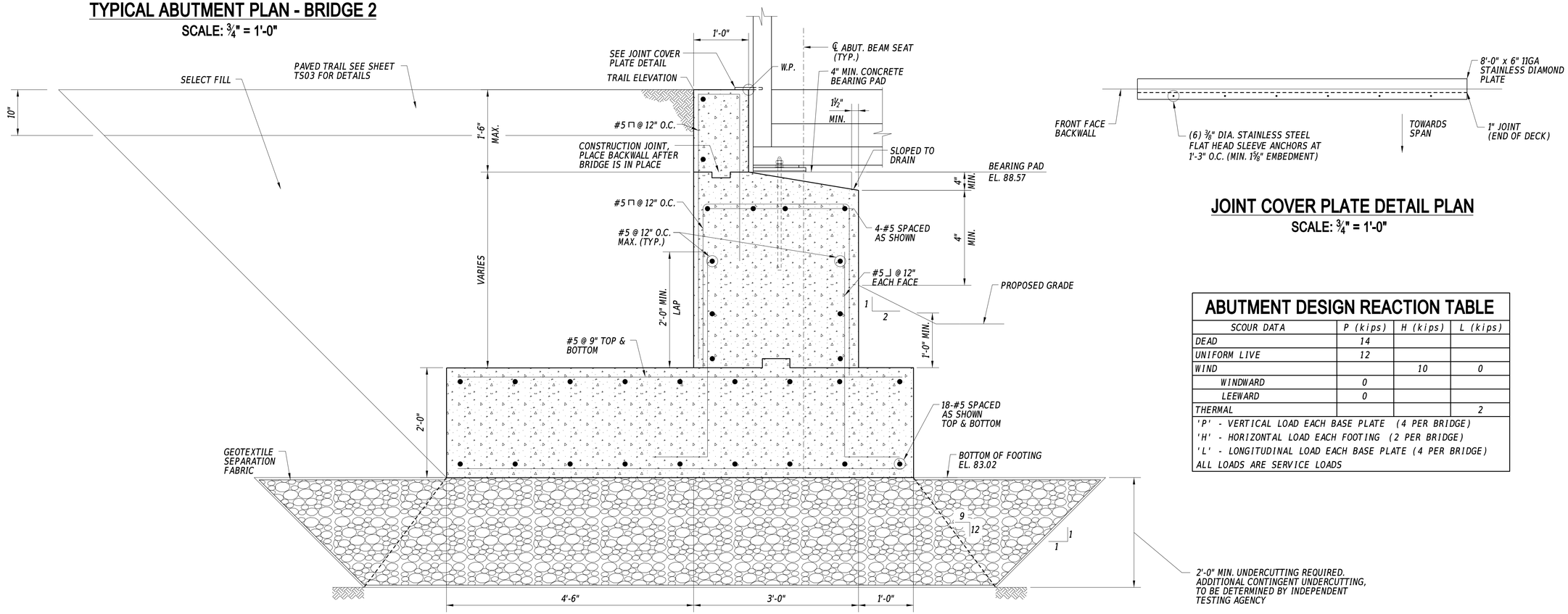
NO.	STATION	OFFSET	NORTHING	EASTING
WP-1	1027+80.30	0.00	634697.38	599505.42
WP-2	1027+15.13	0.00	634756.78	599478.62
WP-3	1027+47.71	0.00	634727.08	599492.02
WP-4	1026+99.55	0.00	634769.58	599470.04



TYPICAL SECTION BRIDGE 2

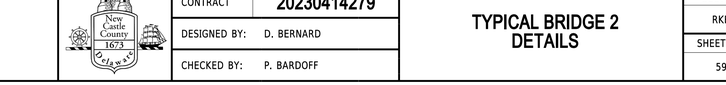
SCALE: ½" = 1'-0"

NOTES:
1. OVERALL STRUCTURE DEPTH VARIES BY MANUFACTURER. CONTRACTOR TO COORDINATE TRAIL AND BACKWALL ELEVATIONS AS NEEDED PRIOR TO CONSTRUCTION. THE BEAM SEAT ELEVATIONS SHOWN ON SHEET 57 ARE MINIMUMS.
2. SEE SHEET 20 FOR BRIDGE LOCATIONS.



TYPICAL ABUTMENT - BRIDGE 2

SCALE: 1" = 1'-0"



JOINT COVER PLATE DETAIL PLAN

SCALE: ¾" = 1'-0"

ABUTMENT DESIGN REACTION TABLE

SCOUR DATA	P (kips)	H (kips)	L (kips)
DEAD	14		
UNIFORM LIVE	12		
WIND		10	0
WINDWARD	0		
LEEWARD	0		
THERMAL			2

'P' - VERTICAL LOAD EACH BASE PLATE (4 PER BRIDGE)
'H' - HORIZONTAL LOAD EACH FOOTING (2 PER BRIDGE)
'L' - LONGITUDINAL LOAD EACH BASE PLATE (4 PER BRIDGE)
ALL LOADS ARE SERVICE LOADS

ADDENDA / REVISIONS

SCALE AS NOTED

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: D. BERNARD
CHECKED BY: P. BARDOFF

TYPICAL BRIDGE 2 DETAILS

ST-06
SECTION
RKK
SHEET NO.
59

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TEST BORING LOG — Boring No. BR-B-01

Page 1 of 1

PROJECT: Little Mill Creek Restoration at Woodland Park

LOCATION: - New Castle County, DE
LATITUDE: 39.742883 **NORTHING:** 634,801.2 **STATION:**
LONGITUDE: -75.619893 **EASTING:** 598,993.5 **OFFSET:** -
Surface EL: 90.5-ft MSL **System:** DE State Plane (ft) **Baseline:**

RKK Comm. No.: 23046.001
Drilling Co.: HCEA
Driller: B. Van Doren
Inspector: RH
Start: 09/06/2023 09:10 AM
Complete: 09/06/2023 11:00 AM

GROUNDWATER DATA (ft)

Date / Time	Water	Cave In
09/06/2023 11:30 AM	3.0	6.5
09/07/2023 08.00 AM	4.0	8.0

Rig: Track-Mounted Rig **Hammer Calibration Date:**
Advancement Method: Hollow Stem Auger (3.25") **Soil Sampler Inner Diameter:** 1.375-in
SPT Hammer Type: Automatic **Weight:** 140-lb **Fall:** 30-in
Rock Coring Method: Wireline NQ Double-Tube **Rock Core Diameter:** 1.875-in
Notes:

SAMPLE NUMBER	SAMPLE ATTEMPT TYPE	RECOVERY (in)	BLOWS/6" (N VALUE)	NMC	LL	PL	DEPTH (ft) / ELEVATION (ft)	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
S-1	SS	12 (67)	3 2 3				0.0 EL 90.2		4-Inches Topsoil Moist, Medium Stiff, Brown, Gray, SILT, And Coarse to Fine Sand, Trace Fine Gravel, Trace Mica (ML) [A-4 (0)]	
S-2	SS	18 (100)	6 7 8	17.0	28	25			Sample S-2: Stiff, Brown, Light Brown, Gray	
S-3	SS	2 (11)	13 11 10				6		Sample S-3: Very Stiff	
S-4	SS	1 (100)	50/1"	19.4			9.5 EL 81.0			Water on Split Spoon Sampler 8.0-ft Auger Refusal 9.5-ft
R-1	RC	3 (25)	(0)				10		Sample S-4: Wet, Hard AMPHIBOLITE: Strong, Black, Medium-Grained, Massive, Slightly Weathered, Moderately to Slightly Fractured	
R-2	RC	18 (100)	(69)				15		Sample R-2: UC Str. 2506-ksf	
R-3	RC	60 (100)	(93)				17.0 EL 73.5		Sample R-3: Sound	Sample R-3: UC Str. 2763-ksf
							20		Bottom of Boring @ 17.0-ft	Backfilled with auger cuttings after 24-hr water reading.
							25			
							30			
							35			
							40			

SAMPLE IDENTIFICATION
- S - SPLIT SPOON
- T - SHELBY TUBE
- R - ROCK CORE
- D - DENISON
- B / G - BULK or GRAB Sample

SOIL CLASSIFICATION
UPPERCASE symbols (i.e. SM): based on laboratory results
Lowercase symbols (i.e. sm) based on visual classification

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-30	MEDIUM DENSE
31-50	DENSE
OVER 50	VERY DENSE

BLOWS/FT	CONSISTENCY
0-2	VERY SOFT
3-4	SOFT
5-8	MEDIUM STIFF
9-15	STIFF
16-30	VERY STIFF
OVER 30	HARD

PROPORTIONS (PERCENT)	
TRACE	1-10
LITTLE	11-20
SOME	21-35
AND	36-50

SOIL STRATIFICATION LINES: Solid = Observed, Dashed = Estimated

Boring No. BR-B-01

TEST BORING LOG — Boring No. BR-B-02

Page 1 of 1

PROJECT: Little Mill Creek Restoration at Woodland Park

LOCATION: - New Castle County, DE
LATITUDE: 39.742761 **NORTHING:** 634,839.7 **STATION:**
LONGITUDE: -75.619977 **EASTING:** 599,018.0 **OFFSET:** -
Surface EL: 90-ft MSL **System:** DE State Plane (ft) **Baseline:**

RKK Comm. No.: 23046.001
Drilling Co.: HCEA
Driller: B. Van Doren
Inspector: RH
Start: 09/05/2023 10:00 AM
Complete: 09/05/2023 11:45 AM

GROUNDWATER DATA (ft)

Date / Time	Water	Cave In
09/05/2023 12.30 PM	4.0	10.0
09/07/2023 08.45 AM	4.5	8.0

Rig: Track-Mounted Rig **Hammer Calibration Date:**
Advancement Method: Hollow Stem Auger (3.25") **Soil Sampler Inner Diameter:** 1.375-in
SPT Hammer Type: Automatic **Weight:** 140-lb **Fall:** 30-in
Rock Coring Method: Wireline NQ Double-Tube **Rock Core Diameter:** 1.875-in
Notes:

SAMPLE NUMBER	SAMPLE ATTEMPT TYPE	RECOVERY (in)	BLOWS/6" (% ROD)	NMC	LL	PL	DEPTH (ft) / ELEVATION (ft)	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
S-1	SS	16 (89)	2 2 2	18.1	24	20	0.0 EL 89.7		3-Inches Topsoil Moist, Very Loose, Brown, Light Brown, Gray, Medium to Fine SAND, And Clay, Trace Mica (SC-SM) [A-4 (0)]	
S-2	SS	18 (100)	1 2 1							
S-3	SS	16 (89)	9 12 11	9.2	NP	NP	5 5.5 EL 84.5		Sample S-3: Medium Dense Moist, Medium Dense, Brown, Gray, Coarse to Fine SAND, Some Fine Gravel, Trace Silt, Trace Mica (SP-SM) [A-1-a]	
S-4	SS	17 (100)	37 38 50/5"				8.5 EL 81.5		COMPLETELY WEATHERED ROCK Sampled As: Moist, Brown, Light Brown, Orange, Medium to Fine SAND, Little Silt, Trace Mica	
R-1	RC	48 (80)	(96)				10 12.0 EL 78.0		Granitic GNEISS: Strong, Black and Gray, Coarse to Medium-Grained, Thinly Foliated, Moderate to Slightly Weathered, Slightly Fractured	Auger Refusal 12.0-ft
							15 16.0 EL 74.0			Sample R-1: UC Str. 2068-ksf
							17.0 EL 73.0		AMPHIBOLITE: Strong to Very Strong, Black, Medium-Grained, Massive, Slightly Weathered, Slightly Fractured to Sound Bottom of Boring @ 17.0-ft	Backfilled with auger cuttings after 48-hr water reading.
							20			
							25			
							30			
							35			
							40			

SAMPLE IDENTIFICATION
- S - SPLIT SPOON
- T - SHELBY TUBE
- R - ROCK CORE
- D - DENISON
- B / G - BULK or GRAB Sample

SOIL CLASSIFICATION
UPPERCASE symbols (i.e. SM): based on laboratory results
Lowercase symbols (i.e. sm) based on visual classification

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-30	MEDIUM DENSE
31-50	DENSE
OVER 50	VERY DENSE

BLOWS/FT	CONSISTENCY
0-2	VERY SOFT
3-4	SOFT
5-8	MEDIUM STIFF
9-15	STIFF
16-30	VERY STIFF
OVER 30	HARD

PROPORTIONS (PERCENT)	
TRACE	1-10
LITTLE	11-20
SOME	21-35
AND	36-50

SOIL STRATIFICATION LINES: Solid = Observed, Dashed = Estimated

Boring No. BR-B-02

NOTES:

1. BORINGS AND SAMPLES CONFORM TO AASHTO T-206, T-225 AND T-306.
2. BORINGS WERE TAKEN IN SEPTEMBER 2023 BY HILLIS CARNES ENGINEERING ASSOCIATES, INC. (HCEA).
3. LABORATORY TESTING FOR SELECTED SOIL SAMPLES FROM BORINGS WAS COMPLETED BY HCEA, INC.
4. THE SUBSURFACE CONDITION INFORMATION SHOWN ON THIS SHEET IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. LOCAL VARIATIONS IN THE CHARACTERISTICS OF THE SUBSURFACE MATERIALS MAY BE ANTICIPATED. LOCAL VARIATIONS WHICH MAY BE ENCOUNTERED INCLUDE BUT ARE NOT LIMITED TO VARIATION IN SOIL CLASSIFICATIONS, THICKNESS AND DEPTH OF SOIL AND ROCK STRATA.

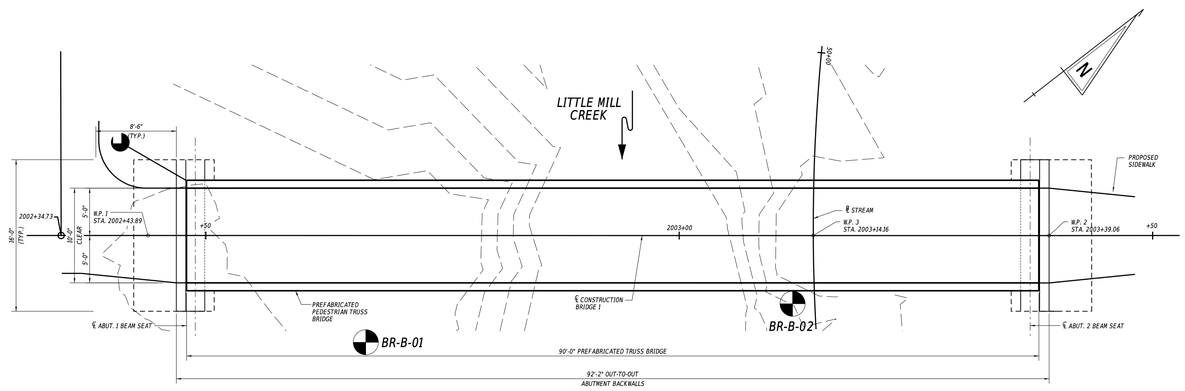
SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE)	GRAVEL AND GRAVELLY SOILS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE)	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS (MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE)	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE)	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND:
- FILL: MAN-MADE DEPOSITS
- CWR: COMPLETELY WEATHERED ROCK
- BEDROCK
- ▽ - GROUNDWATER EL AT THE COMPLETION OF THE BORING
- ▼ - 24-HR GROUNDWATER ELEVATION



BORING LOCATION

PLAN
SCALE: 1" = 8'-0"

ADDENDA / REVISIONS		SCALE AS NOTED	LITTLE MILL CREEK STREAM RESTORATION	CONTRACT 20230414279	BRIDGE 1 BORING AND DRIVE TEST	ST-07
				DESIGNED BY: T. ROBERSON		SECTION RKK
				CHECKED BY: B. SHRESTHA		SHEET NO. 60

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TEST BORING LOG — Boring No. BR-B-03

Page 1 of 1

PROJECT: Little Mill Creek Restoration at Woodland Park

LOCATION: - New Castle County, DE
LATITUDE: 39.742641 **NORTHING:** 634,715.6 **STATION:**
LONGITUDE: -75.618229 **EASTING:** 599,485.1 **OFFSET:** -
Surface EL: 88-ft MSL **System:** DE State Plane (ft) **Baseline:**

RKK Comm. No.: 23046.001
Drilling Co.: HCEA
Driller: B. Van Doren
Inspector: RH
Start: 09/06/2023 12:40 PM
Complete: 09/06/2023 01:00 PM

GROUNDWATER DATA (ft)

Date / Time	Water	Cave In
09/06/2023 01:00 PM	--	--
No Record		

Rig: Track-Mounted Rig **Hammer Calibration Date:**
Advancement Method: Hollow Stem Auger (3.25") **Soil Sampler Inner Diameter:** 1.375-in
SPT Hammer Type: Automatic **Weight:** 140-lb **Fall:** 30-in
Rock Coring Method: N/A **Rock Core Diameter:** N/A
Notes:

SAMPLE NUMBER	TYPE	RECOVERY (in/%)	BLOWS/6" (% RQD)	LAB TEST RESULTS (%) NMC	LL	PL	DEPTH (ft)	ELEVATION (ft)	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
S-1	SS	16 (89)	3 4 4				0.0	EL 87.7		3-Inches Topsoil Moist, Loose, Brown, Coarse to Fine SAND, Little Fine Gravel, Little Silt, Trace Mica (sm) [a-1-b]	
S-2	SS	18 (100)	2 1 1	31.6	34	24	2.5	EL 85.5		Moist, Very Soft, Gray, SILT, Trace Fine Sand, Trace Mica (ML) [A-4 (10)]	
S-3	SS	14 (100)	2 1 1				5.5	EL 82.5		Sample S-3: Soft	
			6/2"				6.2	EL 81.8		Wet, Medium Dense, Dark Gray, Coarse to Fine SAND, Some Silt, Little Fine Gravel (sm) [a-2-4] Bottom of Boring @ 6.2-ft	SPT Refusal 6.2-ft. Offset 3-ft NW. Backfilled on 9-7-2023 with auger cuttings.

SAMPLE IDENTIFICATION: S - SPLIT SPOON; T - SHELBY TUBE; R - ROCK CORE; D - DENISON; B / G - BULK or GRAB Sample

SOIL CLASSIFICATION: UPPERCASE symbols (i.e. SM); based on laboratory results. Lowercase symbols (i.e. sm) based on visual classification

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-30	MEDIUM DENSE
31-50	DENSE
OVER 50	VERY DENSE

BLOWS/FT	CONSISTENCY
0-2	VERY SOFT
3-4	SOFT
5-8	MEDIUM STIFF
9-15	STIFF
16-30	VERY STIFF
OVER 30	HARD

PROPORTIONS (PERCENT)	
TRACE	1-10
LITTLE	11-20
SOME	21-35
AND	36-50

SOIL STRATIFICATION LINES: Solid = Observed, Dashed = Estimated

Boring No. BR-B-03

TEST BORING LOG — Boring No. BR-B-03A

Page 1 of 1

PROJECT: Little Mill Creek Restoration at Woodland Park

LOCATION: - New Castle County, DE
LATITUDE: 39.742516 **NORTHING:** 634,709.5 **STATION:**
LONGITUDE: -75.617976 **EASTING:** 599,486.7 **OFFSET:** -
Surface EL: 88-ft MSL **System:** DE State Plane (ft) **Baseline:**

RKK Comm. No.: 23046.001
Drilling Co.: HCEA
Driller: B. Van Doren
Inspector: RH
Start: 09/06/2023 01:10 PM
Complete: 09/06/2023 02:35 PM

GROUNDWATER DATA (ft)

Date / Time	Water	Cave In
09/06/2023 02:50 PM	8.5	13.5
09/07/2023 10:00 AM	4.0	10.0

Rig: Track-Mounted Rig **Hammer Calibration Date:**
Advancement Method: Hollow Stem Auger (3.25") **Soil Sampler Inner Diameter:** 1.375-in
SPT Hammer Type: Automatic **Weight:** 140-lb **Fall:** 30-in
Rock Coring Method: N/A **Rock Core Diameter:** N/A
Notes:

SAMPLE NUMBER	TYPE	RECOVERY (in/%)	BLOWS/6" (% RQD)	LAB TEST RESULTS (%) NMC	LL	PL	DEPTH (ft)	ELEVATION (ft)	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
							0.0				
							5.0	EL 83.0			
S-1	SS	14 (78)	3 11 10							Moist, Very Stiff, Dark Gray, CLAY, Some Medium to Fine Sand, Trace Mica (CL) [A-6 (9)]	Wood Fragments observed from 6.1-ft to 6.5-ft.
S-2	SS	4 (22)	4 5 5	28.2	34	20				Sample S-2: Stiff, No Sand Observed	Water on Split Spoon Sampler 9.0-ft.
S-3	SS	16 (89)	4 5 8				13.5	EL 74.5		Wet, Medium Dense, Orange, Gray, White, Brown, Medium to Fine SAND, Some Silt, Trace Mica, Residual (SM) [A-2-5 (0)]	
S-4	SS	18 (100)	5 6 7	24.9	44	NP					
S-5	SS	17 (94)	9 23 39				23.5	EL 64.5		COMPLETELY WEATHERED ROCK Sampled As: Wet, Orange, Gray, White, Brown, Medium to Fine SAND, Some Silt, Trace Mica	
S-6	SS	16 (100)	14 23 50/4"								
S-7	SS	4 (100)	50/4"							Sample S-7: Little Fine Gravel	
S-8	SS	0 (0)	50/0"				35.5	EL 52.5		Bottom of Boring @ 35.5-ft	Auger Refusal 35.5-ft. Backfilled with auger cuttings after 24-hr water reading.

SAMPLE IDENTIFICATION: S - SPLIT SPOON; T - SHELBY TUBE; R - ROCK CORE; D - DENISON; B / G - BULK or GRAB Sample

SOIL CLASSIFICATION: UPPERCASE symbols (i.e. SM); based on laboratory results. Lowercase symbols (i.e. sm) based on visual classification

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-30	MEDIUM DENSE
31-50	DENSE
OVER 50	VERY DENSE

BLOWS/FT	CONSISTENCY
0-2	VERY SOFT
3-4	SOFT
5-8	MEDIUM STIFF
9-15	STIFF
16-30	VERY STIFF
OVER 30	HARD

PROPORTIONS (PERCENT)	
TRACE	1-10
LITTLE	11-20
SOME	21-35
AND	36-50

SOIL STRATIFICATION LINES: Solid = Observed, Dashed = Estimated

Boring No. BR-B-03A

TEST BORING LOG — Boring No. BR-B-04

Page 1 of 1

PROJECT: Little Mill Creek Restoration at Woodland Park

LOCATION: - New Castle County, DE
LATITUDE: 39.742519 **NORTHING:** 634,758.1 **STATION:**
LONGITUDE: -75.618202 **EASTING:** 599,473.5 **OFFSET:** -
Surface EL: 88-ft MSL **System:** DE State Plane (ft) **Baseline:**

RKK Comm. No.: 23046.001
Drilling Co.: HCEA
Driller: B. Van Doren
Inspector: RH
Start: 09/05/2023 01:00 PM
Complete: 09/05/2023 03:05 PM

GROUNDWATER DATA (ft)

Date / Time	Water	Cave In
09/05/2023 03:10 PM	10.0	17.0
09/07/2023 11:20 AM	4.5	7.5

Rig: Track-Mounted Rig **Hammer Calibration Date:**
Advancement Method: Hollow Stem Auger (3.25") **Soil Sampler Inner Diameter:** 1.375-in
SPT Hammer Type: Automatic **Weight:** 140-lb **Fall:** 30-in
Rock Coring Method: N/A **Rock Core Diameter:** N/A
Notes:

SAMPLE NUMBER	TYPE	RECOVERY (in/%)	BLOWS/6" (% RQD)	LAB TEST RESULTS (%) NMC	LL	PL	DEPTH (ft)	ELEVATION (ft)	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
							0.2	EL 87.8		2-Inches Topsoil	
S-1	SS	15 (83)	2 2 3							Moist, Medium Stiff, Brown, CLAY, Little Medium to Fine Sand (CL) [A-4 (9)]	
S-2	SS	17 (94)	2 2 2	29.0	33	23				Sample S-2: Soft	
S-3	SS	13 (72)	1 1 1	24.0			5.8	EL 82.2		Sample S-3: Very Soft	
S-4	SS	12 (67)	8 6 13	17.9	NP	NP	9.1	EL 78.9		Wet, Very Loose, Brown, Gray, White, Coarse to Fine SAND, Little Fine Subrounded Gravel, Little Silt (sm) [a-2-4] Sample S-4: Medium Dense	
							13.5	EL 74.5		Moist, Medium Dense, Brown, Orange, Gray, White, Medium to Fine SAND, Some Silt, Trace Mica, Residual (SM) [A-2-4 (0)]	
S-5	SS	12 (100)	29 50	9.0						COMPLETELY WEATHERED ROCK Sampled As: Moist, Brown, Orange, Gray, White, Medium to Fine SAND, Some Silt, Trace Mica	
S-6	SS	18 (100)	29 47 50/4"								
S-7	SS	15 (83)	14 28 45	12.5	37	24	23.5	EL 64.5		COMPLETELY WEATHERED ROCK Sampled As: Moist, Red, Brown, Orange, Coarse to Fine SAND, Some Fine Angular Gravel, Little Clay, Trace Mica	
S-8	SS	16 (89)	35 36 37								
S-9	SS	5 (100)	50/5"	16.5	32	21	33.5	EL 54.5		COMPLETELY WEATHERED ROCK Sampled As: Moist, Red, Brown, Orange, Coarse to Fine SAND, Little Fine Subangular Gravel, Some Clay	
S-10	SS	1 (100)	50/1"				38.0	EL 50.0		Bottom of Boring @ 38.0-ft	Auger Refusal 37.9-ft Backfilled with auger cuttings after 48-hr water reading.

SAMPLE IDENTIFICATION: S - SPLIT SPOON; T - SHELBY TUBE; R - ROCK CORE; D - DENISON; B / G - BULK or GRAB Sample

SOIL CLASSIFICATION: UPPERCASE symbols (i.e. SM); based on laboratory results. Lowercase symbols (i.e. sm) based on visual classification

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-30	MEDIUM DENSE
31-50	DENSE
OVER 50	VERY DENSE

BLOWS/FT	CONSISTENCY
0-2	VERY SOFT
3-4	SOFT
5-8	MEDIUM STIFF
9-15	STIFF
16-30	VERY STIFF
OVER 30	HARD

PROPORTIONS (PERCENT)	
TRACE	1-10
LITTLE	11-20
SOME	21-35
AND	36-50

SOIL STRATIFICATION LINES: Solid = Observed, Dashed = Estimated

Boring No. BR-B-04

NOTES:

1. BORINGS AND SAMPLES CONFORM TO AASHTO T-206, T-225 AND T-306.
2. BORINGS WERE TAKEN IN SEPTEMBER 2023 BY HILLIS CARNES ENGINEERING ASSOCIATES, INC. (HCEA).
3. LABORATORY TESTING FOR SELECTED SOIL SAMPLES FROM BORINGS WAS COMPLETED BY HCEA, INC.
4. THE SUBSURFACE CONDITION INFORMATION SHOWN ON THIS SHEET IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. LOCAL VARIATIONS IN THE CHARACTERISTICS OF THE SUBSURFACE MATERIALS MAY BE ANTICIPATED. LOCAL VARIATIONS WHICH MAY BE ENCOUNTERED INCLUDE BUT ARE NOT LIMITED TO VARIATION IN SOIL CLASSIFICATIONS, THICKNESS AND DEPTH OF SOIL AND ROCK STRATA.

SOIL CLASSIFICATION CHART

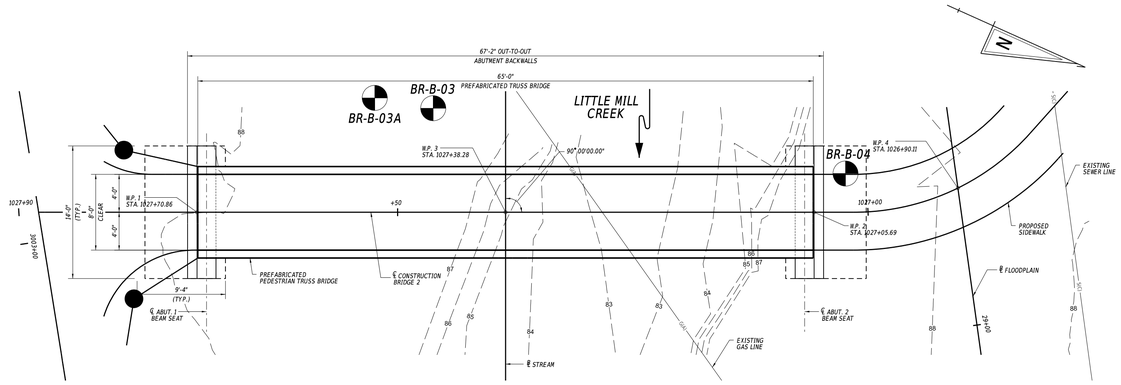
MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND:

- FILL: MAN-MADE DEPOSITS
- CWR: COMPLETELY WEATHERED ROCK
- BEDROCK
- ▽ - GROUNDWATER EL AT THE COMPLETION OF THE BORING
- ▼ - 24-HR GROUNDWATER ELEVATION



PLAN
SCALE: 1" = 8'-0"

BORING LOCATION

ADDENDA / REVISIONS		

SCALE AS NOTED

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	T. ROBERSON
CHECKED BY:	B. SHRESTHA

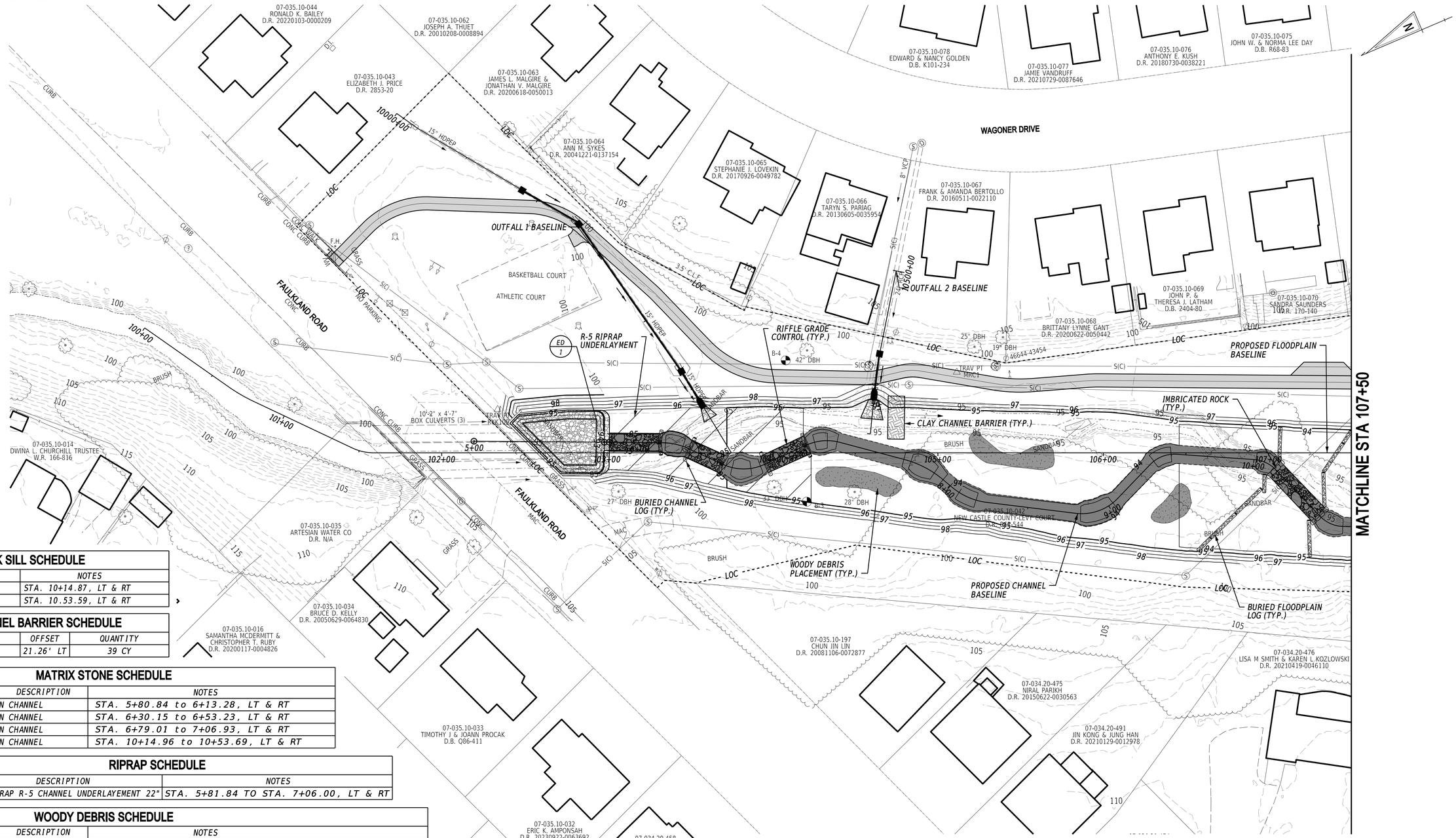
BRIDGE 2 BORING AND DRIVE TEST

ST-08
SECTION
RKK
SHEET NO.
61

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NOTES:

1. SEE STREAM RESTORATION FEATURES LEGEND ON SHEET 4 FOR ALL PROPOSED FEATURES.



ROCK SILL SCHEDULE

NO.	QUANTITY	NOTES
RS-1	4 TN	STA. 10+14.87, LT & RT
RS-2	4 TN	STA. 10.53.59, LT & RT

CLAY CHANNEL BARRIER SCHEDULE

NO.	STATION	OFFSET	QUANTITY
CB-1	104+74.78	21.26' LT	39 CY

MATRIX STONE SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
MS-1	7 TN	MAIN CHANNEL	STA. 5+80.84 to 6+13.28, LT & RT
MS-2	4 TN	MAIN CHANNEL	STA. 6+30.15 to 6+53.23, LT & RT
MS-3	6 TN	MAIN CHANNEL	STA. 6+79.01 to 7+06.93, LT & RT
MS-4	8 TN	MAIN CHANNEL	STA. 10+14.96 to 10+53.69, LT & RT

RIPRAP SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
RR-1	376 CY	RIPRAP R-5 CHANNEL UNDERLAYEMENT 22"	STA. 5+81.84 TO STA. 7+06.00, LT & RT

WOODY DEBRIS SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
WD-1	62 SY	MAIN CHANNEL	STA. 104+26.14, 14.65' RT TO STA. 104+76.00, 23.82' RT
WD-2	64 SY	MAIN CHANNEL	STA. 105+20.66, 11.65' LT TO STA. 105+70.30, 2.89' RT
WD-3	39 SY	MAIN CHANNEL	STA. 106+29.02, 39.29' RT TO STA. 106+49.86, 20.07' RT

V-SHAPED CHANNEL LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
VL-1	15 LF	MAIN CHANNEL	STA. 6+12.33, LT & RT
VL-2	15 LF	MAIN CHANNEL	STA. 6+52.32, LT & RT
VL-3	15 LF	MAIN CHANNEL	STA. 7+06.00, LT & RT

STRAIGHT CHANNEL LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
SL-1	15 LF	MAIN CHANNEL	STA. 6+31.18, LT & RT
SL-2	15 LF	MAIN CHANNEL	STA. 6+80.06, LT & RT

BURIED FLOODPLAIN LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
BL-1	54 LF	MAIN CHANNEL	STA. 106+76.35, 40.50' RT
BL-2	11 LF	MAIN CHANNEL	STA. 106+97.40, 18.53' RT
BL-3	21 LF	MAIN CHANNEL	STA. 107+06.77, 5.42' LT
BL-4	22 LF	MAIN CHANNEL	STA. 107+24.64, 51.73' RT
BL-5	21 LF	MAIN CHANNEL	STA. 107+33.43, 22.29' RT
BL-6	30 LF	MAIN CHANNEL	STA. 107+41.57, 0.88' LT

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK
STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

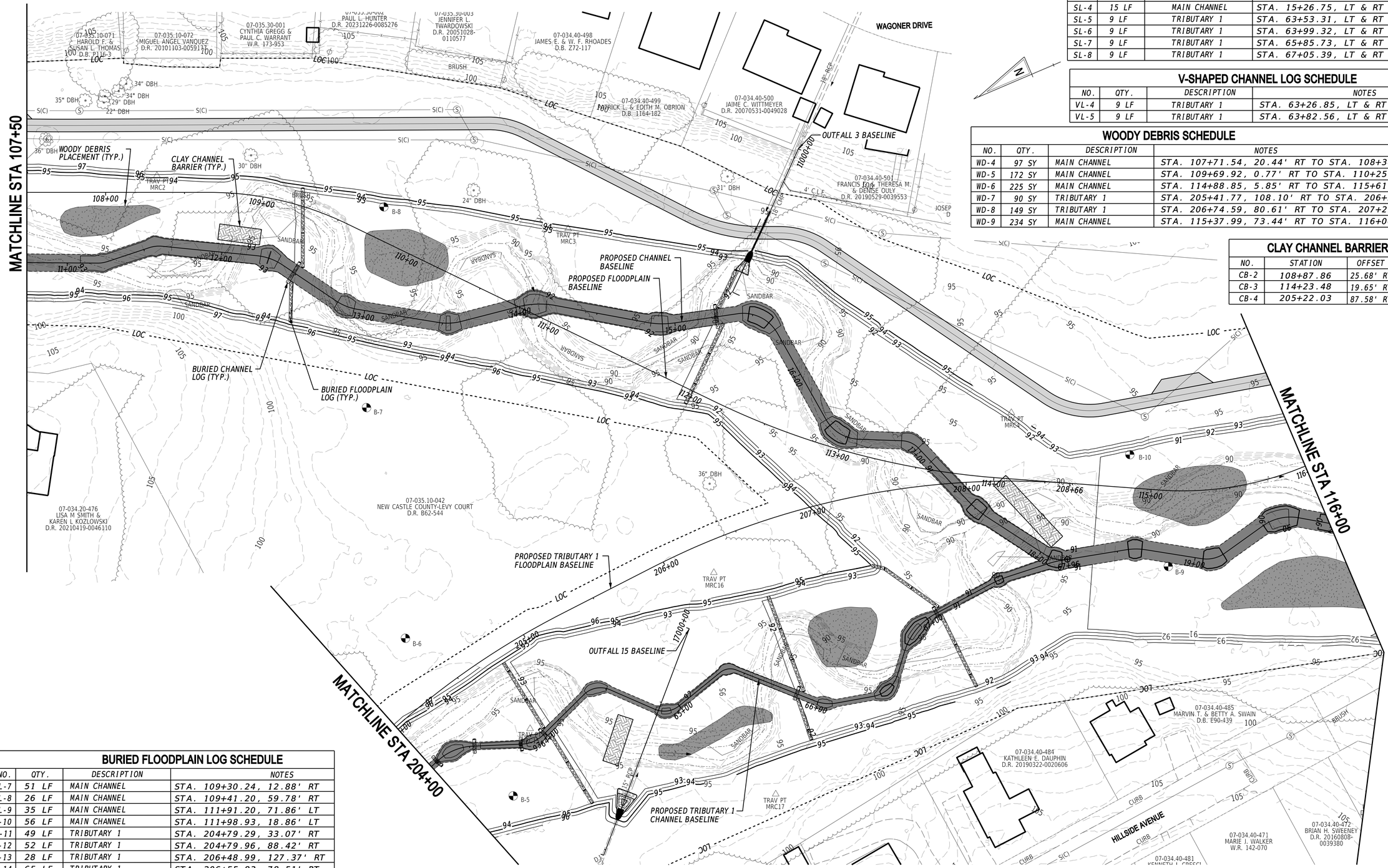
STREAM RESTORATION PLAN

SR-01	
SECTION	
RKK	
SHEET NO.	
62	

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NOTES:

1. SEE STREAM RESTORATION FEATURES LEGEND ON SHEET 4 FOR ALL PROPOSED FEATURES.



STRAIGHT CHANNEL LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
SL-3	15 LF	MAIN CHANNEL	STA. 12+48.42, LT & RT
SL-4	15 LF	MAIN CHANNEL	STA. 15+26.75, LT & RT
SL-5	9 LF	TRIBUTARY 1	STA. 63+53.31, LT & RT
SL-6	9 LF	TRIBUTARY 1	STA. 63+99.32, LT & RT
SL-7	9 LF	TRIBUTARY 1	STA. 65+85.73, LT & RT
SL-8	9 LF	TRIBUTARY 1	STA. 67+05.39, LT & RT

V-SHAPED CHANNEL LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
VL-4	9 LF	TRIBUTARY 1	STA. 63+26.85, LT & RT
VL-5	9 LF	TRIBUTARY 1	STA. 63+82.56, LT & RT

WOODY DEBRIS SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
WD-4	97 SY	MAIN CHANNEL	STA. 107+71.54, 20.44' RT TO STA. 108+34.60, 11.90' RT
WD-5	172 SY	MAIN CHANNEL	STA. 109+69.92, 0.77' RT TO STA. 110+25.72, 0.99' RT
WD-6	225 SY	MAIN CHANNEL	STA. 114+88.85, 5.85' RT TO STA. 115+61.22, 1.38' LT
WD-7	90 SY	TRIBUTARY 1	STA. 205+41.77, 108.10' RT TO STA. 206+25.46, 117.16' RT
WD-8	149 SY	TRIBUTARY 1	STA. 206+74.59, 80.61' RT TO STA. 207+27.00, 76.02' RT
WD-9	234 SY	MAIN CHANNEL	STA. 115+37.99, 73.44' RT TO STA. 116+00.00, 82.19' RT

CLAY CHANNEL BARRIER SCHEDULE

NO.	STATION	OFFSET	QUANTITY
CB-2	108+87.86	25.68' RT	40 CY
CB-3	114+23.48	19.65' RT	79 CY
CB-4	205+22.03	87.58' RT	46 CY

BURIED FLOODPLAIN LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
BL-7	51 LF	MAIN CHANNEL	STA. 109+30.24, 12.88' RT
BL-8	26 LF	MAIN CHANNEL	STA. 109+41.20, 59.78' RT
BL-9	35 LF	MAIN CHANNEL	STA. 111+91.20, 71.86' LT
BL-10	56 LF	MAIN CHANNEL	STA. 111+98.93, 18.86' LT
BL-11	49 LF	TRIBUTARY 1	STA. 204+79.29, 33.07' RT
BL-12	52 LF	TRIBUTARY 1	STA. 204+79.96, 88.42' RT
BL-13	28 LF	TRIBUTARY 1	STA. 206+48.99, 127.37' RT
BL-14	65 LF	TRIBUTARY 1	STA. 206+55.83, 78.51' RT
BL-15	51 LF	TRIBUTARY 1	STA. 207+52.58, 60.28' RT
BL-16	51 LF	TRIBUTARY 1	STA. 207+86.43, 106.31' RT

ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: N. RILEY
CHECKED BY: T. CUTILLO

STREAM RESTORATION PLAN

SR-02
SECTION
RKK
SHEET NO.
63

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NOTES:

1. SEE STREAM RESTORATION FEATURES LEGEND ON SHEET 4 FOR ALL PROPOSED FEATURES.

V-SHAPED CHANNEL LOG SCHEDULE

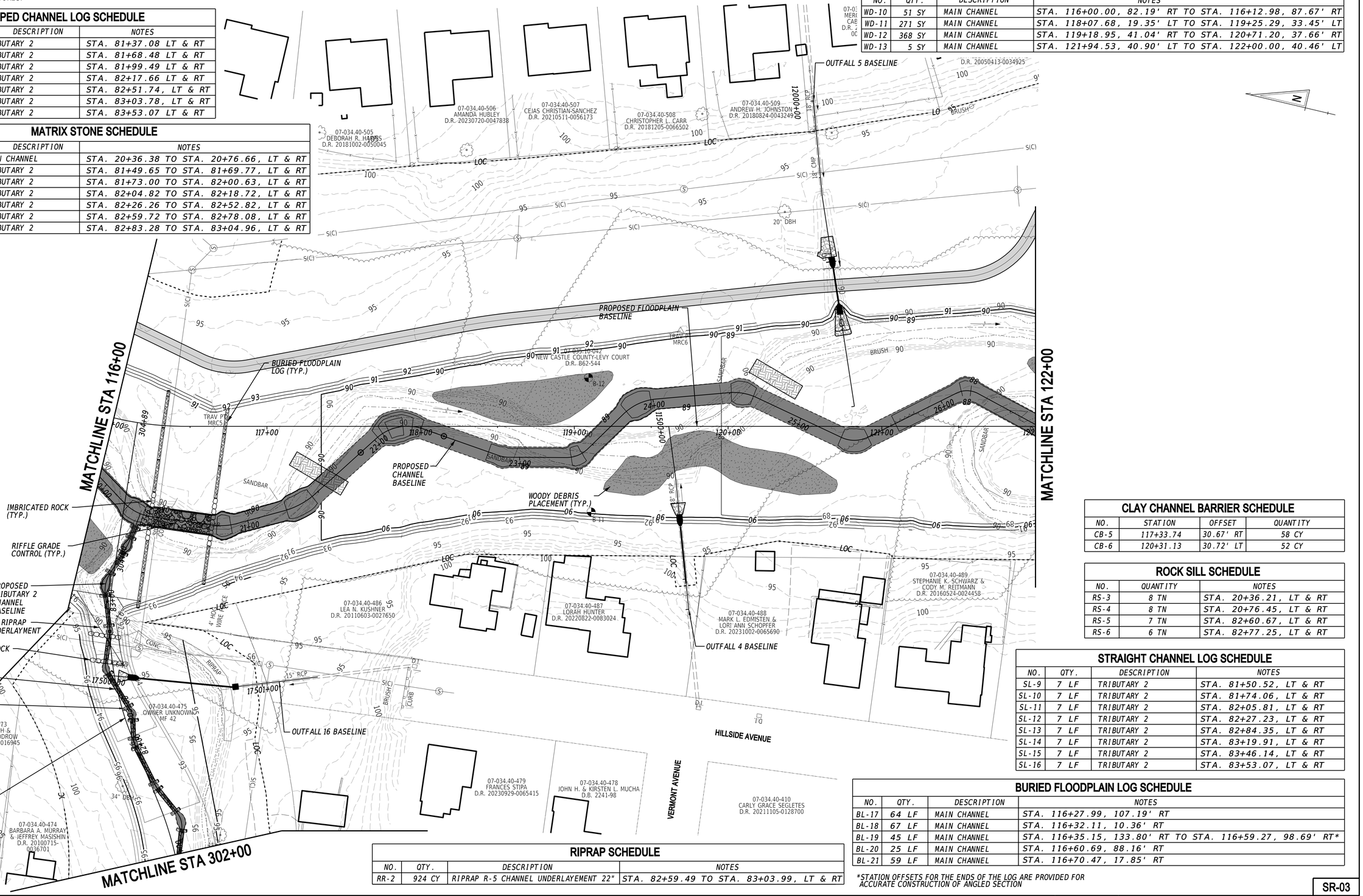
NO.	QTY.	DESCRIPTION	NOTES
VL-6	7 LF	TRIBUTARY 2	STA. 81+37.08 LT & RT
VL-7	7 LF	TRIBUTARY 2	STA. 81+68.48 LT & RT
VL-8	7 LF	TRIBUTARY 2	STA. 81+99.49 LT & RT
VL-9	7 LF	TRIBUTARY 2	STA. 82+17.66 LT & RT
VL-10	7 LF	TRIBUTARY 2	STA. 82+51.74, LT & RT
VL-11	7 LF	TRIBUTARY 2	STA. 83+03.78, LT & RT
VL-12	7 LF	TRIBUTARY 2	STA. 83+53.07 LT & RT

MATRIX STONE SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
MS-5	10 TN	MAIN CHANNEL	STA. 20+36.38 TO STA. 20+76.66, LT & RT
MS-6	1 TN	TRIBUTARY 2	STA. 81+49.65 TO STA. 81+69.77, LT & RT
MS-7	1 TN	TRIBUTARY 2	STA. 81+73.00 TO STA. 82+00.63, LT & RT
MS-8	1 TN	TRIBUTARY 2	STA. 82+04.82 TO STA. 82+18.72, LT & RT
MS-9	1 TN	TRIBUTARY 2	STA. 82+26.26 TO STA. 82+52.82, LT & RT
MS-10	1 TN	TRIBUTARY 2	STA. 82+59.72 TO STA. 82+78.08, LT & RT
MS-11	1 TN	TRIBUTARY 2	STA. 82+83.28 TO STA. 83+04.96, LT & RT

WOODY DEBRIS SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
WD-10	51 SY	MAIN CHANNEL	STA. 116+00.00, 82.19' RT TO STA. 116+12.98, 87.67' RT
WD-11	271 SY	MAIN CHANNEL	STA. 118+07.68, 19.35' LT TO STA. 119+25.29, 33.45' LT
WD-12	368 SY	MAIN CHANNEL	STA. 119+18.95, 41.04' RT TO STA. 120+71.20, 37.66' RT
WD-13	5 SY	MAIN CHANNEL	STA. 121+94.53, 40.90' LT TO STA. 122+00.00, 40.46' LT



CLAY CHANNEL BARRIER SCHEDULE

NO.	STATION	OFFSET	QUANTITY
CB-5	117+33.74	30.67' RT	58 CY
CB-6	120+31.13	30.72' LT	52 CY

ROCK SILL SCHEDULE

NO.	QUANTITY	NOTES
RS-3	8 TN	STA. 20+36.21, LT & RT
RS-4	8 TN	STA. 20+76.45, LT & RT
RS-5	7 TN	STA. 82+60.67, LT & RT
RS-6	6 TN	STA. 82+77.25, LT & RT

STRAIGHT CHANNEL LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
SL-9	7 LF	TRIBUTARY 2	STA. 81+50.52, LT & RT
SL-10	7 LF	TRIBUTARY 2	STA. 81+74.06, LT & RT
SL-11	7 LF	TRIBUTARY 2	STA. 82+05.81, LT & RT
SL-12	7 LF	TRIBUTARY 2	STA. 82+27.23, LT & RT
SL-13	7 LF	TRIBUTARY 2	STA. 82+84.35, LT & RT
SL-14	7 LF	TRIBUTARY 2	STA. 83+19.91, LT & RT
SL-15	7 LF	TRIBUTARY 2	STA. 83+46.14, LT & RT
SL-16	7 LF	TRIBUTARY 2	STA. 83+53.07, LT & RT

BURIED FLOODPLAIN LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
BL-17	64 LF	MAIN CHANNEL	STA. 116+27.99, 107.19' RT
BL-18	67 LF	MAIN CHANNEL	STA. 116+32.11, 10.36' RT
BL-19	45 LF	MAIN CHANNEL	STA. 116+35.15, 133.80' RT TO STA. 116+59.27, 98.69' RT*
BL-20	25 LF	MAIN CHANNEL	STA. 116+60.69, 88.16' RT
BL-21	59 LF	MAIN CHANNEL	STA. 116+70.47, 17.85' RT

*STATION OFFSETS FOR THE ENDS OF THE LOG ARE PROVIDED FOR ACCURATE CONSTRUCTION OF ANGLED SECTION

RIPRAP SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
RR-2	924 CY	RIPRAP R-5 CHANNEL UNDERLAYEMENT 22"	STA. 82+59.49 TO STA. 83+03.99, LT & RT

ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: N. RILEY
CHECKED BY: T. CUTILLO

STREAM RESTORATION PLAN

SR-03
SECTION RKK
SHEET NO. 64

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BURIED FLOODPLAIN LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
BL-22	36 LF	MAIN CHANNEL	STA. 124+30.07, 64.50' RT TO STA. 124+58.01, 41.60' RT*
BL-23	21 LF	MAIN CHANNEL	STA. 124+59.06, 30.84' RT
BL-24	12 LF	MAIN CHANNEL	STA. 124+77.44, 0.34' RT
BL-25	17 LF	MAIN CHANNEL	STA. 124+86.60, 61.49' RT
BL-26	21 LF	MAIN CHANNEL	STA. 125+05.01, 27.74' RT
BL-27	25 LF	MAIN CHANNEL	STA. 125+06.28, 16.96' RT TO STA. 125+25.20, 0.67' RT*
BL-28	51 LF	MAIN CHANNEL	STA. 128+19.78, 63.80' RT
BL-29	20 LF	MAIN CHANNEL	STA. 128+46.70, 22.42' RT
BL-30	18 LF	MAIN CHANNEL	STA. 129+00.11, 70.01' RT
BL-31	11 LF	MAIN CHANNEL	STA. 129+05.99, 36.28' RT
BL-32	15 LF	MAIN CHANNEL	STA. 129+06.12, 30.24' RT TO STA. 129+19.05, 22.45' RT*

*STATION OFFSETS FOR THE ENDS OF THE LOG ARE PROVIDED FOR ACCURATE CONSTRUCTION OF ANGLED SECTION

MATRIX STONE SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
MS-12	19 TN	MAIN CHANNEL	STA. 28+10.09 TO STA. 28+82.45, LT & RT
MS-13	10 TN	MAIN CHANNEL	STA. 29+62.30 TO STA. 30+04.30, LT & RT
MS-14	16 TN	MAIN CHANNEL	STA. 34+31.53 TO STA. 34+90.24, LT & RT

CLAY CHANNEL BARRIER SCHEDULE

NO.	STATION	OFFSET	QUANTITY
CB-7	126+04.52	32.33' RT	44 CY

ROCK SILL SCHEDULE

NO.	QUANTITY	NOTES
RS-7	6 TN	STA. 28+10.16, LT & RT
RS-8	6 TN	STA. 28+82.45, LT & RT
RS-9	6 TN	STA. 29+62.71, LT & RT
RS-10	6 TN	STA. 30+04.51, LT & RT
RS-11	6 TN	STA. 34+31.48, LT & RT
RS-12	6 TN	STA. 34+90.22, LT & RT

RIPRAP SCHEDULE

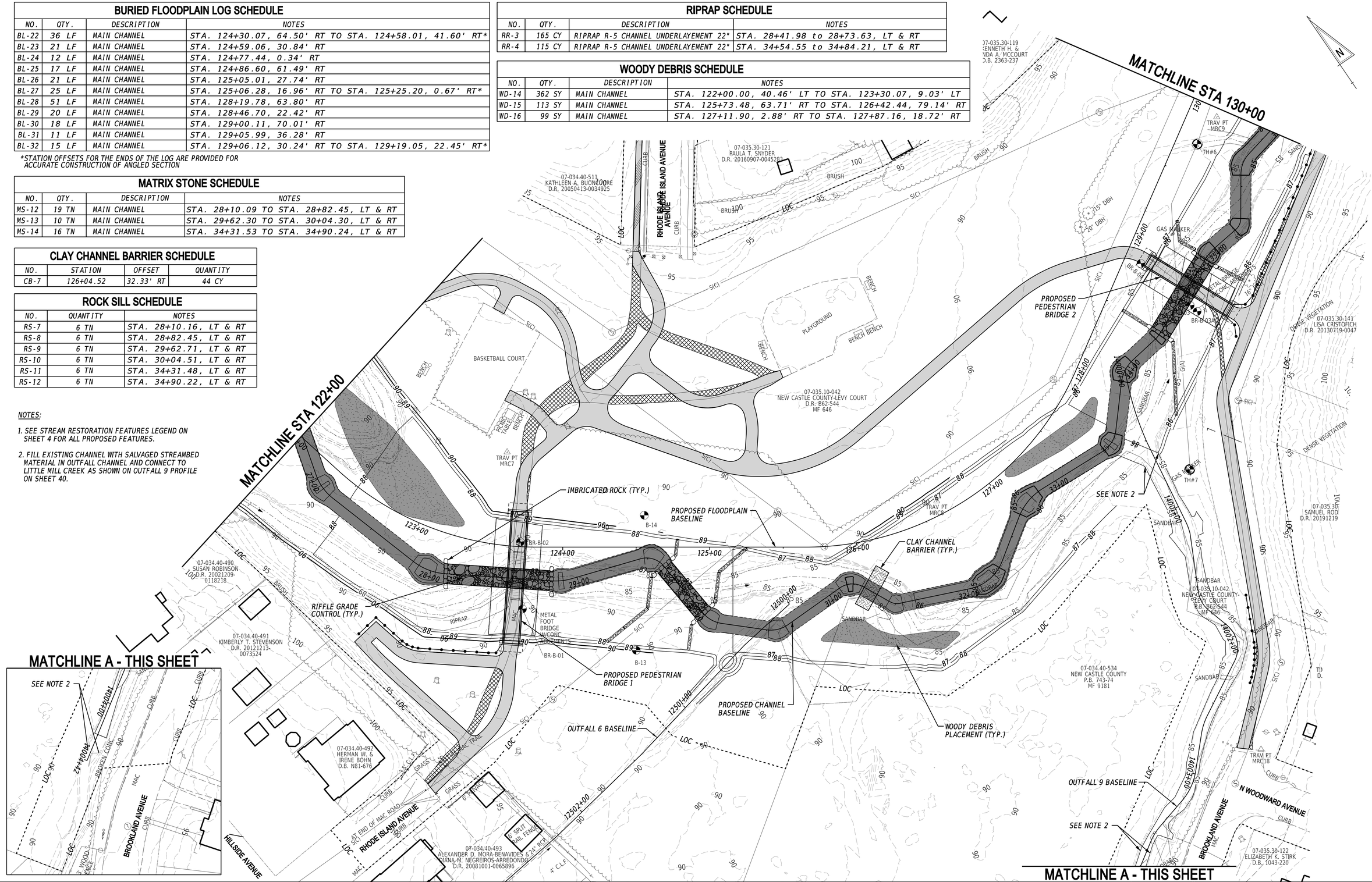
NO.	QTY.	DESCRIPTION	NOTES
RR-3	165 CY	RIPRAP R-5 CHANNEL UNDERLAYEMENT 22"	STA. 28+41.98 to 28+73.63, LT & RT
RR-4	115 CY	RIPRAP R-5 CHANNEL UNDERLAYEMENT 22"	STA. 34+54.55 to 34+84.21, LT & RT

WOODY DEBRIS SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
WD-14	362 SY	MAIN CHANNEL	STA. 122+00.00, 40.46' LT TO STA. 123+30.07, 9.03' LT
WD-15	113 SY	MAIN CHANNEL	STA. 125+73.48, 63.71' RT TO STA. 126+42.44, 79.14' RT
WD-16	99 SY	MAIN CHANNEL	STA. 127+11.90, 2.88' RT TO STA. 127+87.16, 18.72' RT

NOTES:

1. SEE STREAM RESTORATION FEATURES LEGEND ON SHEET 4 FOR ALL PROPOSED FEATURES.
2. FILL EXISTING CHANNEL WITH SALVAGED STREAMBED MATERIAL IN OUTFALL CHANNEL AND CONNECT TO LITTLE MILL CREEK AS SHOWN ON OUTFALL 9 PROFILE ON SHEET 40.



ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

STREAM RESTORATION PLAN

SR-04
SECTION
RKK
SHEET NO.
65

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NOTES:

1. SEE STREAM RESTORATION FEATURES LEGEND ON SHEET 4 FOR ALL PROPOSED FEATURES.



ROCK SILL SCHEDULE

NO.	QUANTITY	NOTES
RS-13	6 TN	STA. 36+61.61, LT & RT
RS-14	6 TN	STA. 36+85.32, LT & RT
RS-15	4 TN	STA. 38+26.09, LT & RT
RS-16	3 TN	STA. 38+17.88, 11.58' LT TO STA. 38+25.84, 6.70' LT*
RS-17	3 TN	STA. 38+26.06, 7.15' RT TO STA. 38+30.07, 13.19' RT*
RS-18	8 TN	STA. 39+05.51, LT & RT
RS-19	8 TN	STA. 41+98.66, LT & RT
RS-20	8 TN	STA. 42+45.72, LT & RT

**STATION OFFSETS FOR THE ENDS OF THE ROCK SILL ARE PROVIDED FOR ACCURATE CONSTRUCTION OF ANGLED SECTION*

BURIED FLOODPLAIN LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
BL-33	12 LF	MAIN CHANNEL	STA. 130+63.42, 72.97' RT
BL-34	4 LF	MAIN CHANNEL	STA. 130+67.81, 44.41' RT
BL-35	5 LF	MAIN CHANNEL	STA. 130+86.54, 74.91' RT
BL-36	11 LF	MAIN CHANNEL	STA. 130+90.75, 46.63' RT
BL-37	42 LF	MAIN CHANNEL	STA. 131+87.22, 30.45' RT
BL-38	31 LF	MAIN CHANNEL	STA. 132+50.24, 35.20' RT
BL-39	21 LF	MAIN CHANNEL	STA. 132+43.14, 48.74' LT
BL-40	29 LF	MAIN CHANNEL	STA. 132+89.06, 24.35' LT
BL-41	54 LF	MAIN CHANNEL	STA. 134+79.19, 0.84' LT

CLAY CHANNEL BARRIER SCHEDULE

NO.	STATION	OFFSET	QUANTITY
CB-8	130+39.04	67.69' RT	56 CY

MATRIX STONE SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
MS-15	6 TN	MAIN CHANNEL	STA. 36+61.55 TO STA. 36+85.25, LT & RT
MS-16	19 TN	MAIN CHANNEL	STA. 38+25.95 TO STA. 39+05.17, LT & RT
MS-17	11 TN	MAIN CHANNEL	STA. 41+99.01 TO STA. 42+46.01, LT & RT

WOODY DEBRIS SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
WD-17	73 SY	MAIN CHANNEL	STA. 134+07.11, 64.78' LT TO STA. 134+57.37, 67.31' LT

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: N. RILEY
CHECKED BY: T. CUTILLO

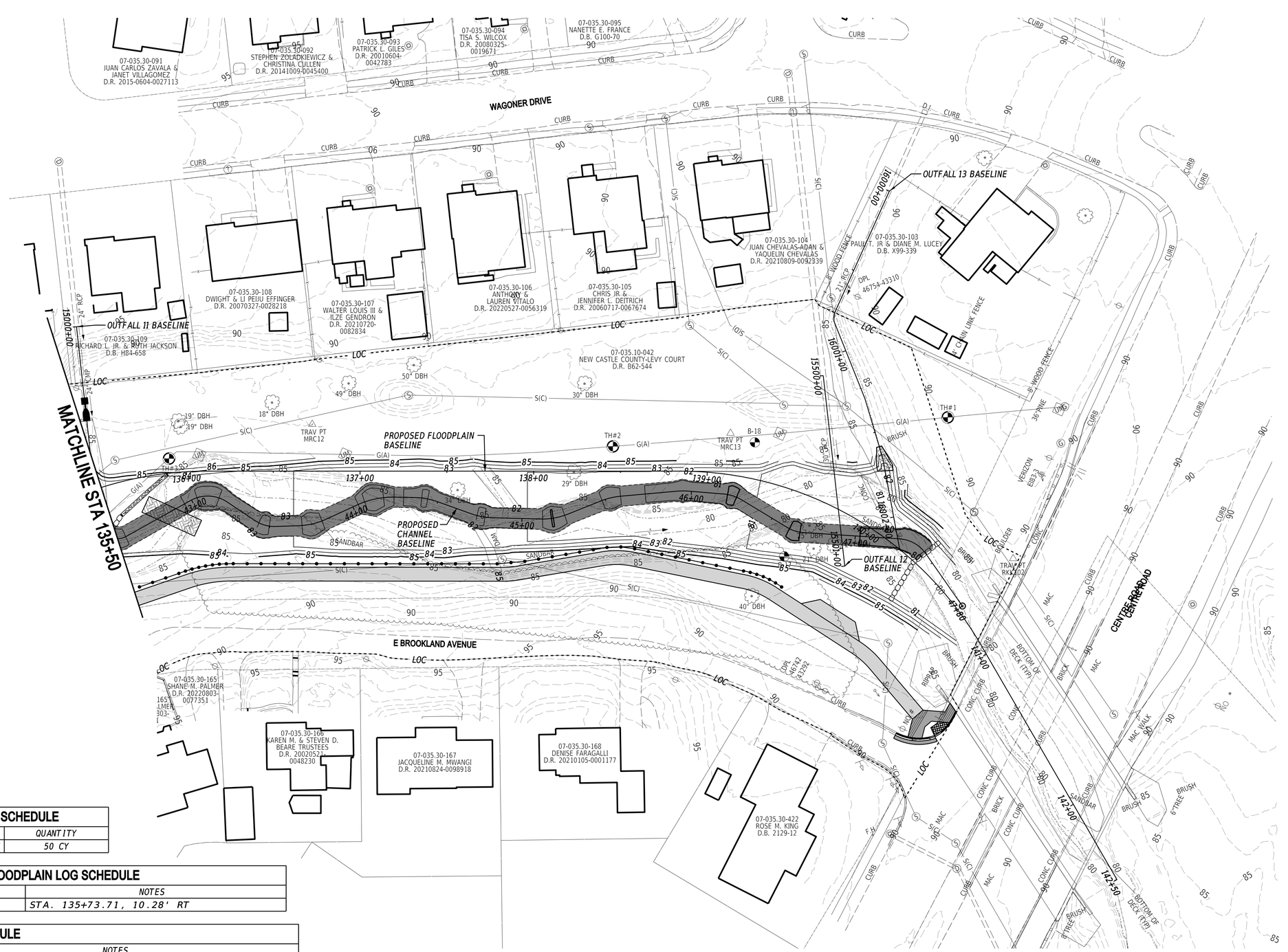
STREAM RESTORATION PLAN

SR-05
SECTION RKK
SHEET NO. 66

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NOTES:

1. SEE STREAM RESTORATION FEATURES LEGEND ON SHEET 4 FOR ALL PROPOSED FEATURES.



CLAY CHANNEL BARRIER SCHEDULE

NO.	STATION	OFFSET	QUANTITY
CB-9	135+88.66	24.88' RT	50 CY

BURIED FLOODPLAIN LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
BL-42	36 LF	MAIN CHANNEL	STA. 135+73.71, 10.28' RT

ROCK SILL SCHEDULE

NO.	QUANTITY	NOTES
RS-21	6 TN	STA. 47+43.16, LT & RT
RS-22	7 TN	STA. 47+44.10, 10.08' RT TO STA. 47+54.04, 32.17' RT*

**STATION OFFSETS FOR THE ENDS OF THE ROCK SILL ARE PROVIDED FOR ACCURATE CONSTRUCTION OF ANGLED SECTION*

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

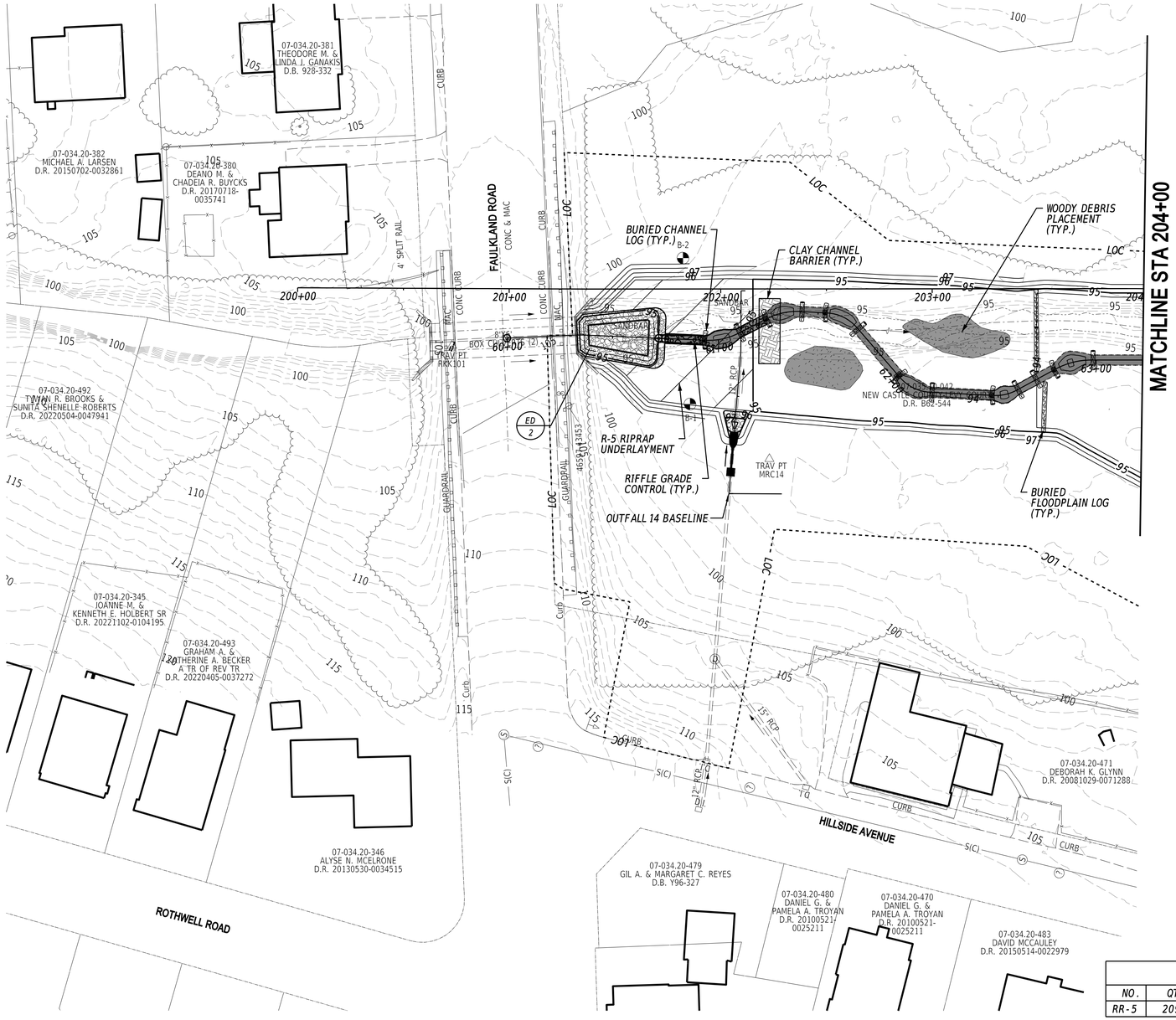
New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

STREAM RESTORATION PLAN

SR-06	
SECTION	
RKK	
SHEET NO.	
67	

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CLAY CHANNEL BARRIER SCHEDULE

NO.	STATION	OFFSET	QUANTITY
CB-10	202+23.07	19.97' RT	46 CY

V-SHAPED CHANNEL LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
VL-13	9 LF	TRIBUTARY 1	STA. 60+93.50, LT & RT
VL-14	9 LF	TRIBUTARY 1	STA. 61+24.75, LT & RT
VL-15	9 LF	TRIBUTARY 1	STA. 61+53.25, LT & RT
VL-16	9 LF	TRIBUTARY 1	STA. 62+00.65, LT & RT
VL-17	9 LF	TRIBUTARY 1	STA. 62+47.13, LT & RT
VL-18	9 LF	TRIBUTARY 1	STA. 62+79.29, LT & RT

STRAIGHT CHANNEL LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
SL-17	9 LF	TRIBUTARY 1	STA. 61+10.91, LT & RT
SL-18	9 LF	TRIBUTARY 1	STA. 61+42.41, LT & RT
SL-19	9 LF	TRIBUTARY 1	STA. 61+71.29, LT & RT
SL-20	9 LF	TRIBUTARY 1	STA. 62+18.78, LT & RT
SL-21	9 LF	TRIBUTARY 1	STA. 62+60.00, LT & RT
SL-22	9 LF	TRIBUTARY 1	STA. 62+69.89, LT & RT
SL-23	9 LF	TRIBUTARY 1	STA. 62+98.64, LT & RT

BURIED FLOODPLAIN LOG SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
BL-43	39 LF	TRIBUTARY 1	STA. 203+49.25, 19.90' RT
BL-44	24 LF	TRIBUTARY 1	STA. 203+52.96, 56.07' RT

MATRIX STONE SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
MS-18	2 TN	TRIBUTARY 1	STA. 60+74.83 TO STA. 60+94.46, LT & RT
MS-19	1 TN	TRIBUTARY 1	STA. 61+09.82 TO STA. 61+25.70, LT & RT

RIPRAP SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
RR-5	209 CY	RIPRAP R-5 CHANNEL UNDERLAYEMENT 22"	STA. 60+74.83 TO STA. 61+17.81, LT & RT

WOODY DEBRIS SCHEDULE

NO.	QTY.	DESCRIPTION	NOTES
WD-18	65 SY	TRIBUTARY 1	STA. 202+30.08, 38.74' RT TO STA. 202+67.14, 38.73' RT
WD-19	69 SY	TRIBUTARY 1	STA. 202+86.02, 18.23' RT TO STA. 203+36.88, 23.83' RT

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: N. RILEY
CHECKED BY: T. CUTILLO

STREAM RESTORATION PLAN

SR-07
SECTION
RKK
SHEET NO.
68

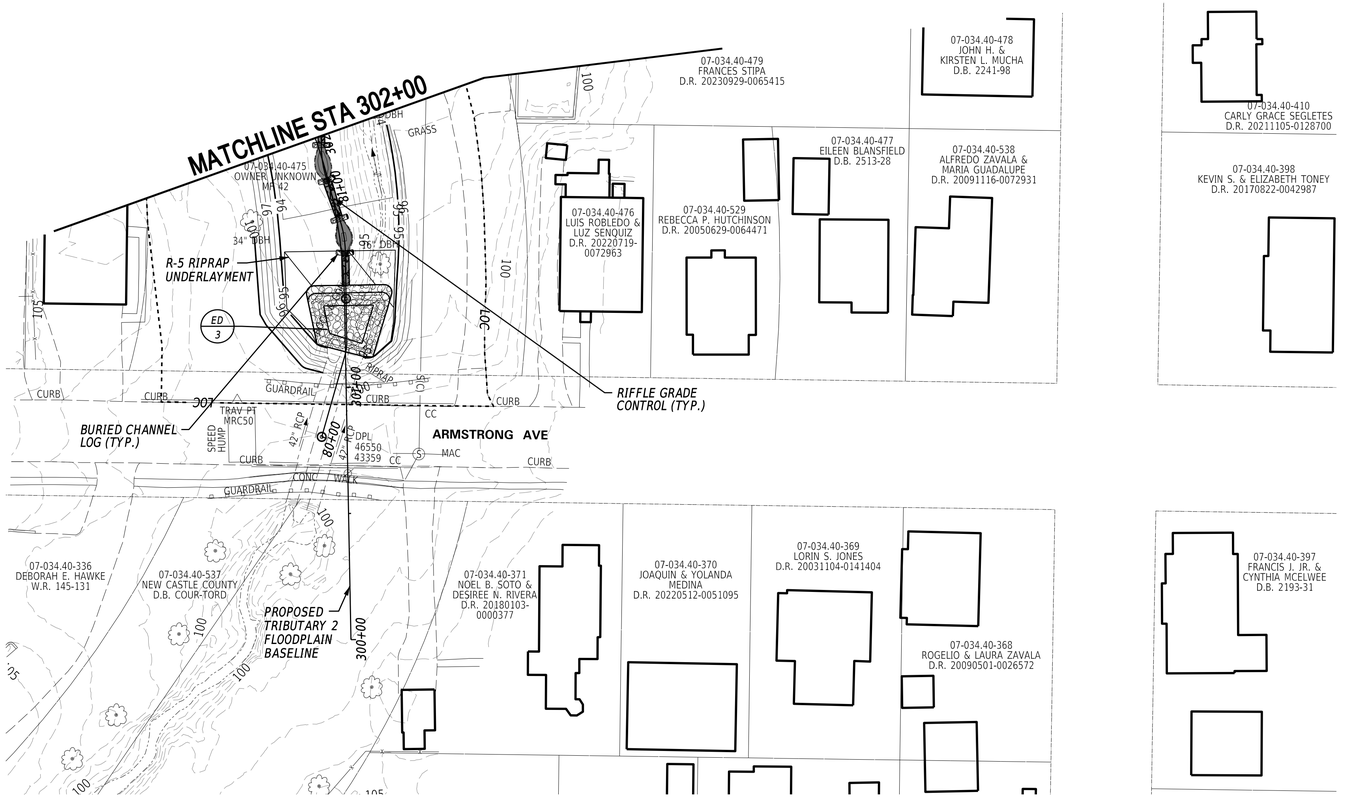
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RIPRAP SCHEDULE			
NO.	QTY.	DESCRIPTION	NOTES
RR-6	165 CY	RIPRAP R-5 CHANNEL UNDERLAYEMENT 22"	STA. 80+35.04 TO STA. 85+75.00, LT & RT

MATRIX STONE SCHEDULE			
NO.	QTY.	DESCRIPTION	NOTES
MS-20	1 TN	TRIBUTARY 2	STA. 80+61.38 TO STA. 80+75.05, LT & RT
MS-21	1 TN	TRIBUTARY 2	STA. 80+86.95 TO STA. 81+04.85, LT &RT
MS-22	1 TN	TRIBUTARY 2	STA. 81+17.16 TO STA. 81+38.47, LT & RT

STRAIGHT CHANNEL LOG SCHEDULE			
NO.	QTY.	DESCRIPTION	NOTES
SL-24	7 LF	TRIBUTARY 2	STA. 80+87.99, LT & RT
SL-25	7 LF	TRIBUTARY 2	STA. 81+18.14, LT & RT

V-SHAPED CHANNEL LOG SCHEDULE			
NO.	QTY.	DESCRIPTION	NOTES
VL-19	7 LF	TRIBUTARY 2	STA. 80+74.00, LT & RT
VL-20	7 LF	TRIBUTARY 2	STA. 81+03.78, LT & RT



ADDENDA / REVISIONS	

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	N. RILEY
CHECKED BY:	T. CUTILLO

STREAM RESTORATION PLAN

SR-08
SECTION
RKK
SHEET NO.
69

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ENVIRONMENTAL COMPLIANCE NOTES

1. GENERAL NOTES:

   A. THE PURPOSE OF THIS SHEET IS TO IDENTIFY THOSE ITEMS ASSOCIATED WITH ENVIRONMENTAL COMPLIANCE. IMPACT CALCULATIONS ARE FOR THE AGENCY PERMIT REPORTING PURPOSES ONLY AND ARE NOT TO BE USED FOR BIDDING PURPOSES.

   B. IF A DEPARTURE FROM THE APPROVED PLANS (WHICH WOULD AFFECT ANY NATURAL AND/OR CULTURAL RESOURCES) IS NECESSARY, THE ENVIRONMENTAL STUDIES SECTION SHALL BE CONTACTED AT (302)760-2264 OR DOT_ENVIRONMENTALSTUDIES@DELAWARE.GOV TO ALLOW FOR COORDINATION WITH THE APPROPRIATE RESOURCE AGENCIES AND APPROVAL.

   C. USE OF THIS SHEET DOES NOT ALLEVIATE THE CONTRACTOR'S RESPONSIBILITY TO COMPLY WITH ALL CONDITIONS SET FORTH IN THE ENVIRONMENTAL STATEMENT AND PERMITS.

2. NATURAL RESOURCE ISSUES:

   A. PERMIT REQUIREMENTS/APPROVALS*:
   U.S. ARMY CORPS OF ENGINEERS (COE): NATIONWIDE PERMIT NWP 27 w/PCN ** - TBD-
   DNREC - WETLANDS & SUBAQUEOUS LANDS (WSLS): SUBAQUEOUS LANDS PERMIT REQUIRED - TBD
   DNREC - WATER QUALITY (WQC) & COASTAL ZONE CONSISTENCY (CZM): ISSUED FOR NWP 27 - TBD

   * THE PERMITS/APPROVALS LISTED ARE THOSE REQUIRED FOR THIS PROJECT. THE ENVIRONMENTAL STUDIES SECTION IS RESPONSIBLE FOR COORDINATING AND/OR OBTAINING THIS APPROVAL.
   ** THE CONTRACTOR MUST ENSURE THAT THESE PERMITS/APPROVALS ARE IN THEIR POSSESSION PRIOR TO BEGINNING CONSTRUCTION IN THE PERMITTED AREA(S) AND ENSURE IT IS DISPLAYED ON-SITE DURING THE ENTIRE CONSTRUCTION PERIOD.

   B. CONSTRUCTION RESTRICTIONS:
   FISHERIES - NO IN-WATER WORK BETWEEN MARCH 1ST AND JUNE 30TH
   ENDANGERED SPECIES - NO MECHANIZED WORK BETWEEN MARCH 1ST AND NOVEMBER 14TH, OR A QUALIFIED BOG TURTLE SURVEYOR MAY BE REQUIRED TO MONITOR CONSTRUCTION ACTIVITIES
   MIGRATORY BIRDS - NONE

3. CULTURAL RESOURCE ISSUES:

   A. ON SEPTEMBER 4, 2024, DE SHPO ISSUED A SECTION 106 FINDING OF NO HISTORIC PROPERTIES AFFECTED. THERE ARE NO CULTURAL RESOURCE CONCERNS AS LONG AS THE PROJECT SCOPE IS NOT MODIFIED AND ALL STAGING AND STOCKPILING REMAIN WITHIN THE EXISTING LIMIT OF CONSTRUCTION. SHOULD IT BE NECESSARY TO ADD ADDITIONAL ACCESS LOCATIONS, OTHER STOCKPILING/STAGING AREAS, OR OTHERWISE ALTER THE SCOPE OF THE PROJECT, NEW CASTLE COUNTY STAFF WILL NEED TO CONTACTED IN ORDER TO REVIEW THESE CHANGES FOR POTENTIAL CULTURAL RESOURCES CONCERNS.

4. THE CONTRACTOR SHALL ACCESS THE STREAM FROM THE STAGING AREAS AND ACCESS ROADS ONLY. CONTRACTOR ACCESS BEYOND THE LOC (AS DEFINED ON THESE PLANS) IS STRICTLY PROHIBITED. ANY CHANGE IN THE LOC MUST BE COORDINATED WITH THE DELDOT ENVIRONMENTAL STUDIES SECTION.

ENVIRONMENTAL COMPLIANCE NOTES - CONTINUED

6. PROTECTION OF RESOURCES:

   A. KEEP CLEARING IN WETLAND AREAS TO A MINIMUM ABSOLUTELY NECESSARY FOR CONSTRUCTION ACCESS. IN WETLAND AREAS THAT ARE CLEARED, NO GRUBBING EXCEPT WHERE NECESSARY TO CONSTRUCT PROJECT COMPONENTS IS PERMITTED.

   B. CONSTRUCTION SAFETY FENCE SHALL BE USED ALONG THE LIMITS OF CONSTRUCTION IN ALL AREAS WHERE WATER/WETLANDS EXIST WITHIN 20 FEET OF THE LOC. CONTRACTOR ACCESS BEYOND THE LOC IS STRICTLY PROHIBITED.

   C. CLEARLY MARK ALL TREES TO BE REMOVED WITH PAINT PRIOR TO THE EROSION AND SEDIMENT CONTROL MEETING.

7. PLANTINGS - SEE LANDSCAPE PLANS FOR DETAILS REGARDING PLANTINGS. ANY CHANGE TO THE LANDSCAPE PLANS SHALL BE COORDINATED THROUGH THE ENVIRONMENTAL STUDIES SECTION AND RESOURCE AGENCIES, AS APPROPRIATE.

8. WETLANDS AREAS WERE DELINEATED BY KARL HELLMANN - RK&K IN NOVEMBER & DECEMBER 2022 IN ACCORDANCE WITH THE US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL (1987) AND THE EASTERN MOUNTAIN PIEDMONT REGIONAL SUPPLEMENT (2010).

USACE SUMMARY TABLE

IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)
TOTAL OPEN WATER CREATION AREA	41419.35	0.9509	767.03
TOTAL OPEN WATER ENHANCEMENT AREA	20038.35	0.4600	371.08
TOTAL PERMANENT OPEN WATER IMPACT AREA	85374.74	1.9593	1808.13
TOTAL TEMPORARY OPEN WATER IMPACT AREA	2845.14	0.0653	52.69
TOTAL WETLAND CREATION AREA	218215.58	5.0095	4041.03
TOTAL WETLAND ENHANCEMENT AREA	157.27	0.0036	2.91
TOTAL PERMANENT WETLAND IMPACT AREA	107.46	0.0025	1.99
TOTAL TEMPORARY WETLAND IMPACT AREA	496.99	0.0114	9.20

DNREC SUMMARY TABLE

IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)
TOTAL OPEN WATER CREATION AREA	41419.35	0.9509	767.03
TOTAL OPEN WATER ENHANCEMENT AREA	20038.35	0.4600	371.08
TOTAL PERMANENT OPEN WATER IMPACT AREA	85374.75	1.9593	1808.13
TOTAL TEMPORARY OPEN WATER IMPACT AREA	2845.14	0.0653	52.69

ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: H. AZIZ
CHECKED BY: J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

SECTION RKK
SHEET NO. 70

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LEGEND

- CREATION AREA
- ENHANCEMENT AREA
- PERMANENT IMPACT AREA
- TEMPORARY IMPACT AREA
- OHW — ORDINARY HIGH WATER
- WL — WETLAND BOUNDARY
- POHW/WL — PROPOSED ORD. HIGH WATER / WETLAND
- PWL — PROPOSED WETLAND BOUNDARY

XX / ?X — IMPACT AREA TYPE ID. (SEE BELOW) / IMPACT AREA ID. AND/OR NUMBER

O = OPEN WATER IMPACT
P = PERMANENT IMPACT
E = ENHANCEMENT AREA
T = TEMPORARY IMPACT
C = CREATION AREA
W = WETLAND IMPACT

PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-49	RIPRAP	649.68	0.0149	72.19	USACE/DNREC
PO-50	CONVERSION OF OHW TO WETLAND	329.47	0.0076	6.10	USACE/DNREC
PO-51	FLOODPLAIN LOG	21.45	0.0005	0.40	USACE/DNREC
PO-52	FLOODPLAIN LOG	4.46	0.0001	0.08	USACE/DNREC
PO-53	RIPRAP	1.46	0.00003	0.16	USACE/DNREC
PO-54	CONVERSION OF OHW TO WETLAND	3441.58	0.0790	63.73	USACE/DNREC
PO-55	FILL	11.86	0.0003	1.32	USACE/DNREC
PO-56	RIPRAP	84.23	0.0019	9.36	USACE/DNREC
PO-57	FILL	407.85	0.0094	45.32	USACE/DNREC
PO-58	CONVERSION OF OHW TO WETLAND	104.15	0.0024	1.93	USACE/DNREC
PO-59	FLOODPLAIN LOG	8.07	0.0002	0.15	USACE/DNREC
PO-60	CONVERSION OF OHW TO WETLAND	10.13	0.0002	0.19	USACE/DNREC
PO-61	ROCK	36.00	0.0008	0.67	USACE/DNREC
PO-62	CONVERSION OF OHW TO WETLAND	0.97	0.00002	0.02	USACE/DNREC
PO-63	FLOODPLAIN LOG	7.29	0.0002	0.14	USACE/DNREC
PO-64	CONVERSION OF OHW TO WETLAND	310.04	0.0071	5.74	USACE/DNREC
PO-65	FLOODPLAIN LOG	40.79	0.0009	0.76	USACE/DNREC
PO-66	ROCK	8.08	0.0002	0.15	USACE/DNREC
PO-67	CONVERSION OF OHW TO WETLAND	316.44	0.0073	5.86	USACE/DNREC
TOTAL FOR THIS SHEET		5794.00	0.1330	214.25	USACE/DNREC

WETLAND CREATION AREA SCHEDULE

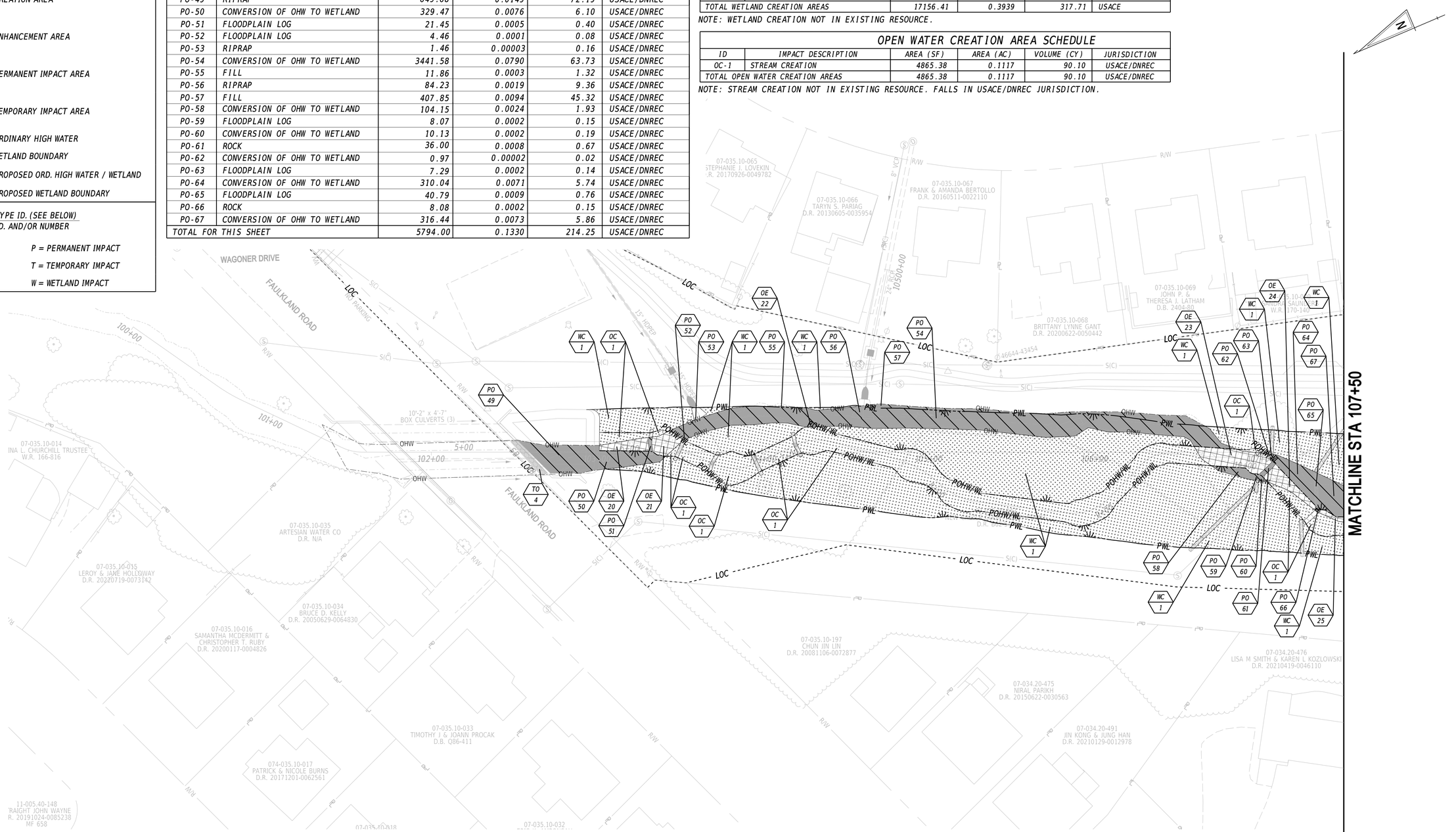
ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WC-1	WETLAND CREATION	17156.41	0.3939	317.71	USACE
TOTAL WETLAND CREATION AREAS		17156.41	0.3939	317.71	USACE

NOTE: WETLAND CREATION NOT IN EXISTING RESOURCE.

OPEN WATER CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OC-1	STREAM CREATION	4865.38	0.1117	90.10	USACE/DNREC
TOTAL OPEN WATER CREATION AREAS		4865.38	0.1117	90.10	USACE/DNREC

NOTE: STREAM CREATION NOT IN EXISTING RESOURCE. FALLS IN USACE/DNREC JURISDICTION.



OPEN WATER ENHANCEMENT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OE-20	CHANNEL ENHANCEMENT	173.30	0.0040	3.21	USACE/DNREC
OE-21	CHANNEL ENHANCEMENT	181.95	0.0042	3.37	USACE/DNREC
OE-22	CHANNEL ENHANCEMENT	2.78	0.0001	0.05	USACE/DNREC
OE-23	CHANNEL ENHANCEMENT	456.65	0.0105	8.46	USACE/DNREC
OE-24	CHANNEL ENHANCEMENT	217.13	0.0050	4.02	USACE/DNREC
OE-25	CHANNEL ENHANCEMENT	38.45	0.0009	0.71	USACE/DNREC
TOTAL FOR THIS SHEET		1070.26	0.0246	19.82	USACE/DNREC

TEMPORARY OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
TO-4	SANDBAG DIKE	109.39	0.0025	2.03	USACE/DNREC
TOTAL FOR THIS SHEET		109.39	0.0025	2.03	USACE/DNREC

ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: H. AZIZ
CHECKED BY: J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

EC-01
SECTION RKK
SHEET NO. 71

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WETLAND CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WC-2	WETLAND CREATION	80127.73	1.8395	1483.85	USACE
TOTAL WETLAND CREATION AREAS		80127.73	1.8395	1483.85	USACE

NOTE: WETLAND CREATION NOT IN EXISTING RESOURCE.

OPEN WATER CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OC-2	STREAM CREATION	10376.92	0.2382	192.17	USACE/DNREC
TOTAL OPEN WATER CREATION AREAS		10376.92	0.2382	192.17	USACE/DNREC

NOTE: STREAM CREATION NOT IN EXISTING RESOURCE. FALLS IN USACE/DNREC JURISDICTION.

SEE SHEET EC-02A FOR ADDITIONAL IMPACT AREA SCHEDULES.



LEGEND

- CREATION AREA
- ENHANCEMENT AREA
- PERMANENT IMPACT AREA
- TEMPORARY IMPACT AREA
- OHW — ORDINARY HIGH WATER
- WL — WETLAND BOUNDARY
- POHW/WL — PROPOSED ORD. HIGH WATER / WETLAND
- PWL — PROPOSED WETLAND BOUNDARY

XX / ?X — IMPACT AREA TYPE ID. (SEE BELOW) / IMPACT AREA ID. AND/OR NUMBER

O = OPEN WATER IMPACT
E = ENHANCEMENT AREA
C = CREATION AREA
P = PERMANENT IMPACT
T = TEMPORARY IMPACT
W = WETLAND IMPACT

TEMPORARY OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
TO-3	SANDBAG DIKE	90.9	0.0021	1.68	USACE/DNREC
TO-5	SANDBAG DIKE	71.13	0.0016	1.32	USACE/DNREC
TO-6	SANDBAG DIKE	62.92	0.0014	1.17	USACE/DNREC
TOTAL FOR THIS SHEET		224.95	0.0052	4.17	USACE/DNREC

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	H. AZIZ
CHECKED BY:	J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

EC-02	
SECTION	RKK
SHEET NO.	72

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PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-16	CONVERSION OF OHW TO WETLAND	1002.82	0.0230	18.57	USACE/DNREC
PO-17	FLOODPLAIN LOG	17.72	0.0004	0.33	USACE/DNREC
PO-18	CONVERSION OF OHW TO WETLAND	499.14	0.0115	9.24	USACE/DNREC
PO-19	CONVERSION OF OHW TO WETLAND	2086.98	0.0479	38.65	USACE/DNREC
PO-20	CONVERSION OF OHW TO WETLAND	434.49	0.0100	8.05	USACE/DNREC
PO-21	FLOODPLAIN LOG	43.90	0.0010	0.81	USACE/DNREC
PO-22	CONVERSION OF OHW TO WETLAND	1171.81	0.0269	21.70	USACE/DNREC
PO-23	CONVERSION OF OHW TO WETLAND	405.53	0.0093	7.51	USACE/DNREC
PO-24	FLOODPLAIN LOG	25.52	0.0006	0.47	USACE/DNREC
PO-25	CONVERSION OF OHW TO WETLAND	947.21	0.0217	17.54	USACE/DNREC
PO-26	CONVERSION OF OHW TO WETLAND	3318.27	0.0762	61.45	USACE/DNREC
PO-27	CONVERSION OF OHW TO WETLAND	4440.86	0.1019	82.24	USACE/DNREC
PO-28	CONVERSION OF OHW TO WETLAND	1492.36	0.0343	27.64	USACE/DNREC
PO-29	RIPRAP	37.49	0.0009	4.17	USACE/DNREC
PO-30	RIPRAP	101.93	0.0023	11.33	USACE/DNREC
PO-31	FLOODPLAIN LOG	31.70	0.0007	0.59	USACE/DNREC
PO-32	RIPRAP	21.13	0.0005	2.35	USACE/DNREC
PO-33	CONVERSION OF OHW TO WETLAND	412.18	0.0095	7.63	USACE/DNREC
PO-34	FLOODPLAIN LOG	3.58	0.0001	0.07	USACE/DNREC
PO-35	FLOODPLAIN LOG	27.22	0.0006	0.50	USACE/DNREC
PO-36	CONVERSION OF OHW TO WETLAND	14.47	0.0003	0.27	USACE/DNREC
PO-37	CONVERSION OF OHW TO WETLAND	2083.34	0.0478	38.58	USACE/DNREC
PO-38	RIPRAP	35.68	0.0008	3.96	USACE/DNREC
PO-39	CONVERSION OF OHW TO WETLAND	1652.37	0.0379	30.60	USACE/DNREC
PO-40	CONVERSION OF OHW TO WETLAND	432.36	0.0099	8.01	USACE/DNREC
PO-41	RIPRAP	23.25	0.0005	2.58	USACE/DNREC
PO-42	CONVERSION OF OHW TO WETLAND	917.00	0.0211	16.98	USACE/DNREC
PO-43	FLOODPLAIN LOG	28.42	0.0007	0.53	USACE/DNREC
PO-44	RIPRAP	27.24	0.0006	3.03	USACE/DNREC
PO-45	CONVERSION OF OHW TO WETLAND	821.35	0.0189	15.21	USACE/DNREC
PO-46	CONVERSION OF OHW TO WETLAND	1202.91	0.0276	22.28	USACE/DNREC
PO-47	RIPRAP	26.95	0.0006	2.99	USACE/DNREC
PO-48	CONVERSION OF OHW TO WETLAND	450.62	0.0103	8.34	USACE/DNREC
TOTAL FOR THIS SHEET		24237.80	0.5564	474.19	USACE/DNREC

OPEN WATER ENHANCEMENT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OE-8	CHANNEL ENHANCEMENT	0.66	0.00002	0.01	USACE/DNREC
OE-9	CHANNEL ENHANCEMENT	65.35	0.0015	1.21	USACE/DNREC
OE-10	CHANNEL ENHANCEMENT	64.19	0.0015	1.19	USACE/DNREC
OE-11	CHANNEL ENHANCEMENT	80.38	0.0018	1.49	USACE/DNREC
OE-12	CHANNEL ENHANCEMENT	89.26	0.0020	1.65	USACE/DNREC
OE-13	CHANNEL ENHANCEMENT	488.51	0.0112	9.05	USACE/DNREC
OE-14	CHANNEL ENHANCEMENT	681.14	0.0156	12.61	USACE/DNREC
OE-15	CHANNEL ENHANCEMENT	129.69	0.0030	2.40	USACE/DNREC
OE-16	CHANNEL ENHANCEMENT	244.21	0.0056	4.52	USACE/DNREC
OE-17	CHANNEL ENHANCEMENT	777.36	0.0178	14.40	USACE/DNREC
OE-18	CHANNEL ENHANCEMENT	126.27	0.0029	2.34	USACE/DNREC
OE-19	CHANNEL ENHANCEMENT	510.37	0.0117	9.45	USACE/DNREC
TOTAL FOR THIS SHEET		3257.39	0.0748	60.32	USACE/DNREC

LEGEND

- CREATION AREA
- ENHANCEMENT AREA
- PERMANENT IMPACT AREA
- TEMPORARY IMPACT AREA
- OHW — ORDINARY HIGH WATER
- WL — WETLAND BOUNDARY
- POHW/WL — PROPOSED ORD. HIGH WATER / WETLAND
- PWL — PROPOSED WETLAND BOUNDARY

XX / 7X — IMPACT AREA TYPE ID. (SEE BELOW) / IMPACT AREA ID. AND/OR NUMBER

O = OPEN WATER IMPACT
P = PERMANENT IMPACT
E = ENHANCEMENT AREA
T = TEMPORARY IMPACT
C = CREATION AREA
W = WETLAND IMPACT

PERMANENT OPEN WATER IMPACT AREA SCHEDULE

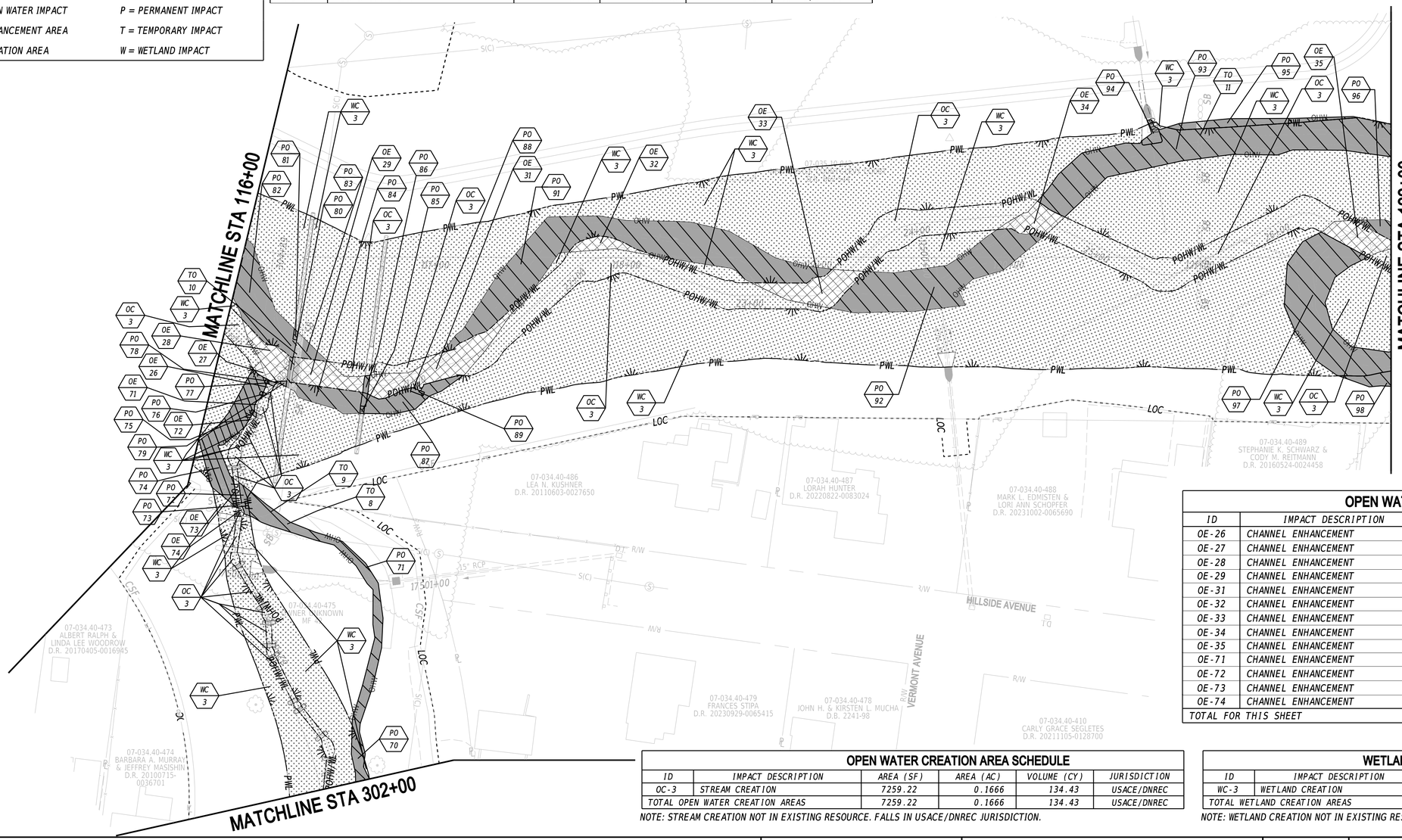
ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-70	FILL	128.68	0.0030	2.38	USACE/DNREC
PO-71	FILL	836.44	0.0192	15.49	USACE/DNREC
PO-72	CONVERSION OF OHW TO WETLAND	54.14	0.0012	1.00	USACE/DNREC
PO-73	FLOODPLAIN LOG	11.68	0.0003	0.22	USACE/DNREC
PO-74	CONVERSION OF OHW TO WETLAND	765.90	0.0176	14.18	USACE/DNREC
PO-75	FLOODPLAIN LOG	7.23	0.0002	0.13	USACE/DNREC
PO-76	FLOODPLAIN LOG	5.37	0.0001	0.10	USACE/DNREC
PO-77	FLOODPLAIN LOG	10.96	0.0003	0.20	USACE/DNREC
PO-78	CONVERSION OF OHW TO WETLAND	0.72	0.00002	0.01	USACE/DNREC
PO-79	CONVERSION OF OHW TO WETLAND	8.58	0.0002	0.16	USACE/DNREC
PO-80	ROCK	68.80	0.0016	1.27	USACE/DNREC
PO-81	FLOODPLAIN LOG	9.54	0.0002	0.18	USACE/DNREC
PO-82	CONVERSION OF OHW TO WETLAND	850.71	0.0195	15.75	USACE/DNREC
PO-83	CONVERSION OF OHW TO WETLAND	113.68	0.0026	2.11	USACE/DNREC
PO-84	CONVERSION OF OHW TO WETLAND	353.14	0.0081	6.54	USACE/DNREC
PO-85	FLOODPLAIN LOG	8.00	0.0002	0.15	USACE/DNREC
PO-86	ROCK	43.96	0.0010	0.81	USACE/DNREC
PO-87	CONVERSION OF OHW TO WETLAND	379.43	0.0087	7.03	USACE/DNREC
PO-88	CONVERSION OF OHW TO WETLAND	0.54	0.00001	0.01	USACE/DNREC
PO-89	FLOODPLAIN LOG	13.99	0.0003	0.26	USACE/DNREC

PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-91	CONVERSION OF OHW TO WETLAND	3344.47	0.0768	61.93	USACE/DNREC
PO-92	CONVERSION OF OHW TO WETLAND	1950.21	0.0448	36.12	USACE/DNREC
PO-93	CONVERSION OF OHW TO WETLAND	3009.32	0.0691	55.73	USACE/DNREC
PO-94	RIPRAP	68.92	0.0016	1.28	USACE/DNREC
PO-95	FILL	280.08	0.0064	5.19	USACE/DNREC
PO-96	CONVERSION OF OHW TO WETLAND	105.38	0.0024	1.95	USACE/DNREC
PO-97	CONVERSION OF OHW TO WETLAND	1958.57	0.0450	36.27	USACE/DNREC
PO-98	FILL	125.12	0.0029	2.32	USACE/DNREC
TOTAL FOR THIS SHEET		14513.53	0.3332	268.77	USACE/DNREC

TEMPORARY OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
TO-8	SANDBAG DIKE	13.25	0.0003	0.25	USACE/DNREC
TO-9	SANDBAG DIKE	20.99	0.0005	0.39	USACE/DNREC
TO-10	SANDBAG DIKE	117.11	0.0027	2.17	USACE/DNREC
TO-11	SANDBAG DIKE	77.88	0.0018	1.44	USACE/DNREC
TOTAL FOR THIS SHEET		229.23	0.0053	4.25	USACE/DNREC



OPEN WATER ENHANCEMENT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OE-26	CHANNEL ENHANCEMENT	13.65	0.0003	0.25	USACE/DNREC
OE-27	CHANNEL ENHANCEMENT	53.58	0.0012	0.99	USACE/DNREC
OE-28	CHANNEL ENHANCEMENT	290.12	0.0067	5.37	USACE/DNREC
OE-29	CHANNEL ENHANCEMENT	411.48	0.0094	7.62	USACE/DNREC
OE-31	CHANNEL ENHANCEMENT	868.31	0.0199	16.08	USACE/DNREC
OE-32	CHANNEL ENHANCEMENT	184.46	0.0042	3.42	USACE/DNREC
OE-33	CHANNEL ENHANCEMENT	563.49	0.0129	10.44	USACE/DNREC
OE-34	CHANNEL ENHANCEMENT	303.49	0.0070	5.62	USACE/DNREC
OE-35	CHANNEL ENHANCEMENT	384.18	0.0088	7.11	USACE/DNREC
OE-71	CHANNEL ENHANCEMENT	9.58	0.0002	0.18	USACE/DNREC
OE-72	CHANNEL ENHANCEMENT	10.27	0.0002	0.19	USACE/DNREC
OE-73	CHANNEL ENHANCEMENT	29.63	0.0007	0.55	USACE/DNREC
OE-74	CHANNEL ENHANCEMENT	6.37	0.0001	0.12	USACE/DNREC
TOTAL FOR THIS SHEET		3128.61	0.0718	57.49	USACE/DNREC

OPEN WATER CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OC-3	STREAM CREATION	7259.22	0.1666	134.43	USACE/DNREC
TOTAL OPEN WATER CREATION AREAS		7259.22	0.1666	134.43	USACE/DNREC

NOTE: STREAM CREATION NOT IN EXISTING RESOURCE. FALLS IN USACE/DNREC JURISDICTION.

WETLAND CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WC-3	WETLAND CREATION	49604.23	1.1388	918.60	USACE
TOTAL WETLAND CREATION AREAS		49604.23	1.1388	918.60	USACE

NOTE: WETLAND CREATION NOT IN EXISTING RESOURCE.

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: H. AZIZ
CHECKED BY: J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

EC-03
SECTION
RKK
SHEET NO.
74

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TEMPORARY OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
TO-12	SANDBAG DIKE	81.41	0.0019	1.51	USACE/DNREC
TO-17	CONSTRUCTION ACCESS	77.73	0.0018	1.44	USACE/DNREC
TO-18	CONSTRUCTION ACCESS	473.12	0.0109	8.76	USACE/DNREC
TO-19	CONSTRUCTION ACCESS	95.03	0.0022	1.76	USACE/DNREC
TOTAL FOR THIS SHEET		727.29	0.0167	13.47	USACE/DNREC

WETLAND CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WC-4	WETLAND CREATION	35858.20	0.8232	664.04	USACE
TOTAL WETLAND CREATION AREAS		35858.20	0.8232	664.04	USACE

NOTE: WETLAND CREATION NOT IN EXISTING RESOURCE.

TEMPORARY WETLAND IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
TW-1	CONSTRUCTION ACCESS	496.99	0.0114	9.20	USACE
TOTAL FOR THIS SHEET		496.99	0.0114	9.20	USACE

PERMANENT WETLAND IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PW-1	FILL	59.54	0.0014	1.10	USACE
PW-2	CONVERSION OF WETLAND TO OHW	47.92	0.0011	0.89	USACE
TOTAL FOR THIS SHEET		107.46	0.0025	1.99	USACE

WETLAND ENHANCEMENT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WE-1	WETLAND ENHANCEMENT	157.27	0.0036	2.91	USACE
TOTAL FOR THIS SHEET		157.27	0.0036	2.91	USACE

OPEN WATER CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OC-4	STREAM CREATION	8052.45	0.1849	149.12	USACE/DNREC
TOTAL OPEN WATER CREATION AREAS		8052.45	0.1849	149.12	USACE/DNREC

NOTE: STREAM CREATION NOT IN EXISTING RESOURCE. FALLS IN USACE/DNREC JURISDICTION.

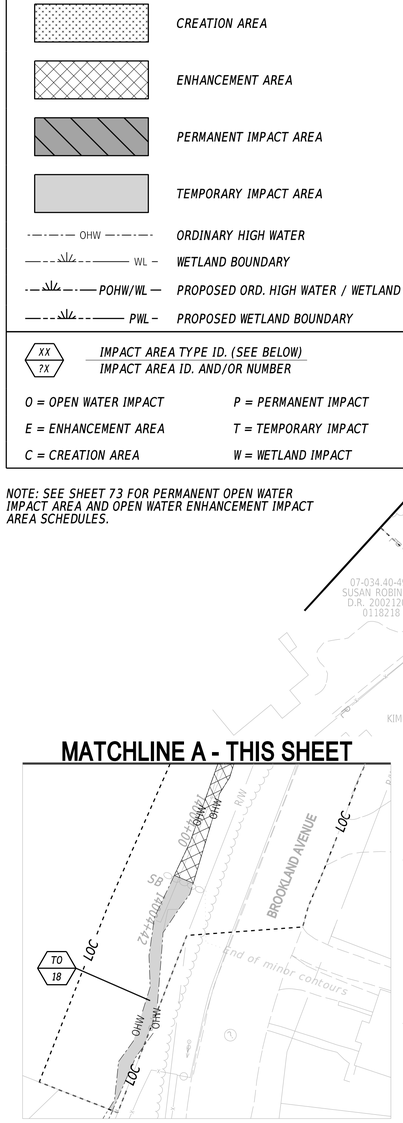
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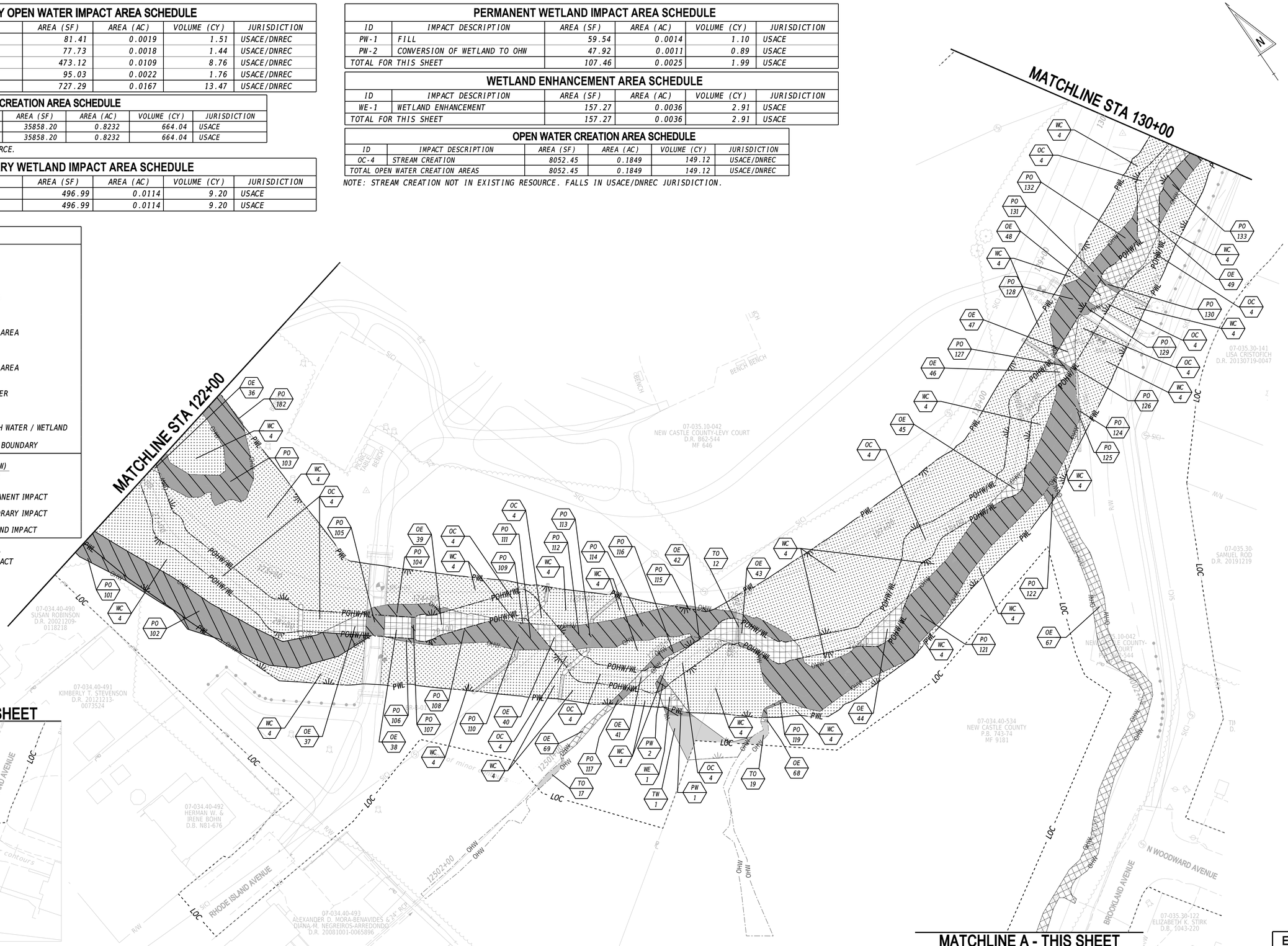
- CREATION AREA
- ENHANCEMENT AREA
- PERMANENT IMPACT AREA
- TEMPORARY IMPACT AREA
- OHW — ORDINARY HIGH WATER
- WL — WETLAND BOUNDARY
- POHW/WL — PROPOSED ORD. HIGH WATER / WETLAND
- PWL — PROPOSED WETLAND BOUNDARY

XX / ?X — IMPACT AREA TYPE ID. (SEE BELOW) / IMPACT AREA ID. AND/OR NUMBER

O = OPEN WATER IMPACT
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W = WETLAND IMPACT

NOTE: SEE SHEET 73 FOR PERMANENT OPEN WATER IMPACT AREA AND OPEN WATER ENHANCEMENT IMPACT AREA SCHEDULES.





ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	H. AZIZ
CHECKED BY:	J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

EC-04
SECTION
RKK
SHEET NO.
75

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PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-101	FILL	331.73	0.0076	6.14	USACE/DNREC
PO-102	CONVERSION OF OHW TO WETLAND	3054.15	0.0701	56.56	USACE/DNREC
PO-103	CONVERSION OF OHW TO WETLAND	1761.79	0.0404	32.63	USACE/DNREC
PO-104	CONVERSION OF OHW TO WETLAND	318.59	0.0073	5.90	USACE/DNREC
PO-105	BRIDGE	154.98	0.0036	N/A	USACE/DNREC
PO-106	CONVERSION OF OHW TO WETLAND	24.64	0.0006	0.46	USACE/DNREC
PO-107	ROCK	51.42	0.0012	0.95	USACE/DNREC
PO-108	CONVERSION OF OHW TO WETLAND	650.88	0.0149	12.05	USACE/DNREC
PO-109	ROCK	3.05	0.0001	0.06	USACE/DNREC
PO-110	FLOODPLAIN LOG	33.03	0.0008	0.61	USACE/DNREC
PO-111	CONVERSION OF OHW TO WETLAND	224.89	0.0052	4.16	USACE/DNREC
PO-112	CONVERSION OF OHW TO WETLAND	212.29	0.0049	3.93	USACE/DNREC
PO-113	FLOODPLAIN LOG	30.83	0.0007	0.57	USACE/DNREC
PO-114	CONVERSION OF OHW TO WETLAND	1658.41	0.0381	30.71	USACE/DNREC
PO-115	FILL	43.40	0.0010	0.80	USACE/DNREC
PO-116	CONVERSION OF OHW TO WETLAND	182.78	0.0042	3.38	USACE/DNREC
PO-117	CONVERSION OF OHW TO WETLAND	63.79	0.0015	1.18	USACE/DNREC
PO-119	CONVERSION OF OHW TO WETLAND	33.10	0.0008	0.61	USACE/DNREC
PO-121	CONVERSION OF OHW TO WETLAND	5906.25	0.1356	109.38	USACE/DNREC
PO-122	CONVERSION OF OHW TO WETLAND	84.53	0.0019	1.57	USACE/DNREC
PO-124	CONVERSION OF OHW TO WETLAND	6.09	0.0001	0.11	USACE/DNREC
PO-125	FLOODPLAIN LOG	38.23	0.0009	0.71	USACE/DNREC
PO-126	CONVERSION OF OHW TO WETLAND	4.16	0.0001	0.08	USACE/DNREC
PO-127	ROCK	41.46	0.0010	0.77	USACE/DNREC
PO-128	CONVERSION OF OHW TO WETLAND	729.20	0.0167	13.50	USACE/DNREC
PO-129	BRIDGE	49.69	0.0011	N/A	USACE/DNREC
PO-130	ROCK	46.83	0.0011	0.87	USACE/DNREC
PO-131	FLOODPLAIN LOG	17.81	0.0004	0.33	USACE/DNREC
PO-132	CONVERSION OF OHW TO WETLAND	462.28	0.0106	8.56	USACE/DNREC
PO-133	CONVERSION OF OHW TO WETLAND	411.47	0.0094	7.62	USACE/DNREC
PO-182	FILL	7.80	0.0002	0.14	USACE/DNREC
TOTAL FOR THIS SHEET		16639.57	0.3820	304.35	USACE/DNREC

OPEN WATER ENHANCEMENT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OE-36	CHANNEL ENHANCEMENT	11.47	0.0003	0.21	USACE/DNREC
OE-37	CHANNEL ENHANCEMENT	216.19	0.0050	4.00	USACE/DNREC
OE-38	CHANNEL ENHANCEMENT	234.45	0.0054	4.34	USACE/DNREC
OE-39	CHANNEL ENHANCEMENT	551.24	0.0127	10.21	USACE/DNREC
OE-40	CHANNEL ENHANCEMENT	256.49	0.0059	4.75	USACE/DNREC
OE-41	CHANNEL ENHANCEMENT	85.86	0.0020	1.59	USACE/DNREC
OE-42	CHANNEL ENHANCEMENT	2.13	0.00005	0.04	USACE/DNREC
OE-43	CHANNEL ENHANCEMENT	769.02	0.0177	14.24	USACE/DNREC
OE-44	CHANNEL ENHANCEMENT	338.72	0.0078	6.27	USACE/DNREC
OE-45	CHANNEL ENHANCEMENT	178.55	0.0041	3.31	USACE/DNREC
OE-46	CHANNEL ENHANCEMENT	78.43	0.0018	1.45	USACE/DNREC
OE-47	CHANNEL ENHANCEMENT	223.20	0.0051	4.13	USACE/DNREC
OE-48	CHANNEL ENHANCEMENT	159.09	0.0037	2.95	USACE/DNREC
OE-49	CHANNEL ENHANCEMENT	1231.00	0.0283	22.80	USACE/DNREC
OE-67	CHANNEL ENHANCEMENT	2622.55	0.0602	48.57	USACE/DNREC
OE-68	CHANNEL ENHANCEMENT	10.97	0.0003	0.20	USACE/DNREC
OE-69	CHANNEL ENHANCEMENT	150.57	0.0035	2.79	USACE/DNREC
TOTAL FOR THIS SHEET		7119.93	0.1635	131.85	USACE/DNREC

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ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK
STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT 20230414279
DESIGNED BY: H. AZIZ
CHECKED BY: J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

SECTION
RKK
SHEET NO.
76

LEGEND

- CREATION AREA
- ENHANCEMENT AREA
- PERMANENT IMPACT AREA
- TEMPORARY IMPACT AREA
- OHW — ORDINARY HIGH WATER
- WL — WETLAND BOUNDARY
- POHW/WL — PROPOSED ORD. HIGH WATER / WETLAND
- PWL — PROPOSED WETLAND BOUNDARY

XX / ?X — IMPACT AREA TYPE ID. (SEE BELOW) / IMPACT AREA ID. AND/OR NUMBER

O = OPEN WATER IMPACT
P = PERMANENT IMPACT
E = ENHANCEMENT AREA
T = TEMPORARY IMPACT
C = CREATION AREA
W = WETLAND IMPACT

TEMPORARY OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
TO-14	SANDBAG DIKE	88.10	0.0020	1.63	USACE/DNREC
TO-15	SANDBAG DIKE	84.57	0.0019	1.57	USACE/DNREC
TO-20	CONSTRUCTION ACCESS	15.72	0.0004	0.29	USACE/DNREC
TOTAL FOR THIS SHEET		188.39	0.0043	3.49	USACE/DNREC

WETLAND CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WC-5	WETLAND CREATION	13872.90	0.3185	256.91	USACE
TOTAL WETLAND CREATION AREAS		13872.90	0.3185	256.91	USACE

NOTE: WETLAND CREATION NOT IN EXISTING RESOURCE.

OPEN WATER CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OC-5	STREAM CREATION	5668.04	0.0460	104.96	USACE/DNREC
TOTAL OPEN WATER CREATION AREAS		5668.04	0.0460	104.96	USACE/DNREC

NOTE: STREAM CREATION NOT IN EXISTING RESOURCE. FALLS IN USACE/DNREC JURISDICTION.



PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-134	CONVERSION OF OHW TO WETLAND	685.19	0.0157	12.69	USACE/DNREC
PO-135	FILL	162.15	0.0037	3.00	USACE/DNREC
PO-136	FLOODPLAIN LOG	30.64	0.0007	0.57	USACE/DNREC
PO-137	ROCK	5.35	0.0001	0.10	USACE/DNREC
PO-138	CONVERSION OF OHW TO WETLAND	207.60	0.0048	3.84	USACE/DNREC
PO-139	FILL	98.29	0.0023	1.82	USACE/DNREC
PO-140	FLOODPLAIN LOG	14.84	0.0003	0.27	USACE/DNREC
PO-141	ROCK	26.87	0.0006	0.50	USACE/DNREC
PO-142	FILL	492.09	0.0113	9.11	USACE/DNREC
PO-143	CONVERSION OF OHW TO WETLAND	2045.24	0.0470	37.87	USACE/DNREC
PO-144	CONVERSION OF OHW TO WETLAND	16.87	0.0004	0.31	USACE/DNREC
PO-145	FILL	4.35	0.00001	0.08	USACE/DNREC
PO-146	ROCK	9.18	0.0002	0.17	USACE/DNREC
PO-147	FLOODPLAIN LOG	33.32	0.0008	0.62	USACE/DNREC
PO-148	CONVERSION OF OHW TO WETLAND	502.72	0.0115	9.31	USACE/DNREC
PO-149	CONVERSION OF OHW TO WETLAND	628.42	0.0144	11.64	USACE/DNREC
PO-150	FLOODPLAIN LOG	33.81	0.0008	0.63	USACE/DNREC
PO-151	ROCK	14.74	0.0003	0.27	USACE/DNREC

PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-152	CONVERSION OF OHW TO WETLAND	1049.80	0.0241	19.44	USACE/DNREC
PO-153	FILL	2.63	0.00006	0.05	USACE/DNREC
PO-154	FILL	10.50	0.0002	0.19	USACE/DNREC
PO-155	CONVERSION OF OHW TO WETLAND	1425.04	0.0327	26.39	USACE/DNREC
PO-156	FILL	363.84	0.0084	6.74	USACE/DNREC
PO-157	CONVERSION OF OHW TO WETLAND	2151.94	0.0494	39.85	USACE/DNREC
PO-158	FILL	732.33	0.0168	13.56	USACE/DNREC
PO-159	CONVERSION OF OHW TO WETLAND	129.77	0.0030	2.40	USACE/DNREC
PO-160	FLOODPLAIN LOG	15.93	0.0004	0.30	USACE/DNREC
PO-161	ROCK	26.29	0.0006	0.49	USACE/DNREC
PO-162	CONVERSION OF OHW TO WETLAND	761.24	0.0175	14.10	USACE/DNREC
PO-163	FILL	221.82	0.0051	4.11	USACE/DNREC
PO-164	ROCK	46.82	0.0011	0.87	USACE/DNREC
PO-165	CONVERSION OF OHW TO WETLAND	38.44	0.0009	0.71	USACE/DNREC
PO-166	CONVERSION OF OHW TO WETLAND	50.68	0.0012	0.94	USACE/DNREC
PO-184	FILL	12.34	0.0003	0.23	USACE/DNREC
TOTAL FOR THIS SHEET		12051.08	0.2767	223.17	USACE/DNREC

OPEN WATER ENHANCEMENT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OE-50	CHANNEL ENHANCEMENT	367.47	0.0084	6.81	USACE/DNREC
OE-51	CHANNEL ENHANCEMENT	59.60	0.0014	1.10	USACE/DNREC
OE-52	CHANNEL ENHANCEMENT	790.25	0.0181	14.63	USACE/DNREC
OE-53	CHANNEL ENHANCEMENT	404.20	0.0093	7.49	USACE/DNREC
OE-54	CHANNEL ENHANCEMENT	4.08	0.00009	0.08	USACE/DNREC
OE-55	CHANNEL ENHANCEMENT	565.77	0.0130	10.48	USACE/DNREC
OE-56	CHANNEL ENHANCEMENT	277.51	0.0064	5.14	USACE/DNREC
OE-57	CHANNEL ENHANCEMENT	315.76	0.0072	5.85	USACE/DNREC
OE-58	CHANNEL ENHANCEMENT	11.89	0.0003	0.22	USACE/DNREC
OE-59	CHANNEL ENHANCEMENT	35.30	0.0008	0.65	USACE/DNREC
OE-60	CHANNEL ENHANCEMENT	9.67	0.0002	0.18	USACE/DNREC
OE-61	CHANNEL ENHANCEMENT	64.88	0.0015	1.20	USACE/DNREC
OE-70	CHANNEL ENHANCEMENT	0.33	0.00001	0.01	USACE/DNREC
TOTAL FOR THIS SHEET		2906.68	0.0667	53.83	USACE/DNREC

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673

CONTRACT 20230414279
DESIGNED BY: H. AZIZ
CHECKED BY: J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

EC-05
SECTION
RKK
SHEET NO.
77

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LEGEND

- CREATION AREA
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- TEMPORARY IMPACT AREA
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PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-168	FILL	128.29	0.0029	2.38	USACE/DNREC
PO-169	CONVERSION OF OHW TO WETLAND	316.86	0.0073	5.87	USACE/DNREC
PO-170	CONVERSION OF OHW TO WETLAND	1345.51	0.0309	24.92	USACE/DNREC
PO-171	FILL	253.78	0.0058	4.70	USACE/DNREC
PO-172	CONVERSION OF OHW TO WETLAND	2937.81	0.0674	54.40	USACE/DNREC
PO-173	FILL	1503.63	0.0345	27.85	USACE/DNREC
PO-174	CONVERSION OF OHW TO WETLAND	1591.00	0.0365	29.46	USACE/DNREC
PO-175	FILL	12.99	0.0003	0.24	USACE/DNREC
PO-176	FILL	200.46	0.0046	3.71	USACE/DNREC
PO-177	FILL	36.39	0.0008	0.67	USACE/DNREC
PO-178	ROCK	33.35	0.0008	0.62	USACE/DNREC
PO-179	FILL	3.06	0.00007	0.06	USACE/DNREC
TOTAL FOR THIS SHEET		8363.13	0.1920	154.87	USACE/DNREC

WETLAND CREATION AREA SCHEDULE

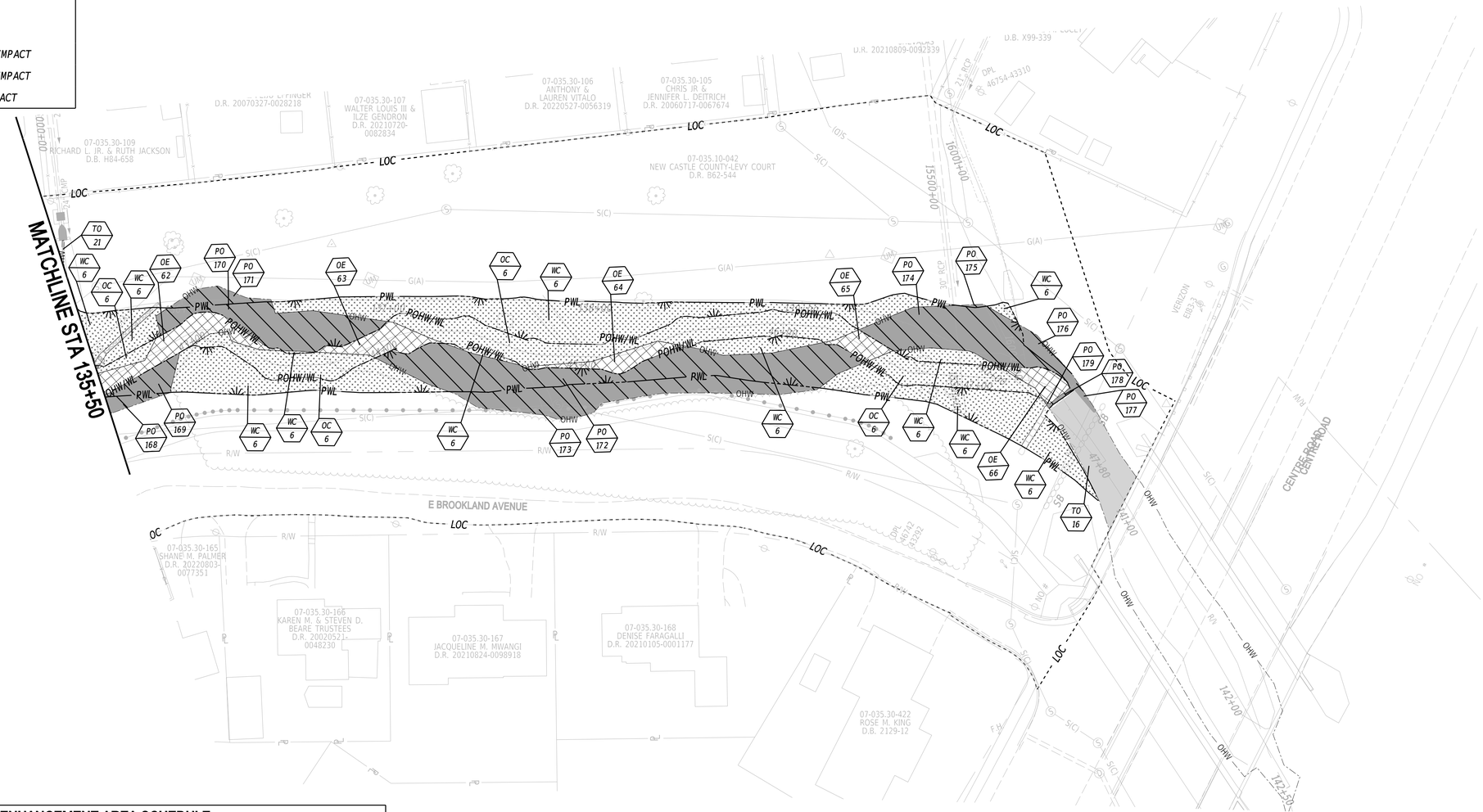
ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WC-6	WETLAND CREATION	8171.09	0.1876	151.32	USACE
TOTAL WETLAND CREATION AREAS		8171.09	0.1876	151.32	USACE

NOTE: WETLAND CREATION NOT IN EXISTING RESOURCE.

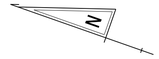
OPEN WATER CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OC-6	STREAM CREATION	4124.32	0.0947	76.38	USACE/DNREC
TOTAL OPEN WATER CREATION AREAS		4124.32	0.0947	76.38	USACE/DNREC

NOTE: STREAM CREATION NOT IN EXISTING RESOURCE. FALLS IN USACE/DNREC JURISDICTION.


MATCHLINE STA 135+50
LOC
PWL
POHW/WL
OHW
S(C)
G(A)
R/W
E BROOKLAND AVENUE
CENTRE ROAD
07-035.30-109 RICHARD L. JR. & RUTH JACKSON D.B. H84-658
07-035.30-107 WALTER LOUIS III & ILZE GENDRON D.R. 20210720-0082834
07-035.30-106 ANTHONY & LAUREN VITALO D.R. 20220527-0056319
07-035.30-105 CHRIS JR. & JENNIFER L. DEITRICH D.R. 20060717-0067674
07-035.10-042 NEW CASTLE COUNTY-LEVY COURT D.R. 862-544
07-035.30-165 SHANE M. PALMER D.R. 20220803-0077351
07-035.30-166 KAREN M. & STEVEN D. BEARE TRUSTEES D.R. 20020521-0048230
07-035.30-167 JACQUELINE M. MWANGI D.R. 20210824-0098918
07-035.30-168 DENISE FARAGALLI D.R. 20210105-0001177
07-035.30-422 ROSE M. KING D.B. 2129-12
D.R. 20210809-0092939
D.B. X99-339
TO 21
WC 6
OC 6
OE 62
PO 170
PO 171
OE 63
OC 6
WC 6
OE 64
OE 65
PO 174
PO 175
WC 6
PO 176
PO 179
PO 178
PO 177
PO 169
PO 168
WC 6
WC 6
OC 6
WC 6
PO 173
PO 172
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WC 6
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OE 66
WC 6
TO 16
1350+00
1400+00
1425+00
1450+00
1475+00
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1935-00
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1986-00
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2037-00
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2071-00
2088-00





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PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-1	RIPRAP	771.30	0.0177	85.70	USACE/DNREC
PO-2	CONVERSION OF OHW TO WETLAND	15.88	0.0004	0.29	USACE/DNREC
PO-3	CONVERSION OF OHW TO WETLAND	314.67	0.0072	5.83	USACE/DNREC
PO-4	FLOODPLAIN LOG	13.40	0.0003	0.25	USACE/DNREC
PO-5	CONVERSION OF OHW TO WETLAND	1.10	0.00003	0.02	USACE/DNREC
PO-6	FLOODPLAIN LOG	16.91	0.0004	0.31	USACE/DNREC
PO-7	CONVERSION OF OHW TO WETLAND	303.01	0.0070	5.61	USACE/DNREC
PO-8	FLOODPLAIN LOG	16.72	0.0004	0.31	USACE/DNREC
PO-9	CONVERSION OF OHW TO WETLAND	0.26	0.00001	0.005	USACE/DNREC
PO-10	FLOODPLAIN LOG	9.99	0.0002	0.19	USACE/DNREC
PO-11	FLOODPLAIN LOG	10.43	0.0002	0.19	USACE/DNREC
PO-12	FLOODPLAIN LOG	18.61	0.0004	0.34	USACE/DNREC
PO-13	CONVERSION OF OHW TO WETLAND	1035.50	0.0238	19.18	USACE/DNREC
PO-14	FLOODPLAIN LOG	21.52	0.0005	0.40	USACE/DNREC
PO-15	CONVERSION OF OHW TO WETLAND	535.27	0.0123	9.91	USACE/DNREC
TOTAL FOR THIS SHEET		3084.57	0.0708	128.54	USACE/DNREC

OPEN WATER ENHANCEMENT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OE-1	CHANNEL ENHANCEMENT	81.40	0.0019	1.51	USACE/DNREC
OE-2	CHANNEL ENHANCEMENT	80.44	0.0018	1.49	USACE/DNREC
OE-3	CHANNEL ENHANCEMENT	56.84	0.0013	1.05	USACE/DNREC
OE-4	CHANNEL ENHANCEMENT	76.60	0.0018	1.42	USACE/DNREC
OE-5	CHANNEL ENHANCEMENT	27.43	0.0006	0.51	USACE/DNREC
OE-6	CHANNEL ENHANCEMENT	88.80	0.0020	1.64	USACE/DNREC
OE-7	CHANNEL ENHANCEMENT	36.79	0.0008	0.68	USACE/DNREC
TOTAL FOR THIS SHEET		448.30	0.0103	8.30	USACE/DNREC

TEMPORARY OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
TO-1	SANDBAG DIKE	30.15	0.0007	0.56	USACE/DNREC
TO-2	SANDBAG DIKE	30.15	0.0007	0.56	USACE/DNREC
TOTAL FOR THIS SHEET		60.30	0.0014	1.12	USACE/DNREC

WETLAND CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WC-7	WETLAND CREATION	11211.12	0.2574	207.61	USACE
TOTAL WETLAND CREATION AREAS		11211.12	0.2574	207.61	USACE

NOTE: WETLAND CREATION NOT IN EXISTING RESOURCE.

OPEN WATER CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OC-7	STREAM CREATION	870.33	0.0200	16.12	USACE/DNREC
TOTAL OPEN WATER CREATION AREAS		870.33	0.0200	16.12	USACE/DNREC

NOTE: STREAM CREATION NOT IN EXISTING RESOURCE. FALLS IN USACE/DNREC JURISDICTION.

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: H. AZIZ
CHECKED BY: J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

EC-07
SECTION
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PERMANENT OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
PO-68	RIPRAP	299.15	0.0069	33.24	USACE/DNREC
PO-69	CONVERSION OF OHW TO WETLAND	364.91	0.0084	6.76	USACE/DNREC
TOTAL FOR THIS SHEET		664.06	0.0152	40.00	USACE/DNREC

TEMPORARY OPEN WATER IMPACT AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
TO-7	SANDBAG DIKE	206.81	0.0047	3.83	USACE/DNREC
TOTAL FOR THIS SHEET		206.81	0.0047	3.83	USACE/DNREC

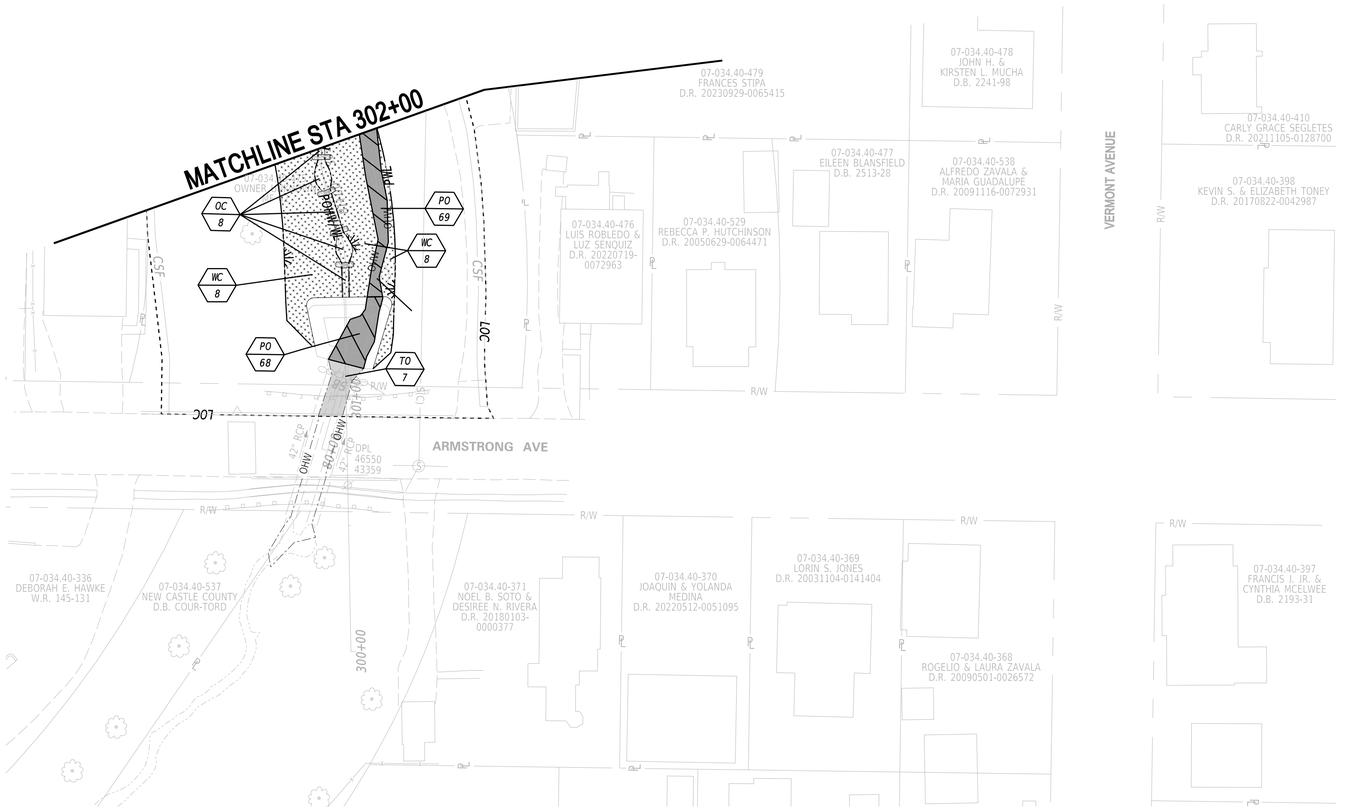
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LEGEND

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C = CREATION AREA
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WETLAND CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
WC-8	WETLAND CREATION	2213.90	0.0508	41.00	USACE
TOTAL WETLAND CREATION AREAS		2213.90	0.0508	41.00	USACE

NOTE: WETLAND CREATION NOT IN EXISTING RESOURCE.

OPEN WATER CREATION AREA SCHEDULE

ID	IMPACT DESCRIPTION	AREA (SF)	AREA (AC)	VOLUME (CY)	JURISDICTION
OC-8	STREAM CREATION	202.69	0.0047	3.75	USACE/DNREC
TOTAL OPEN WATER CREATION AREAS		202.69	0.0047	3.75	USACE/DNREC

NOTE: STREAM CREATION NOT IN EXISTING RESOURCE. FALLS IN USACE/DNREC JURISDICTION.

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279
DESIGNED BY: H. AZIZ
CHECKED BY: J. REEL

ENVIRONMENTAL COMPLIANCE PLAN

EC-08
SECTION
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SHEET NO.
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MAINTENANCE OF TRAFFIC NOTES

1. AMERICAN TRAFFIC SAFETY SERVICES ASSOCIATION (ATSSA) CERTIFIED TRAFFIC CONTROL SUPERVISOR REQUIREMENT FOR THIS PROJECT.

(X)	THE CONTRACTOR SHALL NOT BE REQUIRED TO HAVE AN ATSSA SUPERVISOR ASSIGNED TO THIS PROJECT.
( )	THE CONTRACTOR SHALL HAVE AN ATSSA SUPERVISOR ASSIGNED TO THIS PROJECT. THE CONTRACTOR'S GENERAL SUPERINTENDENT FOR THIS PROJECT OR ANOTHER ATSSA CERTIFIED MEMBER OF THE CONTRACTOR'S PROJECT STAFF MAY BE THE ATSSA SUPERVISOR. PAYMENT FOR ATSSA SUPERVISOR IS INCIDENTAL TO ITEM 801000.

2. ACCEPTABLE MATERIALS FOR TEMPORARY PEDESTRIAN PATHS SHALL INCLUDE CONCRETE, HOT-MIX, COMPACTED MILLINGS OR PLYWOOD WALKWAY STRUCTURE. PLYWOOD WALKWAY STRUCTURES SHALL ALSO INCLUDE DETECTABLE EDGING AND RAILINGS IN ACCORDANCE WITH ADA GUIDELINES AND THE DELAWARE MUTCD. TEMPORARY PEDESTRIAN PATHS SHALL BE INCIDENTAL TO ITEM 801000 UNLESS OTHERWISE SPECIFIED IN THE PLANS. STONE OR GRADED AGGREGATE BASE COURSE SHALL NOT BE USED FOR TEMPORARY PEDESTRIAN PATHS.

3. NO LANE CLOSURE TIME RESTRICTIONS ARE ASSOCIATED WITH THIS PROJECT.

4. MAINTENANCE OF TRAFFIC DURING LANE CLOSURES AND LANE SHIFTS SHALL CONFORM TO TYPICAL APPLICATION TA-28 OF THE DELAWARE MUTCD.

TREE PROTECTION NOTES

1. REFER TO CONSTRUCTION PLANS FOR PROPOSED TREE REMOVALS AND TREES TO REMAIN.

2. ALL TREES TO REMAIN SHALL BE PROTECTED WITH CONSTRUCTION SAFETY FENCE (CSF). CSF SHALL BE PLACED AROUND INDIVIDUAL OR GROUPS OF TREES TO REMAIN AND INCLUDE AS MUCH OF THE CRITICAL ROOT ZONE (CRZ) AS POSSIBLE DURING CONSTRUCTION. CRZ (IN FEET) IS CALCULATED AS 1.5 X DIAMETER AT BREAST HEIGHT ((DBH) IN INCHES). DBH IS MEASURED AT 4.5' ABOVE THE GROUND. THE CONTRACTOR SHALL SUBMIT THE LIMITS OF CSF TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

3. THE CONTRACTOR SHALL IDENTIFY LIMITS OF ROOT PRUNING ON ALL TREES TO REMAIN ADJACENT TO PROPOSED GRADING AND STONE DUST/HOT MIX TRAIL AND SUBMIT THE LIMITS OF ROOT PRUNING TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

EROSION AND SEDIMENT CONTROL NOTES

1. THE SEDIMENT AND STORMWATER MANAGEMENT PLANS HAVE BEEN APPROVED BY DELDOT'S STORMWATER ENGINEER UNDER DELDOT'S DELEGATED AUTHORITY. THE SEDIMENT AND STORMWATER MANAGEMENT PLANS ARE VALID FOR A FIVE YEAR PERIOD, BEGINNING ON THE DATE THE STORMWATER ENGINEER SIGNED THE CONSTRUCTION TITLE SHEET. IF THE FINAL ACCEPTANCE OF THE PROJECT IS ANTICIPATED TO EXTEND BEYOND THE FIVE YEARS, THE CONTRACTOR WILL INFORM THE ENGINEER THREE MONTHS PRIOR TO THE EXPIRATION OF THE APPROVED SEDIMENT AND STORMWATER MANAGEMENT PLANS. THE STORMWATER ENGINEER WILL REVIEW THE CURRENT SEDIMENT AND STORMWATER MANAGEMENT PLAN AND ISSUE AN EXTENSION WITH ANY APPROPRIATE MODIFICATIONS.

2.

EROSION POTENTIAL FOR THIS PROJECT	CONTRACTOR EROSION AND SEDIMENT CONTROL SUPERVISOR REQUIREMENT
( ) INSIGNIFICANT	NONE
( ) MINOR	CONTRACTOR TRAINING PROGRAM, AS DEFINED IN SECTION 6.2 OF THE DELAWARE SEDIMENT AND STORMWATER REGULATIONS.
(X) MAJOR	CERTIFIED CONSTRUCTION REVIEWER (CCR), AS DEFINED IN SECTION 6.3 OF THE DELAWARE SEDIMENT AND STORMWATER REGULATIONS.

3. THE DISTURBED AREA FOR THIS PROJECT IS 23.69 ACRES.

4. THE INCREASED IMPERVIOUS AREA FOR THIS PROJECT IS 0.89 ACRES.

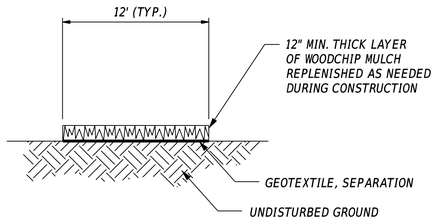
5. STOCKPILES OF ERODIBLE MATERIALS SHALL BE PLACED AS FAR AWAY FROM WATERWAYS AND DRAINAGE COURSES AS POSSIBLE, AND A MINIMUM OF 10 FEET FROM PROPERTY LINES.

CONSTRUCTION PHASING & M.O.T

	BARRICADE, TYPE 3
	CONCRETE SAFETY BARRIER - PORTABLE
CSF XXX	CONSTRUCTION SAFETY FENCE / LENGTH
CSF	CONSTRUCTION SAFETY FENCE
	CONSTRUCTION WARNING SIGN LOCATION
END ROAD WORK	CONSTRUCTION WARNING SIGN
	CRASH CUSHION ARRAY
	DRUM - TRAFFIC CONTROL
	FLAGGER LOCATION
PHASE	PHASING TRAFFIC FLOW ARROW
	TEMPORARY CONSTRUCTION
	TEMPORARY PAVEMENT MARKING ARROW
	TRUCK WITH MOUNTED ATTENUATOR
	WORK AREA - ACTIVE PHASE
	MULCH ACCESS ROAD

EROSION & SEDIMENT CONTROL

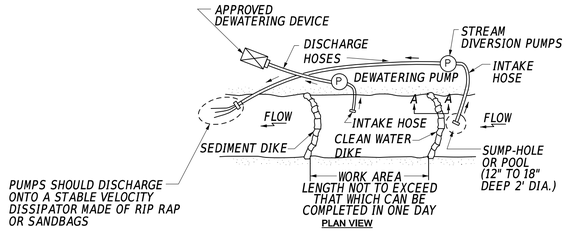
CFL	COMPOST FILTER LOG
CFL	COMPOST FILTER LOG / LENGTH
DWBAG	DEWATERING BAG
DWB	DEWATERING BASIN
ED	EARTH DIKE
	INLET SEDIMENT CONTROL
	PERIMETER DIKE/SWALE
PST	PORTABLE SEDIMENT TANK
SBD	SANDBAG DIKE
SB	SANDBAG DIVERSION
	STONE CHECK DAM
SCE	STABILIZED CONSTRUCTION ENTRANCE
SF	SILT FENCE / LENGTH
SF	SILT FENCE
RSF	REINFORCED SILT FENCE / LENGTH
RSF	REINFORCED SILT FENCE
SSF	SUPER SILT FENCE / LENGTH
SSF	SUPER SILT FENCE
SP	SUMP PIT
ST	SEDIMENT TRAP / NUMBER
ST	SEDIMENT TRAP
ST	SEDIMENT TRAP WITH INLET AS OUTLET
ST	SEDIMENT TRAP PIPE OUTLET
SW	STILLING WELL
	TEMPORARY SWALE
TSD	TEMPORARY SLOPE DRAIN
T XXX	TURBIDITY CURTAIN / LENGTH
T	TURBIDITY CURTAIN



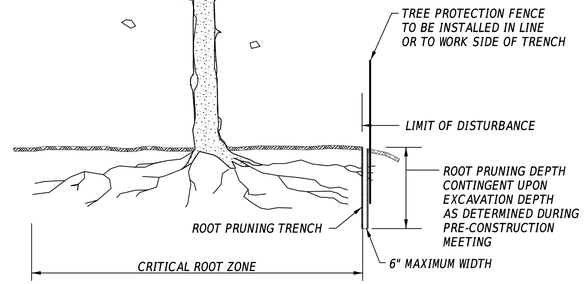
NOTES:

1. ACCESS ROUTES TO BE VERIFIED BY THE ENGINEER AT PRE-CONSTRUCTION MEETING. REVISIONS TO THE ALIGNMENT THAT MINIMIZE TREE DISTURBANCE ARE ENCOURAGED AND REQUIRE REVIEW AND APPROVAL OF THE ENGINEER.
2. GEOTEXTILE, SEPARATION SHALL BE PLACED WITH SEAMS PARALLEL TO THE FLOW OF TRAFFIC. OVERLAP FABRIC BY 18" MIN. AT SEAMS.
3. CONTRACTOR SHALL MAINTAIN TEMPORARY ACCESS ROAD THROUGHOUT CONSTRUCTION PERIOD.

MULCH ACCESS ROAD



PUMP-AROUND PRACTICE DETAIL



NOTES:

1. BOUNDARIES OF RETENTION AREAS TO BE STAKED, FLAGGED AND/OR FENCED PRIOR TO TRENCHING.
2. EXACT LOCATION OF TRENCH SHOULD BE IDENTIFIED.
3. TRENCH SHOULD BE IMMEDIATELY BACKFILLED WITH SOIL REMOVED OR ORGANIC SOIL.
4. ROOTS SHOULD BE CLEANLY CUT USING VIBRATORY KNIFE OR OTHER ACCEPTABLE EQUIPMENT.
5. IN SOME INSTANCES, IT MAY BE BENEFICIAL TO PERFORM ROOT PRUNING AT THE EDGE OF EXCAVATION RATHER THAN AT THE LOD, PROVIDED THE ROOTS BETWEEN THE EXCAVATION AND THE LOD ARE PROTECTED DURING CONSTRUCTION.
6. ROOT PRUNING SHALL BE INCIDENTAL TO ITEM - 727006 - TEMPORARY CONSTRUCTION FENCE.

ROOT PRUNING DETAIL

DELDOT STORMWATER ENGINEER _____ DATE _____

I CERTIFY TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THESE PLANS MEET THE REQUIREMENTS OF THE DELAWARE SEDIMENT AND STORMWATER REGULATIONS AND THAT ALL CLEARING, GRADING, AND CONSTRUCTION WILL BE ACCOMPLISHED PURSUANT TO THE PLAN.

ADDENDA / REVISIONS		NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN	SECTION RKK
					DESIGNED BY: S. ROUPE		SHEET NO. 81
					CHECKED BY: T. CUTILLO		

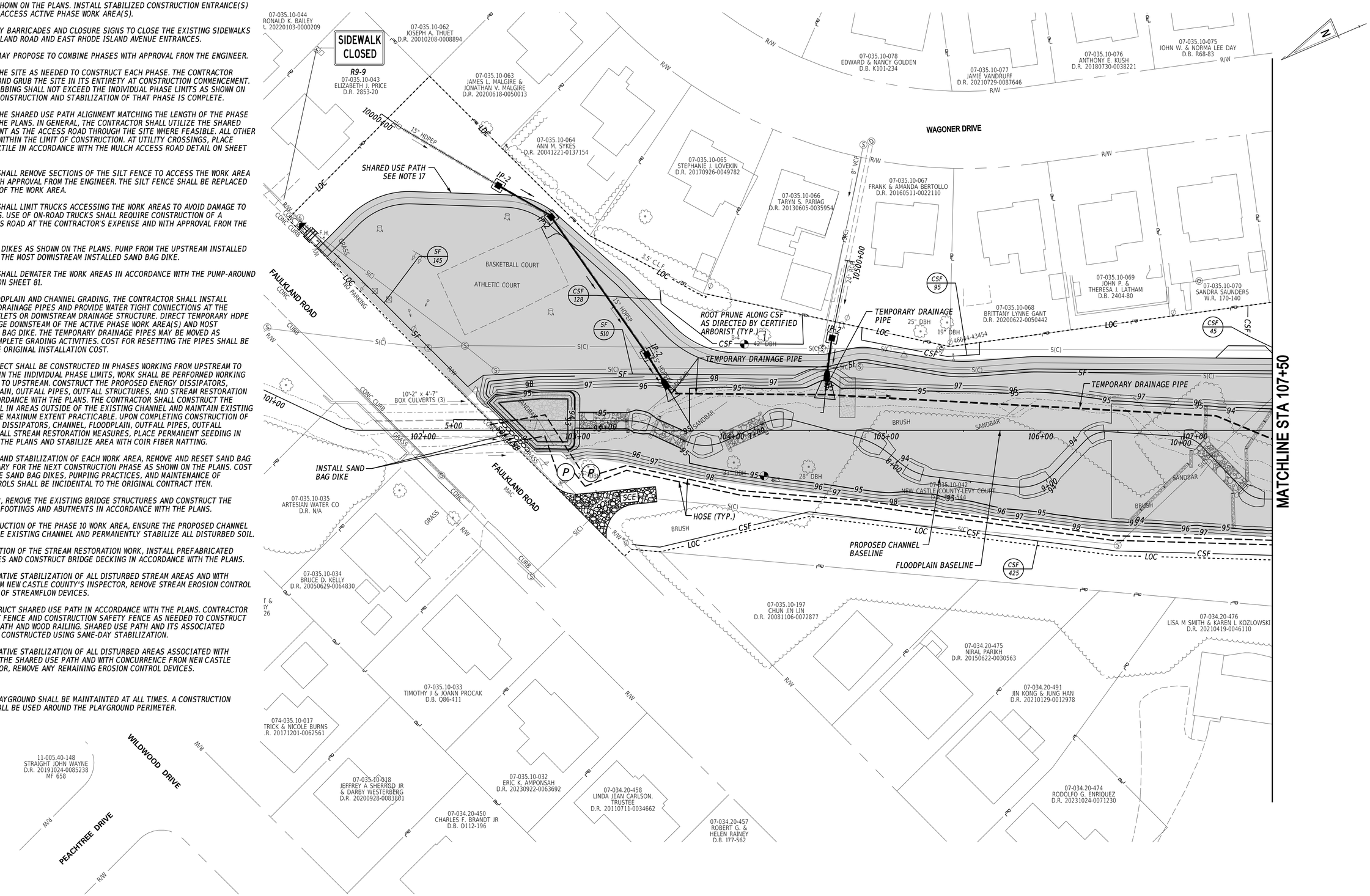
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SEQUENCE OF CONSTRUCTION

1. *INSTALL PERIMETER CONTROLS AND TREE PROTECTION MEASURES WITHIN THE INDIVIDUAL PHASE LIMITS AS SHOWN ON THE PLANS. INSTALL STABILIZED CONSTRUCTION ENTRANCE(S) AS NECESSARY TO ACCESS ACTIVE PHASE WORK AREA(S).*
2. *INSTALL TEMPORARY BARRICADES AND CLOSURE SIGNS TO CLOSE THE EXISTING SIDEWALKS LOCATED AT FAULKLAND ROAD AND EAST RHODE ISLAND AVENUE ENTRANCES.*
3. *THE CONTRACTOR MAY PROPOSE TO COMBINE PHASES WITH APPROVAL FROM THE ENGINEER.*
4. *CLEAR AND GRUB THE SITE AS NEEDED TO CONSTRUCT EACH PHASE. THE CONTRACTOR SHALL NOT CLEAR AND GRUB THE SITE IN ITS ENTIRETY AT CONSTRUCTION COMMENCEMENT. CLEARING AND GRUBBING SHALL NOT EXCEED THE INDIVIDUAL PHASE LIMITS AS SHOWN ON THE PLANS UNTIL CONSTRUCTION AND STABILIZATION OF THAT PHASE IS COMPLETE.*
5. *CLEAR AND GRUB THE SHARED USE PATH ALIGNMENT MATCHING THE LENGTH OF THE PHASE LIMITS SHOWN ON THE PLANS. IN GENERAL, THE CONTRACTOR SHALL UTILIZE THE SHARED USE PATH ALIGNMENT AS THE ACCESS ROAD THROUGH THE SITE WHERE FEASIBLE. ALL OTHER ACCESS SHALL BE WITHIN THE LIMIT OF CONSTRUCTION. AT UTILITY CROSSINGS, PLACE MULCH AND GEOTEXTILE IN ACCORDANCE WITH THE MULCH ACCESS ROAD DETAIL ON SHEET 81.*
6. *THE CONTRACTOR SHALL REMOVE SECTIONS OF THE SILT FENCE TO ACCESS THE WORK AREA AS NECESSARY WITH APPROVAL FROM THE ENGINEER. THE SILT FENCE SHALL BE REPLACED UPON COMPLETION OF THE WORK AREA.*
7. *THE CONTRACTOR SHALL LIMIT TRUCKS ACCESSING THE WORK AREAS TO AVOID DAMAGE TO EXISTING UTILITIES. USE OF ON-ROAD TRUCKS SHALL REQUIRE CONSTRUCTION OF A TEMPORARY ACCESS ROAD AT THE CONTRACTOR'S EXPENSE AND WITH APPROVAL FROM THE ENGINEER.*
8. *INSTALL SAND BAG DIKES AS SHOWN ON THE PLANS. PUMP FROM THE UPSTREAM INSTALLED SAND BAG DIKE TO THE MOST DOWNSTREAM INSTALLED SAND BAG DIKE.*
9. *THE CONTRACTOR SHALL DEWATER THE WORK AREAS IN ACCORDANCE WITH THE PUMP-AROUND PRACTICE DETAIL ON SHEET 81.*
10. *PRIOR TO THE FLOODPLAIN AND CHANNEL GRADING, THE CONTRACTOR SHALL INSTALL TEMPORARY HDPE DRAINAGE PIPES AND PROVIDE WATER TIGHT CONNECTIONS AT THE EXISTING PIPE OUTLETS OR DOWNSTREAM DRAINAGE STRUCTURE. DIRECT TEMPORARY HDPE PIPES TO DISCHARGE DOWNSTEAM OF THE ACTIVE PHASE WORK AREA(S) AND MOST DOWNSTREAM SAND BAG DIKE. THE TEMPORARY DRAINAGE PIPES MAY BE MOVED AS NECESSARY TO COMPLETE GRADING ACTIVITIES. COST FOR RESETTING THE PIPES SHALL BE INCIDENTAL TO THE ORIGINAL INSTALLATION COST.*
11. *OVERALL, THE PROJECT SHALL BE CONSTRUCTED IN PHASES WORKING FROM UPSTREAM TO DOWNSTREAM. WITHIN THE INDIVIDUAL PHASE LIMITS, WORK SHALL BE PERFORMED WORKING FROM DOWNSTREAM TO UPSTREAM. CONSTRUCT THE PROPOSED ENERGY DISSIPATORS, CHANNEL, FLOODPLAIN, OUTFALL PIPES, OUTFALL STRUCTURES, AND STREAM RESTORATION MEASURES IN ACCORDANCE WITH THE PLANS. THE CONTRACTOR SHALL CONSTRUCT THE PROPOSED CHANNEL IN AREAS OUTSIDE OF THE EXISTING CHANNEL AND MAINTAIN EXISTING STREAMFLOW TO THE MAXIMUM EXTENT PRACTICABLE. UPON COMPLETING CONSTRUCTION OF PROPOSED ENERGY DISSIPATORS, CHANNEL, FLOODPLAIN, OUTFALL PIPES, OUTFALL STRUCTURES, AND ALL STREAM RESTORATION MEASURES, PLACE PERMANENT SEEDING IN ACCORDANCE WITH THE PLANS AND STABILIZE AREA WITH COIR FIBER MATTING.*
12. *UPON COMPLETION AND STABILIZATION OF EACH WORK AREA, REMOVE AND RESET SAND BAG DIKES AS NECESSARY FOR THE NEXT CONSTRUCTION PHASE AS SHOWN ON THE PLANS. COST FOR RESETTING THE SAND BAG DIKES, PUMPING PRACTICES, AND MAINTENANCE OF STREAMFLOW CONTROLS SHALL BE INCIDENTAL TO THE ORIGINAL CONTRACT ITEM.*
13. *IN PHASES 7 AND 8, REMOVE THE EXISTING BRIDGE STRUCTURES AND CONSTRUCT THE PROPOSED BRIDGE FOOTINGS AND ABUTMENTS IN ACCORDANCE WITH THE PLANS.*
14. *FOLLOWING CONSTRUCTION OF THE PHASE 10 WORK AREA, ENSURE THE PROPOSED CHANNEL TIES BACK INTO THE EXISTING CHANNEL AND PERMANENTLY STABILIZE ALL DISTURBED SOIL.*
15. *FOLLOWING COMPLETION OF THE STREAM RESTORATION WORK, INSTALL PREFABRICATED BRIDGE STRUCTURES AND CONSTRUCT BRIDGE DECKING IN ACCORDANCE WITH THE PLANS.*
16. *UPON FINAL VEGETATIVE STABILIZATION OF ALL DISTURBED STREAM AREAS AND WITH CONCURRENCE FROM NEW CASTLE COUNTY'S INSPECTOR, REMOVE STREAM EROSION CONTROL AND MAINTENANCE OF STREAMFLOW DEVICES.*
17. *GRADE AND CONSTRUCT SHARED USE PATH IN ACCORDANCE WITH THE PLANS. CONTRACTOR SHALL REMOVE SILT FENCE AND CONSTRUCTION SAFETY FENCE AS NEEDED TO CONSTRUCT THE SHARED USE PATH AND WOOD RAILING. SHARED USE PATH AND ITS ASSOCIATED GRADING SHALL BE CONSTRUCTED USING SAME-DAY STABILIZATION.*
18. *UPON FINAL VEGETATIVE STABILIZATION OF ALL DISTURBED AREAS ASSOCIATED WITH CONSTRUCTION OF THE SHARED USE PATH AND WITH CONCURRENCE FROM NEW CASTLE COUNTY'S INSPECTOR, REMOVE ANY REMAINING EROSION CONTROL DEVICES.*

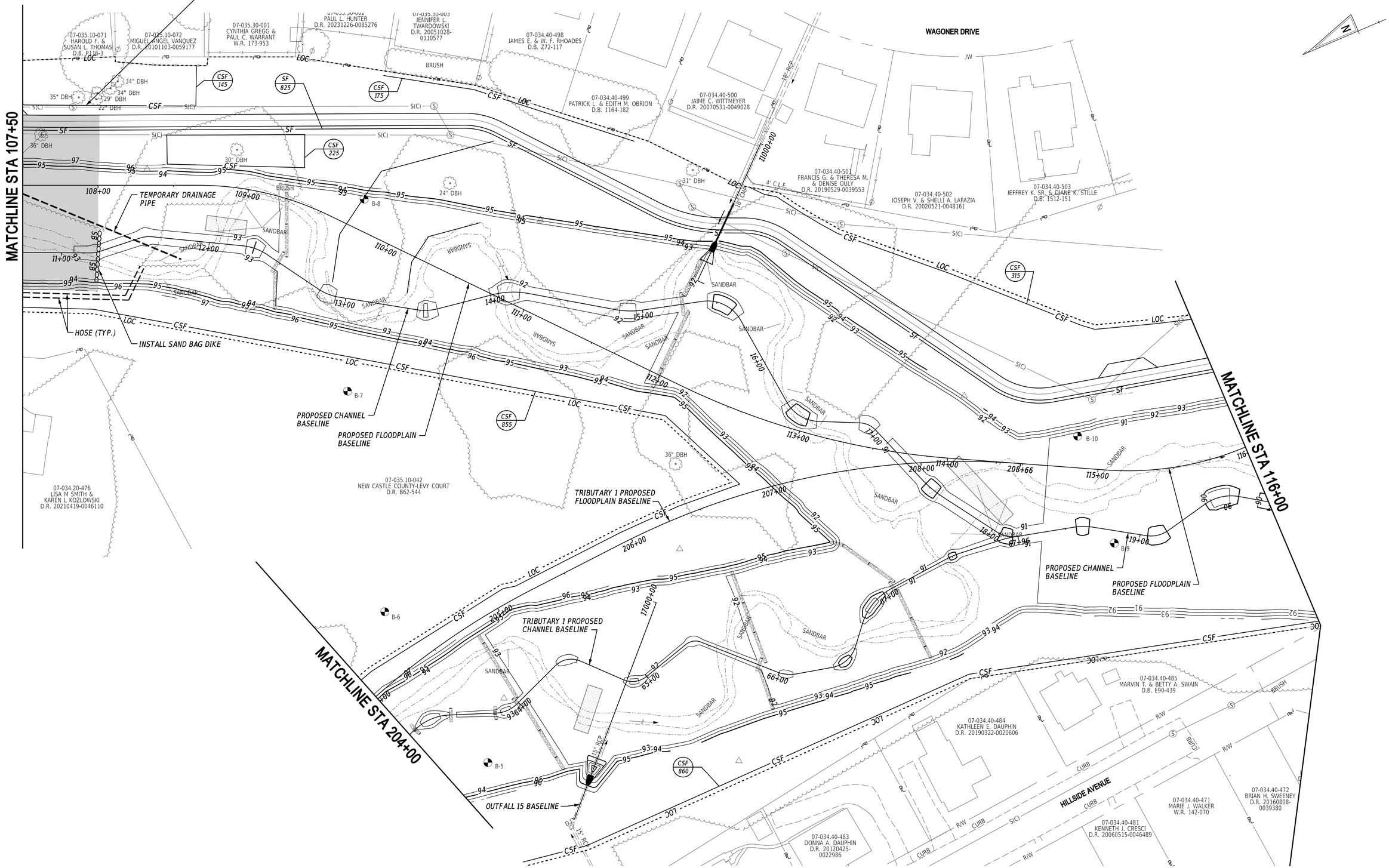
NOTES

1. *ACCESS TO THE PLAYGROUND SHALL BE MAINTAINTED AT ALL TIMES. A CONSTRUCTION SAFETY FENCE SHALL BE USED AROUND THE PLAYGROUND PERIMETER.*



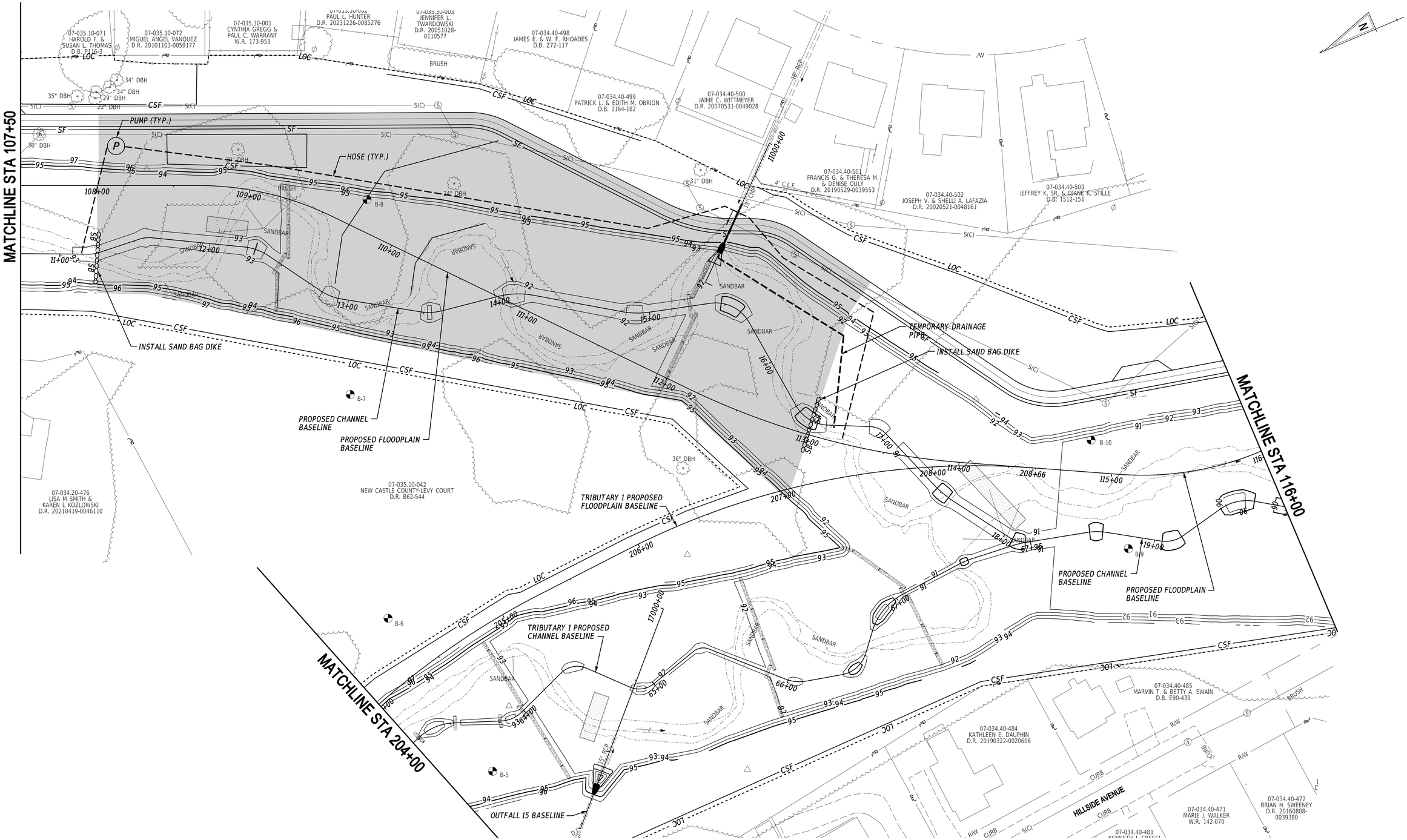
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				DESIGNED BY: S. ROUPE		SHEET NO. 82
				CHECKED BY: T. CUTILLO		

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ADDENDA / REVISIONS		SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT	20230414279	CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 1	SECTION
		0 30 60 90		New Castle County 1673 Delaware	DESIGNED BY:	S. ROUPE		RKK
		FEET			CHECKED BY:	T. CUTILLO		SHEET NO. 83

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ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 2

SECTION
RKK
SHEET NO.
84

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MATCHLINE STA 107+50

MATCHLINE STA 116+00

MATCHLINE STA 204+00

WAGONER DRIVE

07-035.10-071
HAROLD F. & SUSAN L. THOMAS
D.B. P116-3

07-035.10-072
MIGUEL ANGEL VANQUEZ
D.R. 20101103-0059177

07-035.30-001
CYNTHIA GREGG & PAUL C. WARRANT
W.R. 173-953

07-035.30-002
PAUL L. HUNTER
D.R. 20231226-0085276

07-035.30-003
JENNIFER L. TWARDOWSKI
D.R. 20051028-0110577

07-034.40-498
JAMES E. & W. F. RHOADES
D.B. Z72-117

07-034.40-499
PATRICK L. & EDITH M. OBRION
D.B. 1164-182

07-034.40-500
JAIME C. WITTMEYER
D.R. 20070531-0049028

07-034.40-501
FRANCIS G. & THERESA M. & DENISE OLLY
D.R. 20190529-0039553

07-034.40-502
JOSEPH V. & SHELLI A. LAFAZIA
D.R. 20020521-0048161

07-034.40-503
JEFFREY K. SR. & DIANE K. STILLE
D.B. 1512-151

07-034.20-476
LISA M SMITH & KAREN L KOZLOWSKI
D.R. 20210419-0046110

07-035.10-042
NEW CASTLE COUNTY-LEVY COURT
D.R. B62-544

07-034.40-484
KATHLEEN E. DAUPHIN
D.R. 20190322-0020606

07-034.40-485
MARVIN T. & BETTY A. SWAIN
D.B. E90-439

07-034.40-471
MARIE J. WALKER
W.R. 142-070

07-034.40-472
BRIAN H. SWEENEY
D.R. 20160808-0039380

HILLSIDE AVENUE

PROPOSED CHANNEL BASELINE

PROPOSED FLOODPLAIN BASELINE

TRIBUTARY 1 PROPOSED FLOODPLAIN BASELINE

TRIBUTARY 1 PROPOSED CHANNEL BASELINE

INSTALL SAND BAG DIKE

TEMPORARY DRAINAGE PIPE

OUTFALL 15 BASELINE

HOSE (TYP.)

B-5 B-6 B-7 B-8 B-9 B-10

SANDBAR

BRUSH

CSF LOC SF S(C) R/W CURB

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ADDENDA / REVISIONS	

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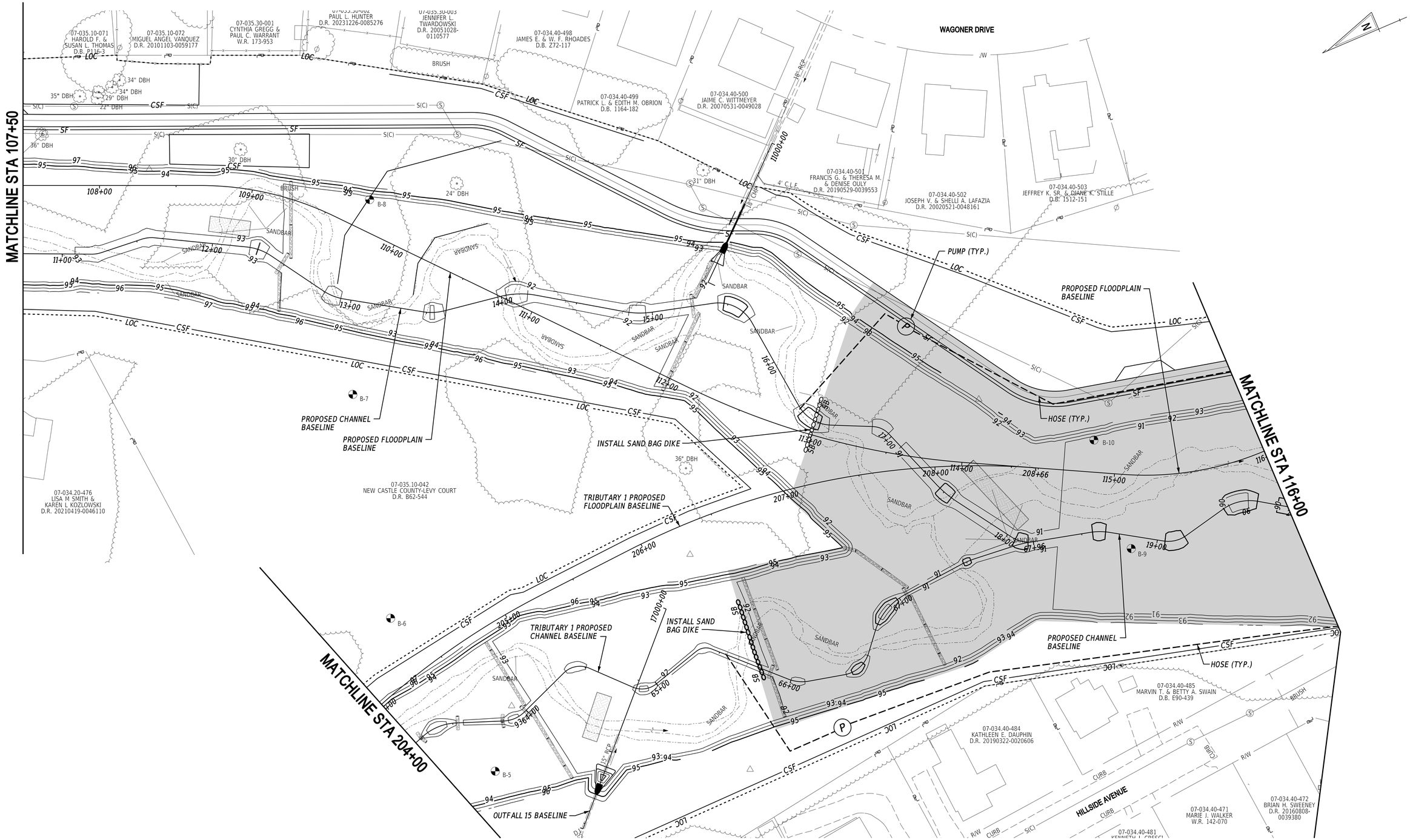
LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

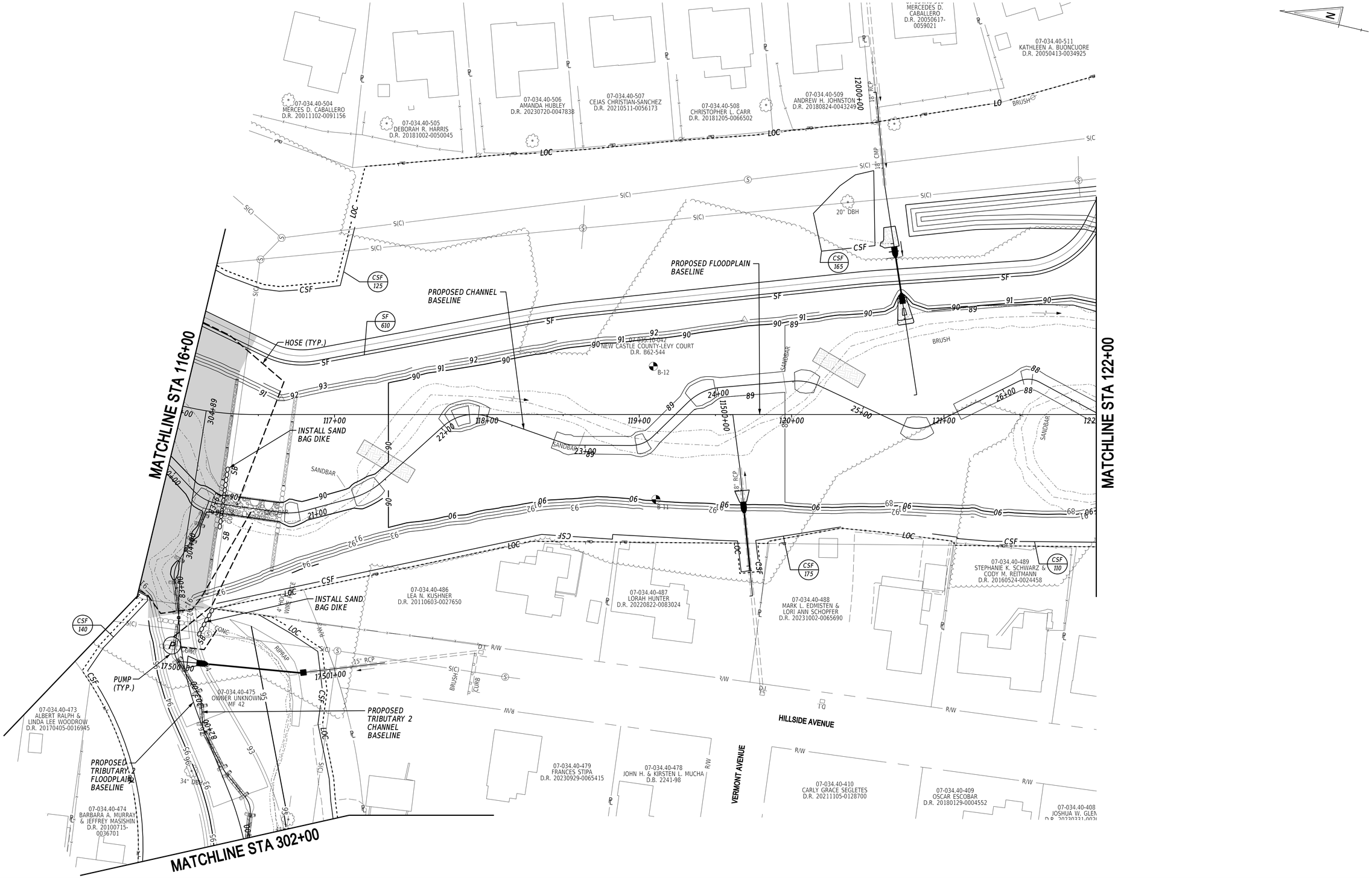
CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 3

SECTION
RKK
SHEET NO.
85



ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 4	SECTION RKK
					DESIGNED BY: S. ROUPE		SHEET NO. 86
					CHECKED BY: T. CUTILLO		

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ADDENDA / REVISIONS	

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FEET

LITTLE MILL CREEK STREAM RESTORATION

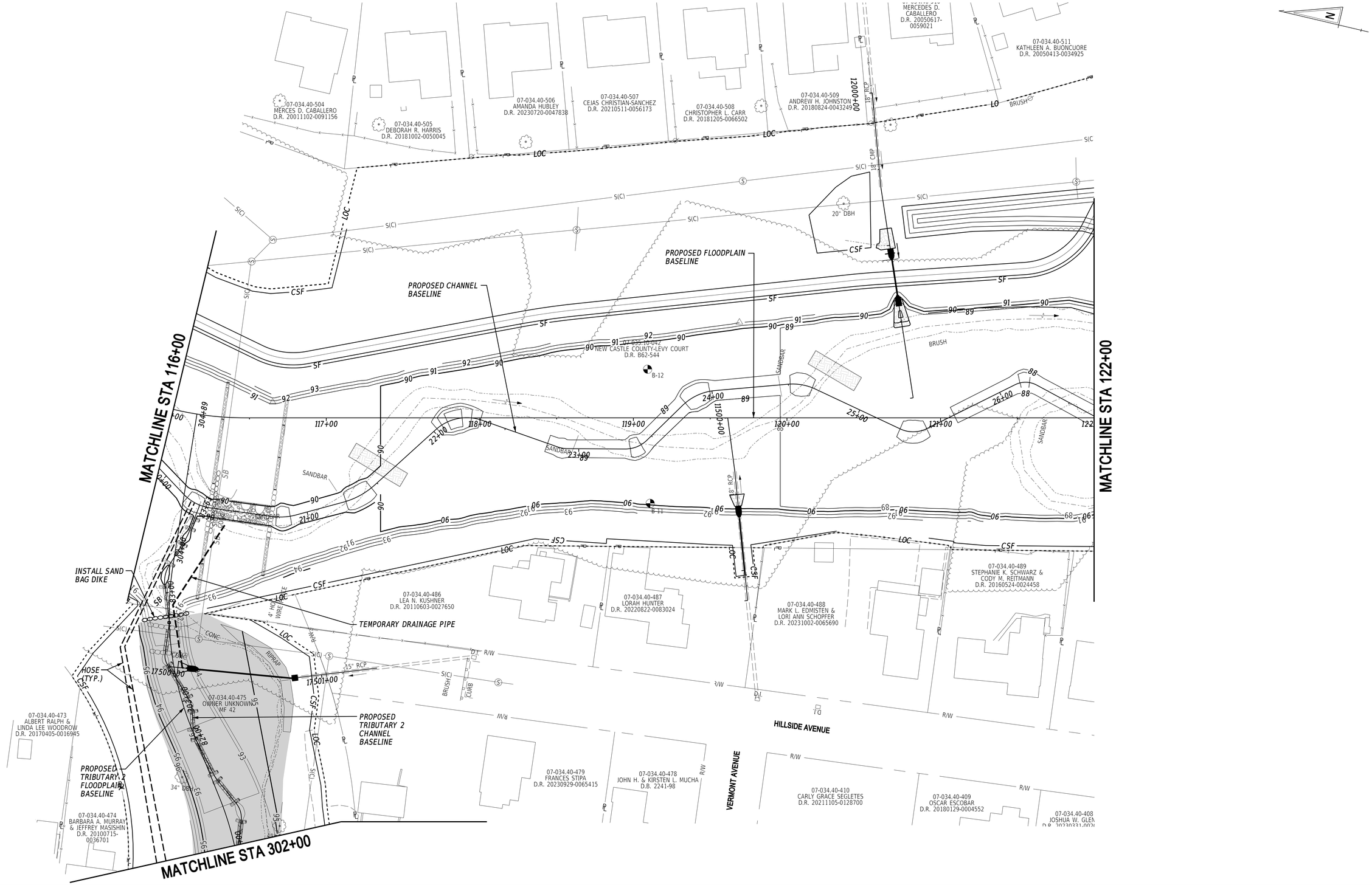
New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 4

SECTION
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87

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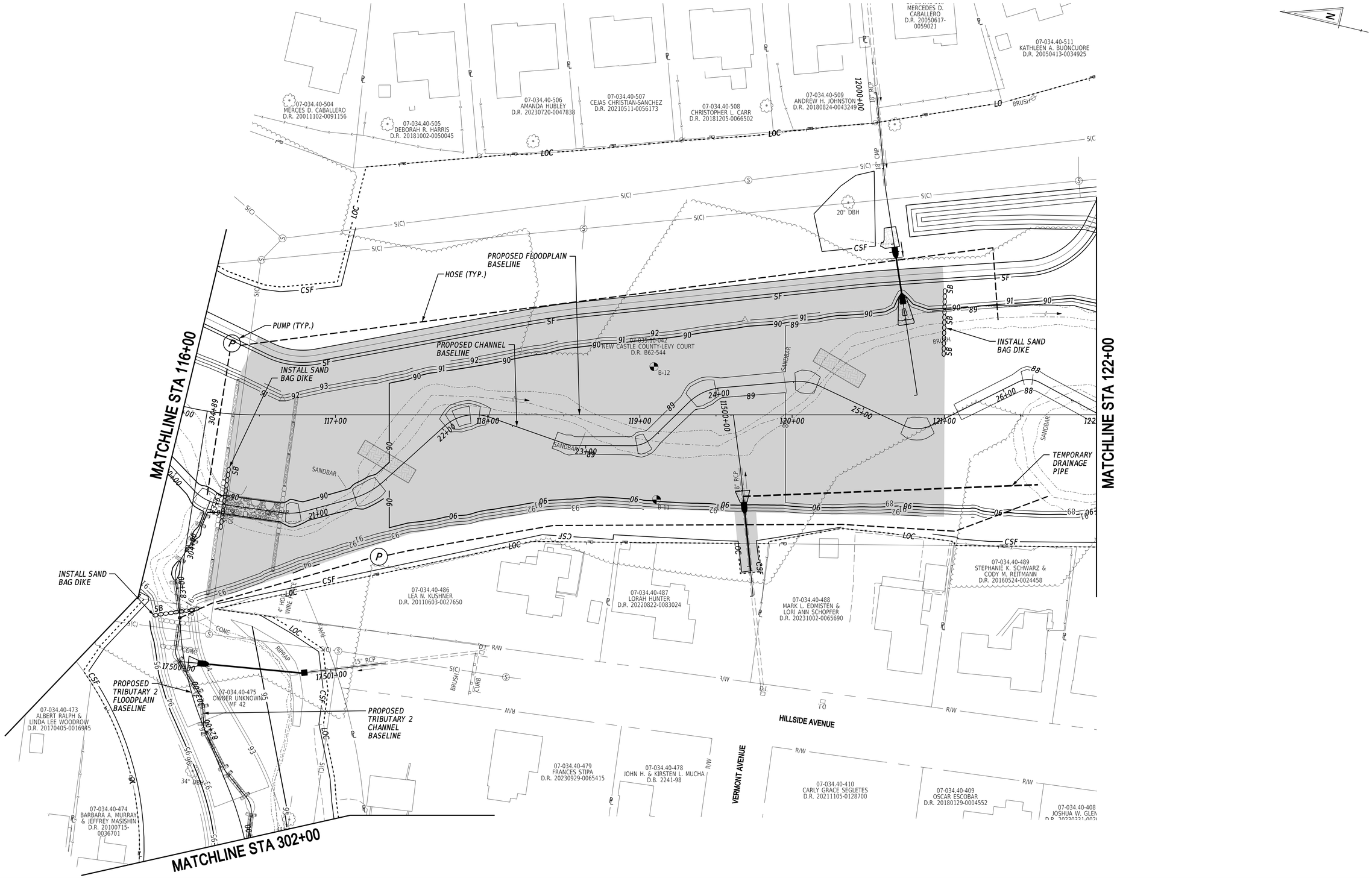
LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

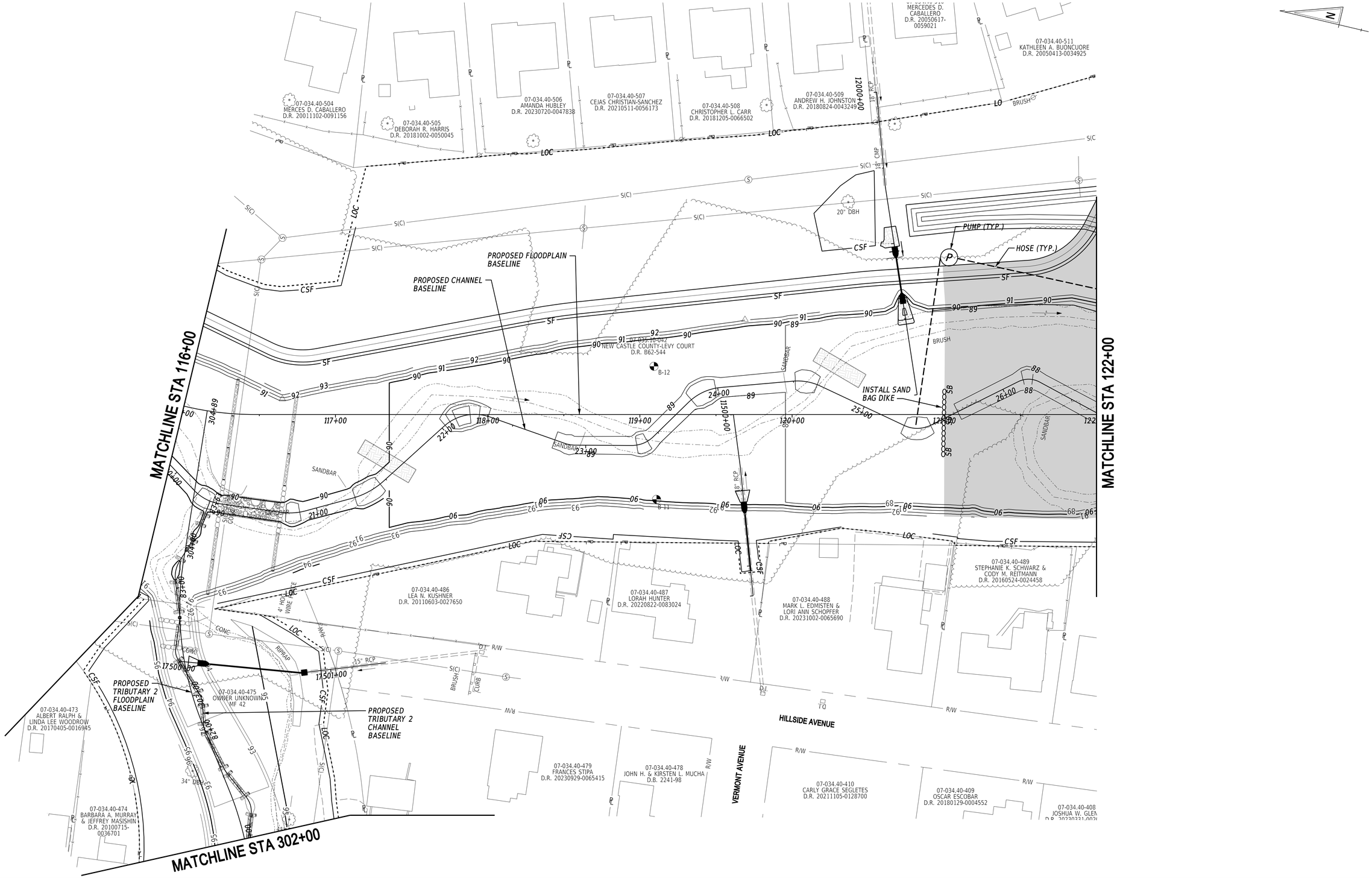
CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 5

SECTION
RKK
SHEET NO.
88



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					CHECKED BY: T. CUTILLO		SHEET NO. 89

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WAGONER DRIVE

SIDEWALK CLOSED
R9-9

RHODE ISLAND AVENUE

07-034.40-511
KATHLEEN A. BUONCUORE
D.R. 20050413-0034925

07-035.30-119
KENNETH H. &
BRENDA A. MCCOURT
D.B. 2363-237

07-035.30-120
SERGIO CAMARENA LARA &
MARIA DE LA LUZ GARCIA
D.R. 20180517-0023521

07-035.30-121
PAULA T. SNYDER
D.R. 20160907-0045283

MATCHLINE STA 130+00

MATCHLINE STA 122+00

BASKETBALL COURT

PLAYGROUND

07-035.10-042
NEW CASTLE COUNTY-LEVY COURT
D.R. B62-544
MF 646

PROPOSED FLOODPLAIN BASELINE

PROPOSED CHANNEL BASELINE

INSTALL SAND BAG DIKE

HOSE (TYP.)

METAL FOOT BRIDGE W/CONC ABUTMENTS

BR-B-01

BR-B-02

BR-B-03

B-13

B-14

TH#6

TH#7

GAS MARKER

07-035.30-141
LISA CRISTOFICH
D.R. 20130719-0047

07-035.30-
SAMUEL ROD
D.R. 20191219

07-034.40-490
SUSAN ROBINSON
D.R. 20021209-
0118218

07-034.40-491
KIMBERLY T. STEVENSON
D.R. 20121213-
0073524

07-034.40-492
HERMAN W. &
IRENE BOHN
D.B. N81-676

07-034.40-493
ALEXANDER D. MORA-BENAVIDES &
DIANA M. NEGREIROS-ARREDONDO
D.R. 20081001-0065896

07-034.40-534
NEW CASTLE COUNTY
P.B. 743-74
MF 9181

07-035.30-122
ELIZABETH K. STIRK
D.B. 1043-220

SANDBAR
07-035.10-042
NEW CASTLE COUNTY-
LEVY COURT
P.B. B62-544
MF 646

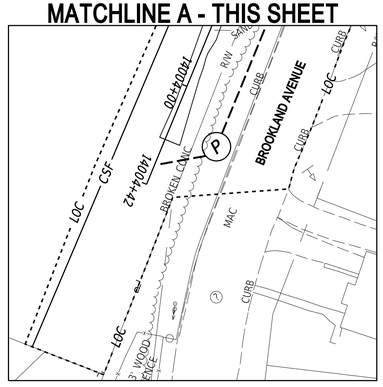
RHODE ISLAND AVENUE

BROOKLAND AVENUE

N WOODWARD AVENUE

MATCHLINE A - THIS SHEET

MATCHLINE A - THIS SHEET



ADDENDA / REVISIONS	

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 7

SECTION
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SHEET NO.
91

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WAGONER DRIVE

RHODE ISLAND AVENUE

SIDEWALK CLOSED
R9-9

07-034.40-511
KATHLEEN A. BUONCUORE
D.R. 20050413-0034925

07-035.30-119
KENNETH H. &
BRENDA A. MCCOURT
D.B. 2363-237

07-035.30-120
SERGIO CAMARENA LARA &
MARIA DE LA LUZ GARCIA
D.R. 20180517-0023521

07-035.30-121
PAULA T. SNYDER
D.R. 20160907-0045283

MATCHLINE STA 130+00

MATCHLINE STA 122+00

BASKETBALL COURT

PLAYGROUND

07-035.10-042
NEW CASTLE COUNTY-LEVY COURT
D.R. B62-544
MF 646

HOSE (TYP.)

PUMP (TYP.)

PROPOSED FLOODPLAIN BASELINE

INSTALL SAND BAG DIKE

PROPOSED CHANNEL BASELINE

METAL FOOT BRIDGE W/CONC ABUTMENTS

07-035.30-141
LISA CRISTOFICH
D.R. 20130719-0047

07-035.30-
SAMUEL ROD
D.R. 20191219

07-034.40-490
SUSAN ROBINSON
D.R. 20021209-
0118218

07-034.40-491
KIMBERLY T. STEVENSON
D.R. 20121213-
0073524

07-034.40-492
HERMAN W. &
IRENE BOHN
D.B. N81-676

07-034.40-493
ALEXANDER D. MORA-BENAVIDES &
DIANA M. NEGREIROS-ARREDONDO
D.R. 20081001-0065896

07-034.40-534
NEW CASTLE COUNTY
P.B. 743-74
MF 9181

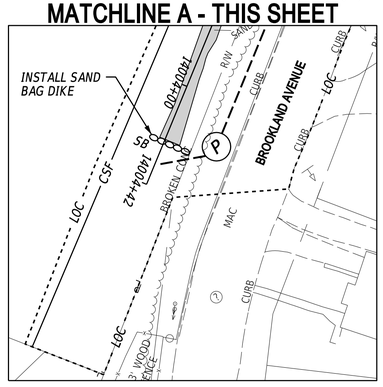
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ELIZABETH K. STIRK
D.B. 1043-220

SANDBAR
07-035.10-042
NEW CASTLE COUNTY-
LEVY COURT
P.B. B62-544
MF 646

N WOODWARD AVENUE

BROOKLAND AVENUE

MATCHLINE A - THIS SHEET



MATCHLINE A - THIS SHEET

ADDENDA / REVISIONS	

SCALE
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FEET

LITTLE MILL CREEK STREAM RESTORATION

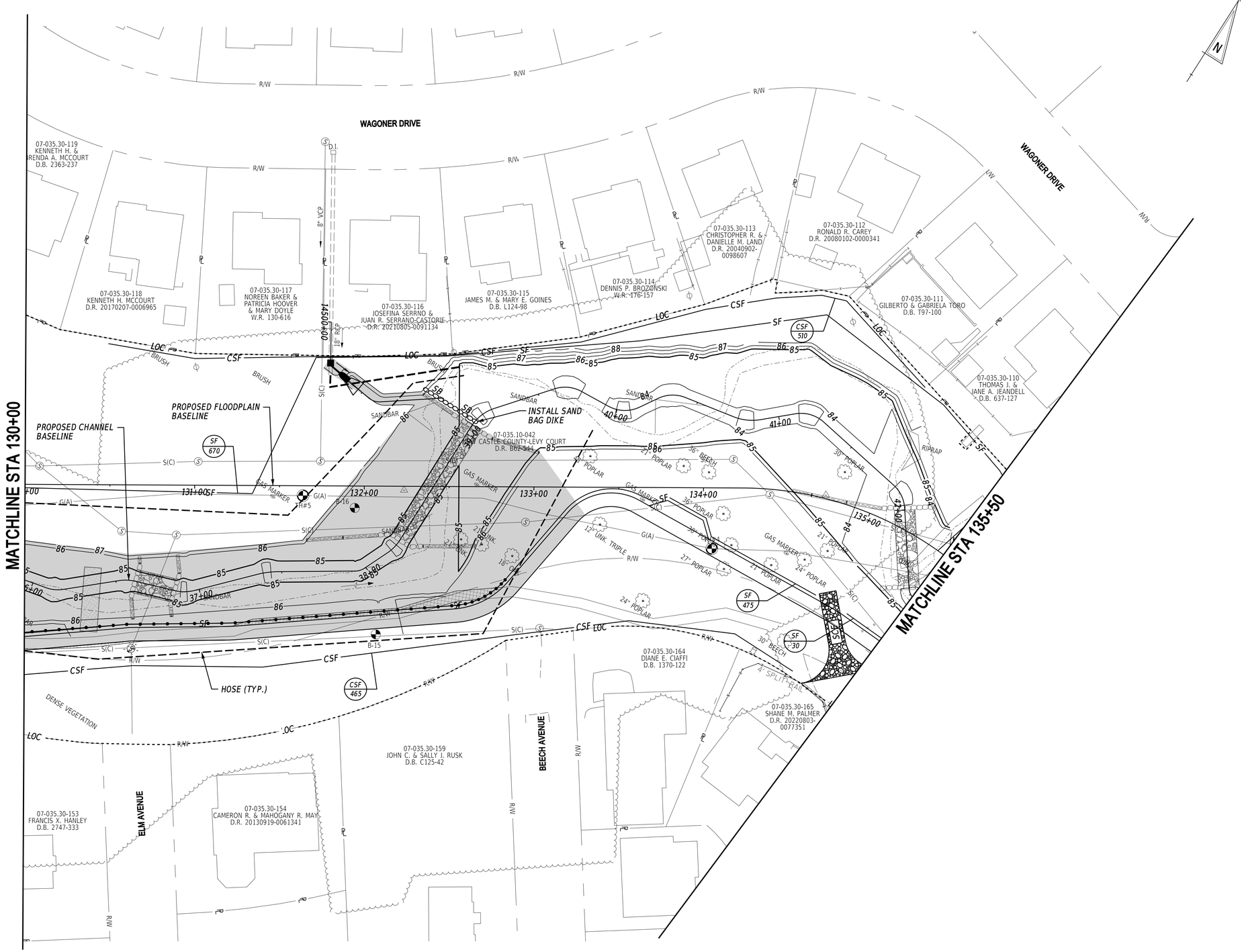
New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 8

SECTION
RKK
SHEET NO.
92

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ADDENDA / REVISIONS

SCALE
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FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 8

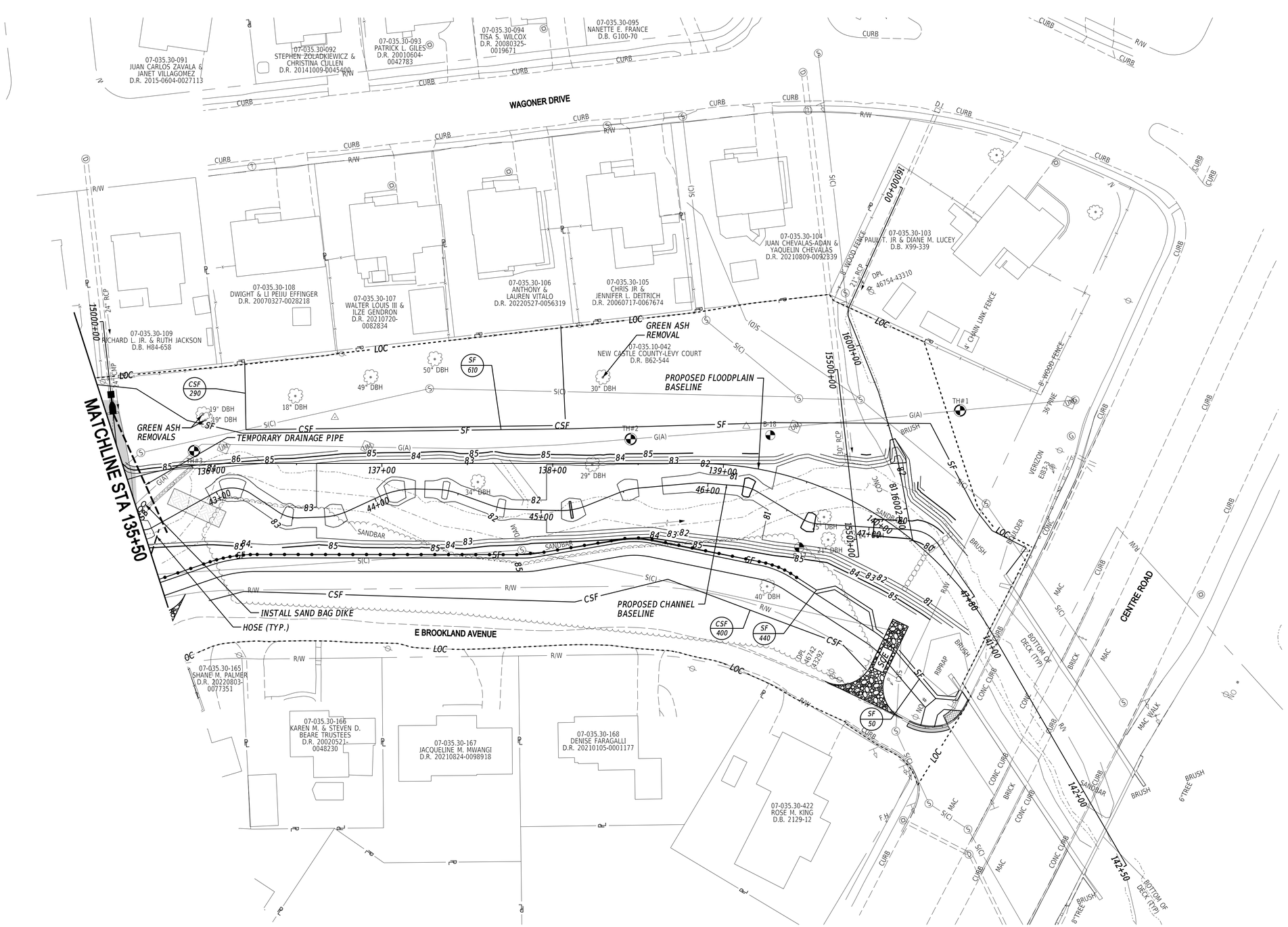
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ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 9	SECTION RKK
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					CHECKED BY: T. CUTILLO		

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ADDENDA / REVISIONS	

SCALE
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FEET

LITTLE MILL CREEK STREAM RESTORATION

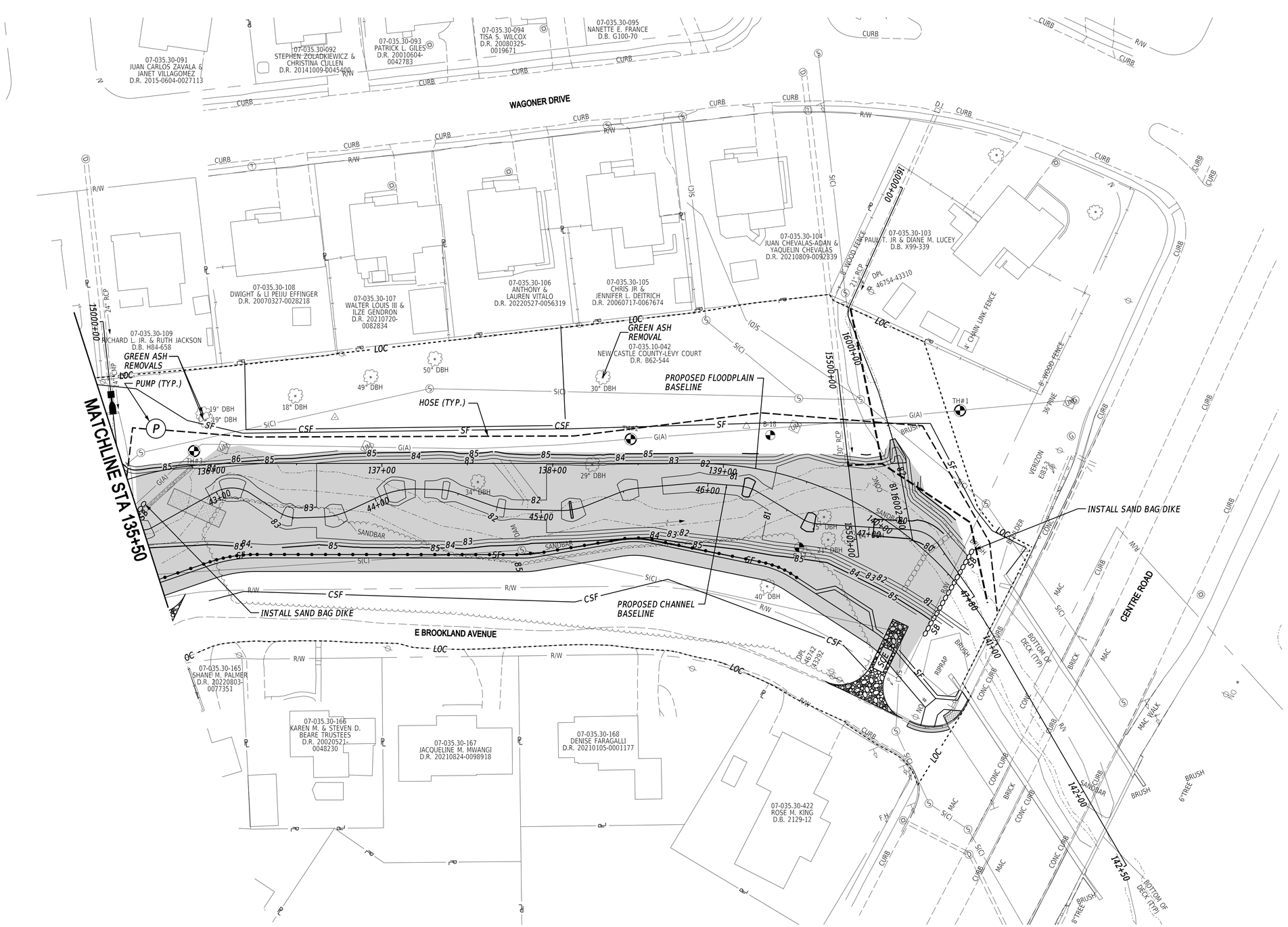
New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 9

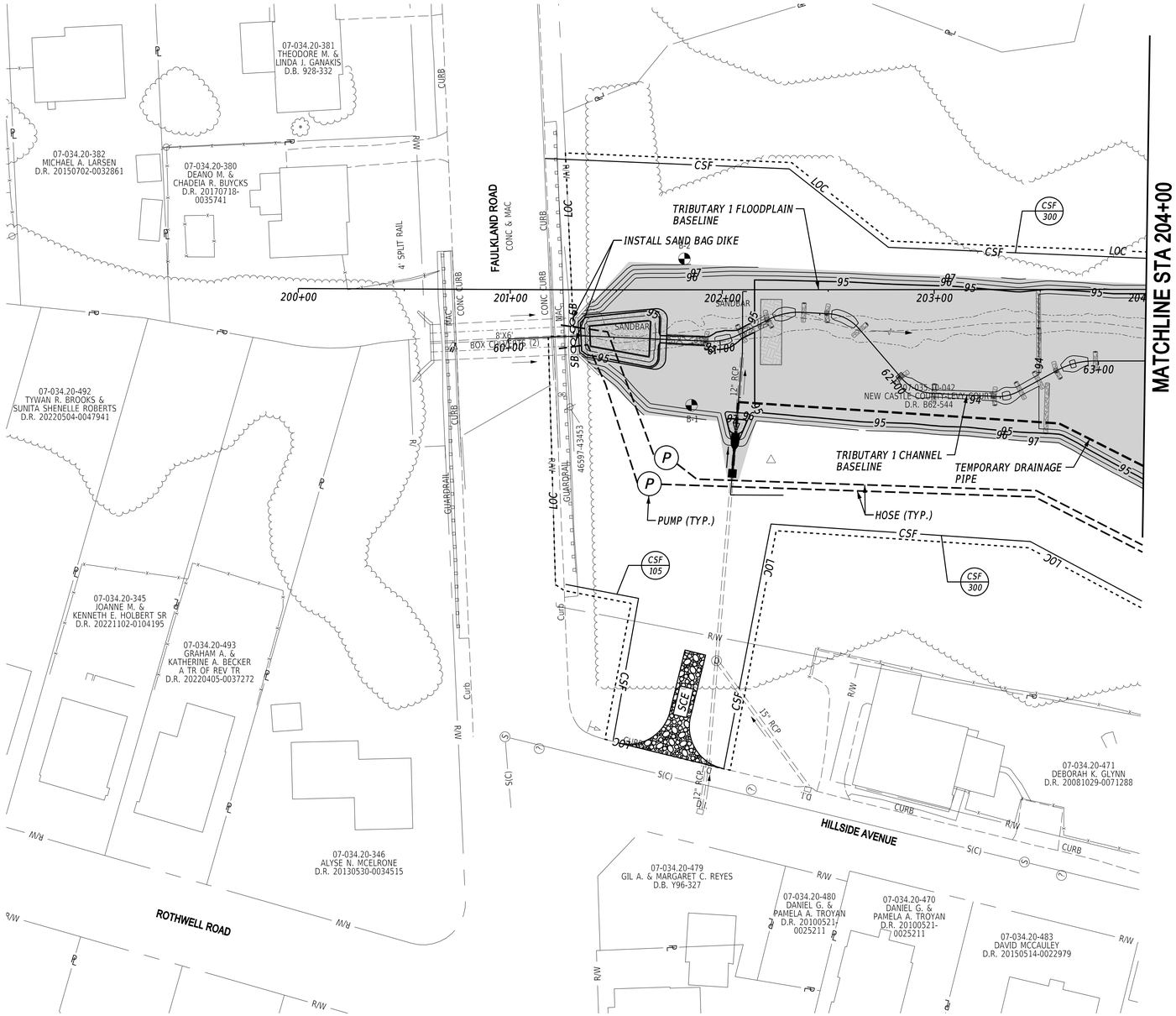
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ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 10	SECTION RKK
					DESIGNED BY: S. ROUPE		SHEET NO. 96
					CHECKED BY: T. CUTILLO		

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ADDENDA / REVISIONS	

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FEET

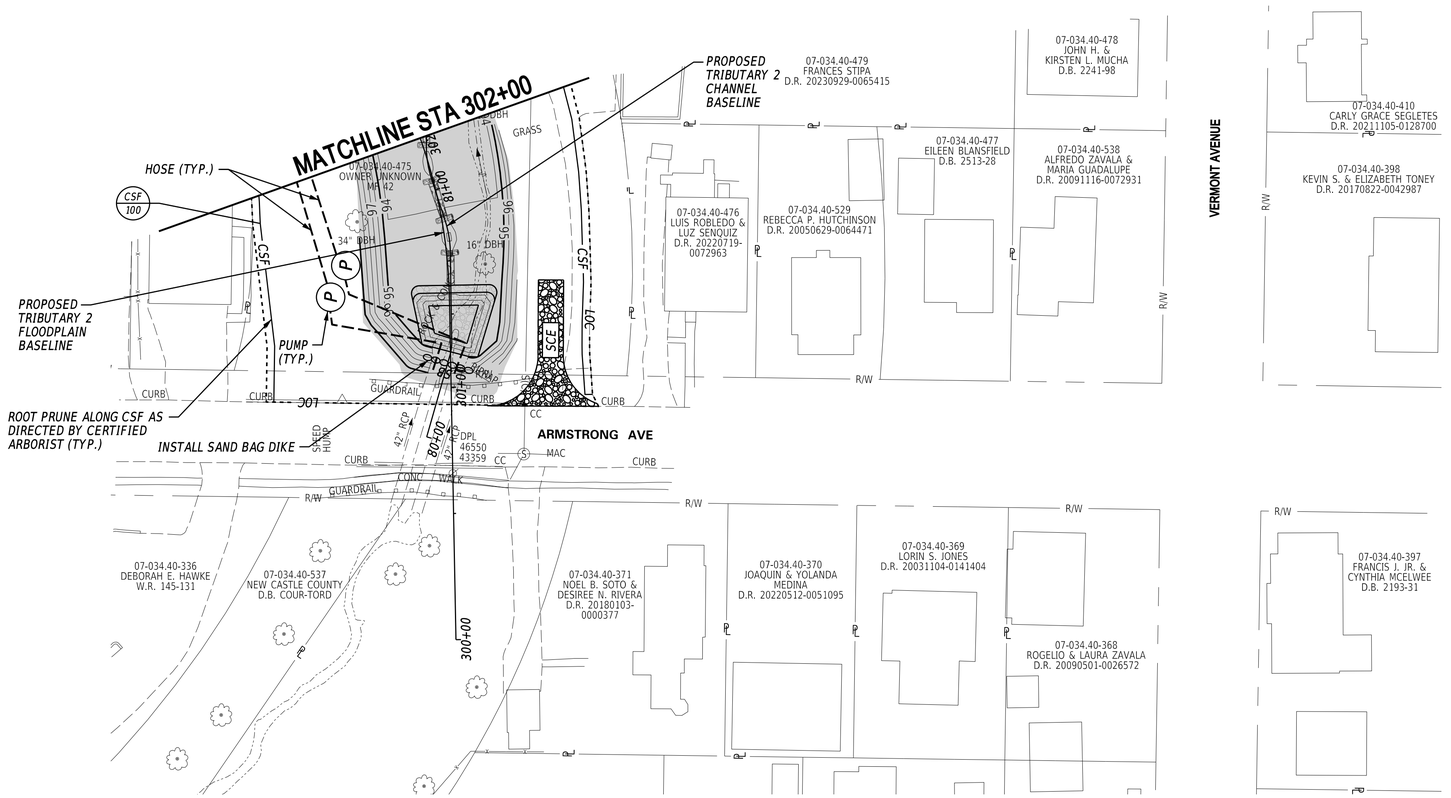
LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 3

SECTION
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ADDENDA / REVISIONS		SCALE	LITTLE MILL CREEK STREAM RESTORATION		CONTRACT 20230414279	CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 5	SECTION RKK
		0 30 60 90 FEET		New Castle County 1673	DESIGNED BY: S. ROUPE		SHEET NO. 98
					CHECKED BY: T. CUTILLO		

MATCHLINE STA 122+00

MATCHLINE STA 130+00

WAGONER DRIVE

RHODE ISLAND AVENUE

HILLSIDE AVENUE

N WOODWARD AVENUE

BROOKLAND AVENUE

07-034.40-511
KATHLEEN A. BUONCUORE
D.R. 20050413-0034925

07-035.30-119
KENNETH H. &
BRENDA A. MCCOURT
D.B. 2363-237

07-035.30-120
SERGIO CAMARENA LARA &
MARIA DE LA LUZ GARCIA
D.R. 20180517-0023521

07-035.30-121
PAULA T. SNYDER
D.R. 20160907-0045283

07-034.40-490
SUSAN ROBINSON
D.R. 20021209-
0118218

07-034.40-491
KIMBERLY T. STEVENSON
D.R. 20121213-
0073524

07-034.40-492
HERMAN W. &
IRENE BOHN
D.B. N81-676

07-034.40-493
ALEXANDER D. MORA-BENAVIDES &
DIANA M. NEGREIROS-ARREDONDO
D.R. 20081001-0065896

07-035.10-042
NEW CASTLE COUNTY-LEVY COURT
D.R. B62-544
MF 646

07-035.30-141
LISA CRISTOFICH
D.R. 20130719-0047

07-035.30-
SAMUEL ROD
D.R. 20191219

07-035.30-122
ELIZABETH K. STIRK
D.B. 1043-220

07-034.40-534
NEW CASTLE COUNTY
P.B. 743-74
MF 9181

SEE NOTE x ON SHEET XX

PROPOSED FLOODPLAIN BASELINE

PROPOSED CHANNEL BASELINE

METAL FOOT BRIDGE W/CONC ABUTMENTS

BR-B-01

BR-B-02

BR-B-03

BR-B-04

B-13

B-14

TH#6

TH#7

BASKETBALL COURT

PLAYGROUND

BENCH

PICNIC TABLE

GAS MARKER

SANDBAR

DENSE VEGETATION

BRUSH

RIPRAP

6' PRIVACY

6' SPLIT RAIL FENCE

4' C.L.F.

AT END OF MAC ROAD

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	S. ROUPE
CHECKED BY:	T. CUTILLO

CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLAN - PHASE 11

SECTION
RKK
SHEET NO.
99

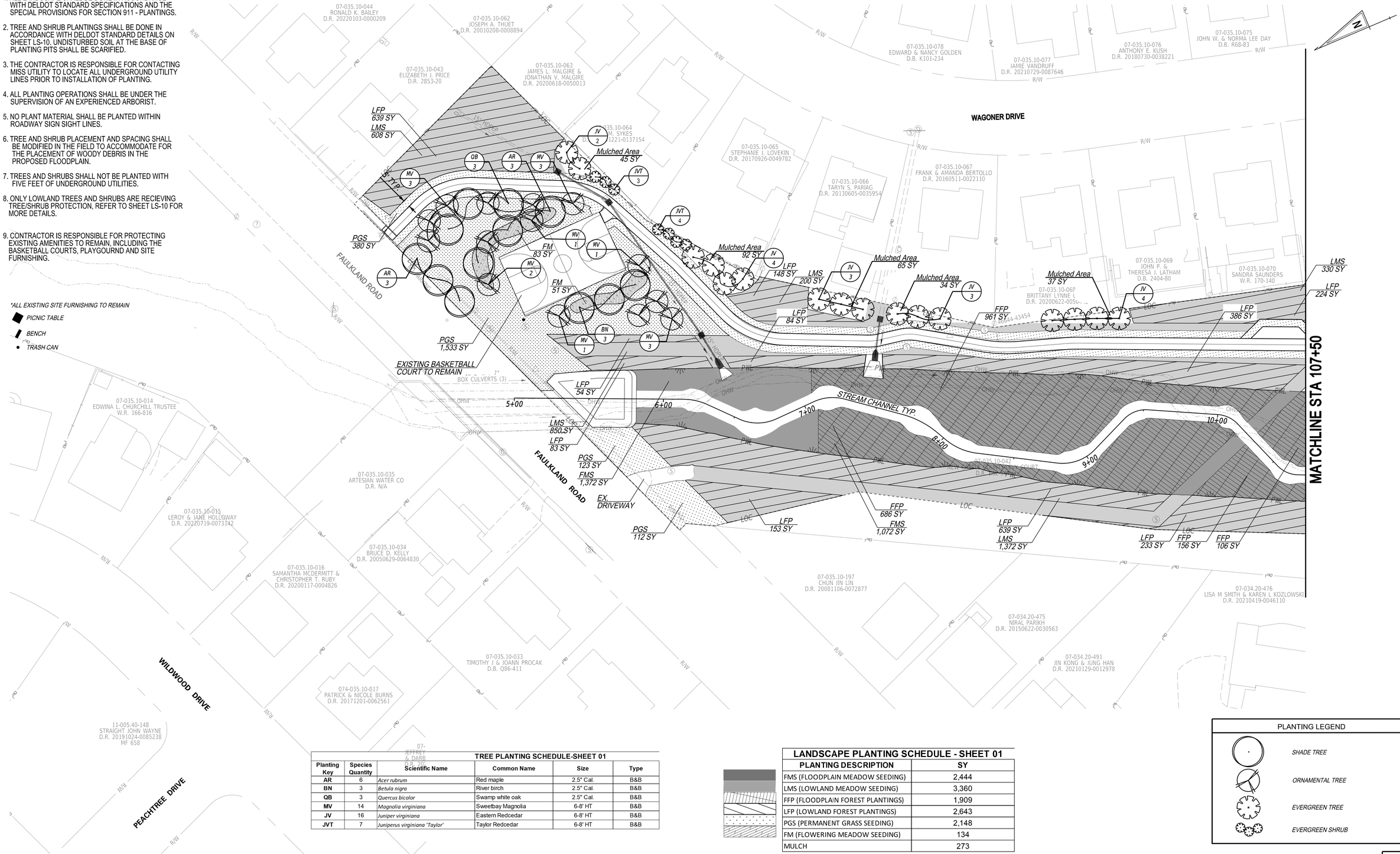
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LANDSCAPE NOTES:

1. ALL LANDSCAPE SHALL BE DONE IN ACCORDANCE WITH DELDOT STANDARD SPECIFICATIONS AND THE SPECIAL PROVISIONS FOR SECTION 911 - PLANTINGS.
2. TREE AND SHRUB PLANTINGS SHALL BE DONE IN ACCORDANCE WITH DELDOT STANDARD DETAILS ON SHEET LS-10. UNDISTURBED SOIL AT THE BASE OF PLANTING PITS SHALL BE SCARIFIED.
3. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING MISS UTILITY TO LOCATE ALL UNDERGROUND UTILITY LINES PRIOR TO INSTALLATION OF PLANTING.
4. ALL PLANTING OPERATIONS SHALL BE UNDER THE SUPERVISION OF AN EXPERIENCED ARBORIST.
5. NO PLANT MATERIAL SHALL BE PLANTED WITHIN ROADWAY SIGN SIGHT LINES.
6. TREE AND SHRUB PLACEMENT AND SPACING SHALL BE MODIFIED IN THE FIELD TO ACCOMMODATE FOR THE PLACEMENT OF WOODY DEBRIS IN THE PROPOSED FLOODPLAIN.
7. TREES AND SHRUBS SHALL NOT BE PLANTED WITH FIVE FEET OF UNDERGROUND UTILITIES.
8. ONLY LOWLAND TREES AND SHRUBS ARE RECIEVING TREE/SHRUB PROTECTION, REFER TO SHEET LS-10 FOR MORE DETAILS.
9. CONTRACTOR IS RESPONSIBLE FOR PROTECTING EXISTING AMENITIES TO REMAIN, INCLUDING THE BASKETBALL COURTS, PLAYGOURND AND SITE FURNISHING.

*ALL EXISTING SITE FURNISHING TO REMAIN

- PICNIC TABLE
- BENCH
- TRASH CAN



TREE PLANTING SCHEDULE-SHEET 01

Planting Key	Species Quantity	Scientific Name	Common Name	Size	Type
AR	6	*Acer rubrum*	Red maple	2.5" Cal.	B&B
BN	3	*Betula nigra*	River birch	2.5" Cal.	B&B
QB	3	*Quercus bicolor*	Swamp white oak	2.5" Cal.	B&B
MV	14	*Magnolia virginiana*	Sweetbay Magnolia	6-8' HT	B&B
JV	16	*Juniper virginiana*	Eastern Redcedar	6-8' HT	B&B
JVT	7	*Juniperus virginiana 'Taylor'*	Taylor Redcedar	6-8' HT	B&B

LANDSCAPE PLANTING SCHEDULE - SHEET 01

PLANTING DESCRIPTION	SY
FMS (FLOODPLAIN MEADOW SEEDING)	2,444
LMS (LOWLAND MEADOW SEEDING)	3,360
FFP (FLOODPLAIN FOREST PLANTINGS)	1,909
LFP (LOWLAND FOREST PLANTINGS)	2,643
PGS (PERMANENT GRASS SEEDING)	2,148
FM (FLOWERING MEADOW SEEDING)	134
MULCH	273

PLANTING LEGEND

- SHADE TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- EVERGREEN SHRUB

ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

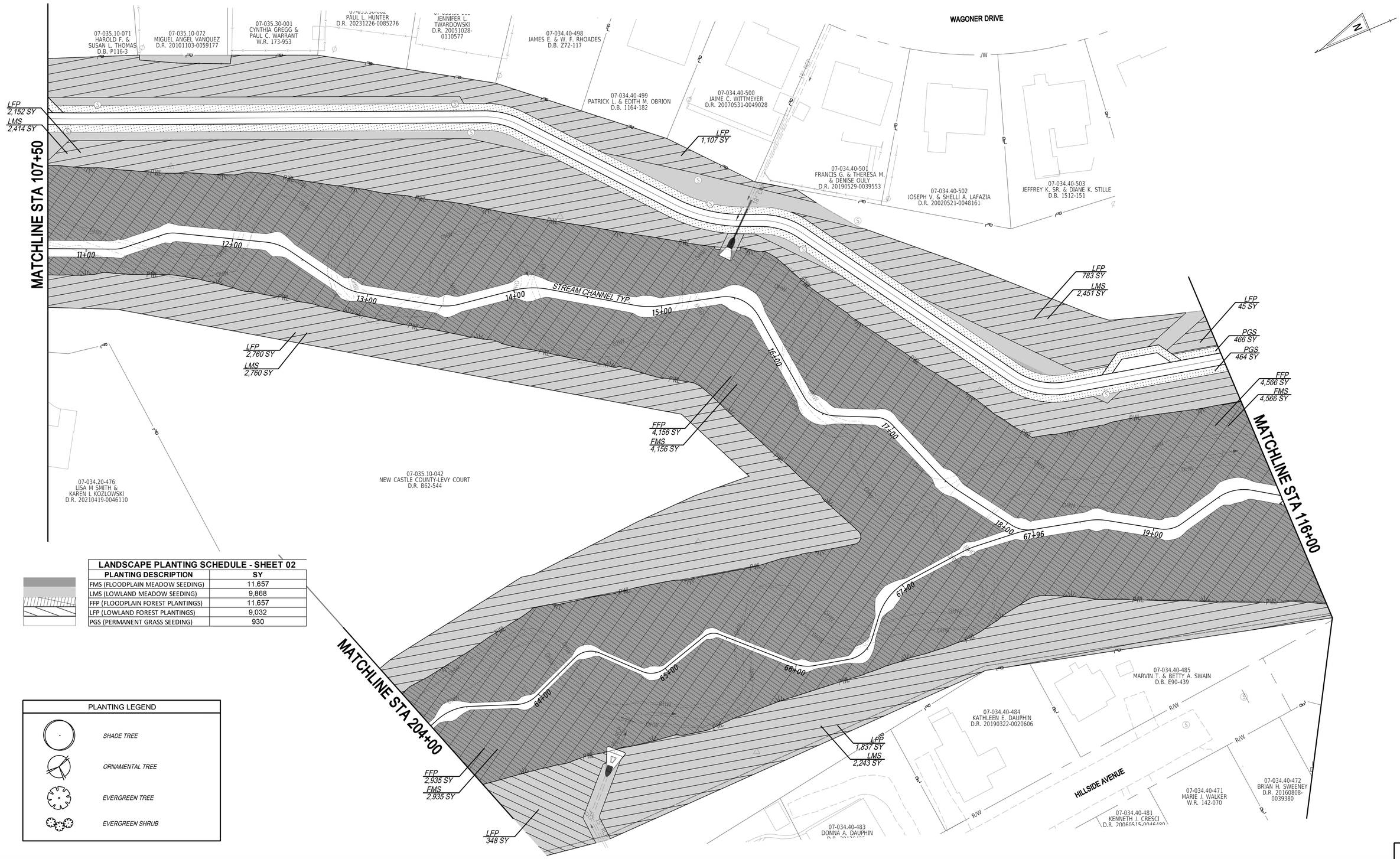
New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	ZN/JD/KH
CHECKED BY:	MM/BD

LANDSCAPE PLAN

LS-01 | SECTION | RKK | SHEET NO. | 100

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LANDSCAPE PLANTING SCHEDULE - SHEET 02	
PLANTING DESCRIPTION	**SY**
FMS (FLOODPLAIN MEADOW SEEDING)	11,657
LMS (LOWLAND MEADOW SEEDING)	9,868
FFP (FLOODPLAIN FOREST PLANTINGS)	11,657
LFP (LOWLAND FOREST PLANTINGS)	9,032
PGS (PERMANENT GRASS SEEDING)	930

PLANTING LEGEND

- SHADE TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- EVERGREEN SHRUB

ADDENDA / REVISIONS

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	ZN/JD/KH
CHECKED BY:	MM/BD

LANDSCAPE PLAN

LS-02	
SECTION	RKK
SHEET NO.	101

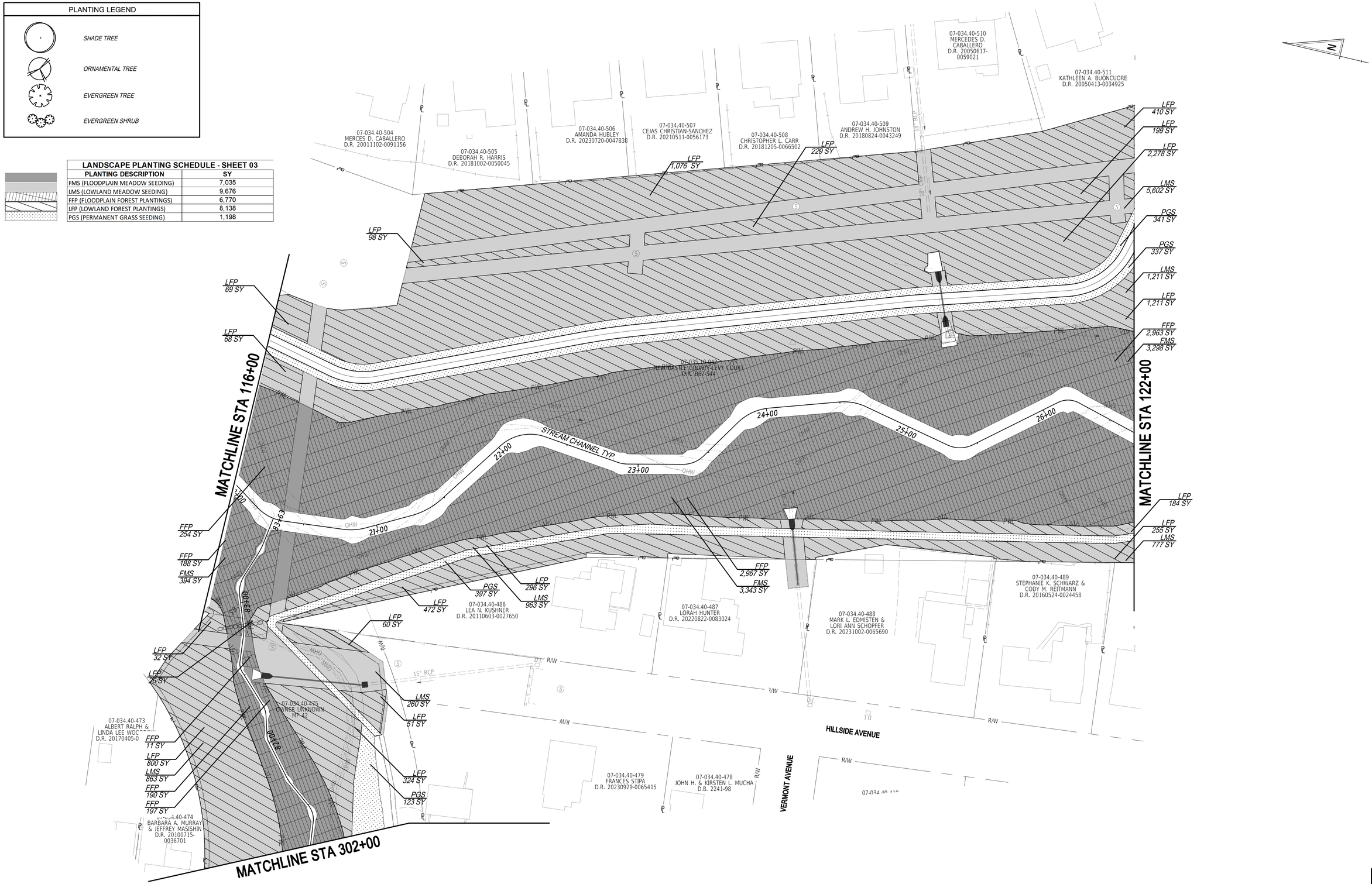
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PLANTING LEGEND

- SHADE TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- EVERGREEN SHRUB

LANDSCAPE PLANTING SCHEDULE - SHEET 03

PLANTING DESCRIPTION	SY
FMS (FLOODPLAIN MEADOW SEEDING)	7,035
LMS (LOWLAND MEADOW SEEDING)	9,676
FFP (FLOODPLAIN FOREST PLANTINGS)	6,770
LFP (LOWLAND FOREST PLANTINGS)	8,138
PGS (PERMANENT GRASS SEEDING)	1,198



ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	ZN/JD/KH
CHECKED BY:	MM/BD

LANDSCAPE PLAN

	LS-03
SECTION	RKK
SHEET NO.	102

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PLANTING LEGEND

- SHADE TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- EVERGREEN SHRUB

*ALL EXISTING SITE FURNISHING TO REMAIN

- PICNIC TABLE
- BENCH
- TRASH CAN

LANDSCAPE PLANTING SCHEDULE - SHEET 04

PLANTING DESCRIPTION	SY
FMS (FLOODPLAIN MEADOW SEEDING)	5,702
LMS (LOWLAND MEADOW SEEDING)	12,733
FFP (FLOODPLAIN FOREST PLANTINGS)	5,391
LFP (LOWLAND FOREST PLANTINGS)	11,502
PGS (PERMANENT GRASS SEEDING)	3,301
FM (FLOWERING MEADOW SEEDING)	221
MULCH AREA	659

WAGONER DRIVE

RHODE ISLAND AVENUE

STREAM CHANNEL

MATCHLINE STA 122+00

MATCHLINE STA 130+00

MATCHLINE A - THIS SHEET

MATCHLINE A - THIS SHEET

SEE THIS SHEET FOR QUANTITIES

Existing Court to Remain

Existing Playground to Remain

Mulched Area 83 SY

Mulched Area 160 SY

Mulched Area 416 SY

NO SEEDING WITHIN TRIBUTARY- TYP.

BROOKLAND AVENUE

HILLSIDE AVENUE

N WOODWARD AVENUE

07-034.40-511 KATHLEEN A. BUONCUORE D.R. 20050413-0034925

07-035.30-119 KENNETH H. & BRENDA A. MCCOURT D.B. 2363-237

07-035.30-120 SERGIO CAMARENA LARA & MARIA DE LA LUZ GARCIA D.R. 20180517-0023521

07-035.30-121 PAULA T. SNYDER D.R. 20160907-0045283

07-034.40-490 SUSAN D.R. 2 01

07-034.40-491 KIMBERLY T. STEVENSON D.R. 20121213-0073524

07-034.40-492 HERMAN W. & IRENE BOHN D.B. N81-676

07-034.40-493 ALEXANDER D. MORA-BENAVIDES & D.R. 20081001-0065896

07-034.40-534 NEW CASTLE COUNTY P.B. 743-74 MF 9181

07-035.30-140 SAMUEL RODRIGUEZ D.R. 20191219-0103420

07-035.30-141 LISA CRISTOFICH D.R. 20130719-0047301

07-035.30-129 TIM & VICTORIA LATHAM D.R. 20080429-0029349

07-035.30-122 ELIZABETH K. STIRK D.B. 1043-220

TREE PLANTING SCHEDULE-SHEET 04

Planting Key	Species Quantity	Scientific Name	Common Name	Size	Type	Placement
AR	10	*Acer rubrum*	Red maple	2.5" Cal.	B&B	AS SHOWN
BN	8	*Betula nigra*	River birch	2.5" Cal.	B&B	AS SHOWN
QB	5	*Quercus bicolor*	Swamp white oak	2.5" Cal.	B&B	AS SHOWN
CF	5	*Cornus florida*	Flowering dogwood	6-8' HT	B&B	AS SHOWN
CC	10	*Cercis canadensis*	Eastern Redbud	6-8' HT	B&B	AS SHOWN
MV	8	*Magnolia virginiana*	Sweetbay Magnolia	6-8' HT	B&B	AS SHOWN
IOD	5	*Ilex opaca 'David'*	David Leach American Holly	6-8' HT	B&B	AS SHOWN
IOMH	16	*Ilex opaca 'Miss Helen'*	Miss Helen American Holly	6-8' HT	B&B	AS SHOWN
NSH	4	*Ilex 'Nellie Stevens'*	Nellie Stevens Holly	6-8' HT	B&B	AS SHOWN
JV	7	*Juniper virginiana*	Eastern Redcedar	6-8' HT	B&B	AS SHOWN

ADDENDA / REVISIONS

SCALE 0 30 60 90 FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT 20230414279

DESIGNED BY: ZN/JD/KH

CHECKED BY: MM/BD

LANDSCAPE PLAN

LS-04

SECTION RKK

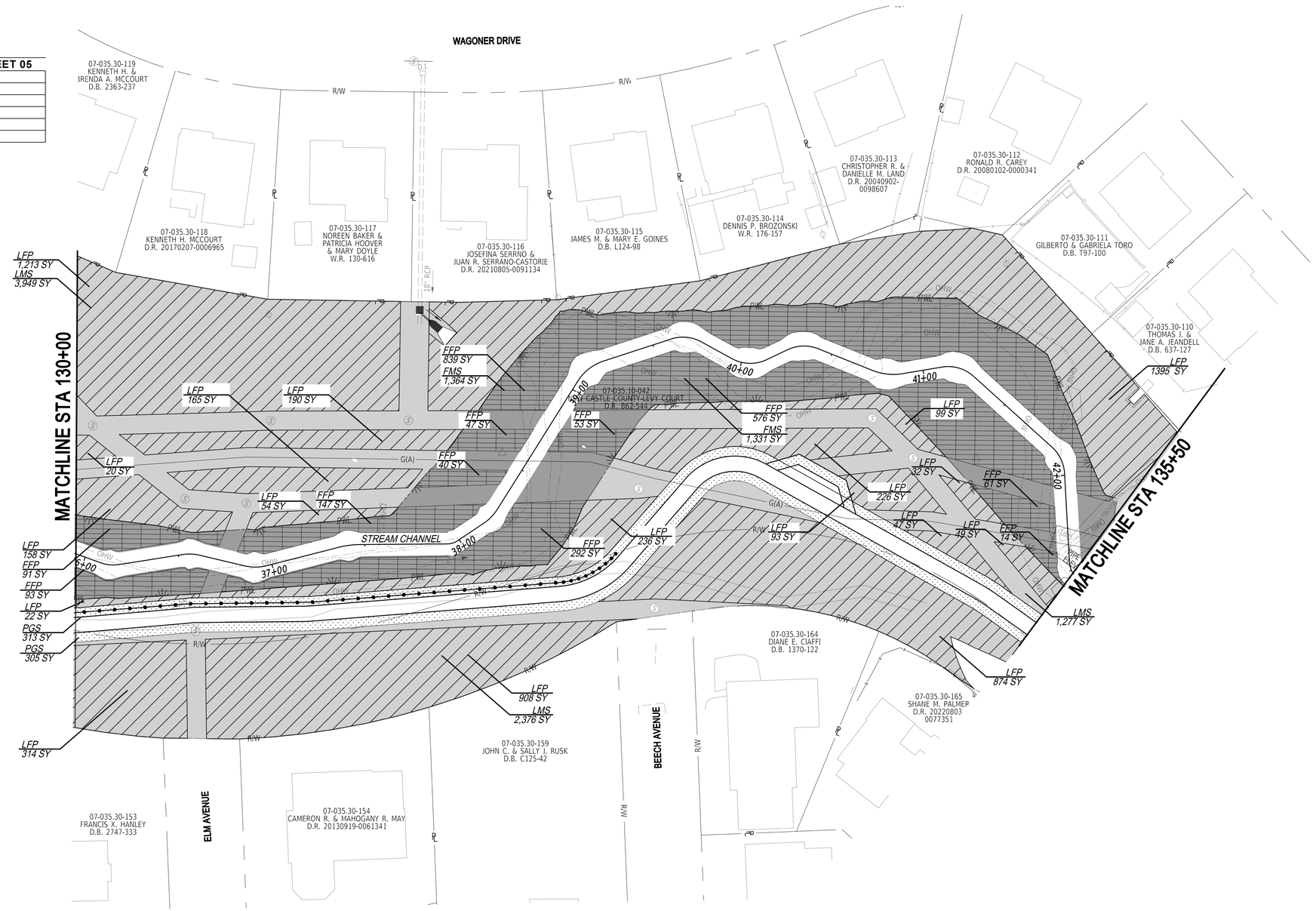
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PLANTING LEGEND

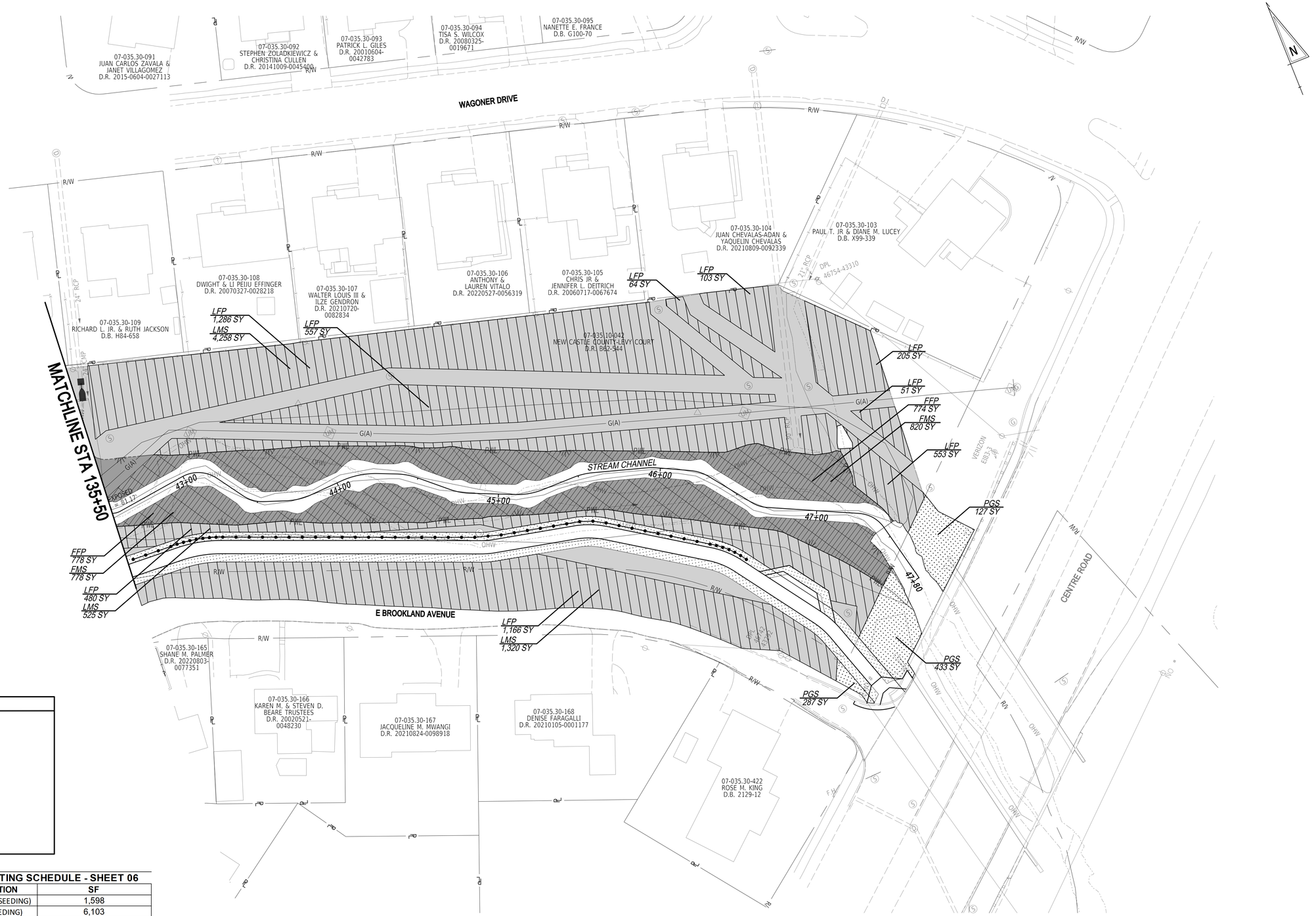
- SHADE TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- EVERGREEN SHRUB

LANDSCAPE PLANTING SCHEDULE - SHEET 05	
PLANTING DESCRIPTION	**SY**
FMS (FLOODPLAIN MEADOW SEEDING)	2,695
LMS (LOWLAND MEADOW SEEDING)	7,602
FFP (FLOODPLAIN FOREST PLANTINGS)	2,253
LFP (LOWLAND FOREST PLANTINGS)	6,095
PGS (PERMANENT GRASS SEEDING)	618



ADDENDA / REVISIONS		SCALE 0 30 60 90 FEET	LITTLE MILL CREEK STREAM RESTORATION	New Castle County 1673 Delaware	CONTRACT 20230414279	LANDSCAPE PLAN	LS-05
					DESIGNED BY: ZN/JD/KH		SECTION RKK
					CHECKED BY: MM/BD		SHEET NO. 104

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PLANTING LEGEND

- SHADE TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- EVERGREEN SHRUB

LANDSCAPE PLANTING SCHEDULE - SHEET 06

PLANTING DESCRIPTION	SF
FMS (FLOODPLAIN MEADOW SEEDING)	1,598
LMS (LOWLAND MEADOW SEEDING)	6,103
FFP (FLOODPLAIN FOREST PLANTINGS)	1,552
LFP (LOWLAND FOREST PLANTINGS)	4,465
PGS (PERMANENT GRASS SEEDING)	847

ADDENDA / REVISIONS

SCALE
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FEET

LITTLE MILL CREEK STREAM RESTORATION

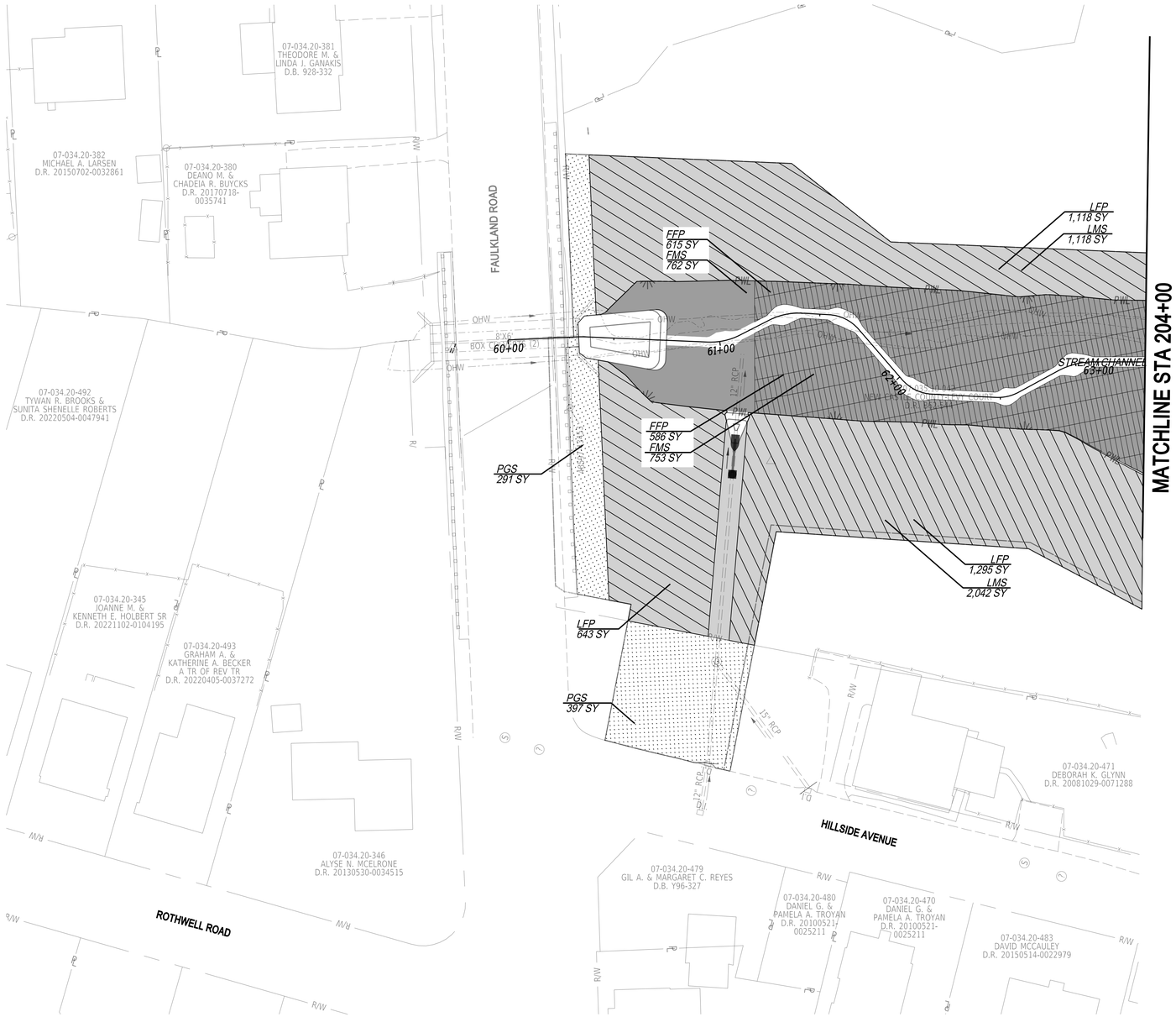
New Castle County 1673 Delaware

CONTRACT	20230414279
DESIGNED BY:	ZN/JD/KH
CHECKED BY:	MM/BD

LANDSCAPE PLAN

	LS-06
SECTION	RKK
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PLANTING LEGEND

- SHADE TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- EVERGREEN SHRUB

LANDSCAPE PLANTING SCHEDULE - SHEET 07

PLANTING DESCRIPTION	SF
FMS (FLOODPLAIN MEADOW SEEDING)	1,515
LMS (LOWLAND MEADOW SEEDING)	3,160
FFP (FLOODPLAIN FOREST PLANTINGS)	1,201
LFP (LOWLAND FOREST PLANTINGS)	3,056
PGS (PERMANENT GRASS SEEDING)	688

ADDENDA / REVISIONS

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

New Castle County 1673 Delaware

CONTRACT 20230414279
DESIGNED BY: ZN/JD/KH
CHECKED BY: MM/BD

LANDSCAPE PLAN

LS-07
SECTION
RKK
SHEET NO.
106

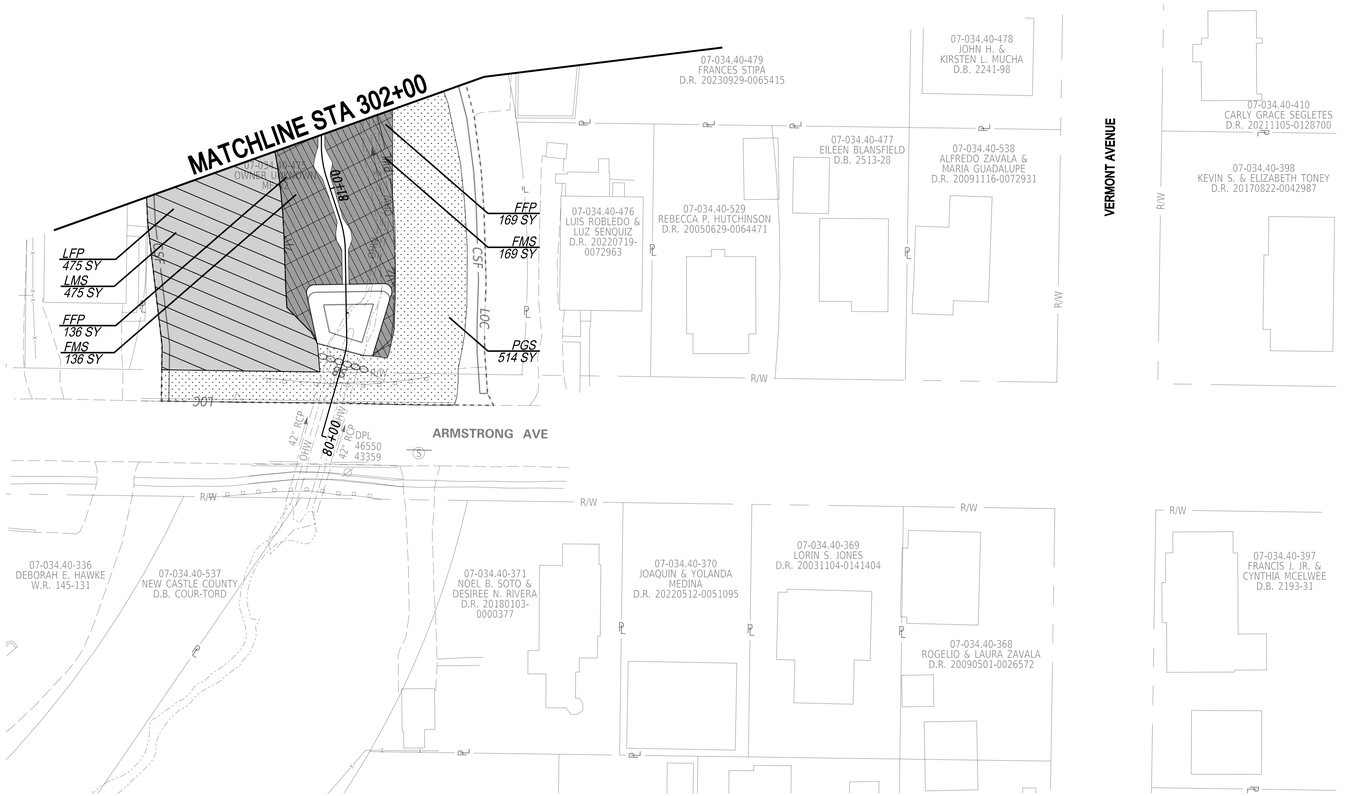
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PLANTING LEGEND

- SHADE TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- EVERGREEN SHRUB

LANDSCAPE PLANTING SCHEDULE - SHEET 08

PLANTING DESCRIPTION	SF
FMS (FLOODPLAIN MEADOW SEEDING)	305
LMS (LOWLAND MEADOW SEEDING)	475
FFP (FLOODPLAIN FOREST PLANTINGS)	305
LFP (LOWLAND FOREST PLANTINGS)	475
PGS (PERMANENT GRASS SEEDING)	514



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ADDENDA / REVISIONS	

SCALE
0 30 60 90
FEET

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT	20230414279
DESIGNED BY:	ZN/JD/KH
CHECKED BY:	MM/BD

LANDSCAPE PLAN

	LS-08
SECTION	
	RKK
SHEET NO.	
	107

FLOODPLAIN FOREST PLANTING ZONE

Acres: 6.41 | **Square Yard: 31,038**

Quantity per acre	Frequency (%)	Species Quantity	Vegetation Starta/Species Name	Common Name	Indicator Status	Size	Type	Placement
			TREES					
200	20	257	*Acer saccharinum*	Silver maple	FACW	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	10	128	*Betula nigra*	River birch	FACW	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	10	128	*Magnolia virginiana*	Sweetbay magnolia	FACW	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	20	257	*Platanus occidentalis*	American sycamore	FACW	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	20	257	*Populus deltoides*	Eastern cottonwood	FAC	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	10	128	*Quercus bicolor*	Swamp white oak	FACW	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	10	128	*Quercus palustris*	Pin oak	FACW	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
Total:	**100**	**1283**						
100			**SHRUBS**					
	20	130	*Alnus serrulata*	Smooth alder	OBL	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
	15	98	*Cephalanthus occidentalis*	Buttonbush	OBL	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
	25	163	*Clethra alnifolia*	Sweet pepperbush	FACW	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
	15	98	*Ilex verticillata*	Winterberry	FACW	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
	25	163	*Salix sericea*	Silky willow	OBL	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
Total:	**100**	**652**						

Note: The Floodplain Planting Zone will be seeded in accordance with the Floodplain Meadow Seed Specification. See 908600 for additional information.

LOWLAND FOREST PLANTING ZONE

Acres: 9.38 | **Square Yard: 45,406**

Quantity per acre	Frequency (%)	Species Quantity	Vegetation Starta/Species Name	Common Name	Indicator Status	Size	Type	Placement
			TREES					
200	20	375	*Acer rubrum*	Red maple	FAC	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	10	188	*Carpinus caroliniana*	American hornbeam	FAC	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	20	375	*Liriodendron tulipifera*	Tulip poplar	FACU	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	20	375	*Nyssa sylvatica*	Black gum	FAC	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	20	375	*Prunus serotina*	Black cherry	FACU	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
	10	188	*Quercus phellos*	Willow Oak	FACW	1/2" caliper. 5' ht.	#5 container grown	15' O.C. naturalized spacing
Total:	**100**	**1876**						
100			**SHRUBS**					
	20	188	*Hamamelis virginiana*	Witch hazel	FAC	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
	20	188	*Aronia melanocarpa*	Black chokeberry	FAC	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
	10	94	*Lindera benzoin*	Spicebush	FAC	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
	25	235	*Viburnum dentatum*	Southern arrowwood	FAC	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
	25	235	*Viburnum lentago*	Nanny-Berry	FAC	2' ht.	#3 container grown	Groups of 3 or 5 @ 6' OC
Total:	**100**	**940**						

Note: The Lowland Planting Zone will be seeded in accordance with the Lowland Meadow Seed Specification. See 908601 for additional information.

MASTER TREE PLANTING SCHEDULE (Excluding Forest Planting)

Planting Key	Species Quantity	Scientific Name	Common Name	Size	Type
AR	16	*Acer rubrum*	Red maple	2.5" Cal.	B&B
BN	11	*Betula nigra*	River birch	2.5" Cal.	B&B
QB	8	*Quercus bicolor*	Swamp white oak	2.5" Cal.	B&B
AC	5	*Cornus florida*	Flowering dogwood	6-8' HT	B&B
CC	10	*Cercis canadensis*	Eastern Redbud	6-8' HT	B&B
MV	22	*Magnolia virginiana*	Sweetbay Magnolia	6-8' HT	B&B
IOD	5	*Ilex opaca 'David'*	David Leach American Holly	6-8' HT	B&B
IOMH	16	*Ilex opaca 'Miss Helen'*	Miss Helen American Holly	6-8' HT	B&B
JV	23	*Juniper virginiana*	Eastern Redcedar	6-8' HT	B&B
JVT	7	*Juniperus virginiana 'Taylor'*	Taylor Redcedar	6-8' HT	B&B
NSH	4	*Ilex 'Nellie Stevens'*	Nellie Stevens Holly	6-8' HT	B&B

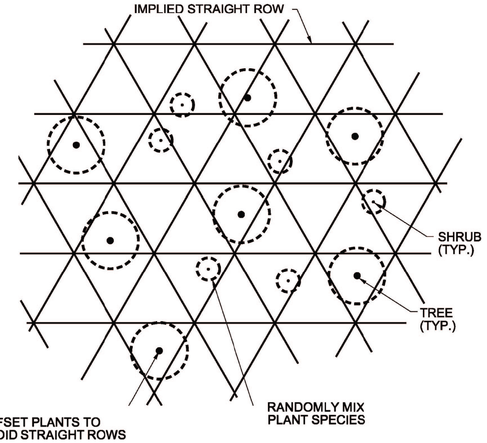
MASTER FOREST PLANTING SCHEDULE

PLANTING DESCRIPTION	SY
FFP (FLOODPLAIN FOREST PLANTINGS)	31,038
LFP (LOWLAND FOREST PLANTINGS)	45,406
MULCH AROUND SCREENING AREAS	891

SEEDING SCHEDULE

Seed Mix	Square Yard	Acres
Floodplain Meadow Seeding	32,951	6.81
Lowland Meadow Seeding	52,977	10.95
Permanent Grass Seeding - Subdivision Mix	10,244	2.12
Flowering Meadow Seeding	355	0.07

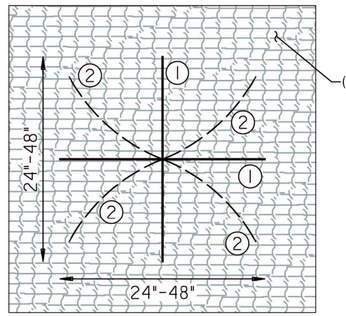
Note: See seed mix specifications for species and application rates. See 908600-908602 for additional informati



NATURALIZED PLANT SPACING

NOT TO SCALE

(Floodplain Forest Planting, Lowland Forest Planting)



NOTES:

1. MAKE CUT WITH SHARP KNIFE THROUGH SOIL STABILIZATION MATTING - SEE SOLID LINE IN DIAGRAM ABOVE. NOTE THAT ALL CUTS IN THE MATTING SHALL BE A MINIMUM OF 2 FEET CLEAR OF ALL MATTING SEAMS, OVERLAPS AND EDGES.
2. TEMPORARILY PIN BACK MATTING WITH 4 STAPLES TO INSTALL TREE OR SHRUB - SEE DASHED LINE IN DIAGRAM ABOVE.
3. INSTALL PLANT THROUGH PINNED BACK MATTING. INSTALL PLANT AT PROPER GRADE TO GROUND PLANE.
4. REMOVE 4 STAPLES PLACED IN STEP 2 ABOVE THAT WERE USED TO TEMPORARILY PIN BACK THE MATTING DURING ROOT BALL INSTALLATION.
5. PLACE 4 STAPLES IN EACH OF FOUR CUT SECTIONS TO WELL ANCHOR SOIL STABILIZATION MATTING BACK OVER TOP OF THE ROOT BALL.
6. FOR TREE INSTALLATIONS, INSTALL TREE STAKES THROUGH MATTING, ONCE RE-ANCHORED OVER ROOT BALL.

TREE & SHRUB INSTALLATION THROUGH COIR FIBER MATTING

NOT TO SCALE

ADDENDA / REVISIONS

NOT TO SCALE

LITTLE MILL CREEK STREAM RESTORATION

CONTRACT 20230414279

DESIGNED BY: ZN/JD/KH

CHECKED BY: MM/BD

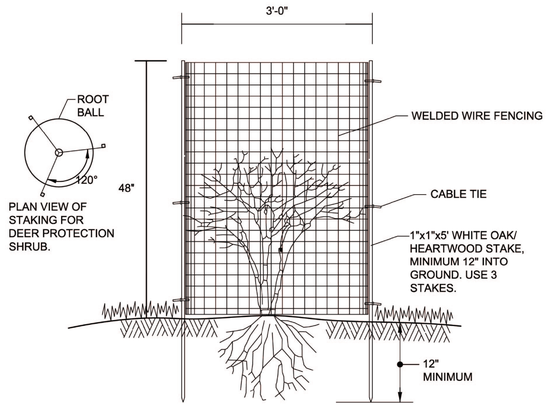
LANDSCAPE DETAILS

LS-09

SECTION RKK

SHEET NO. 108

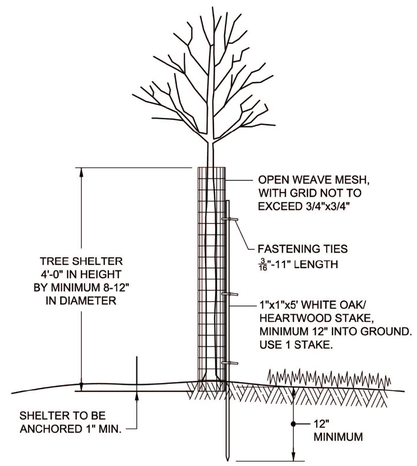
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LOWLAND SHRUB PROTECTION
MULTISTEM TREE PROTECTION

NOTES:

1. UP TO 2" OF SOIL CAN BE MOUNDED AROUND THE OUTSIDE OF TREE SHELTER.
2. REFER TO THE CONTRACT PLANTING SPECIFICATIONS FOR ADDITIONAL INFORMATION.
3. INSTALL WIRE CAGES ON LOWLAND MULTI-STEM SHRUBS ONLY.

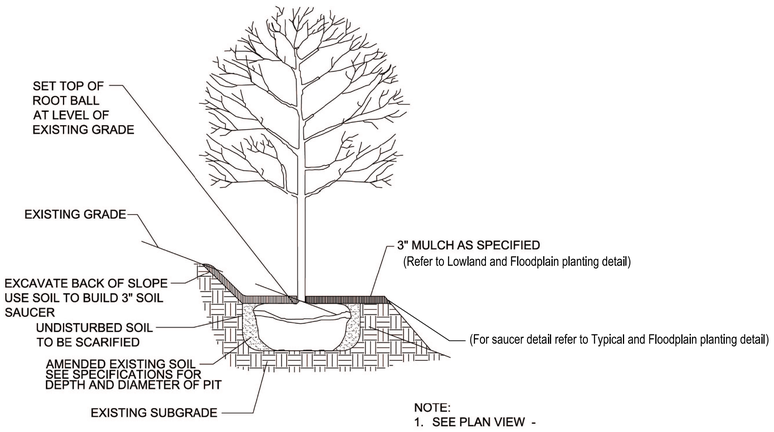


LOWLAND TREE PROTECTION

NOT TO SCALE

NOTES:

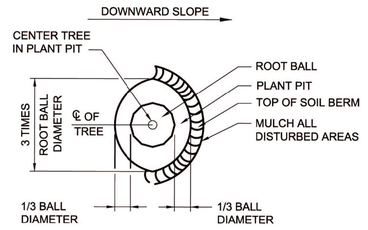
1. UP TO 2" OF SOIL CAN BE MOUNTED AROUND THE OUTSIDE OF TREE SHELTER.
2. REFER TO THE CONTRACT PLANTING SPECIFICATIONS FOR ADDITIONAL INFORMATION.
3. INSTALL TREE SLEEVES ON LOWLAND SINGLE STEM HARDWOOD TREES ONLY.



NOTE:
1. SEE PLAN VIEW -

TREE / SHRUB INSTALLATION ON SLOPED AREAS

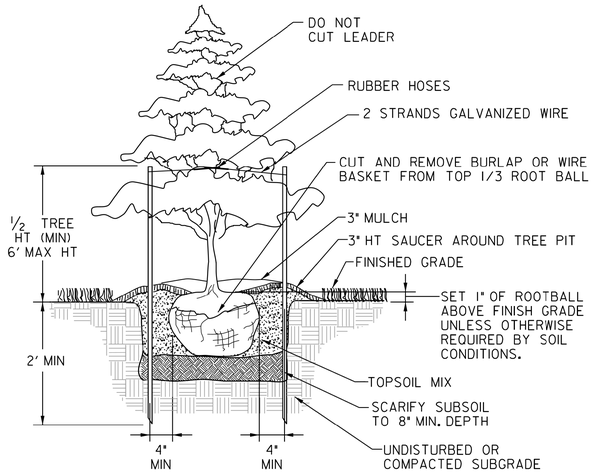
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PLAN VIEW

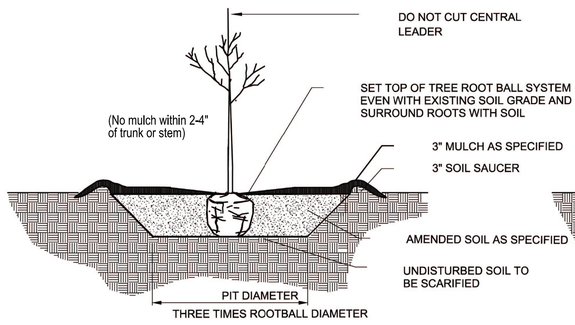
TREE/SHRUB INSTALLATION ON SLOPEDAREAS -

NOT TO SCALE



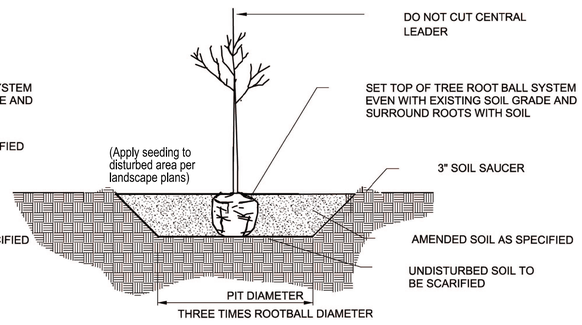
EVERGREEN TREE PLANTING

NOT TO SCALE



TYPICAL TREE/SHRUB PLANTING

NOT TO SCALE



FLOODPLAIN TREE/SHRUB PLANTING

NOT TO SCALE

(No mulch application in Floodplain)

SEE DELDOT STANDARD DETAIL L-1 FOR PLANTING DETAILS

ADDENDA / REVISIONS		NOT TO SCALE	LITTLE MILL CREEK STREAM RESTORATION	CONTRACT 20230414279	LANDSCAPE DETAILS	LS-10
				DESIGNED BY: ZN/JD/KH		SECTION RKK
				CHECKED BY: MM/BD		SHEET NO. 109

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ATTACHMENT E

Final Design Report

LITTLE MILL CREEK RESTORATION AT WOODLAND PARK

FINAL DESIGN REPORT

NEW CASTLE COUNTY, DELAWARE
CONTRACT NO. 20230414279



April 2025

PREPARED FOR:

NEW CASTLE COUNTY | DE

NEW CASTLE COUNTY
87 READ'S WAY
NEW CASTLE, DE 19720

PREPARED BY:

RK&K

RUMMEL, KLEPPER & KAHL, LLC
700 EAST PRATT STREET, SUITE 500
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Table of Contents

FIGURES iii
TABLES iv
APPENDICES iv
EXECUTIVE SUMMARY 1
1. INTRODUCTION 3
2. WATERSHED SUMMARY 6
2.1 Watershed Characterization and Land Use 6
2.2 Physiography, Climate, and Surface Geology 6
2.3 Landscape Morphology (Valley Type) 8
2.4 Jurisdictional Wetlands and Waters 8
2.5 Plant Community Descriptions 9
2.6 Subsurface Soil Conditions 10
3. CONSTRAINTS ANALYSIS 14
3.1 Utilities 14
3.1.1 Sanitary Sewer 14
3.1.2 Storm Drain Outfalls 14
3.1.3 Gas Main 14
3.2 Existing Infrastructure 15
3.3 Property Ownership 15
3.4 Site Access 15
3.5 FEMA Floodplain 15
3.6 In-Stream Work Restrictions 16
4. EXISTING STREAM CONDITIONS 17
4.1 Historical/Modern Impacts and Potential Sources of Stream Instability 17
4.2 Existing Conditions Visual Assessment 18
4.2.1 Base Level Control Reach 18
4.2.2 Project Reach 26
4.2.3 Sediment Supply Reaches 51
4.3 Hydrology 62
4.3.1 Bankfull Regional Curve and Regression Equation Analysis 62
4.3.2 Peak Discharge Estimates – FEMA Preliminary Data 64
4.3.5 Peak Discharge Estimates – Statistical Regression Methods 64
4.5 Existing Conditions Hydraulics Analysis 65
4.5.1 Boundary Shear Stress Computation Method 65
4.5.2 Top-of-Bank Cross Section Analysis 65
5. RIFFLE ASSESSMENT REACH CHARACTERIZATION 68
5.1 Threshold Flow Channel Characteristics and Indicators 68
5.2 Threshold (Energy) Slope 68
5.3 Channel Roughness 69

5.4 Threshold Estimates and Boundary Shear Stress 69
5.5 Riffle Assessment Reach Analysis 69
5.5.1 Riffle Geomorphic Analysis 69
5.6 Sediment Mobility Study 70
5.6.1 Principles 71
5.6.2 Riffle Mobility Analysis 72
6. CHANNEL STABILITY ASSESSMENT 73
Stability Predictions 73
7. PROJECT GOALS AND OBJECTIVES 90
7.1 Project Goals 90
7.1.1 TMDL Credits for Sediment and Nutrient Reduction 90
7.1.2 Flooding and Drainage Relief 91
7.1.3 Infrastructure Protection 91
7.1.4 Functional Uplift 91
7.1.5 Wetland Creation/Enhancement 91
7.1.6 Groundwater Recharge 92
7.1.7 Riparian Buffer Enhancement 92
7.1.8 Wildlife Habitat Improvement 92
7.1.9 Fish Passage 92
7.2 Project Objectives 92
8. CONCEPTUAL DESIGN 93
8.1 Concept Design Option 1 93
8.2 Concept Design Option 2 94
8.3 Concept Design Option 3 95
8.4 Recommended Stream Restoration Design Option 96
9. FINAL (95%) DESIGN 96
9.1 Design Components 96
9.1.1 Floodplain Design 96
9.1.2 Energy Dissipators 97
9.1.3 Channel Design 97
9.1.4 Grade Control 97
9.1.5 Pedestrian Bridges 98
9.1.6 Shared Use Path 98
9.1.7 Drainage Outfalls 98
9.1.8 Woody Debris 99
10. HYDRAULIC ANALYSIS 99
10.1 HEC-RAS 1D 100
10.1.1 100-year Water Surface Elevations Comparison 100
10.1.2 2- and 10-year Shear Stress Comparison 104
10.1.3 2- and 10-year Velocity Comparison 107
10.2 TUFLOW (2D) Modeling 109
10.2.1 Downstream Boundary Conditions 110

10.2.2 Upstream Boundary Conditions 110
10.2.3 Computational Grid and Roughness Distribution 112
10.2.4 TUFLOW Model Output 113
11. FUNCTION BASED ASSESSMENT 129
11.1 Functional Assessment Parameters 131
11.1.1 Stream and Floodplain Functions 132
12. POLLUTANT LOAD REMOVAL EFFICIENCIES 135
13. REFERENCES 136

FIGURES

Figure 1: Location Map 4
Figure 2: Project Reach 5
Figure 3: Surface Geology Map 7
Figure 4: FEMA Flood Insurance Rate Map 16
Figure 5: Delaware State Atlas (Pomeroy and Beers, 1868) 18
Figure 6: Scenario 1 Stepped Flow Hydrographs 110
Figure 7: Scenario 2 Stepped Flow Hydrographs 111
Figure 8: Scenario 3 Stepped Flow Hydrographs 111
Figure 9: Scenario 4 Stepped Flow Hydrographs 112
Figure 10: Scenario 1 Existing conditions – 2 Year Storm 114
Figure 11: Scenario 1 Proposed Conditions – 2 Year Storm 114
Figure 12: Scenario 1 Existing Conditions – 10 Year Storm 115
Figure 13: Scenario 1 Proposed Conditions – 10 Year Storm 115
Figure 14: Scenario 1 Existing Conditions – 100 Year Storm 116
Figure 15: Scenario 1 Proposed Conditions – 100 Year Storm 116
Figure 16: Scenario 2 Upper Reach Existing Conditions – 2 Year Storm 117
Figure 17: Scenario 2 Upper Reach Proposed Conditions – 2 Year Storm 117
Figure 18: Scenario 2 Upper Reach Existing Conditions – 10 Year Storm 118
Figure 19: Scenario 2 Upper Reach Proposed Conditions – 10 Year Storm 118
Figure 20: Scenario 2 Upper Reach Existing Conditions – 100 Year Storm 119
Figure 21: Scenario 2 Upper Reach Proposed Conditions – 100 Year Storm 119
Figure 22: Scenario 2 Lower Reach Existing Conditions – 2 Year Storm 120
Figure 23: Scenario 2 Lower Reach Proposed Conditions – 2 Year Storm 120
Figure 24: Scenario 2 Lower Reach Existing Conditions – 10 Year Storm 121
Figure 25: Scenario 2 Lower Reach Proposed Conditions – 10 Year Storm 121
Figure 26: Scenario 2 Lower Reach Existing Conditions – 100 Year Storm 122
Figure 27: Scenario 2 Lower Reach Proposed Conditions – 100 Year Storm 122
Figure 28: Scenario 3 Upper Reach Existing Conditions – 2 Year Storm 123
Figure 29: Scenario 3 Proposed Conditions – 2 Year Storm 123
Figure 30: Scenario 3 Existing Conditions – 10 Year Storm 124
Figure 31: Scenario 3 Proposed Conditions – 10 Year Storm 124
Figure 32: Scenario 3 Existing Conditions – 100 Year Storm 125
Figure 33: Scenario 3 Proposed Conditions – 100 Year Storm 125
Figure 34: Scenario 4 Existing Conditions – 2 Year Storm 126

Figure 35: Scenario 4 Proposed Conditions – 2 Year Storm 126
Figure 36: Scenario 4 Existing Conditions – 10 Year Storm 127
Figure 37: Scenario 4 Proposed Conditions – 10 Year Storm 127
Figure 38: Scenario 4 Existing Conditions – 100 Year Storm 128
Figure 39: Scenario 4 Proposed Conditions – 100 Year Storm 128

TABLES

Table 1: Land Use 6
Table 2: Wetlands and Waters Summary 8
Table 3: Wetland Functions and Values Assessment 9
Table 4: Soils Data at Boring Locations 10
Table 5: Bankfull Regional Discharge Data 63
Table 6: FEMA Preliminary Discharges 64
Table 7: Peak Discharges from Regression Equations 64
Table 8: Summary of Top-of-Bank Hydraulic Data at Riffle Sections 67
Table 9: Summary of Geomorphology Data at the Riffle Assessment Reach 70
Table 10: Summary of Mobility Data (Andrews 1995 Methodology) 72
Table 11: Summary of Lateral Stability using BANCS Methodology 74
Table 12: Little Mill Creek 100-YR Water Surface Elevation Results 101
Table 13: Tributary 1 100-YR Water Surface Elevation Results 103
Table 14: Tributary 1 100-YR Water Surface Elevation Results 103
Table 15: Little Mill Creek 2- and 10-YR Channel Shear Stress Results 104
Table 16: Tributary 1 2- and 10-YR Channel Shear Stress Results 106
Table 17: Tributary 2 2- and 10-YR Channel Shear Stress Results 106
Table 18: Little Mill Creek 2- and 10-YR Channel Velocity Results 107
Table 19: Tributary 1 2- and 10-YR Channel Velocity Results 108
Table 20: Tributary 2 2- and 10-YR Channel Velocity Results 109
Table 21: Summary of Manning's N Values 112
Table 22: Functional Assessment Parameters 134
Table 23: Summary of Protocols 1, 2, and 3 Restoration Credits 135
Table 24: Summary of Buffer Planting Credits 135

APPENDICES

APPENDIX A Data Collection Map
APPENDIX B Hydrologic Analysis
APPENDIX C Natural Resource Inventory Memo
APPENDIX D Tree Inventory Table
APPENDIX E Assessment Reach Analysis Data
APPENDIX F Channel Stability Data
APPENDIX G Top of Bank Analysis Data
APPENDIX H Subsurface Soil Investigation
APPENDIX I HEC-RAS Hydraulic Analysis
APPENDIX J TMDL Credit Calculations
APPENDIX K Outfall Protection Computations

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EXECUTIVE SUMMARY

New Castle County (NCC) identified the restoration of Little Mill Creek and tributaries within Woodland Park as a project to provide ecological enhancement, support the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, and help meet pollutant load reductions associated with the Christina River Total Maximum Daily Load (TMDL). The project includes Little Mill Creek and its tributaries beginning at Faulkland Road and extending downstream to Centre Road (SR 141). Prior to the plan development, a watershed-wide data collection and assessment effort was performed by Rummel, Klepper and Kahl (RK&K) to identify and describe watershed and site resources, describe the impairments to the watershed and stream reaches, and consider three design options for restoration within the identified project area. In addition to the restoration efforts of Little Mill Creek, a proposed shared use path (SUP) and two new pedestrian bridge crossings are proposed to increase accessibility within Woodland Park for sanitary sewer maintenance crews as well as pedestrians and bicyclist.

Little Mill Creek is located primarily within the Piedmont physiographic province. The project area is the focus of this report and encompasses approximately 8,500 linear feet of stream including the main and two tributaries to the main stem, and stormwater outfall channels. In addition to the identified project area, the assessment expanded upstream and downstream of the project stream corridors to evaluate existing conditions of the base level control reach downstream of the project area, project reach through the project area, and supply reaches upstream of the project area.

The stream valley throughout the project reaches have been severely manipulated by anthropogenic changes in the watershed and specifically within the project area. These impacts include floodplain encroachment by residential developments, straightening of the historic stream channel, ditching the floodplain for storm drain outfalls, and sewer and gas line construction within the stream valley.

A constraints analysis was performed to identify limitations and challenges to restoring the stream. Two sewer mains parallel the stream valley and multiple laterals cross the floodplain. Additionally, a 12-inch gas transmission line runs along the stream valley in the most of the downstream reach as the main stem approach Centre Road. The design carefully considered the location and determined elevations of the existing utilities to avoid impacting them with design. Storm drain outfalls and outfall channels on both sides of the stream valley present design challenges based on the outfall elevations compared to the streambed elevation. The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) shows a Zone A (approximate study) flood hazard upstream of the confluence of Little Mill Creek with tributary 2 and a Zone AE (detailed study) flood hazard downstream of the confluence of Little Mill Creek with tributary 2. The recommended design proposes to create an integrated stream and wetland restoration to the extent feasible to reduce flood elevations, create or restore riparian wetlands, recharge groundwater, provide flood storage and reduction, enhance the riparian buffer, improve the channel plan form, improve wildlife habitat, and obtain the required TMDL credits for sediment and nutrient reduction using all three Expert Panel stream restoration protocols while avoiding high-quality natural resources and existing infrastructure. This will be accomplished in the project reach by raising the streambed to the

extent feasible and creating a floodplain bench by excavating into the adjacent higher floodplain terrace to better connect the riparian buffer to groundwater where impacts to natural resources would be minimized.

A function-based assessment has been established for the recommended design approach that consider hydrology, hydraulics, geomorphology, water quality and ecology. Objectives to meet the project goals and functional assessment parameters will be developed and refined as the design progresses.

A TMDL credit analysis was completed for the proposed design utilizing Protocols 1, 2, and 3 described in *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* (Expert Panel). The proposed project creates significant nutrient reductions estimated at approximately 123 tons of sediment per year, 142 pounds of phosphorus per year, and 2,742 pounds of nitrogen per year. These reductions result in an Equivalent Impervious Acre (EIA) credit of 82.0 acres. In addition to Protocols 1, 2, and 3, the Expert Panel recognizes alternative methods to obtain EIA credits including the creation of forest and/or meadow stream buffer plantings through land conversion. Proposed landscaping within Woodland Run Park includes the creation and expansion of lowland forest with meadow establishment resulting in an additional 5.4 acres of EIA credits. Therefore, the total EIA credits obtained by the project is 87.7 (82.2 + 5.5) acres of EIA credits. A summary of the crediting and supporting computations are provided in Appendix J.

1. INTRODUCTION

The Little Mill Creek project reach extends from the Faulkland Road crossing downstream to the Centre Road bridge crossing, including two unnamed tributaries and 16 lateral stormwater outfalls. The project area is the focus of this report and encompasses approximately 4,815 linear feet of the mainstem, 1,215 linear feet of tributary channels, and 1,870 linear feet of outfall channels. In addition to the identified project area, the assessment was expanded to evaluate existing conditions of the base level control reach downstream of the project area and an assessment of the sediment supply reach upstream of the targeted restoration areas. The project is part of the Brandywine-Christina Watershed (HUC 02040205). See Figure 1 for a Project Location Map. The project reach is shown in Figure 2.

A primary purpose of this study is to characterize the stream reach of Little Mill Creek, two tributaries to Little Mill Creek, and several storm drain outfall channels within the identified project area to determine the need for stream restoration, stabilization, floodplain connection, water quality improvements, riparian wetland creation, habitat enhancement, and other potential improvements to help meet the New Castle County requirements of the NPDES MS4 permit requirements and TMDL mandates for nitrogen, phosphorus, and sediment.

Data collection efforts performed to develop this report included the following: geologic data, historical records; natural resource inventories for vegetation/forest cover, wetlands, and Waters of the U.S.; evaluation of site constraints; hydrologic analysis; visual site investigations and photo-documentation; geomorphic surveys, plotting and analysis; channel stability assessments using Banks Assessment for Non-point source Consequences of Sediment (BANCS) methodology, preliminary hydraulic and sediment mobility analysis; functional impairment assessment; bankfull/threshold condition studies; and topographic field surveys. An evaluation of concept design alternatives has been performed to compare advantages and disadvantages of each option and the potential for functional uplift. These efforts have led to the development of a design recommendation to restore the stream reaches within the identified project area for design advancement. This report documents the studies performed to date for the project. A map of the project reach with locations of data collection is included in Appendix A.

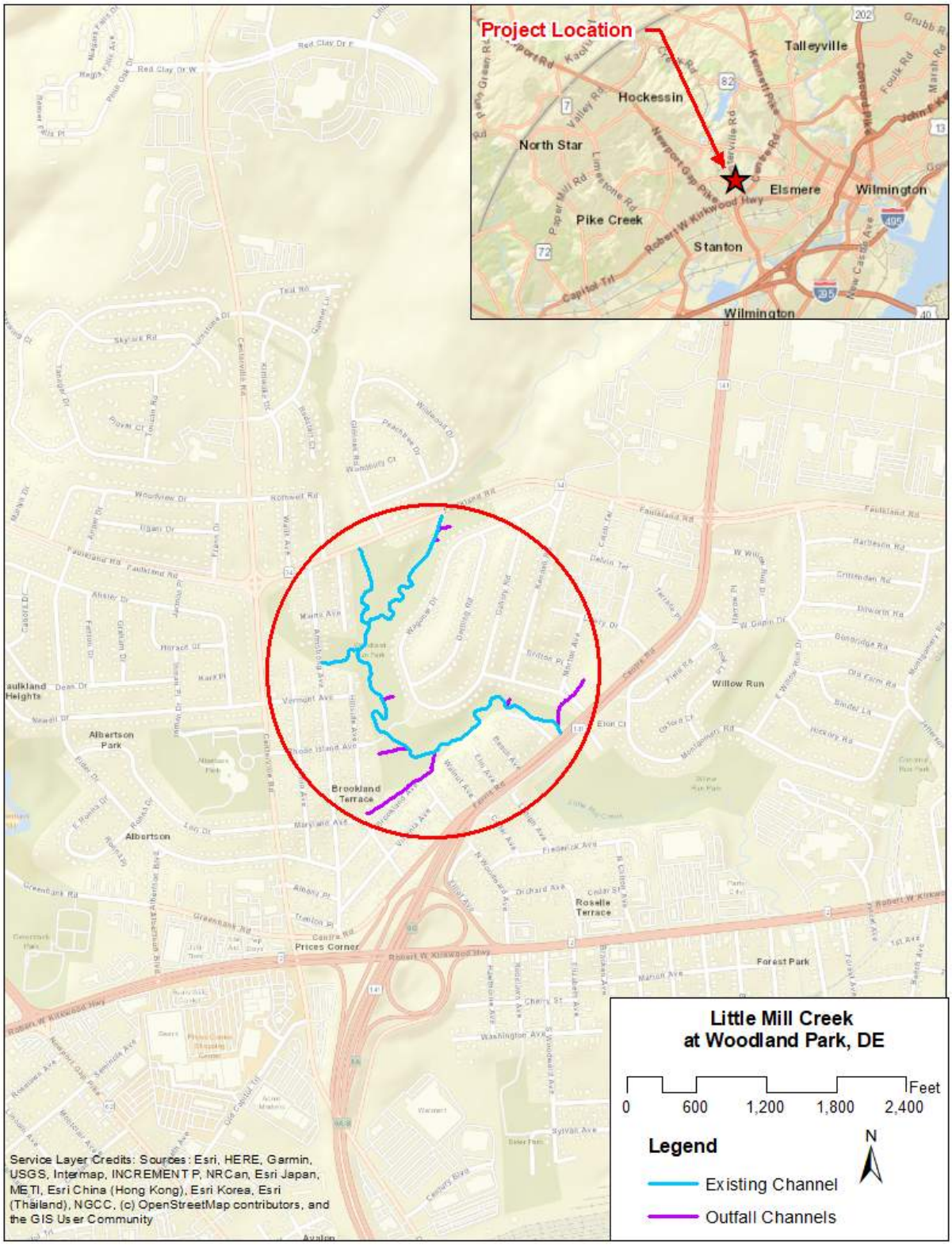


FIGURE 1: LOCATION MAP



FIGURE 2: PROJECT REACH

2. WATERSHED SUMMARY

2.1 Watershed Characterization and Land Use

The project area is in the Christina River Subwatershed of the Brandywine-Christina Watershed (HUC 02040205). The project watershed area is approximately 3.16 square miles at the downstream limit of the project reach, located at Centre Road. According to GISHydroNXT, the watershed consists primarily of urban area (57%) and forest area (32%). The impervious cover of the watershed is 12%.

TABLE 1: LAND USE

Land Use	Area (acres)	Percent of Watershed
Water	4.89	0.24
Open Urban Land	537.97	26.64
Low Density Residential	429.66	21.28
Medium Density Residential	167.02	8.27
High Density Residential	22.68	1.12
Deciduous Forest	531.97	26.35
Evergreen Forest	60.94	3.02
Mixed Forest	62.72	3.11
Brush	70.72	3.50
Grassland	2.00	0.10
Pasture	62.49	3.09
Cropland	16.24	0.80
Wetlands	49.81	2.47
Total	**2019.10**	**100**

2.2 Physiography, Climate, and Surface Geology

Most of the project watershed is located within the Piedmont Plain physiographic province of Delaware with a small portion of the drainage area located within the Coastal Plain physiographic province. Bankfull and larger flow events result from several climatological events including frontal storms, rain on snow, and tropical storm events.

The source of sediments in the project area are Eastern Piedmont metasedimentary rocks and sediment from the Coastal Plain physiographic region. The Eastern Piedmont rocks are primarily derived from Barley Mill Gneiss (Obmg), Faulkland Gneiss (Ofg), and Wissahickon Formation (€Owf). The Coastal Plain sediment is derived from Old College Formation (Qoc). The Geologic survey map is shown in Figure 3. The Barley Mill Gneiss is comprised of biotite, hornblende, plagioclase, and quartz. Faulkland Gneiss is

described as predominantly amphibolites and quartz. Wissahickon Formation is primarily psammitic and pelitic gneiss. Old College Formation is comprised of Clayey silt, silty sand to sandy silt, and quartz sand with pebbles.

Based on field observations, the source of sediment and rock appears to be consistent with the geologic survey findings; however, the site has been greatly impacted and manipulated by centuries of anthropogenic impacts. As a result, the stream banks are primarily composed of legacy sediment infill from past poor land-use practices and mill damming during the post-settlement era.

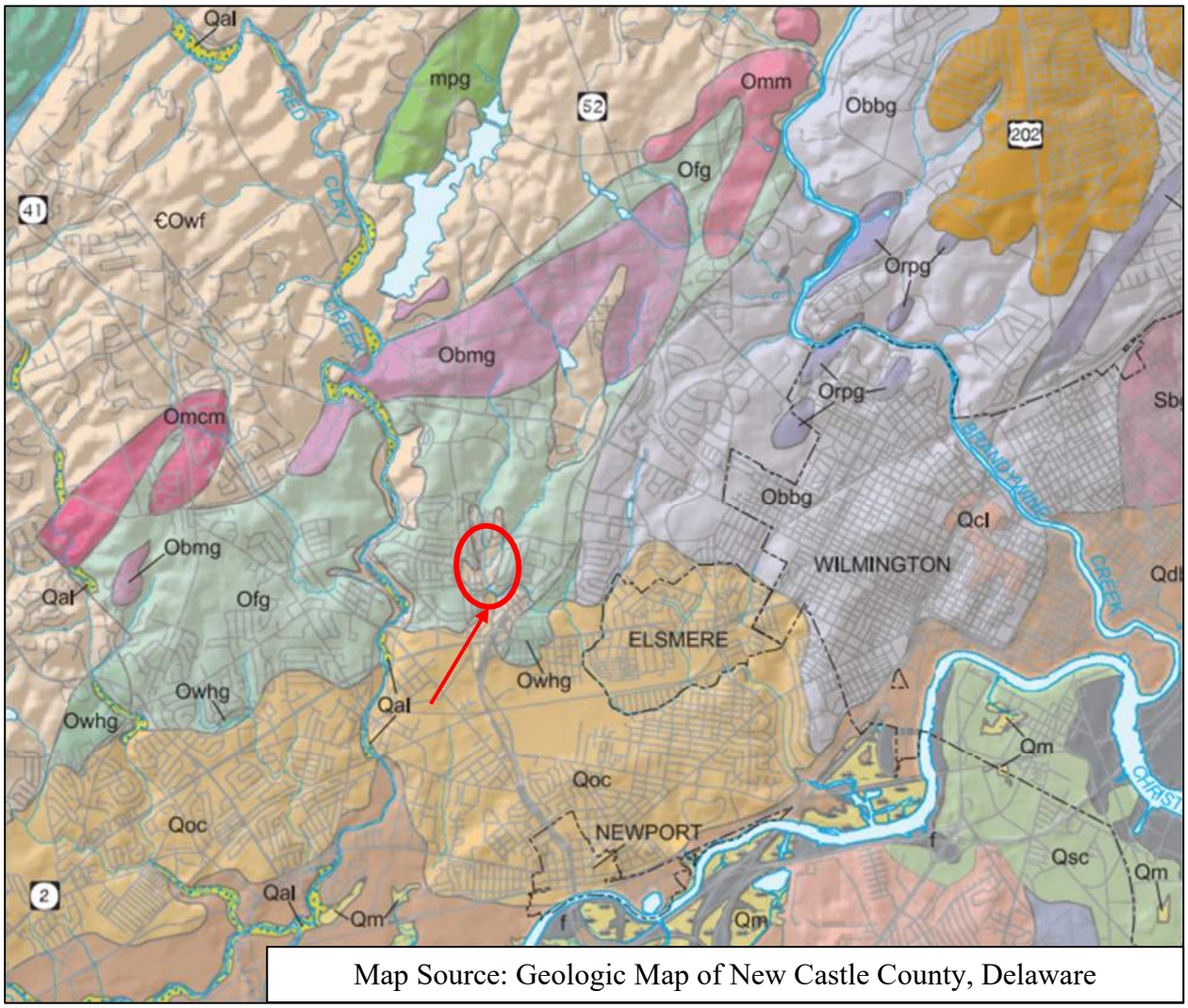


FIGURE 3: SURFACE GEOLOGY MAP

2.3 Landscape Morphology (Valley Type)

The current stream valley characteristics most closely resemble Rosgen's Valley Type C-AL-FD or confined alluvial valley with fluvial deposition. Due to significant historic and modern anthropogenic impacts in the watershed, these valley settings have been heavily manipulated throughout the project area, which is not directly accounted for in the Rosgen Valley Types. It appears that the historic floodplain was likely less confined prior to encroachment of the floodplain to accommodate the residential development.

2.4 Jurisdictional Wetlands and Waters

A wetlands and waters delineation within the Little Mill Creek restoration project area was conducted by RK&K environmental scientists in November and December 2022. A detailed description of jurisdictional wetlands and streams is included in the Natural Resources Inventory Memo in Appendix C. Table 2 summarizes the wetlands and waters and Table 3 summarizes functions and values of the wetlands.

TABLE 2: WETLANDS AND WATERS SUMMARY

Wetlands/Waters*	Type	Watercourse Location
WUS-A	Perennial	Little Mill Creek
WUS-B	Perennial	Tributary 2
WUS-C	Intermittent	Outfall 6
WUS-D	Perennial	Outfall 11
WUS-F	Perennial	Brookland Avenue Tributary 1
WUS-I	Intermittent	Brookland Avenue Tributary 2
WUS-M	Perennial	Tributary 1 (Little Falls Creek)
WET-E	PEM	NA

*As documented in the Natural Resources Inventory Memo in Appendix C

TABLE 3: WETLAND FUNCTIONS AND VALUES ASSESSMENT

Wetland ID	Function and Value Qualifier	Qualifier Comments
WET-E	Medium	• Small (~1,000 SF) PEM wetland located in a floodplain depression that drains to perennial channel WUS-D • Dominated by native herbaceous species (*Persicaria sagittata*) • Provides some wildlife habitat and production export, but limited groundwater recharge, floodflow alteration, and sediment/toxicant retention due to the wetland's small size.

2.5 Plant Community Descriptions

The forest at Little Mill Creek is mostly comprised of a mid-successional Sycamore – Green Ash – Box Elder – Silver Maple Association Forest. The dominant size class in the canopy is 20-30 inches diameter at breast height (DBH). Dominant canopy tree species consists of green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), American sycamore (*Platanus occidentalis*), and silver maple (*Acer saccharinum*). There is a large number standing dead green ash trees in the canopy. Dominant understory species include wineberry (*Rubus phoenicolasius*), spicebush (*Lindera benzoin*), bush honeysuckle (*Lonicera maackii*), and multi-flora rose (*Rosa multiflora*). The herbaceous layer consists of tall fescue (*Festuca arundinacea*), ground ivy (*Glechoma hederacea*), wild onion (*allium vineale*), English ivy (*Hedera helix*), calico aster

(*Symphyotrichum lateriflorum*), poison ivy (*Toxicodendron radicans*), and Japanese honeysuckle (*Lonicera japonica*). The herbaceous layer contains a high level of invasive species, with several areas in the floodplain that consist of maintained mowed lawn with patches of invasive vegetation growing around larger trees and the stream channel. There are several large areas in the floodplain that consist of maintained mowed lawn, with patches of volunteer species growing around larger trees and the stream channel. Twenty-two specimen trees and nine stand-alone trees were inventoried outside of the existing forest. For further information on the forest stands and tree inventory, see the Natural Resources Inventory Memo in Appendix C and the Tree Inventory Table in Appendix D.

2.6 Subsurface Soil Conditions

Subsurface soil data was collected by direct-push boring on December 8 and December 9, 2021, to a depth of approximately 10 feet at 18 locations within the floodplain of the project reach. The soil borings were laid along a survey rod, photographed, and visually inspected to determine the cursory soil characteristics. The depth of groundwater was measured wherever encountered. If encountered, the presence of high clay content was noted as this material may pose issues for floodplain stability and vegetation growth. The field observations and subsurface soil characteristics are noted in Table 4. A map showing the soil boring locations is included in Appendix A.

TABLE 4: SOILS DATA AT BORING LOCATIONS

Boring Location	Depth (ft)	Soil Characteristics	Groundwater Level
#1 (Direct Push) 39.7470 N -75.6208 W	0 to 2.5 2.5 to 4.5 4.5 to 4.6 4.6 to 5.5 5.5 to 6.7	Clay Loam Clay – dark gray color Loamy Sand Loamy Sand w/Large Gravels Weathered Bedrock – orange hue	DNM
#2 (Direct Push) 39.7471 N -75.6206 W	0.0 to 3.4 3.4 to 3.7 3.7 to 4.3 4.3 to 4.6 4.6 to 5.6 5.6 to 5.8 5.8 to 7.0	Clay Loam Clay – orange hue Clay – gray Loamy Sand w/Small Gravels Loamy Sand w/few large gravels Rocks Weathered Bedrock / Loamy Sand	DNM
#3 (Direct Push) 39.7476 N -75.6186 W	0.0 to 2.6 2.6 to 3.6 3.6 to 4.0 4.0 to 5.4 5.4 to 5.6 5.6 to 6.5	Clay Loam Clay Loam Clay Loam Loamy Sand w/Large Gravel Weathered Bedrock – orange hue Weathered Bedrock	4.6’
#4 (Direct Push) 39.7475 N -75.6183 W	0.0 to 0.4 0.4 to 3.2 3.2 to 3.8	Loamy Sand Clay Loam, some rock Loamy Sand – dark gray	DNM

Boring Location	Depth (ft)	Soil Characteristics	Groundwater Level
	3.8 to 4.1	Clay Loam– historic layer w/organics	
	4.1 to 5.4	Loamy Sand w/Gravel	
	5.4 to 6.7	Large Gravel w/Red Clay	
	6.7 to 7.0	Weathered Bedrock	
#5 (Direct Push) 39.7464 N -75.6207 W	0.0 to 1.6	Clay Loam	2.7’
	1.6 to 2.6	Loamy Sand	
	2.6 to 3.0	Loamy Sand w/Small Gravels	
	3.0 to 4.0	Clay	
	4.0 to 4.4	Loamy Sand w/Large Gravels	
	4.4 to 4.7	Loamy Sand w/Large Gravels – orange hue	
	4.7 to 5.7	Weathered Bedrock	
#6 (Direct Push) 39.7464 N -75.6202 W	0.0 to 3.5	Clay Loam	4.2’
	3.5 to 3.8	Loamy Sand	
	3.8 to 4.1	Sandy Clay Loam	
	4.1 to 5.4	Sandy Clay Loam w/Large Gravel	
	5.4 to 6.9	Loamy Sand	
#7 (Direct Push) 39.7463 N -75.6197 W	0.0 to 2.8	Silty Clay Loam	DNM
	2.8 to 3.4	Loamy Sand	
	3.4 to 4.6	Loamy Sand w/Large Gravels	
	4.6 to 5.2	Loamy Sand w/Large Gravels – orange hue	
	5.2 to 5.6	Crushed White Rock	
	5.6 to 5.9	Weathered Bedrock	
#8 (Direct Push) 39.7462 N -75.6193 W	0.0 to 0.6	Clay Loam, Top Soil (darker)	4.6’
	0.6 to 2.4	Clay Loam – red clay, blue and gray hue	
	2.4 to 2.8	Loamy Sand	
	2.8 to 3.5	Clay – blue and gray	
	3.5 to 3.7	Clay Loam, Historic layer – dark	
	3.7 to 4.2	Loamy Sand w/Gravels	
	4.2 to 5.8	Weathered Bedrock w/Gravels	
	5.8 to 6.7	Weathered Bedrock	
#9 (Direct Push) 39.7452 N -75.6208 W	0.0 to 4.0	Clay Loam	DNM
	4.0 to 4.3	Clay	
	4.3 to 4.9	Loamy Sand w/Small Gravels	
	4.9 to 6.1	Loamy Sand w/Large Gravels	
	6.1 to 7.0	Weathered Bedrock	
#10 (Direct Push) 39.7451 N	0.0 to 2.6	Clay Loam	4.6’
	2.6 to 2.9	Loamy Sand	

Boring Location	Depth (ft)	Soil Characteristics	Groundwater Level
-75.6205 W	2.9 to 4.4 4.4 to 4.9 4.9 to 6.6 6.6 to 7.4	Sandy Loam w/Large Gravels Sandy Loam – red hue Weathered Bedrock Finer Weathered Bedrock	
#11 (Direct Push) 39.7440 N -75.6206 W	0.0 to 2.4 2.4 to 3.5 3.5 to 4.3 4.3 to 5.5 5.5 to 6.7	Clay Loam Clay Loam Sandy Loam Sandy Loam w/Large Gravel Weathered Bedrock	4.3’
#12 (Direct Push) 39.7441 N -75.6203 W	0.0 to 3.7 3.7 to 4.2 4.2 to 4.5 4.5 to 5.2 5.2 to 7.5	Sandy Loam Gravels w/Loamy Sand Gravels – orange hue Sand w/Large Gravels Weathered Bedrock	DNM
#13 (Direct Push) 39.7426 N -75.6198 W	0.0 to 2.0 2.0 to 3.6 3.6 to 4.2 4.2 to 5.3 5.3 to 6.0 6.0 to 7.0	Clay Loam Clay Loam – light gray, orange hues Loam Clay Loam – gray and dark gray Sandy Loam w/Large Gravels Weathered Bedrock	4.3’
#14 (Direct Push) 39.7428 N -75.6196 W	0.0 to 1.6 1.6 to 3.1 3.1 to 3.8 3.8 to 4.3 4.3 to 4.9	Clay Loam Silty Clay Loam Sand w/Large Gravels Sandy Loam w/Large Gravels Compact Rock Material - Refusal	DNM
#15 (Direct Push) 39.7429 N 75.6171 W	0.0 to 1.5 1.5 to 2.5 2.5 to 4.2 4.2 to 5.3 5.3 to 6.7	Clay Loam Clay Sandy Clay Sandy Clay w/Large Gravel Weathered Bedrock	3.8’
#16 (Direct Push) 39.7431 N 75.6173 W	0.0 to 1.1 1.1 to 1.4 1.4 to 2.9 2.9 to 3.1 3.1 to 3.8 3.8 to 4.7 4.7 to 5.1	Clay Loam Clay Loam w/Organics Silty Clay Loam Sandy Loam Sand w/Gravels Weathered Bedrock Weathered Bedrock w/Gravels	3.8’
#17 (Direct Push) 39.7430 N	0.0 to 3.0 3.0 to 4.1	Clay Loam Clay Loam	3.5’

Boring Location	Depth (ft)	Soil Characteristics	Groundwater Level
75.6150 W	4.1 to 5.1 5.1 to 5.9 5.9 to 6.5 6.5 to 7.0	Clay Sandy Loam Loamy Sand w/Small Gravel Loamy Sand w/Large Gravel	
#18 (Direct Push) 39.7432 N 75.6150 W	0.0 to 2.5 2.5 to 4.0 4.0 to 7.5 7.5 to 7.8	Clay Loam Clay Loam Clay Loamy Sand	DNM

3. CONSTRAINTS ANALYSIS

3.1 Utilities

Several utilities are present in the stream valley as described below.

3.1.1 Sanitary Sewer

The topographic survey shows several two sanitary sewer mains running along the stream valley with several laterals crossing the Little Mill Creek and its tributaries. The diameters of the sewer lines range from 8 inches to 21 inches. There are several manholes within the floodplain of the project area. One area of the channel has an exposed manhole with the stream cutting around on both sides. Based on the sewer rehabilitation as-builts plans and profiles received from the County, the top of sewer pipes had approximately 1- foot or less of cover to the channel invert at the time of the as-builts in 2002. Two concrete encased crossings were observed to be exposed during field reconnaissance which is consistent with the 2002 as-built plans.

3.1.2 Storm Drain Outfalls

Within the project area, there are 16 storm drain outfalls that discharge runoff from the adjacent neighborhoods on both sides of the stream valleys of Little Mill Creek and tributaries. Some stormwater outfalls have a concrete end walls before discharging into an outfall channel leading to Little Mill Creek. The discharge pipes are RCP or CMP, with varying sizes ranging from 12-inch to 42-inch diameters. Outfalls 2, 4, 11, and 14 are partially covered with sediment and debris and are no longer supporting effective flow through the pipe. The storm drain outfall locations are shown in Figure 2. Additional discussion of each outfall is included in Section 4.2.2 of this report.

3.1.3 Gas Main

The topographic survey showed several gas utility markers in the most downstream reach of Little Mill Creek starting near Walnut Avenue and continuing down to Centre Road. RK&K reached out to Delmarva Power and performed seven test holes to determine there is a 12-inch transmission line that runs approximately down the center of the valley and crosses Little Mill Creek three times between Walnut Avenue and Centre Road. Since the gas main is not a gravity system, exact elevations along the entire stretch of the main within the project limits can not be determined; however, the results of the seven test holes were used to inform the design and eliminate conflicts.

3.2 Existing Infrastructure

Existing infrastructure throughout the project area includes single family homes and associated roadway networks, existing park amenities and pedestrian trails and bridge crossings. Near the middle of the project reach, there are two pedestrian footbridges. There are also two basketball courts and a playground within the project area.

Little Mill Creek is conveyed under Faulkland Road by triple 10-ft 2-in wide by 4-ft 7-in tall concrete box culverts. Similarly, tributary 1, approximately 830-ft to the west along Faulkland Road, is conveyed under the roadway through twin 8-ft wide by 6-ft tall box culverts. The inverts of both concrete box culvert crossings are perched above the invert of the stream; therefore, represent a blockage to aquatic organism passage. Tributary 2 is conveyed under Armstrong Avenue by twin 42-inch reinforced concrete pipe culverts with shallow baseflow flowing through one cell.

3.3 Property Ownership

The project site is primarily contained on county-owned property as recreation area. Privately-owned residential parcels line most of the floodplain throughout the stream valley. Based on Geographic Information System (GIS) data, restored floodplain grading does impact parcel 0703440486, a private parcel at 606 Hillside Avenue, due to limited amount of public right-of-way in this vicinity. The existing channel alignment for Tributary 2 appears to meander through an approximately 47-foot-wide strip where public open space associated with Woodland Run Park connects to parcel 070340475, also a public open space parcel that contains Tributary 2. The proposed design for Tributary 2 avoids impacts to parcels 0703440486 and 0703440485 by having proposed grading tie into existing grading within the 47-foot-wide strip while still achieving the required TMDL credits. Additional impacts associated with the improvements to the stream valley include changes to flooding/drainage and/or view impacts based on tree. Landowners may also be impacted short-term during construction.

3.4 Site Access

Site access for construction will most-easily occur from E Brookland Ave near the downstream limit of the project, Rhode Island Ave north and south of the stream near the middle of the project reach, Armstrong Ave for access to Tributary 2, Faulkland Road at the northern end of Little Mill Creek, and Hillside Avenue at the northern end Tributary 1. Access points have been provided on the design plans.

3.5 FEMA Floodplain

FEMA's effective Flood Insurance Rate Map (FIRM) 10003C0151K, with Effective Date of 01/22/2020, shows the project area of Little Mill Creek as both Zone AE (1-percent annual chance flood with base flood elevations (BFEs) determined) in the downstream portion of the project site and Zone A (1-percent annual chance flood with no BFEs determined) in the upstream portion of the project site. The BFEs in the Zone AE area range from 89.5 feet just upstream of State Route 141 (Centre Road) to 95.7 feet between Maine Avenue and Vermont Avenue.

Figure 4 shows the effective FIRM through the project reach. While much of the FEMA floodplain occupies County-owned land, multiple privately-owned parcels are shown in the effective floodplain delineation, including at least three homes inundated by the 100-year storm on Wagoner Drive near the intersection with Morton Avenue.

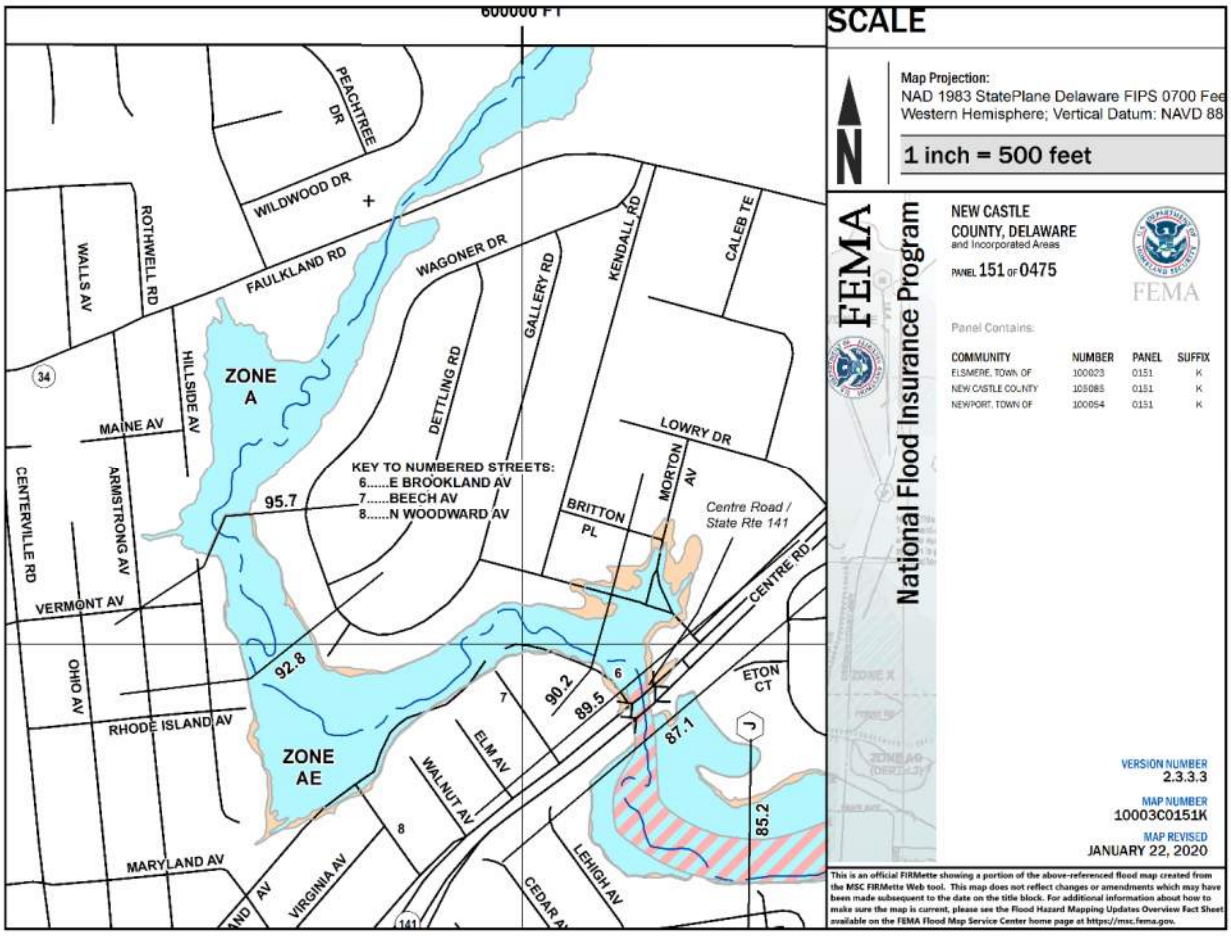


FIGURE 4: FEMA FLOOD INSURANCE RATE MAP

3.6 In-Stream Work Restrictions

Little Mill Creek and its tributaries are classified as perennial and intermittent; therefore, they are regulated waterways by the Delaware Department of Natural Resources and Environmental Control (DNREC). However, no time of year or other in-stream work restrictions apply for construction for these regulated waterways.

4. EXISTING STREAM CONDITIONS

4.1 Historical/Modern Impacts and Potential Sources of Stream Instability

The effects of historical channel and floodplain manipulation are apparent along Little Mill Creek. In general, historic deforestation of the region, massive upland sediment erosion caused by poor land use practices, relocation and straightening of streams, and the construction of milldams that spanned the valley bottoms have created extensive infill or deposits of sediments within the receiving floodplains (reference work from Merritts 2012). These historic impacts that filled the valley bottoms with modern sediments washed from the hillsides (e.g. legacy sediments, post-settlement alluvium) have since led to routine dam breaching followed by channel incision that has largely disconnected the modern floodplain (terrace) from the active channel where grade controls within the modern sediment infill have now degraded or have since been removed.

Figure 5 shows location of historic saw and grist mills downstream of the project reach on Little Mill Creek. The mill pond appears to be in the vicinity of current-day State Route 141 near the downstream project limit. More recently, the construction of roadway embankments, bridges/culverts, utility corridors, filling of floodplains to accommodate land development activities, and realignment or piping of tributaries have severely disrupted natural stream, floodplain and ecological functions and processes in the region.

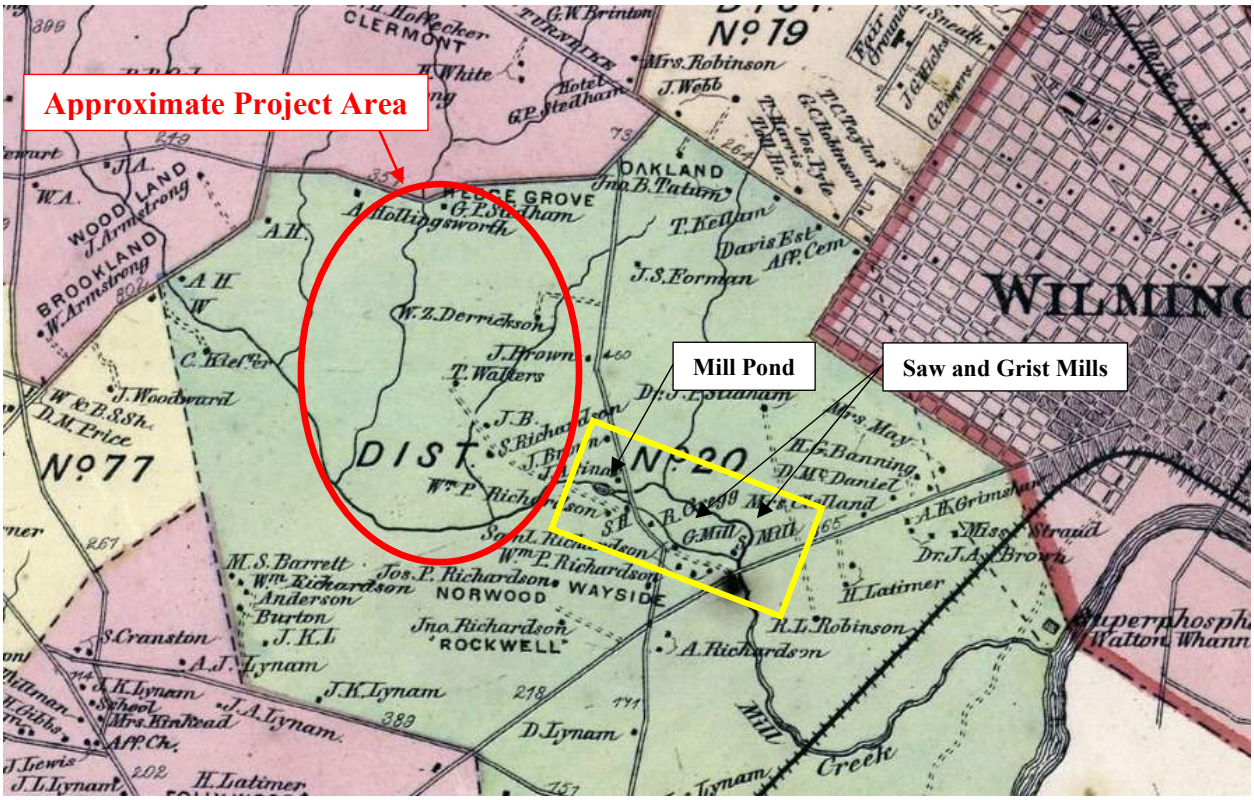


FIGURE 5: DELAWARE STATE ATLAS (POMEROY AND BEERS, 1868)

4.2 Existing Conditions Visual Assessment

As part of developing the concept design for the restoration of Little Mill Creek, a visual assessment was conducted by RK&K on November 18, 2021. The visual assessments were used as a key design component to identify potential sediment and debris sources, degradation and depositional areas, and regional and localized impacts throughout the stream corridor that may influence long-term stability of the project reach proposed for restoration. The visual assessments along the mainstem comprised the areas from the Kirkwood Highway roadway crossing, approximately 3,750 feet downstream of Centre Road, and continued upstream approximately 3,400 feet upstream of the Faulkland Road crossing. The tributaries to Little Mill Creek were assessed from their confluences with Little Mill Creek to some distance upstream of the upstream roadway crossings at the project limit. This visual assessment of the existing conditions includes a description of the Sediment Supply Reaches upstream of the project, the Project Reaches, and the Base Level Control Reach downstream of the project limits.

4.2.1 Base Level Control Reach

The purpose of the visual assessment of the base level control reach is to identify grade control downstream of the project limits and evaluate whether the stream features can be relied upon for long-term grade control of the channel bed and protect the proposed design of the project. Generally, grade controls such as culverts, sewer encasements, armored riffles, backwater from a larger stream or body of water, tidal influences, and/or stable streambed material, where the streambed is expected to stay at its

current elevation, allow for a reliable elevation at which to tie in a project at the downstream limit. When one or more of these controls is not present, it is important to evaluate the potential long-term degradation of the channel downstream of a proposed project such that a sufficient grade control is incorporated into the proposed design of the restoration reach and prevent headcuts or degradation from affecting the project site. Non-permanent low flow – high gradient features such as debris jams or beaver dams should not be relied upon for long-term grade control.

4.2.1.1 Little Mill Creek Mainstem

For the purposes of the project assessment, the base level control reach for the Little Mill Creek Mainstem was defined as the reach from Kirkwood Highway to Centre Road. The base level control reach is heavily manipulated to accommodate development on both sides of the stream including the Wilmington VA Medical Center to the east, the Franbert Shopping Center to the west and south, and residential properties to the north and south. The stream valley is severely confined for approximately 1,000 feet upstream of Kirkwood Highway between the hospital and shopping center. The non-developed portions of the stream valley are forested.

The channel crosses Kirkwood Highway via a dual cell bridge and immediately downstream of the bridge concrete walls and slopes have been constructed to protect businesses located immediately on both sides of the stream (Photo 1). The concrete flume appears to accelerate velocity during flood flows which also appears to move large material in the streamed. A drop of more than 2 feet occurs at the outlet of the bridge and the drop is protected by large riprap (Photo 2). Approximately 10 feet upstream of the upstream face of the bridge (Photo 3) an exposed utility encasement was observed in the channel bed (Photo 4).

Between Kirkwood Highway and Centre Road the stream is incised with bank heights ranging from approximately 4 to 6 feet above baseflow and often unvegetated and/or vertical. The channel is also widened to a point that the channel itself has capacity to carry large floods and floodplain access during flood flow does not appear to be frequent. The baseflow water surface gradient is very mild with most of the reach appearing as a pool with a level water surface (Photo 5). The stream has few riffles with very mild slopes. The baseflow water surface slope changes abruptly at low flow – high gradient features such as debris jams (Photos 6 and 7) and exposed utility encasements (Photos 8 and 9). Photo 7 shows a water surface elevation drop of approximately 2 feet at a debris jam. At this location, a wall was constructed on the right bank (looking downstream) behind a residential structure on Frederick Avenue approximately 700’ (valley distance) downstream of Centre Road.

The streambed material is comprised of primary fine sediment and sand with some periodic gravels and cobbles. The native streambed materials do not appear to withstand the shear stress and velocities that occur within the channel during flood flow, and it appears that the channel bed is highly mobile which leads to the vertical instability of the channel bed.

The channel is also unstable laterally with significant bank erosion and undercutting of trees throughout the base level control reach (Photo 6). Sanitary sewers were observed in the stream valley and the lateral instability of the stream has exposed sewer manholes along the channel banks (Photos 10 and 11).

This debris jam in Photo 7 appears to control the water surface elevation as a near-level pool all the way to the Centre Road Bridge (Photo 12). If this debris jam were to dislodge, the channel upstream would be vulnerable to downcutting as the native streambed materials are evacuated during flood flow, with the potential to lower the streambed by up to 2 feet at Centre Road (the downstream limit of the restoration project reach). The next permanent, or relatively permanent, grade control downstream of the project reach occurs at the exposed sewer encasement shown in Photo 9, which is located approximately 1,350 feet downstream of Centre Road (valley distance).



Photo 1: Downstream of the Kirkwood Highway Crossing



Photo 2: ~2' Drop at Downstream Face of the Kirkwood Highway Crossing



Photo 3: Upstream Face of the Kirkwood Highway Crossing



Photo 4: Exposed Concrete Sewer Encasement just Upstream of Kirkwood Highway



Photo 5: Approximate 6' Channel Banks and Mild Water Surface Slope at Baseflow



Photo 6: Typical Debris Jam and Tree Fall Along Channel



Photo 7: Debris Jam with ~2' Water Surface Drop Near 2400 Frederick Avenue

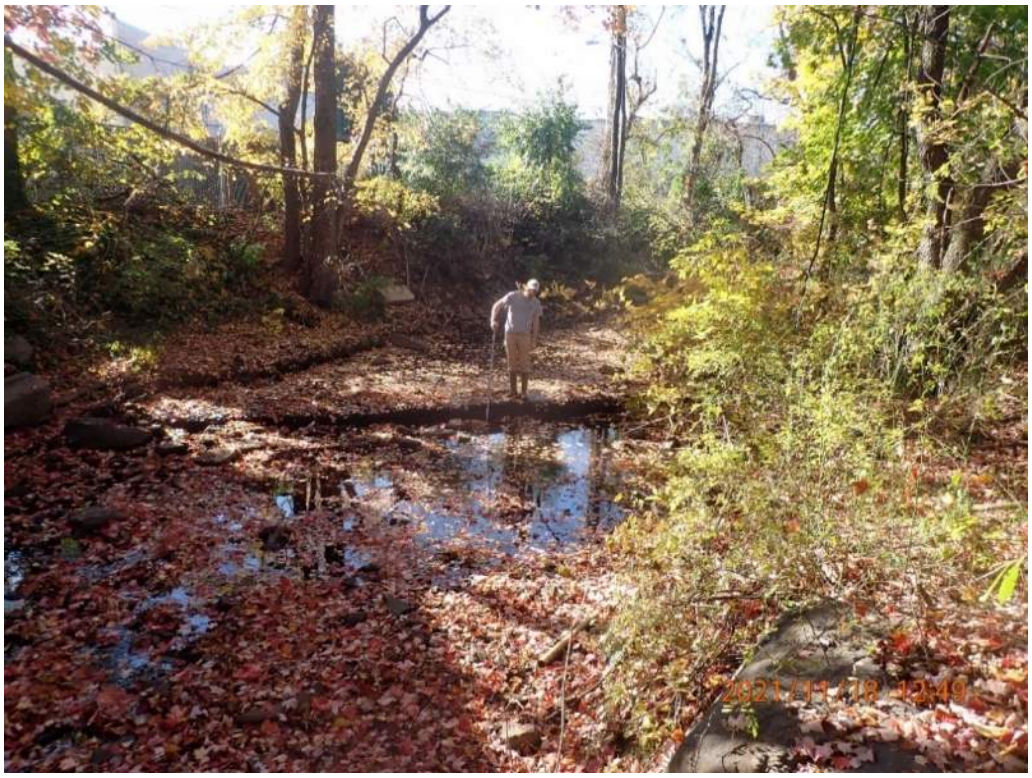


Photo 8: Exposed Sewer Encasement Approximately 200 feet Upstream of Kirkwood Highway



Photo 9: Exposed Sewer Encasement Approximately 1,350 feet Downstream of Centre Road



Photo 10: Lateral Erosion Exposing Sanitary Sewer Manhole



Photo 11: Lateral Erosion Exposing Sanitary Sewer Manhole



PHOTO 12: DOWNSTREAM FACE OF CENTRE ROAD BRIDGE

4.2.1 Little Mill Creek Tributaries

The base level control reach for the Little Mill Creek tributaries is the Little Mill Creek Mainstem at and downstream of the confluence of each tributary. Since each tributary base level control is reliant on the mainstem within the project reach, achieving long-term grade control will be determined by the proposed grade control features within the mainstem.

4.2.2 Project Reach

The purpose of the visual assessment of the project reach is to evaluate the stream and floodplain setting, identify impairments to the stream and stream valley, and identify potential project constraints. The assessment is also leads to justification of temporary project impacts during permitting, identifies impairments to be resolved during the design process, and helps to create goals and objectives for the restoration project.

4.2.2.1 Little Mill Creek Mainstem

The project reach extends from the Centre Road bridge upstream approximately 3,750 linear feet of valley distance to the Faulkland Road crossing and is located on County property that is part of Woodland Run Park.

The project reach appears to have been subjected to several anthropogenic impacts in the stream channels, floodplain areas, and hillside slopes throughout the project area. These impacts include straightening and channelization of the stream channel, construction of park amenities within the stream valley, utility construction within the stream valley, and placement of fill along the valley margins to accommodate the residential developments on both sides of the stream valley. Exposed sewer encasements crossing the stream and perched stormwater outfalls indicate that Little Mill Creek and its tributaries have incised over time.

The downstream project reach, from the Centre Road bridge upstream approximately 1,200 feet (valley distance), is located in a confined valley where residential homes have encroached on the floodplain. The valley width between residential lots is approximately 140 feet. This portion of the project reach has average bank of heights of approximately 3-4 feet (see Photo 16), is lightly forested with bank erosion exposing tree root systems in many locations (see Photo 20), and is crowded with utility infrastructure including sewer pipelines and manholes, a gas pipeline, and multiple stormwater outfalls (see Photo 21). A utility encasement is visible in the stream approximately 20 feet upstream of Centre Road (see Photo 15). A sanitary sewer manhole approximately 320 feet upstream of Centre Road has been exposed and is now in the stream (see Photo 17). A beaver dam with approximately 1.4 feet of drop is located at this same location (see Photo 18) with evidence of recent beaver activity in the immediate vicinity. Riprap bank protection measures were seen in this reach approximately 680 feet upstream of Centre Road with erosion visible upstream and downstream of the protected area (see Photo 19). Approximately 1,500 feet upstream of Centre Road, the floodplain begins to widen out where a pedestrian bridge, referred to as the downstream pedestrian bridge, is located (see Photo 22).



PHOTO 13: UPSTREAM FACE OF CENTRE ROAD BRIDGE



PHOTO 14: UPSTREAM FROM THE CENTRE ROAD BRIDGE



PHOTO 15: SUBMERGED CONCRETE SEWER ENCASEMENT ~20' UPSTREAM OF CENTRE ROAD



PHOTO 16: AVERAGE BANK HEIGHTS OF 3-4'



PHOTO 17: EXPOSED SEWER MANHOLE AND BEAVER DAM APPROXIMATELY 320' UPSTREAM OF CENTRE ROAD



PHOTO 18: ~1.4' DROP AT BEAVER DAM



PHOTO 19: FAILING RIPRAP BANK PROTECTION APPROXIMATELY 680' UPSTREAM OF CENTRE ROAD



PHOTO 20: BANK EROSION UNDERCUTTING TREE ROOTS



PHOTO 21: TYPICAL UTILITY CONSTRAINTS IN THE LOWER SECTION OF THE PROJECT REACH



PHOTO 22: DOWNSTREAM PEDESTRIAN BRIDGE CROSSING

The project reach from the downstream pedestrian bridge upstream to the Faulkland Road crossing (approximately 2,500 linear feet in valley length) is lightly forested and less confined than the downstream area with valley widths ranging from 140 feet to 320 feet. In the lower portion of this reach, park amenities are present in the floodplain (see Photo 22) and a second pedestrian bridge, referred to as the upstream pedestrian bridge, crosses the stream (see Photo 23). There is some riprap bank protection immediately upstream of the upstream pedestrian bridge (see Photo 24) and larger, cobble-sized bed material is present sporadically though the site (see Photo 25). Understory growth and riparian vegetation are limited throughout the reach as the park-like setting is heavily maintained with a focus on turf grass (see Photo 26). Lack of deep-rooting vegetation has exacerbated the bank instability present throughout the project reach. A second sanitary sewer encasement is exposed approximately 1,090 feet upstream of the upstream pedestrian bridge where an approximate 0.7 foot drop is present (see Photo 27). Average bank heights through this section of the project reach are slightly higher at approximately 4 to 5 feet (see Photos 28 and 30). Trees adjacent to the stream are frequently undercut, with root systems exposed and fallen trees common throughout the reach (see Photos 29 and 31). Progressing upstream in the project reach, the buried historic floodplain layer becomes visible near the streambed elevation, indicating that the streambed elevation is near its historic elevation in these locations (see Photo 32). A highly straightened section of Little Mill Creek is present just downstream of Faulkland Road (see Photo 33). This section is fairly confined by residential properties and utility infrastructure adjacent to the stream (see Photo 35). The Faulkland Road triple span culvert represents approximately 1-foot drop at the downstream end (see Photo 34).



PHOTO 23: PARK AMENITIES IN THE FLOODPLAIN



PHOTO 24: UPSTREAM PEDESTRIAN BRIDGE CROSSING



PHOTO 25: BANK PROTECTION UPSTREAM OF PEDESTRIAN BRIDGE



PHOTO 26: LARGER STREAMBED MATERIAL PRESENT IN PORTIONS OF LITTLE MILL CREEK



PHOTO 27: TYPICAL CHANNEL BANKS WITH LIMITED RIPARIAN VEGETATION



PHOTO 28: ~0.7' DROP AT SANITARY SEWER CROSSING



PHOTO 29: TYPICAL BANK HEIGHTS OF ~4-5'



PHOTO 30: TYPICAL EROSION AROUND TREE ROOT SYSTEM



PHOTO 31: TYPICAL BANK EROSION ON OUTSIDE MEANDERS



PHOTO 32: TYPICAL TREE FALL



PHOTO 33: BURIED HISTORIC FLOODPLAIN MATERIAL NEAR BASEFLOW ELEVATION



PHOTO 34: STRAIGHTENED CHANNEL AT UPSTREAM END OF PROJECT REACH



PHOTO 35: ~1' DROP AT DOWNSTREAM FACE OF THE FAULKLAND ROAD CULVERT



PHOTO 36: TYPICAL UTILITY ENCROACHMENT WITHIN THE FLOODPLAIN

4.2.2.2 Tributaries

Tributary 1 enters Little Mill Creek approximately 1,200 feet downstream of the Faulkland Road crossing. From the confluence with Little Mill Creek, Tributary 1 runs approximately 650 feet upstream to Faulkland Road. For the first approximately 400 feet upstream of the confluence with Little Mill Creek, Tributary 1 shares its floodplain with Little Mill Creek. The floodplain upstream to Faulkland Road is bordered by private properties on both sides. Average bank heights through this reach range from 3 to 5 feet (see Photo 36). This reach is lightly forested with trees adjacent to the stream often undercut with exposed roots (see Photo 37). Bank erosion has exposed an outfall structure approximately 200 feet upstream of the confluence with Little Mill Creek (see Photo 38). The Faulkland Road crossing is a dual cell 8-ft wide x 6-ft tall culvert and there is an approximately 1.7-foot drop at the outlet (see Photo 39).



PHOTO 37: AVERAGE BANK HEIGHTS OF 4-5'



PHOTO 38: TYPICAL BANK EROSION AND EXPOSED TREE ROOTS



PHOTO 39: EXPOSED OUTFALL STRUCTURE APPROXIMATELY 200' UPSTREAM OF THE CONFLUENCE



PHOTO 40: ~1.8' DROP AT FAULKLAND ROAD CULVERT

Tributary 2 enters Little Mill Creek approximately 1,500 feet downstream of the Faulkland Road crossing. From the confluence with Little Mill Creek (see Photo 40), Tributary 2 runs approximately 300 feet upstream to Armstrong Road. Sanitary sewer lines and manholes run up the tributary floodplain and are exposed approximately 100 feet upstream of the confluence with Little Mill Creek (see Photo 41). This reach is highly straightened and confined by adjacent private properties. Riprap protection was observed approximately 120 feet upstream of the confluence with Little Mill Creek (see photo 42). Bank heights through this reach are on average around 4 feet (see Photo 43). This reach terminates at the Armstrong Road crossing which contains two 42" pipe culverts (see Photo 44).



PHOTO 41: TRIBUTARY 2 CONFLUENCE WITH LITTLE MILL CREEK



PHOTO 42: EXPOSED SEWER MANHOLE AND ENCASEMENT



PHOTO 43: RIPRAP PROTECTION AND ADJACENT BUILDINGS



PHOTO 44: AVERAGE BANK HEIGHTS ~4'



PHOTO 45: DUAL 42" CULVERTS AT ARMSTRONG ROAD

4.2.2.3 Stormwater Outfalls in the Project Reach

Within the project area, there are 16 storm drain outfalls that discharge stormwater runoff from the adjacent neighborhoods on both sides of the stream valley. The storm drain outfalls consist of a variety pipe sizes and materials and vary in drainage area from a single road inlet to entire residential neighborhoods. Several of the outfalls that were identified have been silted in by debris which is severely limiting the effective flow area through the pipe and likely having a negative impact on the capacity of the upstream system. A few of the storm drain outfall pipes discharge directly into Little Mill Creek or its tributaries (Photo 46), but others are set further back in the floodplain (offset from the main channel) and have defined outfall channels of their own (Photo 47). The applicability of Expert Panel Protocols 1 will be evaluated on a case-by-case basis dependent upon the severity of any existing head cuts and the proposed treatment in the final design.



PHOTO 46: OUTFALL DISCHARGE DIRECTLY TO LITTLE MILL CREEK



PHOTO 47: OUTFALL WITH OUTFALL CHANNEL INTO LITTLE MILL CREEK

A detailed description of each of the storm drain outfalls and outfall channels located within the project reach is included below. The outfalls are numbered 1-13 from upstream to downstream along the main channel of Little Mill Creek, followed by numbers 14-15 along Tributary 1 and number 16 on Tributary 2. The location and naming of all 16 outfalls are shown in the map in Appendix A.

Storm Drain Outfall 1 (DelDOT ID #0111199451) – Outfall 1 is located approximately 120 feet downstream of Faulkland Road and discharges directly into the mainstem of Little Mill Creek. The storm drain is a 15" corrugated HDPE pipe and the invert of the pipe is approximately 2' above the water surface. The drainage network for Outfall 1 consists of several yard inlets in backyards along Faulkland Road, which are connected by 15" corrugated HDPE pipe and include inputs from connected downspouts of several homes. The storm drain has placed riprap protection along the downstream side of the outlet.

Storm Drain Outfall 2 (DelDOT ID #0111066504) – Outfall 2 is located approximately 210 feet downstream of Faulkland Road. The storm drain is a 24" RCP which discharges into an approximately 25' long outfall channel before its confluence with the mainstem of Little Mill Creek. The drainage network for Outfall 2 collects roadway runoff along Wagoner Drive in the Woodland Heights neighborhood. The outfall pipe and channel were completely covered in debris and lawn clippings and had to be dug out during the outfall inventory which is likely limiting the hydraulic capacity of the drainage network upstream. A sanitary sewer manhole is in the vicinity of the outfall pipe which will be a major constraint moving forward.

Storm Drain Outfall 3 (DelDOT ID #0111056286) – Outfall 3 is located approximately 1,150 feet downstream of Faulkland Road. The storm drain is an 18" CMP and discharges into an approximately 20' long outfall channel prior to the confluence with Little Mill Creek. The drainage network for Outfall 3 collects roadway runoff and yard drainage from homes along Wagoner Drive in the Woodland Heights neighborhood. The outfall pipe has no headwall protection and appears to have been damaged at some point.

Storm Drain Outfall 4 (DelDOT ID #0111035238) – Outfall 4 is located approximately 2,050 feet downstream of Faulkland Road. The storm drain is a 18" RCP and discharges directly into the mainstem of Little Mill Creek. The opening of the outfall pipe is heavily obstructed with soil and rock debris which may have a negative impact on the capacity of the upstream system. The drainage network consists of a small group of road inlets around the intersection of Hillside and Vermont Avenues.

Storm Drain Outfall 5 (DelDOT ID #0111055829) – Outfall 5 is located approximately 2,200 feet downstream of Faulkland Road. The storm drain is an 18" CMP which discharges into an approximately 90' long outfall channel prior its confluence with the Little Mill Creek mainstem. The drainage network for this outfall conveys roadway runoff from the intersection of Wagoner Drive and Dettling Road. During the outfall inventory, a headcut was observed in the outfall channel about 35' above the confluence with the mainstem. Over time, if left unaddressed, this headcut will continue to migrate up the entire length of the outfall channel and could potentially compromise the integrity of the outfall pipe. An approximately 40' side channel has begun to develop to the north of the outfall channel, which was likely formed by local drainage from the park and homes along Wagoner Drive. Two sanitary sewer mains run parallel to each other in the vicinity of the Outfall 5.

Storm Drain Outfall 6 (DelDOT ID #0111037821) – Outfall 6 is located approximately 1,838 feet upstream of Centre Road (Rt. 141). The storm drain is a 24" RCP with a flared end section that discharges to an approximately 240' channel prior to confluence with the mainstem. A large amount of debris was observed at the beginning of the outfall channel, but it did not seem like it would have an impact on the hydraulic capacity of the storm drain. The drainage network for Outfall 6 conveys roadway runoff along Rhode Island Avenue between Ohio and Hillside Avenues, as well as some overland drainage from the Brookland Terrace neighborhood.

Storm Drain Outfall 7 (DelDOT ID #011196922) – Outfall 7 is located approximately 1,550 feet upstream of Centre Road (Rt. 141). The storm drain is a 42" RCP through an endwall with 45° wing walls and discharges to an outfall channel that is approximately 850 feet long prior to its confluence with the mainstem of Little Mill Creek. The drainage network for Outfall 7 is extensive and includes road inlets throughout a large portion of Brookland Terrace as well as along Centerville Road between Rhode Island Avenue and Trenton Place. There are two other storm drains that discharge into the same channel as Outfall 7 (see Outfall 8 and Outfall 9, below). The upstream portion of outfall channel is extremely confined and only accessible through easements on private property but opens up back on County owned property about 175' upstream of Outfall 9.

Storm Drain Outfall 8 (DelDOT ID #011165705) – Outfall 8 is located approximately 100 feet further downstream of Outfall 7. The storm drain was inaccessible to RK&K during the outfall inventory due to dense thicket growth and fences along private property lines. According to the DelDOT and NCC GIS databases, the storm drain is an 18" RCP and the drainage network consists of a single inlet in the cul-de-sac at the southern terminus of Hillside Drive.

Storm Drain Outfall 9 (DelDOT ID #0111033938) – Outfall 9 is located approximately 530 feet downstream of Outfall 7. The storm drain is an 18" RCP with a flared end section and appears to have had a concrete apron at one point which has completely deteriorated, leaving a pile of rubble between the outlet and the channel. The invert of the storm drain is 1.6' above the water level of the small scour hole at the end of the apron. As noted in the latest inspection dated August 31, 2020, the outfall pipe itself is also in very poor condition. The drainage network for Outfall 9 collects roadway runoff from portions of Brookland, Virginia, and North Woodland Avenues and discharges at the corner of Brookland and North Woodland Ave.

Storm Drain Outfall 10 (DelDOT ID #0111052954) – Outfall 10 is located approximately 1,150 feet upstream of Centre Road (Rt. 141). The storm drain is an 18" RCP that protrudes from the side slope and discharges to an approximately 120' outfall channel prior to its confluence with the mainstem of Little Mill Creek. A second outfall channel has formed to the west of the primary and conveys local drainage from the nearby playground area and homes off Wagoner Drive. The drainage network is rather small and consists of just two curb inlets on Wagoner Drive, and there is a significant change in elevation between the grate inlets and the pipe outfall. The lower section of the outfall channel near, the confluence with the mainstem, has both sanitary sewer and gas utilities in the immediate vicinity.

Storm Drain Outfall 11 (DelDOT ID #0111051492) – Outfall 11 is located approximately 575 feet upstream of Centre Road (Rt. 141). The storm drain is a 24" CMP discharging to an outfall channel of approximately 65 feet in length prior to entering the Little Mill Creek mainstem. The outfall pipe has a deteriorated brick and concrete headwall and has about 9" of debris obstructing the outlet which is likely limiting the hydraulic capacity of the upstream system. The drainage network for Outfall 11 collects roadway runoff

from the southern portions of Gallery and Kendall Roads and along Wagoner Drive. There are multiple sewer and natural gas utilities and stream crossings near the confluence with the mainstem.

Storm Drain Outfall 12 (DelDOT ID #0111199437) – Outfall 12 is located approximately 125 feet upstream of Centre Road (Rt. 141). The storm drain is a 30" diameter RCP protruding from the streambank and discharging directly into the mainstem of Little Mill Creek. The drainage network for Outfall 12 collects roadway and yard drainage from the Greenville on 141 apartment complex and Woodland Heights neighborhood. The main trunk of the drainage network begins on Caleb Terrace, near the intersection with Faulkland Road, and continues south, through the apartment complex, and down Morton Avenue. There are several sanitary sewer manholes and gas utilities crossing beneath the storm drain outfall before it daylights.

Storm Drain Outfall 13 (DelDOT ID #0111199444) – Outfall 13 is located approximately 115 feet upstream of Centre Road (Rt. 141). The storm drain is a 21" diameter RCP discharging to an approximately 55' long outfall channel prior to the confluence with the mainstem of Little Mill Creek. The drainage network is relatively small, consisting of three road inlets near the intersection of Morton Avenue and Wagoner Drive, but there also appears to be connection to the drainage network to Outfall 12 to equalize flow in case one of the two systems becomes overwhelmed. The outfall pipe riprap protection around the outlet which may have originally been a stone headwall has failed.

Storm Drain Outfall 14 (DelDOT ID #0111033240) – Outfall 14 is located along Tributary 1 to Little Mill Creek, approximately 125 feet downstream of Faulkland Road. The storm drain is a 12" diameter RCP protruding out of the streambank and filled with about 4" of sediment at the outlet. The drainage network for Outfall 14 consists of three road inlets and a junction manhole along the north side of Hillside Avenue in the Brookland Terrace neighborhood.

Storm Drain Outfall 15 (DelDOT ID #0111017378) – Outfall 15 is also located along Tributary 1 to Little Mill Creek, approximately 450 feet downstream of Faulkland Road. The storm drain is a 15" diameter RCP, with a flared end section, discharging directly into the stream channel. The drainage network for Outfall 15 consists of six road inlets and a yard inlet collecting runoff along Maine and Hillside Avenues.

Storm Drain Outfall 16 (DelDOT ID #0111038370) – Outfall 16 is located along Tributary 2 to Little Mill Creek, approximately 200 feet downstream of Armstrong Avenue. The storm drain is a 15" diameter RCP discharging directly into the stream channel. The pipe is protruding from a streambank that has been heavily protected with riprap and much of that rock has been knocked loose and is now sitting at the outlet. The drainage network for Outfall 16 appears to be a single road inlet at the dead end of Hillside Avenue. There are sanitary sewer utilities and manholes crossing the outfall.

4.2.3 Sediment Supply Reaches

4.2.3.1 Little Mill Creek Mainstem

The purpose of the visual assessment of the sediment supply reaches is to evaluate the stream and floodplain setting, identify potential sediment sources to the stream, and evaluate the sediment load to the project reaches. The information is used to inform the design and plan for the expected amount of sediment coming into the project reach.

The Little Mill Creek sediment supply reach, located upstream of Faulkland Road, consists of a highly degraded stream system including vertical stream banks, exposed sewer encasements, and dilapidated concrete structures adjacent to the stream. The first approximately 650 feet upstream of Faulkland Road acts as a transport reach to the Faulkland Road Culvert (see Photo 48) for the sediment load entering the reach. This section is bordered by private land on both sides with maintained turfgrass limiting the number of trees and riparian vegetation. An existing CMP stormwater outfall is exposed approximately 120 feet upstream of Faulkland Road (see Photo 49), indicating lateral bank erosion. It appears that material excavated from a stream bank approximately 330 feet upstream of Faulkland Road (see Photo 50) is actively being used to construct an approximate 3.5-foot high, man-made dam just upstream (see Photo 51). This dam likely stores sediment but should be considered a temporary structure that can wash out, resulting in inconsistent pulses of sediment being released to the project reach. Banks in this transport reach are often vertical and are approximately 5 feet high on average (see Photo 52). There is a small pedestrian bridge approximately 130 feet upstream of the man-made dam and an exposed concrete sewer encasement just upstream of the pedestrian bridge (see Photo 53) indicating lateral instability in this area.

Approximately 650 feet upstream of Faulkland Road, the floodplain shifts to a forested setting with a more sinuous channel and denser riparian vegetation than the transport reach described above. Bank instability is still present and the sediment load to the transport reach and project reach appears to be mainly fine sediments from bank erosion. Larger cobble/boulder-sized material is present in the streambed (see Photo 54) but appears to be largely immobile. Remnants of a concrete structure adjacent to the stream are present approximately 2,300 feet upstream of Faulkland Road (see Photo 55).



PHOTO 48: UPSTREAM FACE OF THE FAULKLAND ROAD CULVERT



PHOTO 49: EXPOSED OUTFALL PIPE ~ 120' UPSTREAM OF FAULKLAND ROAD



PHOTO 50: EXCAVATED BANK MATERIAL ~320' UPSTREAM OF FAULKLAND ROAD



PHOTO 51: ~3.5’ MAN-MADE DAM APPROXIMATELY 330’ UPSTREAM OF FAULKLAND ROAD



PHOTO 52: ~5’ BANKS WITH EXPOSED HISTORIC FLOODPLAIN SOIL



PHOTO 53: EXPOSED CONCRETE SEWER ENCASEMENT



PHOTO 54: BOULDER-SIZED MATERIAL PRESENT IN STREAMBED



PHOTO 55: REMNANTS OF CONCRETE STRUCTURE ADJACENT TO STREAM

4.2.3.2 Tributary 1

The Tributary 1 sediment supply reach extends from the Faulkland Road culvert (see Photo 56) upstream. The stream corridor upstream of Faulkland Road is highly confined for approximately 2,400 feet (valley distance) and is encroached upon by private properties on both sides of the stream. Bank instability occurs often within this section and bank heights average approximately 6 feet (see Photo 57). This section of stream acts as a transport reach for the sediment load entering from furth up in the watershed. Debris jams appear to be frequent (see Photo 58), but likely form and dislodge often which will result in pulses of fine sediment entering the project reach. Undercut trees with exposed roots will result in future debris jams (see Photo 59). The valley confinement in this reach is exacerbated by encroaching private properties, remnant structures, and fencing near the stream banks (see Photo 60).



PHOTO 56: UPSTREAM FACE OF THE FAULKLAND ROAD CULVERT



PHOTO 57: ~5' BANKS IN HIGHLY CONFINED VALLEY



PHOTO 58: FALLEN TREE/DEBRIS JAM AND FENCING ADJACENT TO THE STREAM



PHOTO 59: TYPICAL STREAM BANKS AND EXPOSED TREE ROOTS



PHOTO 60: FENCING AND REMNANT STRUCTURES IN/ADJACENT TO STREAM

4.2.3.3 Tributary 2

The Tributary 2 sediment supply reach extends from the Armstrong Road culvert (see Photo 61) upstream approximately 780 linear feet (valley distance) to the Faulkland Road/Centerville Road intersection. The stream corridor upstream of Armstrong Road is confined and is encroached upon by private properties on both sides of the stream. Bank instability occurs often within this section and bank heights average approximately 4-5 feet (see Photo 62). This section of stream contributes sediment to the project reach mainly in the form of fine sediment from eroding stream banks (see Photo 63). Debris jams appear to be frequent (see Photo 64), but likely form and dislodge often which will result in pulses of fine sediment entering the project reach. Undercut trees with exposed roots will result in future debris jams (see Photo 65). The reach is lightly forested up to the Faulkland Road/Centerville Road intersection. Upstream of the intersection, the channel appears to be less defined, acting as a drainage swale between private properties indicating that sediment load upstream of the intersection is likely limited.



PHOTO 61: UPSTREAM FACE OF THE ARMSTRONG ROAD CULVERT



PHOTO 62: ~4.5' BANKS IN CONFINED VALLEY



PHOTO 63: TYPICAL ERODING STREAM BANKS



PHOTO 64: TYPICAL TREE FALL/DEBRIS JAMS WITHIN REACH



PHOTO 65: TYPICAL EXPOSED TREE ROOTS AND PRIVATE PROPERTY ENCROACHMENT

4.3 Hydrology

Existing conditions hydrology was performed for the project site. Bankfull discharge estimates were determined using regional curve data. Peak discharges were estimated using the regional regression equations in StreamStats. Full flow discharge was assumed and used to estimate peak discharges coming from outfalls throughout the reach. A slope of 1% was assumed for all outfall pipes, except for Outfall 10 where LiDAR data was used to estimate the pipe invert in at the upstream mend along Wagoner Drive, as the upstream pipe inverts in are unknown. Discussion and results are included below.

4.3.1 Bankfull Regional Curve and Regression Equation Analysis

Bankfull discharge and geometry were calculated following relationships presented in Bankfull Discharge and Channel Characteristics of Streams in the Piedmont Hydrologic Region from the U.S. Fish and Wildlife Service (USFWS, McCandless, 2002). The regional curve estimates and fixed region equation discharges are presented in Table 5.

TABLE 5: BANKFULL REGIONAL DISCHARGE DATA

Study Point Location	Drainage Area (sq. mi)	Regional Curve Discharge (cfs)	Cross Sectional Area (sf)	Width (ft)	Mean Depth (ft)
Little Mill Creek at Upstream Project Limit (Faulkland Road)	1.88	137	27.6	18.9	1.46
Little Mill Creek Downstream of Confluence with Tributary 2	2.84	187	37.3	22.2	1.68
Little Mill Creek at Downstream Project Limit (Centre Road)	3.12	201	40.0	23.0	1.74

It is important to note that the developers of the bankfull regional curve relationships following the methods taught in natural channel design courses by Rosgen and others did not appear to consider pervasive historic and modern anthropogenic influences and the subsequent impacts to stream corridors that greatly affected hydrologic, hydraulic, geomorphic, sediment mobility, and ecological functions of watersheds in the Eastern U.S., including the Piedmont region where Little Mill Creek resides. For example, most of the USGS gage sites used to develop the USFWS Piedmont Regional Curves (McCandless, 2002) computed bankfull discharges with boundary shear stresses that far exceeded the estimated critical shear stress for the D50 or even the D84 of the streambed materials, which may lead to a long-term state of degradation and system wide instabilities at many of these stream gage study sites. Project-specific geologic and sediment studies performed by RK&K staff members, often in collaboration with Drs. Merritts and Walter, throughout the Piedmont and Coastal Plain areas have shown Holocene era streams largely evolved and functioned as integrated stream and wetland systems prior to the post-settlement era. Therefore, floodplains primarily evolved by the development of wetland soils that slowly accreted over thousands of years spanned the period of warming and vegetation growth following the last ice age.

These findings and conclusions were not reported in previous observations and studies performed by past geomorphologist (Leopold, 1994 and 1964) that described Eastern U.S. streams as meandering, straight, or braided and often exhibited riffle/pool morphological channel conditions containing bankfull flows that build point bars and retreat concave banks during the process of forming floodplains. These processes are fundamental to natural channel assessment and design methodology. Recent findings from the design team in routine collaboration with Drs. Merritts, Walter, and Parola on many stream sites throughout the region typically find that today's stream conditions as described by Leopold and Wolman are a symptom of anthropogenic impacts that largely began in the early stages of the post-settlement era. Given these findings, it becomes evident that watershed-derived return intervals for yearly storm events likely had little to no bearing on the development stream morphology in the Eastern U.S., especially for smaller, first to fourth order sized, streams. These pre-settlement era integrated stream and floodplain systems conveyed all watershed-derived storm events at low stress conditions such that wetland soils and vegetation was sustainable for thousands of years. These systems retained sediments and organic materials/debris supplied by the watershed and therefore transported highly limited to no bedload sediments. It is also important to note that the reference conditions for the pre-settlement era integrated stream and wetland systems are largely buried under modern sediment (i.e., post-settlement alluvium, legacy sediment) that filled in the valley bottoms.

4.3.2 Peak Discharge Estimates – FEMA Preliminary Data

FEMA preliminary peak discharges were estimated using the 2006 USGS Regression Equations. Table 6 summarizes the FEMA discharges approximately 200' upstream of Centre Road.

TABLE 6: FEMA PRELIMINARY DISCHARGES

Location	FEMA Preliminary Discharges (cfs)			
	10-Year	25-Year	50-Year	100-Year
Approximately 200' Upstream of Centre Road	994	1,330	1,598	1,894

4.3.5 Peak Discharge Estimates – Statistical Regression Methods

Since FEMA discharges were only taken at one POI within the project reach, StreamStats was used to develop additional discharge estimates for Little Mill Creek at several POIs including road crossings and at locations with significant changes in watershed size. Having more detailed POIs allows for more detailed design. The results from StreamStats converge well with the discharges used in the FEMA model. The results of StreamStats are summarized and compared to FEMA discharges in Table 7. See Appendix B for detailed output data.

TABLE 7: PEAK DISCHARGES FROM REGRESSION EQUATIONS

Study Point Location	Peak Discharges for Return Interval (cfs)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
LMC at Faulkland Road	314	538	655	863	1020	1190
Trib 1 at Faulkland Road	167	274	440	619	767	936
LMC US Trib 1	324	551	674	888	1,050	1,230
Trib 1 US LMC	173	283	453	636	787	961
LMC/Trib 1 Confluence	408	676	891	1,190	1,430	1,690
Trib 2 at Armstrong Ave	88	151	202	276	250	295
LMC US Trib 2	408	676	892	1,190	1,430	1,690
Trib 2 US LMC	93	159	213	291	262	308
LMC/Trib 2 Confluence	437	717	948	1,270	1,520	1,800
LMC at Centre Road	497	800	1,070	1,420	1,700	2,010

Study Point Location	Peak Discharges for Return Interval (cfs)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
FEMA Discharges 200' US Centre Road	--	--	994	1,330	1,598	1,894

Due to flashiness of urbanized systems, and timing of peak flow in smaller watersheds, the peak discharges of storm events will occur in the tributaries prior to the mainstem.

It is recommended to use the Regression Equation discharges for design and local permitting to evaluate water surface elevations, shear stress and velocity at various locations of the site to meet the Joint Permit requirements and use FEMA discharges for map revisions through FEMA for ease of FEMA approvals.

4.5 Existing Conditions Hydraulics Analysis

RK&K performed sixteen field-surveyed cross sections located within the project study area which were analyzed to assess hydraulic parameters of the sections when watershed discharges completely fill the active channel. The purpose of this analysis is to determine the existing conditions top of bank shear stresses at multiple points along the project study area, to assess streambed and bank sediment mobility in relation to the top of bank discharges, and to estimate the frequency of these hydraulic conditions.

4.5.1 Boundary Shear Stress Computation Method

The average boundary shear stress produced by a discharge over each riffle was computed as:

$\tau_b = \gamma R S_f$ where τ_b is the cross-section average boundary shear stress (psf), R is the hydraulic radius, and S_f is the energy slope. To assess the maximum boundary shear stress asserted on the streambed, R or hydraulic radius has been approximated using D(max) or the maximum channel depth. The energy slope (friction slope), S_f, for each reach has been estimated from the top-of-bank slope or the valley slope that flood flows would experience at the existing valley flat stage.

4.5.2 Top-of-Bank Cross Section Analysis

The top-of-bank represents the approximate point of incipient flooding, or the point when a hydraulic connection is made to the surrounding valley flat, floodplain, or terrace. Top-of-bank data was computed for nine locations on Little Mill Creek and its tributaries.

The top-of-bank computed data has been plotted and is included in Appendix G. Table 8 summarizes the geomorphic data collected within the project study area at a riffle section for use in identifying the top-of-bank hydraulic parameters without backwater conditions.

Based on the hydrologic study discussed above and this top-of-bank hydraulic data, the active channel through the Project Reach will convey significant flood events within the active channel banks. The in-channel shear stress produced by these magnitudes of discharges is capable of mobilizing sediments much

larger than the native streambed substrate and stream bank materials that exist on-site at the cross section analyzed. Therefore, the active channel where detailed geomorphic and hydraulic data were collected and analyzed finds that long-term degradation of these reaches is anticipated for the foreseeable future.

TABLE 8: SUMMARY OF TOP-OF-BANK HYDRAULIC DATA AT RIFFLE SECTIONS

Location	XS 1-1	XS 3-1	XS 5-1	XS 6-1	XS 8-1	XS 9-1	XS 11-1	UT 1-1	UT 2-1
Width (ft)	16.52	23.02	29.56	27.13	26.70	27.50	20.20	20.17	22.87
Average Depth (ft)	2.52	2.88	2.94	3.35	2.86	2.54	2.01	2.01	2.52
Maximum Depth (ft)	3.30	4.18	4.30	5.04	3.88	3.65	2.87	2.87	3.44
Cross Sectional Area (sf)	41.6	66.3	86.8	91.0	76.4	69.8	40.6	40.6	57.7
Hydraulic Radius, R	2.08	2.57	2.61	2.95	2.55	2.16	1.77	1.77	2.14
Width/Depth Ratio	6.6	8.0	10.1	8.1	9.3	10.8	10.01	10.0	9.1
Estimated Valley Slope (ft/ft)	0.006	0.006	0.0055	0.0038	0.0087	0.0030	0.0026	0.0049	0.0049
D50 (mm) (measured)	12.6	12.6	31.1	31.1	31.1	31.1	31.1	19.1	19.1
D84 (mm) (measured)	23.1	23.1	51.3	51.3	51.3	51.3	51.3	38.1	38.1
Top of Bank Discharge (cfs)	300.2	579.87	645.59	612.68	704.9	327.6	387.6	221.7	356.9
100-Year Discharge (cfs)	1,230	1,230	2,010	2,010	2,010	2,010	2,010	961	961
Average Top of Bank Boundary Shear Stress (psf)	0.78	0.99	0.89	0.70	1.38	0.40	0.43	0.55	0.66
***Mobile Particle (mm) at Average Top of Bank Boundary Shear Stress**	60.2	77.2	69.1	53.8	109.1	30.0	32.4	41.8	50.7
Max Top of Bank Boundary Shear Stress (psf)	1.24	1.60	1.47	1.20	2.10	0.68	0.69	0.88	1.06
***Mobile Particle (mm) at Max Top of Bank Boundary Shear Stress**	97.6	127.2	116.5	94.3	168.9	52.2	53.0	68.2	82.8

** Taken from Shields Diagram as modified by Leopold, Wolman & Miller 1964.*

5. RIFFLE ASSESSMENT REACH CHARACTERIZATION

The project reach was analyzed to document the current sediment threshold conditions at three cross sections within the project area, two on the mainstem of Little Mill Creek and one on Tributary 1. A variety of past and present influences control discharges and sediment regime within the watershed and have altered the channel. This assessment data will serve as a general guide to help establish channel parameters that promote long-term stability of the active channel and floodplain.

5.1 Threshold Flow Channel Characteristics and Indicators

Multiple threshold indicators of differing elevations in the same location occur because of the dynamics associated with a variety of factors. For example, the development of debris jams leads to erosion around the jams, and the height of the jam affects the height of the sediment bar that will build up behind it. When upstream jams or other constrictions give way, stored sediment will be released for transport. The radius of a bend in the channel also affects sediment storage and transport. Tight curves cause the water to slow down, allowing more sediment to deposit before the curve. As the channel evolves, geometric changes in the bed and bank can cause the radius of curvature to change, again altering the capacities for sediment storage and transport. All the multiple threshold indicators are appropriate indicators for a particular set of conditions at the jams and constrictions; however, a consistent forming threshold feature is not obvious throughout the project area. Even where the prevailing set of indicators could be identified, estimation of energy slope, required to estimate discharge, is highly uncertain because of the non-uniform flow conditions. In summary, the instability of the upstream conditions creates differing flow conditions and supplies differing amounts and sizes of sediment material to the downstream receiving waters, depending on what is happening upstream (e.g. new materials eroded from the terraces, debris jams breaking up, debris jams forming, vertical erosion down to a new type of material, etc.). These erratic conditions contribute to deposition at various elevations downstream, making it difficult to determine the natural, long-term elevation of deposits that would be indicative of threshold conditions.

With an understanding of the uncertainties outlined above, an analysis of existing stream sediment was performed using slope and flow depth to determine boundary shear stress.

5.2 Threshold (Energy) Slope

The energy slope (friction slope), S_f, for the assessment reach has been estimated for threshold flow conditions based on field survey measurements. The slope is a critical parameter in determining threshold conditions. The range of slope over an assessment riffle is bound by the water surface slope over just the riffle feature itself (maximum threshold slope) and the water surface slope from the head of the study riffle to the head of the next riffle downstream (minimum threshold slope), which includes the pool water surface slope immediately downstream of the study riffle. Threshold conditions will typically occur somewhere between the minimum threshold slope and the maximum threshold slope. The sediment mobility analysis is used to determine the specific slope at which threshold conditions are met.

5.3 Channel Roughness

For the purposes of this study, channel roughness is considered to be caused primarily by the roughness of the channel bed for sediment threshold purposes. Estimates of Manning roughness coefficient, n, are based on the Limerinos (1970) relation given here as:

$$n = R_h^{1/6} \frac{0.0926}{1.16 + 2\,\mathrm{Log}\frac{R_h}{D_{84riffle}}}$$

Where R_h is the hydraulic radius (feet) and D_{84} (feet) is the particle size for which 84 percent of the particles are smaller based on the pebble count of the riffle surface. As indicated by this relationship, the n value changes with changes to channel hydraulic parameters and resulting changes in flow conditions. The Wolman pebble counting method (Bunte, et al 2001) was used to describe the surface particle size distribution over the active channel portion of the riffle surface. Particle sizes necessary for roughness estimates ($D_{84riffle}$) and for evaluation of the bed surface mobility $D_{50riffle}$ were measured through the pebble count analysis.

5.4 Threshold Estimates and Boundary Shear Stress

The average boundary shear stress produced by the threshold discharge over each riffle was computed as:

$\tau_b = \gamma R S_f$

where τ_b is the cross section average boundary shear stress (psf) over the riffle, R is the hydraulic radius, and S_f is the threshold energy slope. In channels with width-to-depth ratios higher than 10, bank resistance can be considered a minor influence on hydraulic conditions and backwater effects on the steeper riffles were considered to be minor. Average boundary stress was considered to be a good approximation for the average stress on the active channel bed.

5.5 Riffle Assessment Reach Analysis

The purpose of the assessment reach analysis is to estimate the sediment threshold parameters and hydraulic parameters of the stream channels within the detailed project areas that may be targeted for restoration. The assessment reach data presented below represents the best data available for the given conditions.

5.5.1 Riffle Geomorphic Analysis

Three riffle assessment reaches were studied within the Little Mill Creek project area, two on the mainstem of Little Mill Creek and one on Tributary 1. Appendix A shows the locations of the riffle

assessment reach cross sections. The riffle assessment reaches were carefully selected during the watershed walk investigations to locate a study area that would predominately operate under uniform flow or near uniform flow conditions at the threshold discharge stage. The geomorphic survey/data collection efforts included longitudinal thalweg profiles, cross sections near the head of riffle, and detailed Wolman Pebble Counts with enough particles until a normal distribution was achieved. Analysis of this data yielded the threshold slope, depth, flow area, boundary shear stress, discharge, and the riffle particle size distribution.

Table 9 summarizes the riffle assessment reach geomorphic data collected at Little Mill Creek for use in identifying the sediment threshold parameters to inform the channel stability analysis and restoration design strategies for channel sizing.

TABLE 9: SUMMARY OF GEOMORPHOLOGY DATA AT THE RIFFLE ASSESSMENT REACH

Riffle Assessment Reach Data			
	LMC US	*LMC DS*	*UT1*
Threshold Width (ft)	8.5	9.1	10.8
Depth (ft)	0.40	0.43	0.18
Cross Section Area (sf)	3.4	3.9	1.8
Width/Depth Ratio	21.0	21.1	60.2
Flood-Prone Width (ft)	15.7	30.3	12.8
Entrenchment Ratio	1.85	3.34	1.18
D50 (mm)	12.6	30.9	18.4
D84 (mm)	23.1	51.1	37.8
Estimated Slope (ft/ft)	0.0068	0.016	0.021
Discharge (cfs)	6.3	8.2	1.8
Boundary Shear Stress (psf)	0.16	0.39	0.23

5.6 Sediment Mobility Study

The targeted project reach for restoration has been greatly altered by both historic and modern encroachments to the stream channel and floodplain areas. The bedload sediment supply from the upper watershed reaches is expected to be delivered to the targeted project reaches in pulses over time during moderate to large flood events. These pulses of sediment are likely to create waves of sediment slugs transported through the channel system in some areas and deposited in others. Under one flow condition bedload will be transported in some reaches and the same flow event will create conditions of deposition in another nearby reach. This same flow event may transport bedload in a particular reach today, but tomorrow the same flow event may transport no bedload at all or the constitutes of the bedload in mass or size could be completely different. The full range of flow conditions that are capable of transport bedload in some areas will yield highly dynamic and everchanging transport/deposition conditions at any

given location where backwater from floodplain constrictions, roadway crossings/encroachments, debris jams, etc. are present.

Based on our field observation, it appears that most of the bedload being generated within the identified project reach and upstream sediment supply reach is primarily derived from Little Mill Creek and its tributaries themselves as a result of local streambed and stream bank erosion. The notion of establishing channel designs that achieve a transport balance of sediment in equates to sediment out is extremely unlikely and typically unattainable in the Eastern U.S. Given this understanding, the focus of this sediment mobility study is to analyze the threshold of bedload sediment mobility for the current/native streambed particle sizes within the targeted reach for restoration to inform the design process in how to preserve these streambed particles to the extent feasible, rather than transport these particles under the assumption the proposed riffles will reform in a similar location and structure after every bankfull or larger flood event.

5.6.1 Principles

A major premise of the sediment mobility analysis is that threshold conditions defined by any critical shear stress method represent a condition of very low transport rate (Wilcock 1988). A second assumption is that statically armored riffles satisfy the conditions of near-equal mobility; that is, the largest sediments in a sediment mixture require slightly higher shear stresses than do smaller sizes. Very large particles from colluvial material or large fragments of bedrock plucked from the streambed or bank during infrequent high flows may not be mobile, although they can effectively hide or shelter other smaller particles. The largest particles (D_i) on the bars or in the sub-surface represent the maximum size present in the bedload.

Methods considered in this report for the computation of the critical dimensionless shear stress condition for marginal transport of a specific size fraction in mixed-grain sediments (Andrews et al 1995) have the form:

$$\tau^*_{ci} = a\,(D_1/D_2)^b$$

where τ^*_{ci} is the critical dimensionless shear stress for a very low transport rate for the specific size fraction in the matrix armor layer. This equation is used to estimate the conditions under which marginal transport will exist in the channel. An assumption is made that the minimum shear stress under threshold conditions in the assessment riffle should be that which mobilizes the largest particles in the bedload. The variables D_1 and D_2 are representative sizes of the sediment samples. Using Andrews' 1995 equation, D_1 is equal to D_i identified below, and D_2 is the mean diameter particle size of the riffle surface using the Wolman Pebble Count method. Coefficient 'a' and exponent 'b' are 0.0376 and –0.994, respectively, for the 1995 equation.

The critical shear stress for marginal transport rate of the largest size fraction in the bedload corresponding to $\tau^*_{ci,}$ which relates shear stress to bedload material, is given as:

$$\tau_{ci} = \tau^*_{ci}\,(s\text{-}1)\,\gamma\,D_i$$

where τ_{ci} is the critical shear stress required to mobilize D_i, which represents the largest size fraction that is considered to be mobile; s is the specific gravity of the sediment (typically 2.65); and γ is the specific weight of water (62.4 psf). The average boundary shear stress produced by the threshold discharge over each assessment reach riffle was computed as described above.

The use of critical shear stress (τ_{ci}) and boundary shear stress (τ_b) methodologies provides a sound approach for estimating the threshold or recommended threshold parameters at the riffles studied, and for establishing the proper and/or threshold values for the depth and width-to-depth ratio in the channel design process. Our analysis compared sediment mobility and threshold parameters at one Assessment Reach located within the project area. The methodology used for this analysis was derived by Andrews from specific bed-load data sets for streams located in the western United States and therefore may not be directly applicable to the project reaches. However, it provides an estimate of the expected shear stress required for mobility of coarse, mixed-grain sediments.

5.6.2 Riffle Mobility Analysis

Sediment mobility analysis was performed at the same riffle assessment reach location discussed above. At the riffle assessment reach we collected measurements of particle sizes over the riffle surface. The mobility analysis was performed using *Andrews's 1995 methodology.* Critical dimensionless shear stress (τ_{ci}^*) has been computed from the mean particle size from the riffle section (D_{50}) using the Wolman Pebble Count methodology outlined above and by estimating the particle size being mobilized during threshold events (D_i). For design assessment purposes, we have assumed the D_i particle size to be slightly less than the D_{50} of the riffle surface computed from the Wolman Pebble Count such that the current/native riffle matrix material remains static and is not assumed to be under transport. See Table 10 below for the sediment mobility summary and Appendix F for the threshold analysis of the data.

TABLE 10: SUMMARY OF MOBILITY DATA (ANDREWS 1995 METHODOLOGY)

Riffle Assessment Reach Data			
	LMC US	*LMC DS*	*UT1*
D_{50} = Mean Riffle Material Size (mm)	12.6	30.9	18.4
D_i = Mobilized Particle Size (mm)	11.6	29.9	17.4
s = Estimated Slope (ft/ft)	0.0068	0.016	0.021
τ_{ci}^* = Critical Dim. Shear Stress	0.0408	0.0388	0.0397
τ_{ci} = Critical Shear Stress (psf)	0.16	0.39	0.23
d_r = Required Critical Depth (ft)	0.38	0.39	0.18
τ_b = Boundary Shear Stress (psf)	0.16	0.39	0.23
d_e = Estimated Threshold Depth (ft)	0.40	0.43	0.18

The boundary shear stresses and critical shear stress of the native streambed materials converge well for the three assessment reaches of the project. The assessment reaches exhibited ideal characteristics for this analysis including a well-defined depositional bar. Therefore, the estimates of discharge at the threshold stage and slope from the assessment reach provided a useful guide for sizing the proposed

active channel in conjunction with preserving most of the current/native streambed materials to preserve the riffle controlling matrix materials.

6. CHANNEL STABILITY ASSESSMENT

A field data collection effort was performed in December 2021 and January 2022 to assess channel stability at thirteen areas (four cross sections) along the project corridor. A map showing the locations of these cross sections is included in Appendix A. The purpose of this effort was to document existing channel conditions via visual assessments, photographs, and monumented geomorphic cross sections and profiles to measure and quantify the current process of bank erosion occurring along the project study area using the Bank Assessment for Non-Point Source Consequences of Sediment (BANCS) methodology, as documented in the *Watershed Assessment of River Stability and Sediment Supply* (WARSSS) document (Rosgen, 2006). This effort will serve as a resource to confirm and help quantify channel instability occurring along each reach over the monitoring period. The data collection sites, referred to as Study Reaches, include a longitudinal profile and cross sections. Each cross section was monumented with 18-inch rebar stakes and caps on both the left and right banks. The following sections describe the work performed to assess channel stability within the project study area.

Stability Predictions

An on-site assessment was performed to analyze, quantify, and predict morphological changes at one point in time using empirical methods at Little Mill Creek. Consideration was given to the influence of riparian vegetation, flow regime, incision, confinement, entrenchment, debris occurrences, depositional features, and bank erodibility properties. The cross-sectional surveys within the project study area are described below. The locations of the monumented cross sections were selected to give a fair representation of the channel condition. Several empirical methodologies have been developed to estimate stability and predict changes at a point in time along the Project Reach.

As part of the BANCS methodology, the Bank Erodibility Hazard Index (BEHI) methodology was used to estimate the potential lateral (bank) erosion rates based upon current conditions. The BEHI methodology uses field data to determine expected erosion rates at a specific stream bank at the time the study was performed. Note that as stream banks deform or change over time, so do the BEHI properties. The BEHI is computed on banks that appear to be raw or unstable by analyzing the following bank properties: exposed bank height, stratification of materials, root depth, root density, bank angle, and Near Bank Shear Stress (NBSS). These measured properties have been used to predict the amount of lateral bank erosion from the *Bank Erosion Rate Curve* produced by the U.S. Fish and Wildlife Service (USFWS) for Hickey Run in Washington, DC. Ultimately, these predictions provide a quantity of mass wasting or surface erosion from the analyzed study bank. These data provide a comparison tool to help establish a prioritization for restoration measures based on rates of predicted erosion from various stream banks. The BEHI and NBSS data forms are included in Appendix F. Each cross section has been analyzed using the above methodologies. A summary of results is included in Table 11.

TABLE 11: SUMMARY OF LATERAL STABILITY USING BANCS METHODOLOGY

Stability Assessment Reach	BEHI Rating (Value)	NBSS Rating	*Predicted Lateral Erosion Rate (ft/yr)	Study Bank Length (ft)	Study Bank Height (ft)	Predicted Erosion Volume (cf/yr)	**Predicted Erosion (tons/yr)
1-1 L	Very High (40.9)	Low	0.4	70	3.84	107.52	3.77
1-1 R	High (36.5)	Moderate	0.55	116	3.03	193.314	6.78
2-1 L	Moderate (21.6)	Very Low	0.09	150	3.99	53.87	1.89
2-1 R	High (30.6)	Low	0.4	45	4.01	72.18	2.53
3-1 L	High (33.9)	Moderate	0.55	81	5.08	226.31	7.94
3-1 R	High (30.0)	Moderate	0.55	41	3.43	77.3465	1.97
4-1 L	High (33.8)	Low	0.4	53	3.6	76.32	2.68
4-1 R	High (37.0)	Moderate	0.55	66	4.47	162.261	5.69
5-1 L	Moderate (27.7)	Low	0.125	47	5.06	29.7275	1.04
5-1 R	Moderate (26.7)	Low	0.125	54	3.85	25.9875	0.91
6-1 L	Moderate (23.3)	Moderate	0.3	156	4.59	214.812	7.53
6-1 R	High (34.5)	High	1	158	4.9	774.2	27.15
7-1 L	Low (11.2)	Low	0.02	157	1.96	6.1544	0.22
7-1 R	High (35.2)	Low	0.4	38	4.41	67.032	2.35
8-1 L	High (30.2)	Low	0.4	62	3.66	90.768	3.18
8-1 R	High (37.1)	Low	0.4	24	4.39	42.144	1.48
9-1 L	Low (15.5)	High	0.15	34	3.39	17.289	0.61
9-1 R	Low (16.6)	High	0.15	41	3.98	24.477	0.86
10-1 L	Very High (42.3)	High	1	47	5.88	276.36	9.69
10-1 R	Moderate (24.5)	Moderate	0.3	50	4.64	69.6	2.44
11-1 L	Moderate (29.7)	High	0.8	67	4.04	216.544	7.59
11-1 R	High (34.5)	High	1	35	3.7	129.5	4.54
UT 1-1 L	High (30.9)	High	1	25	2.62	65.5	2.30
UT 1-1 R	High (33.1)	High	1	65	3.06	198.9	6.97
UT 2-1 L	High (33.6)	Low	0.4	34	3.6	48.96	1.72
UT 2-1 R	High (33.9)	Low	0.4	42	2.9	48.72	1.71

*Based on the U.S. Fish and Wildlife Bank Erosion Rate Curve for Hickey Run in Washington, DC.

**Bulk density is based on soil samples collected in field and analyzed at lab.

7. PROJECT GOALS AND OBJECTIVES

The visual site assessments, natural resources investigations, geomorphic studies, and hydraulic analyses have been used to identify potential stream, wetland and floodplain restoration measures based on local site conditions, natural resource impacts, sediment sources and storage areas, and other anthropogenic impacts that may affect long-term stability on a watershed or regional scale. These efforts have been performed to recommend conceptual design approaches for each reach using the most environmentally beneficial methods to provide high functional uplift potential, cost-effective TMDL credits, and long-term sustainability and success.

7.1 Project Goals

7.1.1 TMDL Credits for Sediment and Nutrient Reduction

A goal of the project is to develop a restoration approach that provides maximize TMDL credits for sediment and nutrient reduction while also providing significant functional uplift to aquatic resources. TMDL credits for the targeted restoration reaches will be calculated using the latest protocols from the *Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* (Expert Panel Report), dated January 17, 2014 incorporating updates from *Consensus Recommendations for Improving the Application of the Prevented Sediment Protocol for Urban Stream Restoration Projects Built for Pollutant Removal Credit,* dated February 27, 2020 and *Consensus Recommendations to Improve Protocols 2 and 3 for Defining Stream Restoration Pollutant Removal Credits,* dated October 27, 2020. A restored stream channel and floodplain is an acceptable ecological alternative to address stormwater management requirements at the watershed scale for both water quality and quantity. Water quality enhancements can be obtained immediately by eliminating sources of sediment and nutrients stored in erosive stream banks, which corresponds to Protocol 1 of the *Expert Panel Report* for TMDL reductions.

Attaching flood flows, base flows and/or groundwater to a highly attached riparian wetland floodplain system serves to trap and filter incoming sediment and nutrient laden floodwaters. This results in improved water quality to the downstream receiving waters, which corresponds to Protocol 3 of the *Expert Panel Report* for TMDL reductions. Water quantity benefits can be enhanced by creating larger flood storage areas by removing concrete and modern soils (post-1600s floodplain deposits) when creating a highly attached floodplain area. Floodplain pinch points created by natural or manmade (i.e., bridges or culverts) features often attenuate flood flows. Attenuation of flood flows in a restored floodplain area with increased storage volume will often reduce downstream peak discharges. Flood flow volume reductions can be achieved through the removal of low permeability soils and concrete to promote more frequent flooding into the floodplain area thereby enhancing evapo-transpiration, floodplain ponding, and infiltration.

Restoring the active channel by enhancing the plan-form pattern, adding in-channel flow diversity and incorporating woody material allows for improved base flow quality and channel stability, which corresponds well to Protocol 2 of the *Expert Panel Report* for TMDL reductions. *Planners should consider*

how the proposed project may be used to further other related efforts in the watershed, such as increasing riparian habitat continuity, reducing flooding, and/or enhancing downstream water quality (USEPA, 2000).

7.1.2 Flooding and Drainage Relief

The FEMA floodplain delineation shows private properties and roadways in the FEMA-mapped floodplain. The proposed project provides some reduction in flood elevations throughout the project reach due to a net cut of material to create a restored floodplain. Well-attached and highly functional floodplains help alleviate nuisance flooding both in the immediate area of restoration and in downstream reaches as well. A well-connected floodplain also reduces the shear stresses or erosive forces in the channel and floodplain areas, significantly reducing erosion, undermined/fallen trees and subsequent in-channel debris jams. In addition, the connected floodplain area serves to trap incoming debris and sediments on the floodplain itself, which helps to reduce the frequency of debris jams at floodplain or channel constriction points, including bridges and culverts. Lowering of water surface elevations during flood flow also creates additional capacity for storm drainage systems throughout the watershed allowing for better drainage of roadways.

7.1.3 Infrastructure Protection

Protection of existing infrastructure within the identified Project Reach is another targeted goal of the proposed restoration. There are multiple active and exposed sanitary sewer concrete encasements, several exposed or at-risk manholes, a pedestrian trail and bridge crossings, and several degraded storm drain outfalls within the project reach. To help limit excavation associated with the restored floodplain, the elevation of the streambed is being raised throughout the project reach. This also serves to provide additional protection to existing sanitary sewer lines and the gas main that cross the proposed floodplain and channel by providing additional cover over the pipes. Additionally, rock grade control structures and buried floodplain logs are proposed over and/or in the vicinity of the utility crossings to provide additional in-stream and floodplain protection during larger storm events.

7.1.4 Functional Uplift

The project will serve to restore/enhance stream, wetland, and floodplain functions. The uplift potential of physical, chemical, and biological processes and functions is discussed in more detail in Section 9 and functional assessment parameters and measurement metrics to assess success will be further developed as the design progresses.

7.1.5 Wetland Creation/Enhancement

Creating sustainable riparian wetlands in and along the floodplain areas of the project reaches has multiple benefits, including water quality enhancement, flood storage, groundwater recharge, and creation or enhancement of wildlife habitat. Frequent out-of-bank flows settle in the wetlands, where sediments conveyed in the wash-load can drop out, nutrient uptake by vegetation can occur, and nuisance flooding can be minimized. Water stored in the wetland systems gradually filters through the ground, thereby recharging groundwater. Vegetated riparian wetlands provide vital habitat for a variety of aquatic and terrestrial wildlife. *Reestablishing the appropriate natural structure can bring back beneficial functions. For example, restoring the bottom elevation in a wetland can be critical for reestablishing the hydrological regime, natural disturbance cycles, and nutrient fluxes (USEPA, 2000)*.

7.1.6 Groundwater Recharge

As water from higher stage stream flows enters onto the newly restored floodplains, the water collects in the created wetland areas, where it is slowed down by surface roughness, filtered by vegetation, and allowed to infiltrate into the soil to recharge the groundwater supply and help sustain base flow periods during dryer periods. *A wetlands restoration project is not likely to succeed if the hydrological regime that existed prior to degradation cannot be reestablished* (USEPA, 2000).

7.1.7 Riparian Buffer Enhancement

Native plants, both herbaceous and woody, provide numerous benefits to instream water quality and to the water that moves through the adjacent floodplain areas. Riparian buffers are most effective when a dense vegetated root zone is highly connected to groundwater, stream base flows and flood flows, which is often not the case due to anthropogenic impacts. Trees and shrubs shade the stream, keeping water temperature cooler in the warmer seasons, creating cool-water habitat and promoting healthier aquatic life. Leaf litter from woody plants provides a source of food for macroinvertebrates. Herbaceous plants in the riparian wetlands reduce nutrients through the uptake of nitrogen and phosphorus.

7.1.8 Wildlife Habitat Improvement

A stable stream with an expansive well-vegetated riparian wetland floodplain creates and improves habitat for instream and terrestrial wildlife species, starting with the macroinvertebrate population and extending up to fish, birds, and mammals. The restored stream and floodplain system will provide food, shelter, and nesting for a wide variety of species. *Restoration strives for the greatest progress toward ecological integrity achievable within the current limits of the watershed, by using designs that favor the natural processes and communities that have sustained native ecosystems through time* (USEPA, 2000).

7.1.9 Fish Passage

Fish passage for local fish species is anticipated to be improved by the project by eliminating passage barriers, such as at low flow-high gradient features like drops at existing sanitary sewer encasements and vertical drops at culvert outfalls which have been subjected to bed degradation.

7.2 Project Objectives

The main objectives of the project include:

1. Obtain TMDL credit via Protocols 1, 2, 3, and alternative methods following the Expert Panel Report latest methods.
2. Maintain or reduce flood flow water surface elevations where privately-owned habitable structures and/or public roads are located adjacent to the proposed restoration reaches to prevent increased flood impacts. Design approaches to raise the channel bed and connect flood flow to the high floodplain terrace should be avoided as to not raise water surface elevations.
3. Minimize impacts to existing natural resources to the extent practicable.
4. Enhance sediment and carbon retention and storage and capacity within the restored project reaches.

5. Reduce sediment sources within the project reach to negligible amounts by creating a low stress channel and floodplain condition. Remove high stream banks subject to erosive forces and incorporate design measure that provide for floodplain-wide grade control to prevent incision. In reaches where low stress conditions cannot be achieved, such as highly confined zones, combat the high stress environment with channel/floodplain armoring measures.
6. Where feasible, create frequently inundated wetland floodplains that exchanges water, nutrients and carbon during even minor runoff events. This will be accomplished by creating stream channels with very low bank heights.
7. Where feasible, create groundwater conditions that support wetland hydrology and extensive hyporheic flow. The streambed and base flow water level will be increased and/or the floodplain elevation will be graded lower to create a consistent groundwater level below the floodplain surface in the stream and wetland complex reach.

8. CONCEPTUAL DESIGN

Three concept design options were prepared for Little Mill Creek and presented to NCC in a PowerPoint format in May of 2022. The concept design narrative is included herein for documentation of the design process.

8.1 Concept Design Option 1

Concept Option 1 includes an integrated stream and wetland restoration approach that proposes to lower the existing stream banks and adjacent floodplain area to create a stream/floodplain system that is highly connected to groundwater as the existing floodplain width, potentially usable land, and property limits allow. This option presents the second-best opportunity to meet the project goals and objectives by maximizing TMDL credits while creating sustainable riparian wetlands, recharging groundwater, attenuating peak flood flows, enhancing the riparian buffer, and improving wildlife habitat. Option 1 begins at Faulkland Road and extends approximately 4,000 feet along the valley downstream to Centre Road. An additional 860 feet along the valley of TMDL credit is available in the restoration of Tributaries 1 and 2.

Option 1 includes excavation of a restored floodplain that varies between 30-feet to 135-feet wide to create a low shear stress environment, create riparian wetlands that will be frequently inundated and connected to groundwater, attenuate flood flows, and provide habitat. A smaller channel, with a width and depth of approximately 10 feet and 0.5 feet, respectively, will meander within the restored floodplain that will allow for frequent access to the riparian wetland that approximately 10 acres is size. Valley slopes between 0.39 and 0.84 feet/feet are proposed within the project reach. The restored floodplain will convey approximately the 100-year storm in the upstream reach and approximately the 10-year storm in the downstream reach.

<u>Option 1 Pros:</u>

- Fully incorporates all Targeted Benefits and Goals including higher TMDL credits for Expert Panel Protocols 1, 2 and 3, sediment/nutrient reduction, wetland creation, groundwater recharge, flood flow storage/reduction, and stormwater management benefits.

- Reduction of channel energy for all storm events, which creates a stable channel and floodplain for all flows up to the 100-year storm.
- Establishes an expansive riparian wetland and native vegetation root zone that is hydraulically connected to base flow and attempts to tie into the current location of the groundwater aquifer.
- Limits the need for "rock armoring" required for long-term stability.
- Provides a low-energy, stable stream/wetland system.
- Avoids impacts to existing sewer and park infrastructure.
- Provides stabilization for the numerous of outfalls that discharge directly to the system.
- Moderate construction cost and ecological functional uplift as compared to Options 2 and 3.

Option 1 Cons:

- Requires significant excavation, but less than Option 2.
- Does not eliminate the need for "rock armoring".
- Moderate valley wide forest and tree impacts

8.2 Concept Design Option 2

Option 2 includes an integrated stream and wetland restoration approach that proposes to lower the existing stream banks and adjacent floodplain area to create a stream/floodplain system that is highly connected to groundwater as the existing floodplain width, potentially usable land, and property limits allow. This option is like Option 1 except that the proposed floodplain width is expanded where feasible. This option presents the greatest opportunity to meet the project goals and objectives by maximizing TMDL credits while creating self-sustaining riparian wetlands, recharging groundwater, attenuating peak flood flows, enhancing the riparian buffer, and improving wildlife habitat. The proposed upstream and downstream limits, including the Tributaries 1 and 2, remains the same as in Option 1.

Option 2 includes excavation of a restored floodplain that varies between 70-feet to 225-feet wide to create a low shear stress environment, create riparian wetlands that will be frequently inundated and connected to groundwater, attenuate flood flows, and provide habitat. A smaller channel, with a width and depth of approximately 10 feet and 0.5 feet, respectively, will meander within the restored floodplain that will allow for frequent access to the riparian wetland that approximately 14 acres is size. Valley slopes between 0.39 and 0.84 feet/feet are proposed within the project reach. The restored floodplain will convey approximately the 100-year storm throughout the reach.

Option 2 Pros:

- Fully incorporates all targeted benefits and goals including maximum TMDL credits for Expert Panel Protocols 1, 2, 3 due to the expanded width of the project, sediment/nutrient reduction, wetland creation, groundwater recharge, flood flow storage/reduction.
- Reduction of channel energy for all storm events, which creates the most stable channel and floodplain for all flows up to the 100-year storm.
- Establishes the most expansive riparian wetland and native vegetation root zone that is hydraulically connected to base flow and attempts to tie into the current location of the groundwater aquifer.
- Eliminates the need for "rock armoring" of an oversized stream channel.
- Provides a low-energy, stable stream/wetland system.

- Provides the greatest ecological functional uplift.

Option 2 Cons:

- Requires significant excavation.
- Extensive valley wide forest and tree impacts.
- Impacts to existing sewer and park infrastructure.
- Anticipated to have the highest construction costs.

8.3 Concept Design Option 3

Concept Option 3 includes an integrated stream and wetland restoration approach, that approximately matches the existing steam meander belt width, that proposes to lower the existing stream banks and adjacent floodplain area to create a stream/floodplain system that is connected to groundwater as the existing floodplain width, potentially usable land, utility infrastructure, park infrastructure, and property limits allow. This option presents the third-best opportunity to meet the project goals and objectives by obtaining the minimal TMDL credits required while creating some riparian wetlands, recharging groundwater, attenuating peak flood flows, enhancing the riparian buffer, and improving wildlife habitat. The proposed upstream and downstream limits, including the Tributaries 1 and 2, remains the same as in Options 1 and 2.

Option 3 includes excavation of a restored floodplain that varies between 20-feet to 115-feet wide to create a low shear stress environment, create riparian wetlands that will be frequently inundated and connected to groundwater, attenuate flood flows, and provide habitat. A smaller channel, with a width and depth of approximately 10 feet and 0.5 feet, respectively, will meander within the restored floodplain that will allow for frequent access to the riparian wetland that approximately 8 acres is size. Valley slopes between 0.39 and 0.84 feet/feet are proposed within the project reach. The restored floodplain will convey approximately the 100-year storm in the upstream reach and approximately the 2-year storm in the downstream reach. Due to the narrow width of the restored floodplain and anticipated interaction between the restored floodplain and existing floodplain during higher storm events, it is anticipated this option will require extensive “rock armoring” and/or grade control measures to ensure the restored floodplain and channel are able to withstand concentrated flood flows.

Option 3 Pros:

- Incorporates some targeted benefits and goals including achieving some TMDL credits for Protocols 1, 2, 3, sediment/nutrient reduction, minimal wetland creation, groundwater recharge, minimal flood flow storage/reduction.
- Avoids impacts to existing sewer and park infrastructure.
- Provides stabilization for the numerous of outfalls that discharge directly to the system.
- Minimizes impacts to existing forests and trees.
- Avoids impacts to existing sewer and park infrastructure.
- Lowest construction cost and ecological functional uplift as compared to Options 2 and 3.

Option 3 Cons:

- Will require more armoring and potential for significant rock import.
- Expected to yield less Protocol 2 credits than Options 1 or 2; and therefore, yield less TMDL credits.

- Provides the lowest ecological functional uplift.

8.4 Recommended Stream Restoration Design Option

RK&K recommends a hybrid of Option 1 and Option 3 to achieve design goals and objectives. The hybrid approach would use the general limits of restoration as defined by Option 3 as a basis and look to expand the limits of restoration where feasible to ensure that required TMDL credits are obtained while minimizing and/or eliminating impacts to existing sewer and park infrastructure. The hybrid design approach will require approvals from the review agencies to impact resources, but the impacts are limited to the extent practicable while still achieving project goals. Justification for impacts to existing nautral resources include improvements to the floodplain connection, reduction of bank erosion, creation of riparian wetlands well-connected to groundwater, improvement to the hyporheic exchange, and reduction of flooding in the park and to some extent in community near Centre Road.

The construction of any of the Concept Design options will require temporary impacts to natural resources to allow for construction access. Erosion and sediment control plans showing construction access have been developed as part of the design progress that look to minimize impacts to the extent practicable. It should also be noted that design widths described above will be refined based on detailed grading and detailed hydraulic modeling.

9. FINAL (95%) DESIGN

The advancement of the semi-final to final design incorporates channel profiles, floodplain grading refinements, detailed channel grading, proposed log grade control, proposed large woody debris placement, detailed landscaping plans, and advancement/updates of pertinent design details.

9.1 Design Components

9.1.1 Floodplain Design

The design incorporates excavating the existing floodplain to the extents feasible within the constrained valley walls, and existing utilities that cross and parallel the floodplain. The restored floodplains have the following valley slope ranges:

- Little Mill Creek: 0.17% to 0.74%
- Tributary 1: 0.37% to 0.75%
- Tributary 2: 1.80% to 2.13%

with bottom widths ranging as follows:

- Little Mill Creek: 32-feet to 144-feet
- Tributary 1: 59-feet to 104-feet
- Tributary 2: 17-feet to 44-feet

The restored riparian wetlands have been designed to allow flood flow to access the floodplain during most every runoff event. These design parameters will lead to regular inundation of the adjacent

floodplain wetlands during runoff events. The restored floodplain will also provide flood relief and significantly reduce the shear stress carried by the channel.

9.1.2 Energy Dissipators

Hydraulic modeling of the culverts at Little Mill Creek, Tributary 1, and Tributary 2 indicate the culvert exit velocities range from 6.1 – 13.2 feet per second (fps); therefore, energy dissipators comprised of Class R-5 riprap based on DelDOT's standard construction detail E-20 are proposed. The energy dissipators will provide long-term protection against instability and ensure a stable transition exists between the culvert outlets and restored reaches. The three main energy dissipators are in the following location:

- Downstream of the triple cell culverts at Faulkland Road along Little Mill Creek
- Downstream of the dual cell culverts at Faulkland Road along Tributary 1
- Downstream of the twin RCPs at Armstrong Avenue along Tributary 2

The energy dissipators will collect discharge and serve to break flow momentum leaving the structures, allow for turbulence in the pool, and reduce energy by spreading flow across the floodplain at the outlet of the energy dissipators.

9.1.3 Channel Design

The channel riffle dimensions for Little Mill Creek and the tributaries have been sized based on proposed channel slopes and average threshold discharges determined in the riffle assessment reaches. The channels are proposed to convey the following threshold discharges:

- Little Mill Creek upstream of Tributary 1: 6.3 cubic feet per second (cfs)
- Little Mill Creek Downstream of Tributary 1: 8.3 cfs
- Tributary 1: 1.8 cfs
- Tributary 2: 1.1 cfs

Proposed pool depths vary from approximately 0.5 to 3 feet deep, dependent on pool length.

9.1.4 Grade Control

Where shear stress and velocity values in the 2D model exceed the critical shear stress of the native streambed materials and/or wetland vegetation in the restored floodplain, imported streambed materials ranging in size from R-4 to R-6 riprap are proposed. Underlayment extends across the proposed restored floodplain bench to provide a permanent grade control layer that is covered with soil/topsoil to promote wetland vegetation over the armor layer. For locations where floodplain underlayment is proposed, armored riffles in the proposed channel consisting of a mixture of R-4 to R-6 riprap choked in with salvaged streambed material are proposed as well. Armored riffles will provide long-term stability within the channel in these locations of elevation shear stresses. Armored riffles are also proposed over each of the utility crossing that cross the proposed floodplain and channel. A series of buried in-channel and floodplain logs are proposed throughout the project to provide additional protection of the constructed riffle-pool sequences as well to provide protection of the floodplain against rilling and/or head-cutting through the topsoil. Clay barriers are proposed within the existing channel to block subsurface flow and protect against flow downcutting into the abandoned channel.

9.1.5 Pedestrian Bridges

To accommodate the wider proposed floodplain, the existing pedestrian bridges are being replaced as part of the project. The proposed pedestrians are being placed in the same location as the old bridges and will span the entirety of the proposed floodplain, which is preferable for long-term stability of the floodplain in the vicinity of the bridges as obstructions such as piers can cause local instability. The upstream and downstream bridges will consist of prefabricated steel structure with 95-foot and 65-foot long clear spans, respectively, of Little Mill Creek and concrete abutments on both banks. The upstream bridge will be 10-feet in width and the downstream bridge will be 8-feet in width. The 100-year floodplain spans almost the entire valley width near the proposed bridges; therefore, it was not possible to have the structures set above the 100-year water surface elevation.

9.1.6 Shared Use Path

In addition to the two new bridges, the existing asphalt trail infrastructure is being expanded upon to increase accessibility for maintenance vehicles and to increase accessibility for pedestrians and bicyclists. The proposed shared use path will run from Faulkland Road down to Centre Road with connections to Rhode Island Avenue and Brookland Avenue. The proposed trail will tie into the proposed bridges and provide direct access to existing park infrastructure such as the existing basketball courts and playground. The proposed path will be in 8-feet in width.

9.1.7 Drainage Outfalls

The existing 15” HDPE at outfall 1 will remain in place and tie-in to a proposed inlet, 15” RCP, and flared end section. The 15” RCP ties into the toe of the proposed floodplain where a 6.25 feet long class R-5 riprap apron is proposed to dissipate energy.

The existing 24” RCP at outfall 2 will remain in place and tie-in to a proposed manhole, 24” RCP, and flared end section. The proposed 24” RCP ties into the toe of the proposed floodplain where a 10 feet long class R-5 riprap apron is proposed to dissipate energy.

The existing 18” CMP at outfall 3 will be extended approximately 18’ with proposed 18” RCP. The proposed 18” RCP ties into the toe of the proposed floodplain where a 7.5 feet long class R-5 riprap apron is proposed to dissipate energy.

Outfall 4 is partially buried by sediment in its existing condition. The existing 18” RCP will be cut back until it meets the side slope of the proposed floodplain. The proposed 18” RCP ties into the toe of the proposed floodplain where a 7.5 feet long class R-5 riprap apron is proposed to dissipate energy.

The existing 18” CMP at outfall 5 will remaining; however, 26-ft of 18” RCP with flared end sections at the upstream and downstream limits will be used to convey flow under the proposed trail. R-5 riprap for inflow protection is proposed at the upstream limits while a plunge pool at the outfall will dissipate energy from exiting flows and ties into the toe of the proposed floodplain.

The existing channel at outfall 6 is also stable. The existing 24” RCP will remain in place and a proposed 1% slope will connect the existing channel to the proposed floodplain.

Outfalls 7, 8, and 9 contribute to the same existing channel. The downstream end of the existing channel will tie into the proposed channel of Little Mill Creek. The existing channel will be filled with salvaged streambed material, forming a 0.1% slope that ties into the existing channel upstream of outfall 9.

The existing 18” RCP at outfall 10 will remain in place and tie-in to a proposed inlet, 18” RCP, and flared end section. The 18” RCP ties into the proposed floodplain where a 7.5 feet long class R-5 riprap apron is proposed to dissipate energy.

The existing endwall at outfall 11 has failed and split in two. The existing 24” CMP will remain in place but a proposed flared end section will replace the existing endwall. A proposed 0.9% slope will tie the outfall to the proposed floodplain.

The existing 30” RCP at outfall 12 will remain in place. A proposed 0.4% slope will tie the outfall of the existing pipe to the toe of the proposed channel of Little Mill Creek.

The existing channel at outfall 13 is stable and the existing 18” RCP will remain in place. The side slope of the proposed floodplain will be reinforced with 14.5 feet of class R-6 riprap to armor the slope from erosion.

The existing 12” RCP at outfall 14 will remain in place and tie-in to a proposed manhole, 12” RCP, and flared end section. A plunge pool at the outfall will dissipate energy from exiting flows and ties into the toe of the proposed floodplain.

The existing 15” RCP at outfall 15 will be cut back until it meets the side slope of the proposed floodplain. Flows will exit the existing pipe through a proposed flared end section and into a proposed energy-dissipating plunge pool. A proposed 0.8% slope ties the plunge pool to the proposed floodplain.

The existing 15” RCP at outfall 16 will be extended 54 feet until it meets the side slope of the proposed floodplain. Flows will exit the existing pipe through a proposed flared end section and over a 6.25’ long class R-5 energy-dissipating riprap apron which connects the outfall to the proposed floodplain.

9.1.8 Woody Debris

Large woody debris from trees harvested on-site, primarily root wad structures, will be incorporated into the proposed floodplain area along with microtopography. Woody debris placement within a proposed restoration can offer improved habitat for many species while also adding carbon directly to the restored area.

10. HYDRAULIC ANALYSIS

Proposed conditions hydraulic/hydrodynamic analyses were performed using HEC-RAS (1D model) and TUFLOW (2D model). The HEC-RAS model was utilized to compare existing and proposed conditions and fulfill permit requirements. The TUFLOW model was utilized to inform and improve the restoration design strategy. TUFLOW offers the following benefits for design as compared to the HEC-RAS analysis:

- Analyzes shear stress along the entire stream channel and floodplain surface areas and not only at HEC-RAS cross section locations,
- Calculates varying shear stress values laterally across the stream channel and floodplain compared to one average shear stress value in each channel and overbank area as calculated by HEC-RAS, and
- More effectively models flow transitions, ineffective flow areas, channel and floodplain bend losses, and flow expansion and contraction using a finite difference solution.

10.1 HEC-RAS 1D

The proposed conditions HEC-RAS model was prepared using the same cross section stations as the existing conditions where feasible to make a direct comparison of water surface elevations, velocities, and shear stresses where feasible. Cross Section 4568 was removed from proposed conditions to properly model the proposed pedestrian bridge and embankment. Flow data, including storm discharges and boundary conditions, are the same as the existing conditions. The proposed conditions geometry data includes cross sections and structures for the proposed pedestrian bridge and shared use path as detailed above. Manning's n values were estimated using standard engineering practices and were based on anticipated plantings, stream/floodplain structures, channel pattern, and surface irregularities and obstructions.

10.1.1 100-year Water Surface Elevations Comparison

Water surface elevations for the 100-year storm event were generally decreased when comparing the proposed floodplain to the existing conditions. Tables 12-14 presents a summary of the comparison of the 100-year water surface elevations for the existing and proposed conditions. As reflected in Tables 12-14 below, the proposed design provides decreased water surface elevations at nearly all cross sections within the project reach. Slight increases in water surface elevations occur at three cross sections due to changes in energy slopes and Manning's n values in the proposed design.

An analysis of the existing and proposed average shear stresses for the 2 and 10-year storm events was conducted. The results are summarized in Tables 15-17. Overall, average 2- and 10-year shear stresses are low (below 1 pound per square foot [psf]) for Little Mill Creek; however, there are isolated cross sections where 1 psf is exceeded. Average shear stresses for Tributary 1 and Tributary 2 are higher than that of Little Mill Creek, which is expected due to the increased valley slopes. In areas of shear stress increases, the channel will be protected to withstand the elevated shear stress. The HEC-RAS model results were used in tandem with the TUFLOW model results, discussed below in Section 10.2, to inform the design throughout the project reach to maintain stability within the proposed channel. The proposed supplemental streambed material has been sized to withstand the modeled shear stress and provide long-term sustainability of the project.

Tables 18-20 presents a comparison summary of the existing and proposed conditions average channel velocities for the 2-year and 10-year storm events. The HEC-RAS output indicates channel velocity increases throughout the reach. In the existing conditions model, flood flows are primarily contained in the area defined as channel via bank station selection. The proposed design allows for better floodplain connection, which was reflected in the cross-section bank station selection. The output results indicate average channel velocity increases between existing and proposed. The TUFLOW model results, discussed below in Section 10.2, were used to further evaluate any areas of high velocity and thus potential stability concern.

Hydraulic conveyance though the restored floodplain and channel is increased throughout the project until flood flows exceed the limits of proposed grading and spill out onto the high, existing floodplain terrace. Therefore, it is expected and supported by the summary tables below, that shear stresses and velocities will increase overall as interaction between the restored floodplain and channel are facilitated. It should be noted that the existing and proposed HEC-RAS model results shown use a downstream boundary condition of normal depth to compare the existing and proposed conditions based on changes.

Since the peak discharge in Tributary 1 and Tributary 2 would occur well before the peak discharge in Little Milll Creek, this method is a more accurate representation of changes in the hydraulic conditions for each of the reaches. HEC-RAS output data for the existing and proposed conditions are included in Appendix I.

TABLE 12: LITTLE MILL CREEK 100-YR WATER SURFACE ELEVATION RESULTS

Reach	River Station	Recurrence Interval	Existing WSEL	Proposed WSEL	Difference
LMC	8758	100-yr	107.81	107.81	0
LMC	8653	100-yr	106.23	106.23	0
LMC	8522	100-yr	105.32	105.32	0
LMC	8353	100-yr	104.86	104.86	0
LMC	8159	100-yr	104.06	104.06	0
LMC	7966	100-yr	103.53	103.53	0
LMC	7926	100-yr	102.87	102.85	-0.02
LMC	7815	100-yr	102.70	102.68	-0.02
LMC	7724	100-yr	102.33	102.08	-0.25
LMC	7544	100-yr	102.23	101.87	-0.36
LMC	Faulkland Road Culvert				
LMC	7349	100-yr	100.61	99.58	-1.03
LMC	7291	100-yr	100.40	99.17	-1.23
LMC	7144	100-yr	99.80	98.56	-1.24
LMC	7066	100-yr	99.46	98.27	-1.19
LMC	6934	100-yr	98.82	97.77	-1.05
LMC	6794	100-yr	98.14	97.15	-0.99
LMC	6594	100-yr	97.55	96.62	-0.93
LMC	6472	100-yr	97.23	96.28	-0.95
LMC	6365	100-yr	97.11	95.99	-1.12
LMC	6199	100-yr	96.94	95.73	-1.21
LMC	6071	100-yr	96.71	95.57	-1.14
LMC	5862	100-yr	95.97	95.01	-0.96
LMC	5762	100-yr	95.66	94.78	-0.88
LMC	5593	100-yr	94.93	94.22	-0.71
LMC	5589	100-yr	94.95	94.19	-0.76
LMC	5354	100-yr	94.15	93.46	-0.69
LMC	5232	100-yr	93.84	93.19	-0.65
LMC	5114	100-yr	93.55	93.00	-0.55
LMC	4671	100-yr	92.61	92.71	0.10
LMC	4585	100-yr	92.62	92.58	-0.04
LMC	4568	100-yr	92.55	--	--
LMC	Upstream Pedestrian Bridge				
LMC	4555	100-yr	92.47	92.38	-0.09
LMC	4537	100-yr	92.45	92.37	-0.08
LMC	4328	100-yr	92.40	92.29	-0.11
LMC	4058	100-yr	92.26	92.13	-0.13

Reach	River Station	Recurrence Interval	Existing WSEL	Proposed WSEL	Difference
LMC	3989	100-yr	92.23	92.08	-0.15
LMC	3960	100-yr	92.20	92.05	-0.15
LMC	Downstream Pedestrian Bridge				
LMC	3939	100-yr	92.18	92.01	-0.17
LMC	3908	100-yr	92.16	91.98	-0.18
LMC	3779	100-yr	92.08	91.87	-0.21
LMC	3641	100-yr	92.02	91.81	-0.21
LMC	3396	100-yr	91.91	91.75	-0.16
LMC	3217	100-yr	91.85	91.71	-0.14
LMC	3002	100-yr	91.79	91.65	-0.14
LMC	2916	100-yr	91.74	91.61	-0.13
LMC	2762	100-yr	91.74	91.60	-0.14
LMC	2668	100-yr	91.74	91.60	-0.14
LMC	2545	100-yr	91.63	91.50	-0.13
LMC	Centre Road Bridge				
LMC	2289	100-yr	86.92	86.92	0.00
LMC	2231	100-yr	86.87	86.87	0.00
LMC	1797	100-yr	86.26	86.26	0.00
LMC	1553	100-yr	85.78	85.78	0.00
LMC	1432	100-yr	85.29	85.29	0.00
LMC	1199	100-yr	84.61	84.61	0.00
LMC	1047	100-yr	84.26	84.26	0.00
LMC	839	100-yr	83.94	83.94	0.00
LMC	682	100-yr	83.63	83.63	0.00
LMC	449	100-yr	82.57	82.57	0.00
LMC	374	100-yr	82.51	82.51	0.00
LMC	138	100-yr	81.88	81.88	0.00

Notes:

Decreased 100-yr WSEL

Increased 100-yr WSEL

TABLE 13: TRIBUTARY 1 100-YR WATER SURFACE ELEVATION RESULTS

Reach	River Station	Recurrence Interval	Existing WSEL	Proposed WSEL	Difference
LMC	1769	100-yr	107.91	107.91	0.00
LMC	1555	100-yr	106.28	106.28	0.00
LMC	1406	100-yr	105.63	105.63	0.00
LMC	1229	100-yr	105.14	105.14	0.00
LMC	1071	100-yr	103.94	103.94	0.00
LMC	964	100-yr	103.83	103.83	0.00
LMC	936	100-yr	103.75	103.75	0.00
LMC	910	100-yr	103.76	103.77	0.01
LMC	Faulkland Road Culvert				
LMC	825	100-yr	99.28	97.59	-1.69
LMC	801	100-yr	98.60	97.98	-0.62
LMC	679	100-yr	98.47	97.44	-1.03
LMC	602	100-yr	98.13	96.62	-1.51
LMC	513	100-yr	97.96	96.01	-1.95
LMC	234	100-yr	96.15	94.30	-1.85

Notes:

Decreased 100-yr WSEL

Increased 100-yr WSEL

TABLE 14: TRIBUTARY 2 100-YR WATER SURFACE ELEVATION RESULTS

Reach	River Station	Recurrence Interval	Existing WSEL	Proposed WSEL	Difference
LMC	833	100-yr	104.31	104.31	0.00
LMC	628	100-yr	102.62	102.62	0.00
LMC	497	100-yr	101.67	101.68	0.01
LMC	436	100-yr	101.72	101.72	0.00
LMC	Armstrong Avenue Culvert				
LMC	362	100-yr	96.98	96.33	-0.65
LMC	336	100-yr	96.78	96.07	-0.71
LMC	271	100-yr	96.17	95.27	-0.90
LMC	191	100-yr	94.94	93.45	-1.49
LMC	77	100-yr	92.20	91.80	-0.40

Notes:

Decreased 100-yr WSEL

Increased 100-yr WSEL

10.1.2 2- and 10-year Shear Stress Comparison

TABLE 15: LITTLE MILL CREEK 2- AND 10-YR CHANNEL SHEAR STRESS RESULTS

River Station	2-Year Channel Shear Stress (psf)		Difference %	10-Year Channel Shear Stress (psf)		Difference %
	Existing	Proposed		Existing	Proposed	
8758	1.23	1.23	0%	2.41	2.41	0%
8653	2.42	2.42	0%	3.02	3.02	0%
8522	0.53	0.53	0%	0.98	0.98	0%
8353	0.52	0.52	0%	0.70	0.70	0%
8159	0.44	0.44	0%	0.79	0.79	0%
7966	0.49	0.49	0%	0.46	0.46	0%
7926	2.02	2.01	0%	1.76	1.76	0%
7815	0.69	0.65	-6%	0.52	0.52	0%
7724	1.66	1.24	-25%	2.60	3.30	27%
7544	0.23	0.81	252%	0.25	0.42	68%
7432	Faulkland Road Culvert					
7349	0.22	0.16	-27%	0.42	0.31	-26%
7291	1.01	0.67	-34%	1.16	1.04	-10%
7144	0.62	0.55	-11%	0.84	0.84	0%
7066	0.60	0.52	-13%	0.86	0.76	-12%
6934	0.84	0.47	-44%	1.32	0.72	-45%
6794	0.64	0.59	-8%	0.89	0.91	2%
6594	0.59	0.46	-22%	0.67	0.68	1%
6472	0.26	0.51	96%	0.49	0.73	49%
6365	0.45	0.58	29%	0.65	0.74	14%
6199	0.46	0.35	-24%	0.38	0.47	24%
6071	0.75	0.34	-55%	0.78	0.44	-44%
5862	0.69	0.52	-25%	1.06	0.71	-33%
5762	0.51	0.34	-33%	0.81	0.49	-40%
5593	0.69	0.58	-16%	1.09	0.86	-21%
5589	0.55	0.58	5%	0.86	0.86	0%
5354	0.40	0.70	75%	0.82	0.88	7%
5232	0.44	0.37	-16%	0.69	0.52	-25%
5114	0.46	0.28	-39%	0.56	0.40	-29%
4671	0.97	0.26	-73%	0.70	0.41	-41%
4585	0.45	0.49	9%	0.28	0.76	171%
4568	1.45	--	--	0.21	--	--
4561	Upstream Pedestrian Bridge					
4555	0.99	0.55	-44%	2.01	0.94	-53%
4537	0.72	0.53	-26%	1.52	0.93	-39%
4328	0.41	0.25	-39%	0.38	0.34	-11%
4058	0.34	0.29	-15%	0.40	0.39	-3%

River Station	2-Year Channel Shear Stress (psf)		Difference %	10-Year Channel Shear Stress (psf)		Difference %
	Existing	Proposed		Existing	Proposed	
3989	0.28	0.37	32%	0.34	0.44	29%
3960	0.50	0.44	-12%	0.49	0.65	33%
3949	Downstream Pedestrian Bridge					
3939	0.50	0.42	-16%	0.40	0.50	25%
3908	0.43	0.42	-2%	0.37	0.47	27%
3779	0.52	0.70	35%	0.49	0.79	61%
3641	0.42	0.44	5%	0.27	0.33	22%
3396	0.56	0.87	55%	0.41	0.55	34%
3217	0.89	0.35	-61%	0.32	0.25	-22%
3002	0.27	0.90	233%	0.16	0.33	106%
2916	0.48	0.62	29%	0.21	0.28	33%
2762	0.27	0.47	74%	0.12	0.20	67%
2668	0.10	0.16	60%	0.07	0.12	71%
2545	0.31	0.22	-29%	0.26	0.31	19%
2469	Centre Road Bridge					
2289	0.45	0.45	0%	0.99	0.99	0%
2231	0.28	0.28	0%	0.57	0.57	0%
1797	0.47	0.47	0%	0.54	0.54	0%
1553	0.33	0.33	0%	0.45	0.45	0%
1432	0.61	0.61	0%	0.85	0.85	0%
1199	0.63	0.63	0%	0.78	0.78	0%
1047	0.41	0.41	0%	0.57	0.57	0%
839	0.43	0.43	0%	0.43	0.43	0%
682	0.20	0.20	0%	0.32	0.32	0%
449	0.67	0.67	0%	1.17	1.17	0%
374	0.16	0.16	0%	0.29	0.29	0%
138	0.54	0.54	0%	0.68	0.68	0%

TABLE 16: TRIBUTARY 1 2- AND 10-YR CHANNEL SHEAR STRESS RESULTS

River Station	2-Year Channel Shear Stress (psf)		Difference %	10-Year Channel Shear Stress (psf)		Difference %
	Existing	Proposed		Existing	Proposed	
1769	1.09	1.09	0%	1.04	1.04	0%
1555	0.60	0.60	0%	0.98	0.98	0%
1406	1.14	1.14	0%	1.44	1.44	0%
1229	0.62	0.62	0%	0.92	0.92	0%
1071	1.17	1.17	0%	1.86	1.86	0%
964	0.98	0.98	0%	1.03	1.03	0%
936	1.80	1.80	0%	1.29	1.29	0%
910	0.51	0.50	-2%	0.61	0.59	-3%
874	Faulkland Road Culvert					
825	0.13	0.42	223%	0.34	1.33	291%
801	0.34	0.22	-35%	0.69	0.56	-19%
679	0.36	0.52	44%	0.47	0.88	87%
602	0.70	0.96	37%	0.91	1.58	74%
513	0.75	0.43	-43%	0.98	0.75	-23%
234	0.99	0.81	-18%	1.58	1.20	-24%

TABLE 17: TRIBUTARY 2 2- AND 10-YR CHANNEL SHEAR STRESS RESULTS

River Station	2-Year Channel Shear Stress (psf)		Difference %	10-Year Channel Shear Stress (psf)		Difference %
	Existing	Proposed		Existing	Proposed	
833	0.73	0.73	0%	0.70	0.70	0%
628	0.70	0.70	0%	1.37	1.37	0%
497	1.92	1.92	0%	0.74	0.75	1%
436	0.09	0.09	0%	0.10	0.10	0%
400	Armstrong Avenue Culvert					
362	1.71	0.38	-78%	2.33	0.86	-63%
336	0.97	1.22	26%	1.16	1.94	67%
271	0.51	0.89	75%	0.95	1.11	17%
191	1.89	1.56	-17%	2.31	2.83	23%
77	1.61	1.04	-35%	2.41	1.65	-32%

10.1.3 2- and 10-year Velocity Comparison

TABLE 18: LITTLE MILL CREEK 2- AND 10-YR CHANNEL VELOCITY RESULTS

River Station	2-Year Channel Velocity (fps)		Difference %	10-Year Channel Channel Velocity (fps)		Difference %
	Existing	Proposed		Existing	Proposed	
8758	5.30	5.30	0%	7.79	7.79	0%
8653	7.26	7.26	0%	8.70	8.70	0%
8522	3.60	3.60	0%	5.13	5.13	0%
8353	3.57	3.57	0%	4.31	4.31	0%
8159	3.31	3.31	0%	4.60	4.60	0%
7966	3.40	3.40	0%	3.49	3.49	0%
7926	6.66	6.65	0%	6.62	6.62	0%
7815	3.63	3.52	-3%	3.39	3.40	0%
7724	6.10	5.34	-12%	7.93	8.86	12%
7544	2.23	3.89	74%	2.50	3.18	27%
7432	Faulkland Road Culvert					
7349	2.48	2.05	-17%	3.53	3.00	-15%
7291	5.11	3.94	-23%	5.76	5.21	-10%
7144	3.96	3.57	-10%	4.85	4.68	-4%
7066	3.94	3.43	-13%	4.94	4.43	-10%
6934	4.51	3.27	-27%	5.93	4.30	-27%
6794	3.91	3.64	-7%	4.84	4.80	-1%
6594	3.80	3.18	-16%	4.21	4.14	-2%
6472	2.66	3.34	26%	3.77	4.27	13%
6365	3.42	3.52	3%	4.24	4.26	0%
6199	3.45	2.93	-15%	3.32	3.56	7%
6071	4.33	2.83	-35%	4.67	3.41	-27%
5862	4.19	3.39	-19%	5.45	4.26	-22%
5762	3.69	2.87	-22%	4.82	3.64	-24%
5593	4.18	3.64	-13%	5.49	4.71	-14%
5589	3.75	3.63	-3%	4.89	4.71	-4%
5354	3.28	4.06	24%	4.83	4.83	0%
5232	3.41	3.07	-10%	4.41	3.83	-13%
5114	3.46	2.57	-26%	3.93	3.28	-17%
4671	4.87	2.56	-47%	4.48	3.35	-25%
4585	3.43	3.35	-2%	2.91	4.34	49%
4568	5.90	--	--	2.48	--	--
4561	Upstream Pedestrian Bridge					
4555	4.91	3.63	-26%	7.31	5.05	-31%
4537	4.19	3.64	-13%	6.41	5.10	-20%
4328	3.30	2.58	-22%	3.34	3.12	-7%
4058	3.04	2.74	-10%	3.47	3.22	-7%

River Station	2-Year Channel Velocity (fps)		Difference %	10-Year Channel Channel Velocity (fps)		Difference %
	Existing	Proposed		Existing	Proposed	
3989	2.85	3.22	13%	3.24	3.57	10%
3960	3.85	3.50	-9%	3.95	4.32	9%
3949	Downstream Pedestrian Bridge					
3939	3.68	3.34	-9%	3.48	3.79	9%
3908	3.44	3.31	-4%	3.38	3.67	9%
3779	3.77	4.25	13%	3.87	4.73	22%
3641	3.34	3.34	0%	2.85	3.08	8%
3396	3.91	4.76	22%	3.56	4.05	14%
3217	4.82	3.10	-36%	3.15	2.76	-12%
3002	2.74	4.81	76%	2.30	3.19	39%
2916	3.63	4.06	12%	2.64	3.01	14%
2762	2.72	3.68	35%	2.04	2.61	28%
2668	1.69	2.20	30%	1.59	2.03	28%
2545	2.98	2.63	-12%	2.94	3.31	13%
2469	Centre Road Bridge					
2289	3.43	3.43	0%	5.30	5.30	0%
2231	2.69	2.69	0%	4.02	4.02	0%
1797	3.46	3.46	0%	3.86	3.86	0%
1553	2.82	2.82	0%	3.44	3.44	0%
1432	3.84	3.84	0%	4.74	4.74	0%
1199	3.96	3.96	0%	4.59	4.59	0%
1047	3.28	3.28	0%	3.98	3.98	0%
839	3.23	3.23	0%	3.37	3.37	0%
682	2.25	2.25	0%	2.88	2.88	0%
449	3.96	3.96	0%	5.43	5.43	0%
374	2.00	2.00	0%	2.76	2.76	0%
138	3.49	3.49	0%	4.10	4.10	0%

TABLE 19: TRIBUTARY 1 2- AND 10-YR CHANNEL VELOCITY RESULTS

River Station	2-Year Channel Velocity (fps)		Difference %	10-Year Channel Channel Velocity (fps)		Difference %
	Existing	Proposed		Existing	Proposed	
1769	4.68	4.68	0%	5.06	5.06	0%
1555	3.62	3.62	0%	4.89	4.89	0%
1406	4.91	4.91	0%	5.95	5.95	0%
1229	3.73	3.73	0%	4.80	4.80	0%
1071	4.94	4.94	0%	6.72	6.72	0%
964	4.51	4.51	0%	5.02	5.03	0%
936	6.00	6.01	0%	5.63	5.63	0%

River Station	2-Year Channel Shear Stress (psf)		Difference %	10-Year Channel Shear Stress (psf)		Difference %
	Existing	Proposed		Existing	Proposed	
910	3.35	3.32	-1%	3.99	3.96	-1%
874	Faulkland Road Culvert					
825	1.78	3.44	93%	3.07	6.35	107%
801	2.76	2.28	-17%	4.17	3.84	-8%
679	2.90	3.20	10%	3.56	4.48	26%
602	3.87	4.14	7%	4.67	5.71	22%
513	4.03	2.88	-29%	4.94	4.08	-17%
234	4.57	3.99	-13%	6.23	5.17	-17%

TABLE 20: TRIBUTARY 2 2- AND 10-YR CHANNEL VELOCITY RESULTS

River Station	2-Year Channel Velocity (fps)		Difference %	10-Year Channel Channel Velocity (fps)		Difference %
	Existing	Proposed		Existing	Proposed	
833	3.73	3.73	0%	3.96	3.96	0%
628	3.70	3.70	0%	5.40	5.40	0%
497	5.33	5.33	0%	3.76	3.79	1%
436	1.41	1.41	0%	1.65	1.66	1%
400	Armstrong Avenue Culvert					
362	5.35	3.01	-44%	6.73	4.78	-29%
336	4.33	4.54	5%	5.03	6.13	22%
271	3.28	3.92	20%	4.69	4.79	2%
191	6.00	5.45	-9%	7.25	7.75	7%
77	5.39	4.05	-25%	7.06	5.49	-22%

10.2 TUFLOW (2D) Modeling

A 2D analysis was performed using SMS version 13.2.10 with TUFLOW add-on package. TUFLOW is a finite difference hydrodynamic modeling computation engine that runs within the SMS software platform. SMS provides the platform to perform pre- and post-processing and graphic production for the TUFLOW simulations. The results of the 2D analysis provide a distribution of shear stress on the topographic digital terrain model, direction and magnitude of velocity, depth, and elevation for base flow and the 2-, 10-, and 100-year return intervals. The results of the 2D model have been used to inform proposed channel/floodplain bench stability as well as to make design refinements to ensure long term sustainability of the design.

10.2.1 Downstream Boundary Conditions

A downstream boundary condition approximately 1,530 feet below Centre Road was implemented for all modeling scenarios. A water surface elevation vs. flow (HQ) boundary condition was used and the water surface slope used for analysis was determined to be 0.4%.

10.2.2 Upstream Boundary Conditions

The upstream boundary conditions inputs were developed using discharge data from the StreamStats hydrologic analysis. Four modeling scenarios were considered to evaluate the different reaches of Little Mill Creek and its tributaries. The four scenarios were:

- Scenario 1: Little Mill Creek upstream of Tributary 1
- Scenario 2: Little Mill Creek downstream of Tributary 1
    - Discharges from Tributary 1 and Tributary 2 were adjusted so that total discharge to the most downstream reach of Little Mill Creek summed to 2,010 cfs (SteamStats 100-year discharge at Centre Road)
- Scenario 3: Tributary 1 upstream of Little Mill Creek
- Scenario 4: Tributary 2 upstream of Little Mill Creek

Scenarios 1, 3, and 4 are intended to model their respective reaches while assuming low flow tailwater conditions due to anticipated difference in timing of peak flows (e.g. Scenario 1 focuses on Little Mill Creek upstream of Tributary 1 assuming the peak flow from Tributary 1 has passed since the contributing drainage is smaller). Scenario 2 was developed so that discharges from Little Mill Creek, Tributary 1, and Tributary 2 totaled 2,010 cfs (SteamStats 100-year discharge at Centre Road) for the downstream reach of Little Mill Creek.

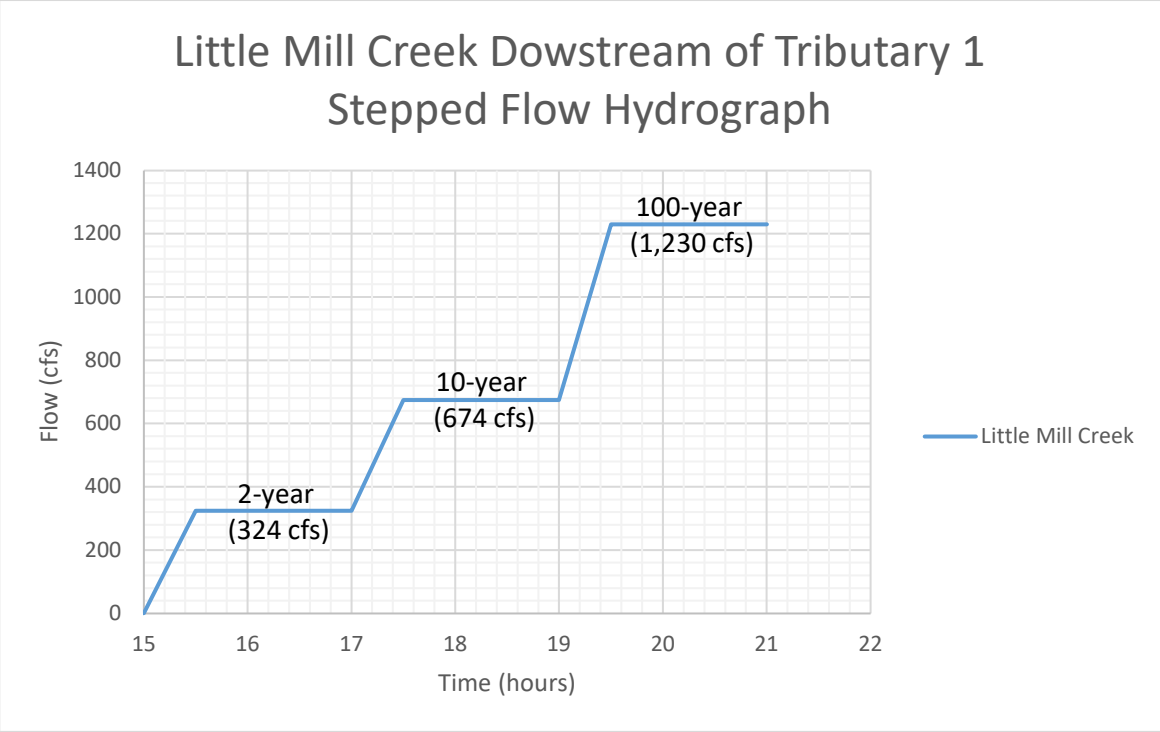


FIGURE 6: SCENARIO 1 STEPPED FLOW HYDROGRAPHS

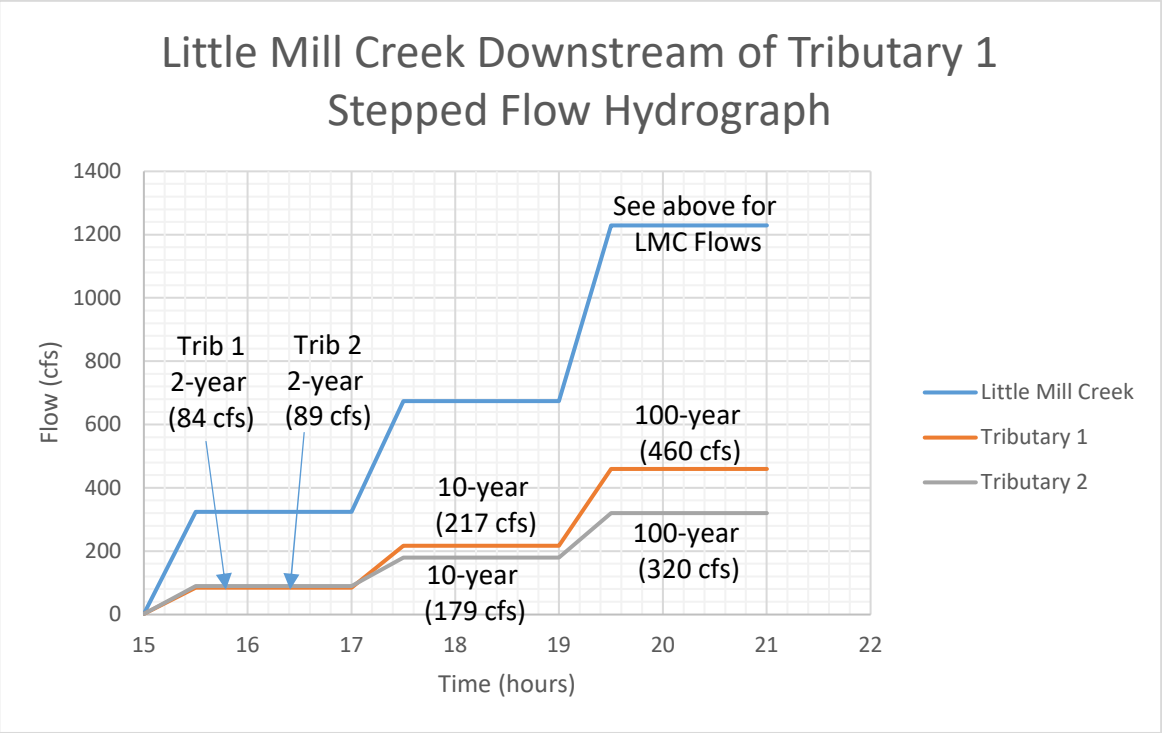


FIGURE 7: SCENARIO 2 STEPPED FLOW HYDROGRAPHS

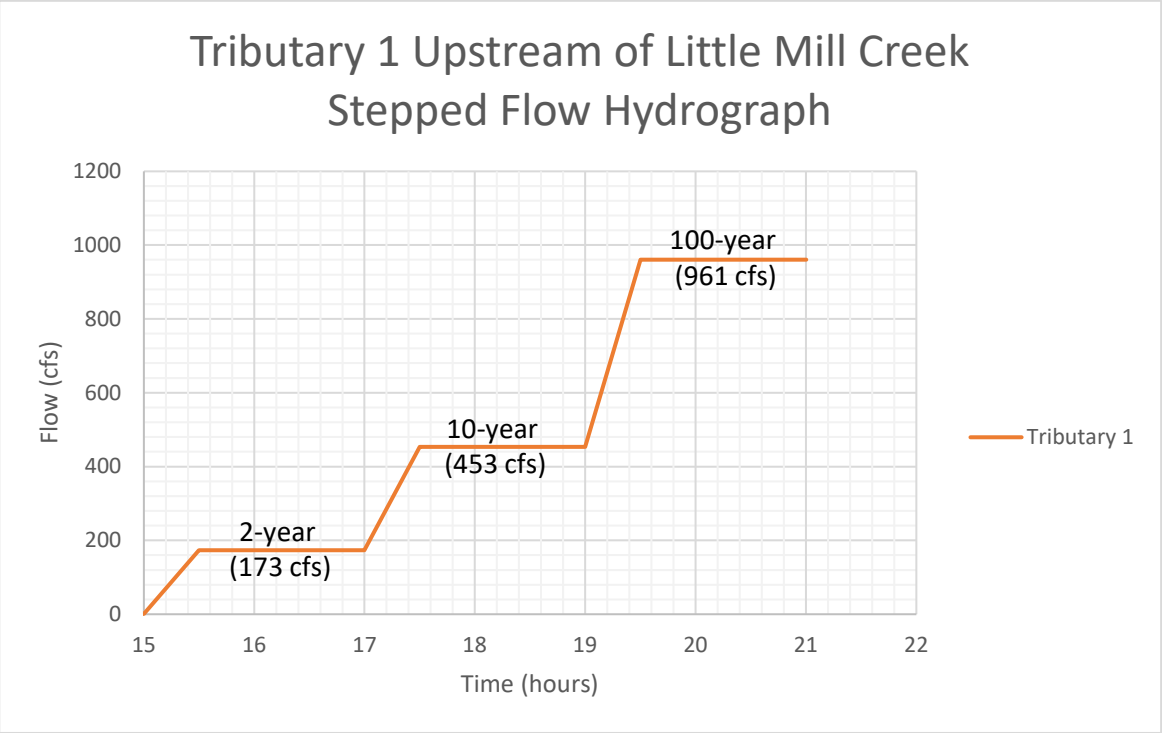


FIGURE 8: SCENARIO 3 STEPPED FLOW HYDROGRAPHS

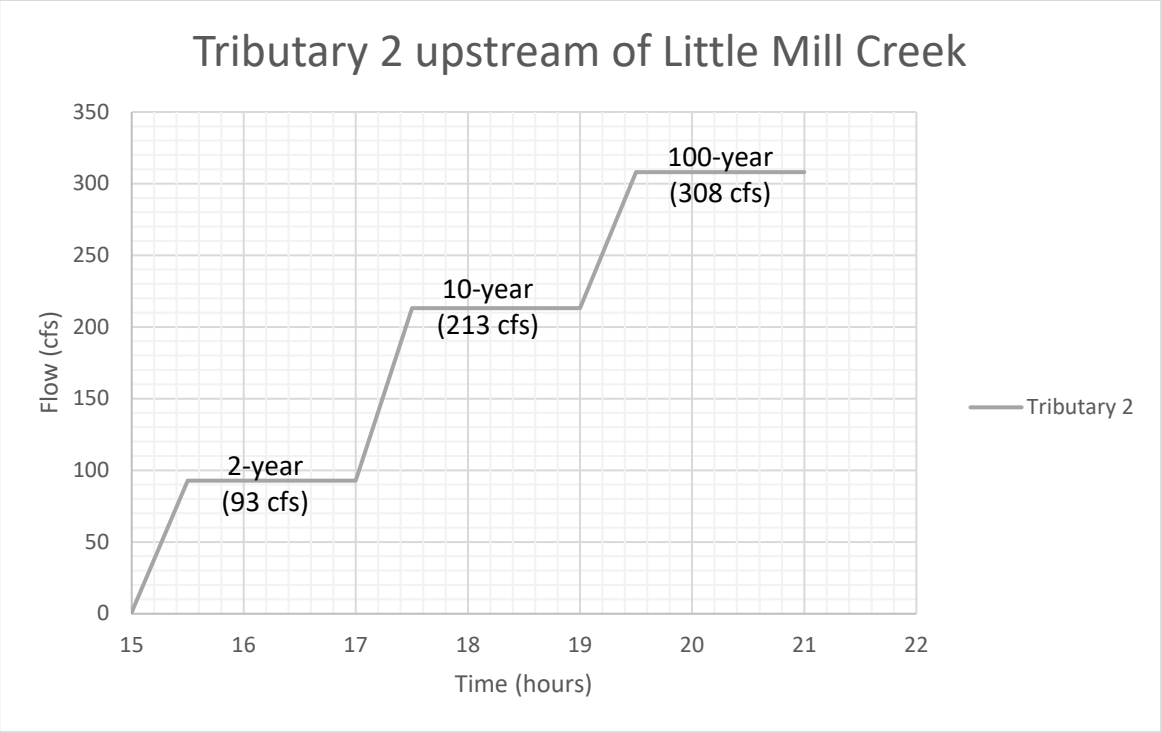


FIGURE 9: SCENARIO 4 STEPPED FLOW HYDROGRAPHS

10.2.3 Computational Grid and Roughness Distribution

The existing conditions computational grid was created using field-run survey data merged with project specific LiDAR flown by AxisGeospatial. Polygons for each Manning's n value were created using aerial photography and site reconnaissance for areas of similar land cover or roughness. Appropriate existing conditions Manning's roughness coefficients were assigned to each polygon encompassing the computational grid see Table 21. The model was run using a 2-foot grid and compiles output data at each cell.

The proposed conditions were modeled using similar methodology. The computational grid based on a composite surface of proposed grading and existing topographic data outside of the proposed limits of grading. Manning's n values were modified as appropriate within the project limits to account for anticipated roughness in the proposed channel and floodplain bench in the proposed conditions.

TABLE 21: SUMMARY OF MANNING'S N VALUES

Land Use	n Value
Existing Channel Bed	0.04
Existing Channel Bank	0.06
Open Park Space	0.04
Impervious	0.013
Residential	0.04

Land Use	n Value
Trail	0.013
Brush	0.06
Woods	0.08
Proposed Floodplain	0.07
Proposed Scour Hole	0.038
Proposed Channel	0.04
Playground	0.04
Lawn	0.03

10.2.4 TUFLOW Model Output

The TUFLOW output includes values for water depth, elevation, velocity, and bed shear stress, as well as velocity vectors for each cell. This discussion relies primarily on the shear stress output to evaluate the stability of the proposed conditions channel and floodplain bench and to demonstrate improvement from the existing to proposed conditions.

The primary objective from this analysis is for the proposed design to maintain shear stresses in the channel and floodplain bench to a sustainable range. Generally, floodplain vegetation can withstand shear stresses up to 2 psf so the goal is to maintain shear stresses below 2 psf through as much of the floodplain as possible so that long-term stability can rely on the wetland vegetation. Within the channel, the proposed shear stress should be less than 0.16 psf for Little Mill Creek upstream of Tributary 1, less than 0.39 psf for Little Mill Creek downstream of Tributary 1, and less than 0.23 psf for Tributary 1 to rely on the native streambed material as grade control in the channel (see sediment mobility analysis in Section 5.6.2). Where this is not achievable, imported streambed material will be added to the proposed channel to reinforce the channel bed. The TUFLOW modeling indicates areas where the shear stress exceeds 2 psf (shown in red in the TUFLOW output below).

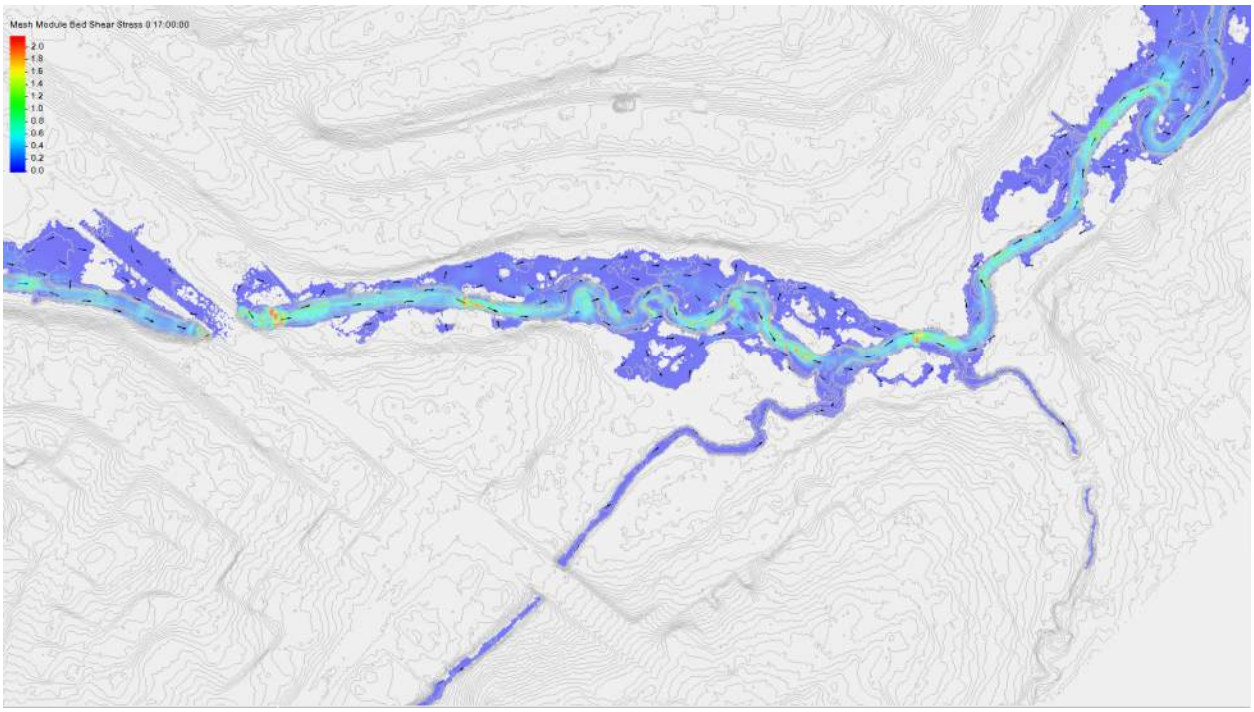


FIGURE 10: SCENARIO 1 EXISTING CONDITIONS – 2 YEAR STORM

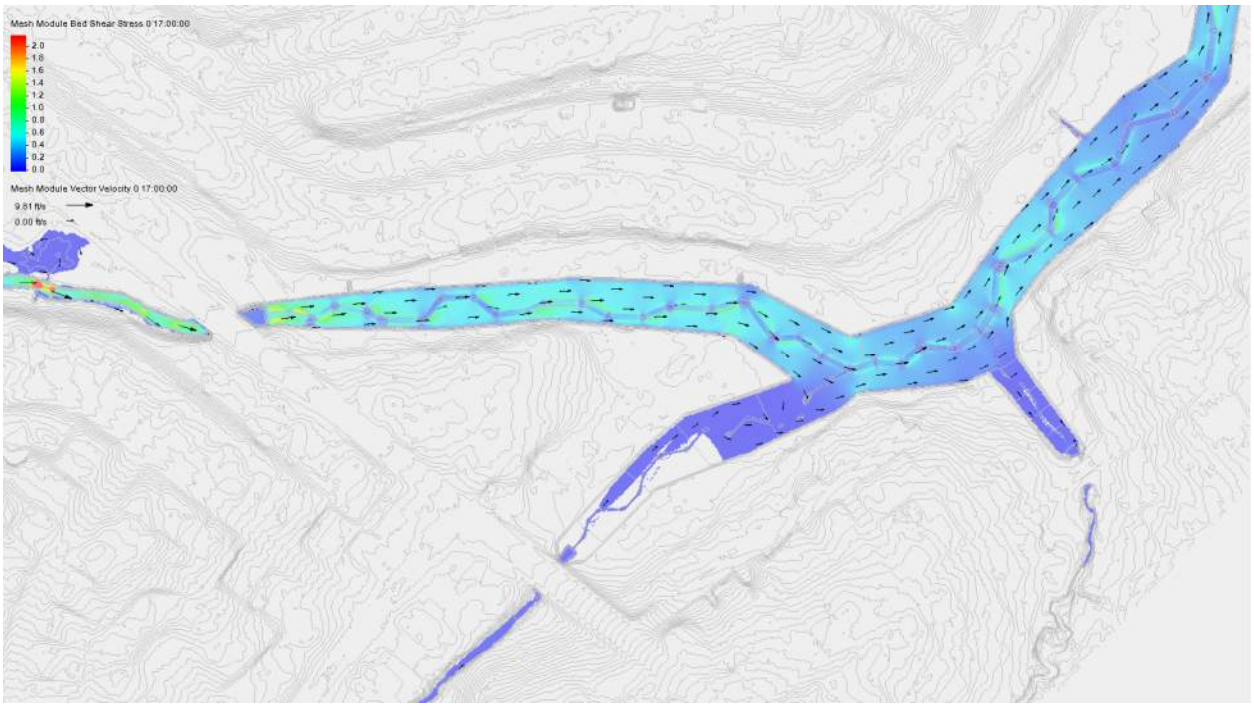


FIGURE 11: SCENARIO 1 PROPOSED CONDITIONS – 2 YEAR STORM

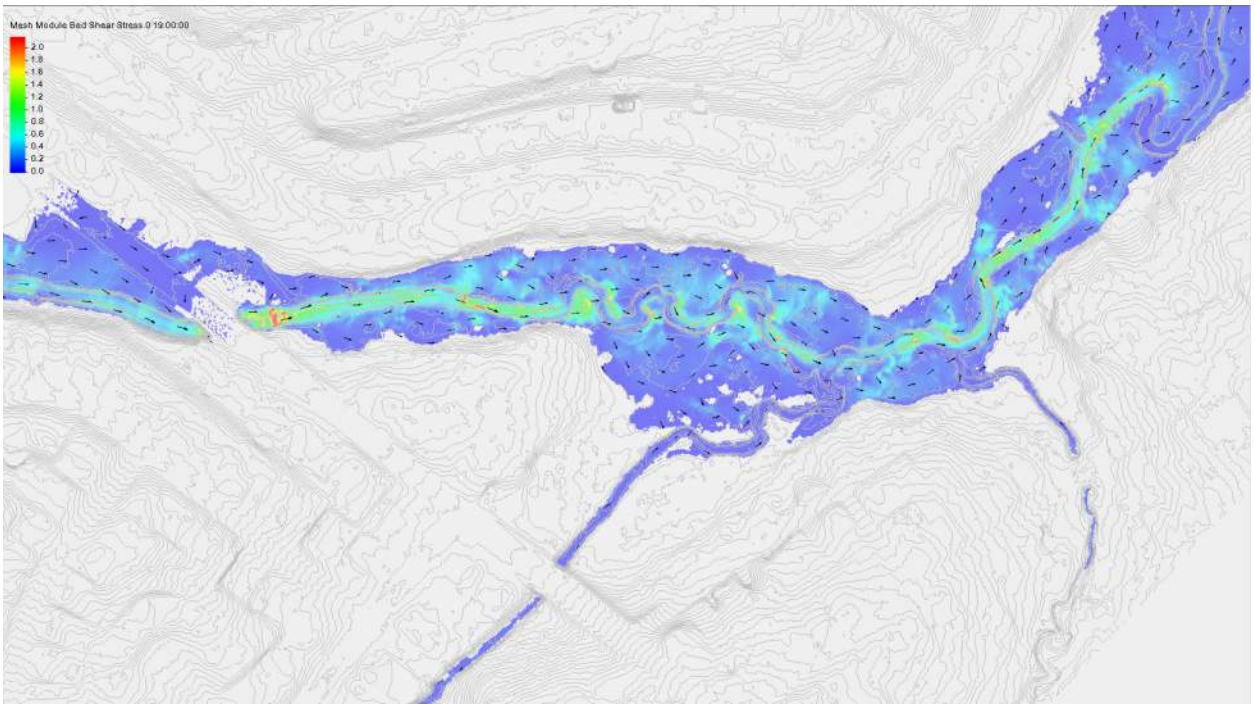


FIGURE 12: SCENARIO 1 EXISTING CONDITIONS – 10 YEAR STORM

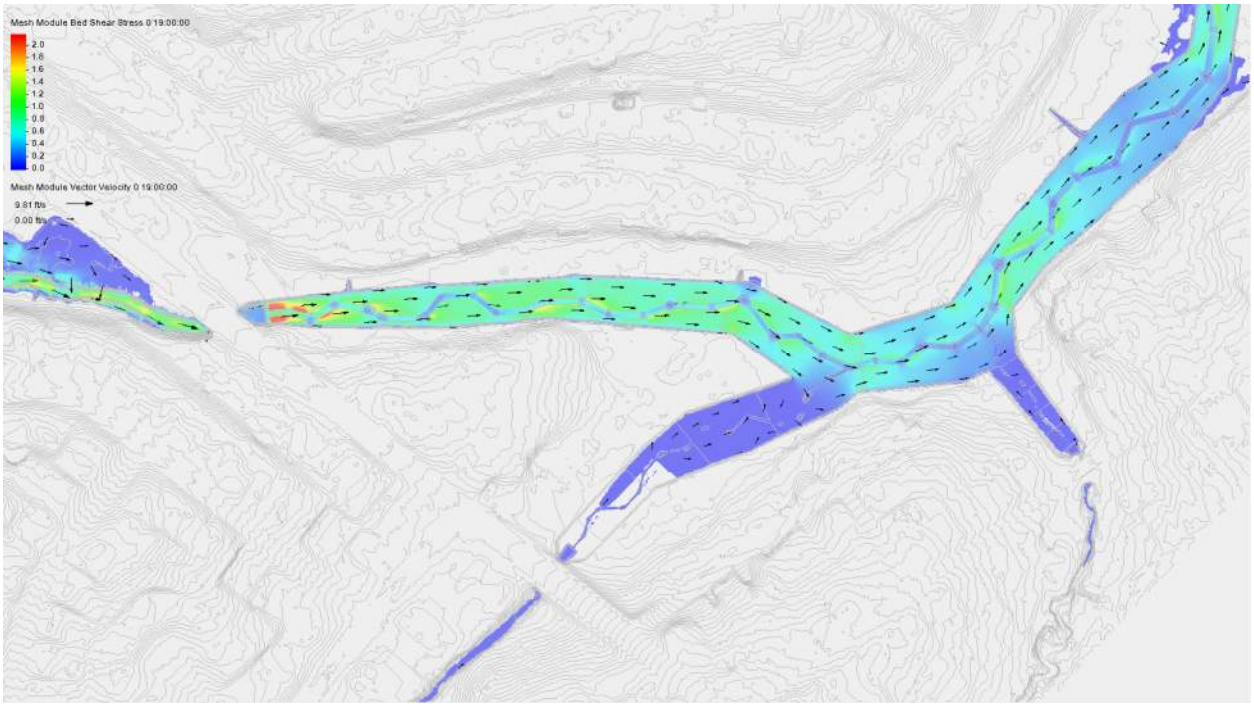


FIGURE 13: SCENARIO 1 PROPOSED CONDITIONS – 10 YEAR STORM

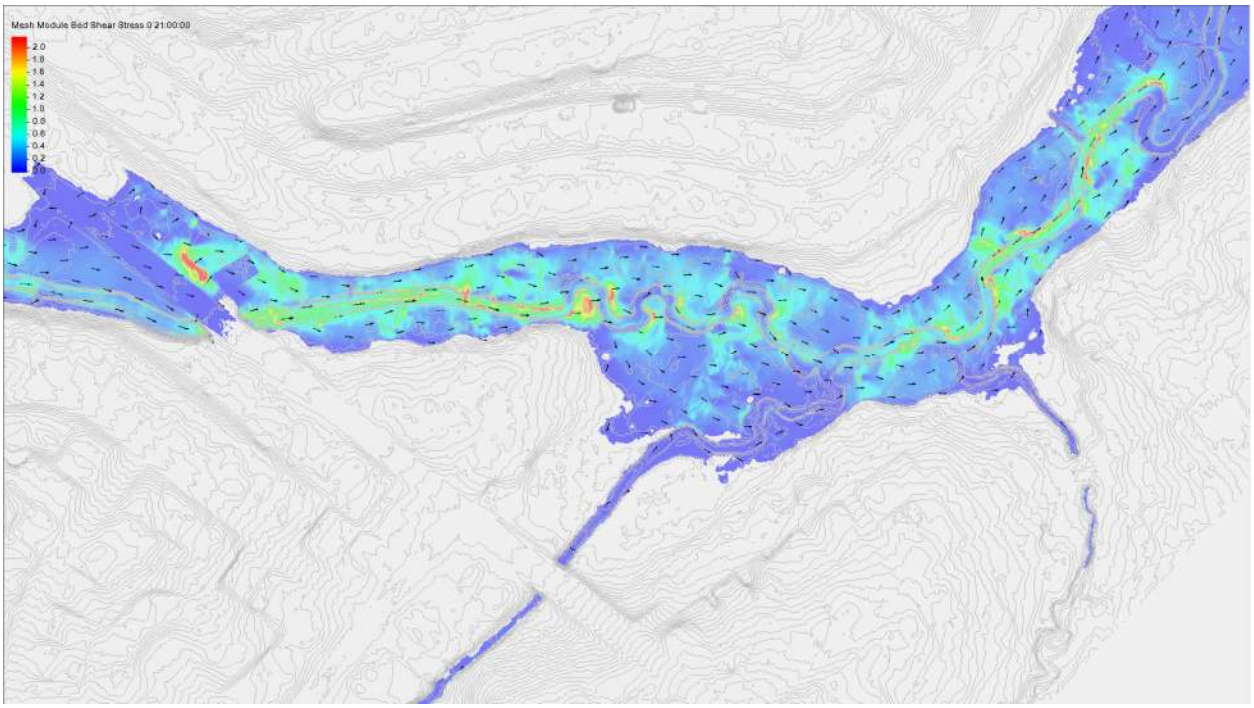


FIGURE 14: SCENARIO 1 EXISTING CONDITIONS – 100 YEAR STORM

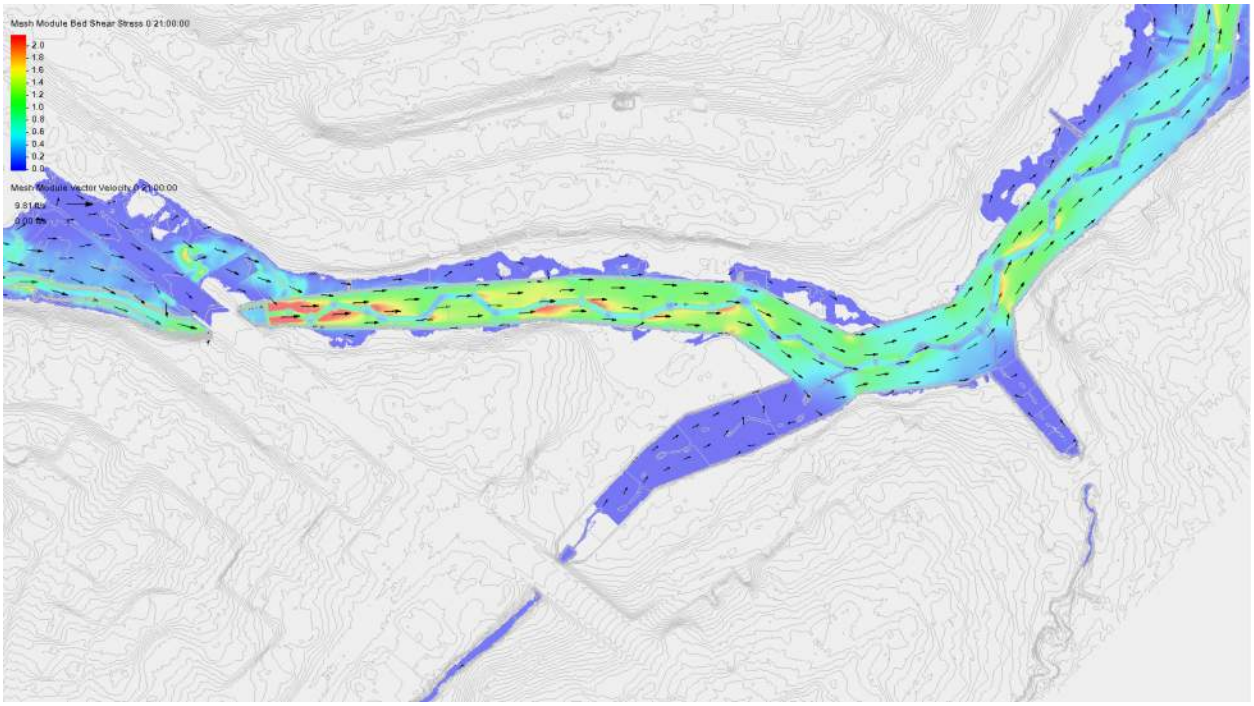


FIGURE 15: SCENARIO 1 PROPOSED CONDITIONS – 100 YEAR STORM

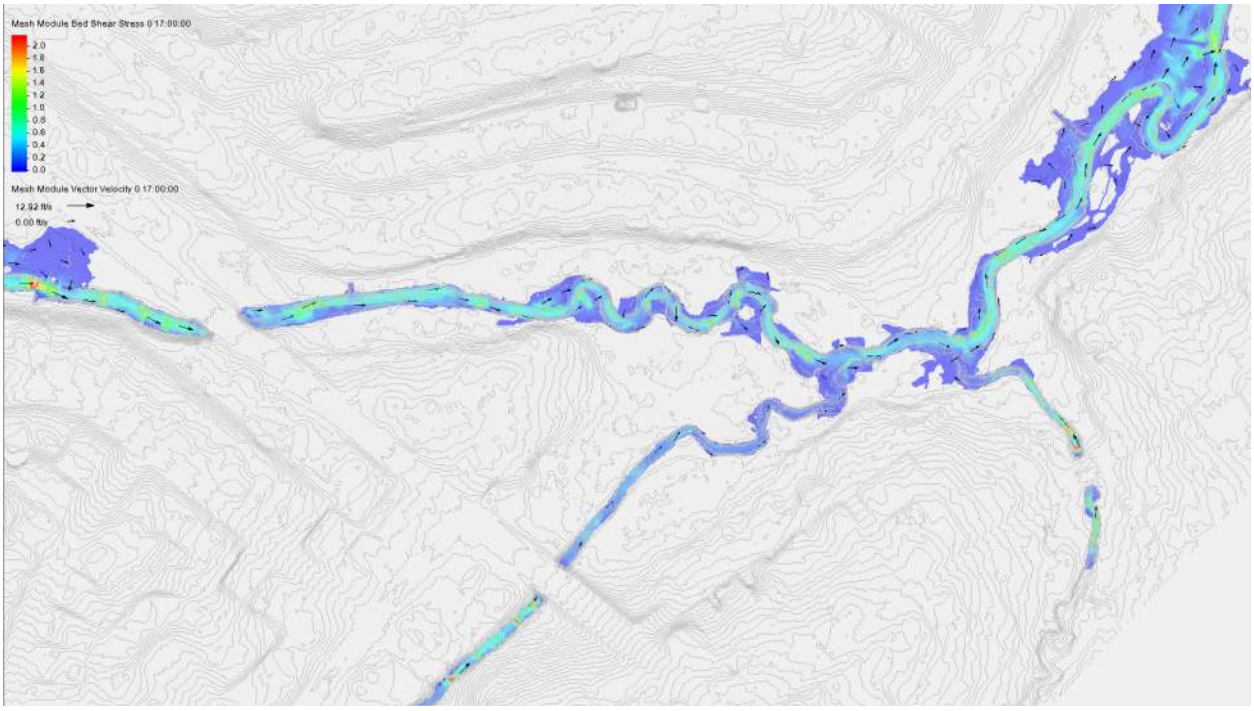


FIGURE 16: SCENARIO 2 UPPER REACH EXISTING CONDITIONS – 2 YEAR STORM

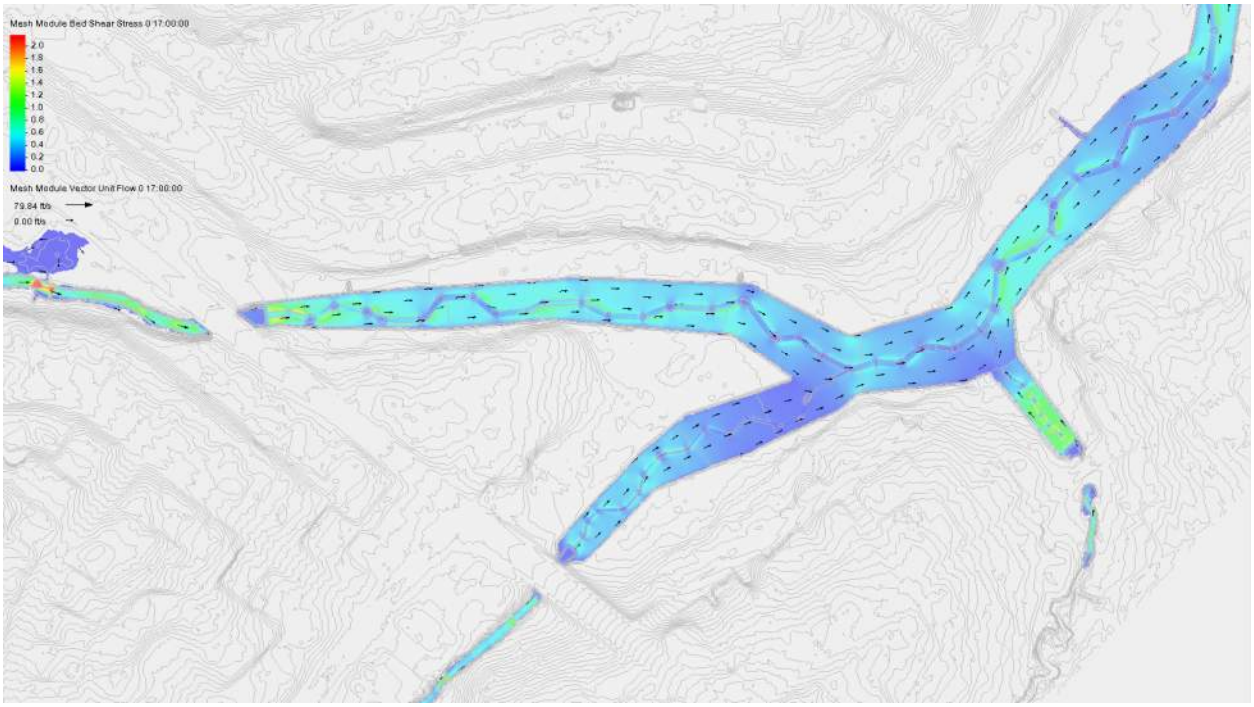


FIGURE 17: SCENARIO 2 UPPER REACH PROPOSED CONDITIONS – 2 YEAR STORM

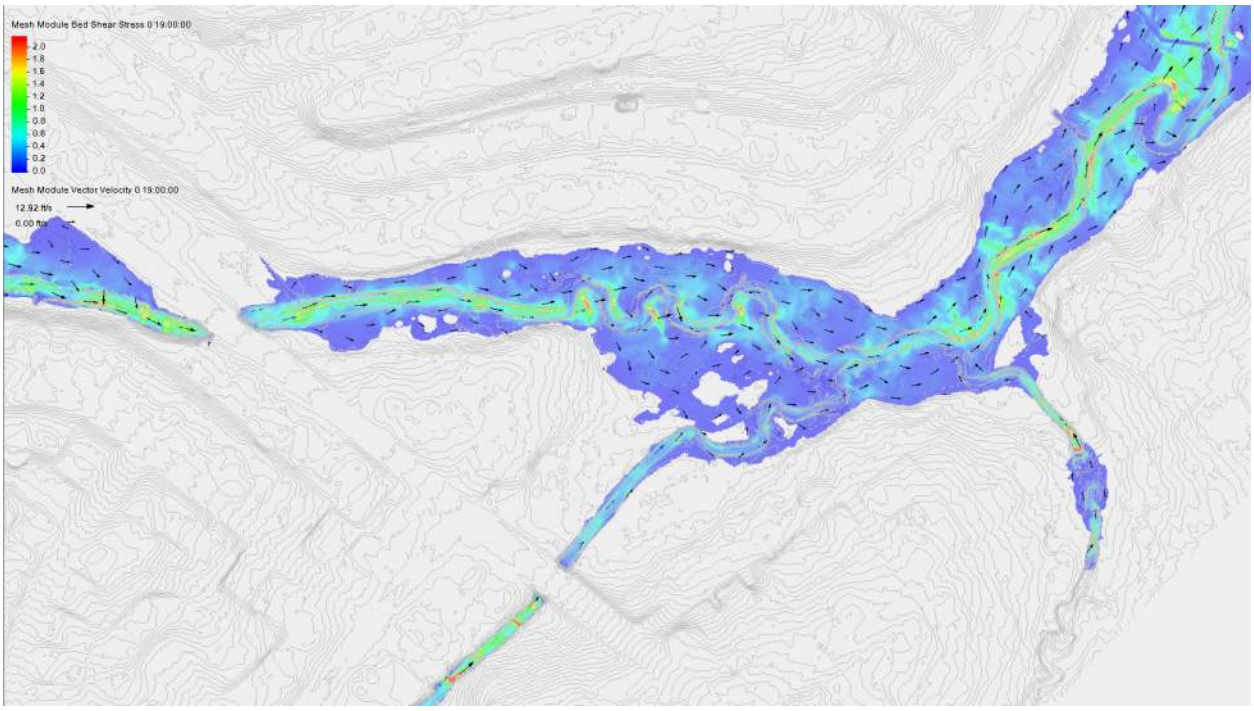


FIGURE 18: SCENARIO 2 UPPER REACH EXISTING CONDITIONS – 10 YEAR STORM

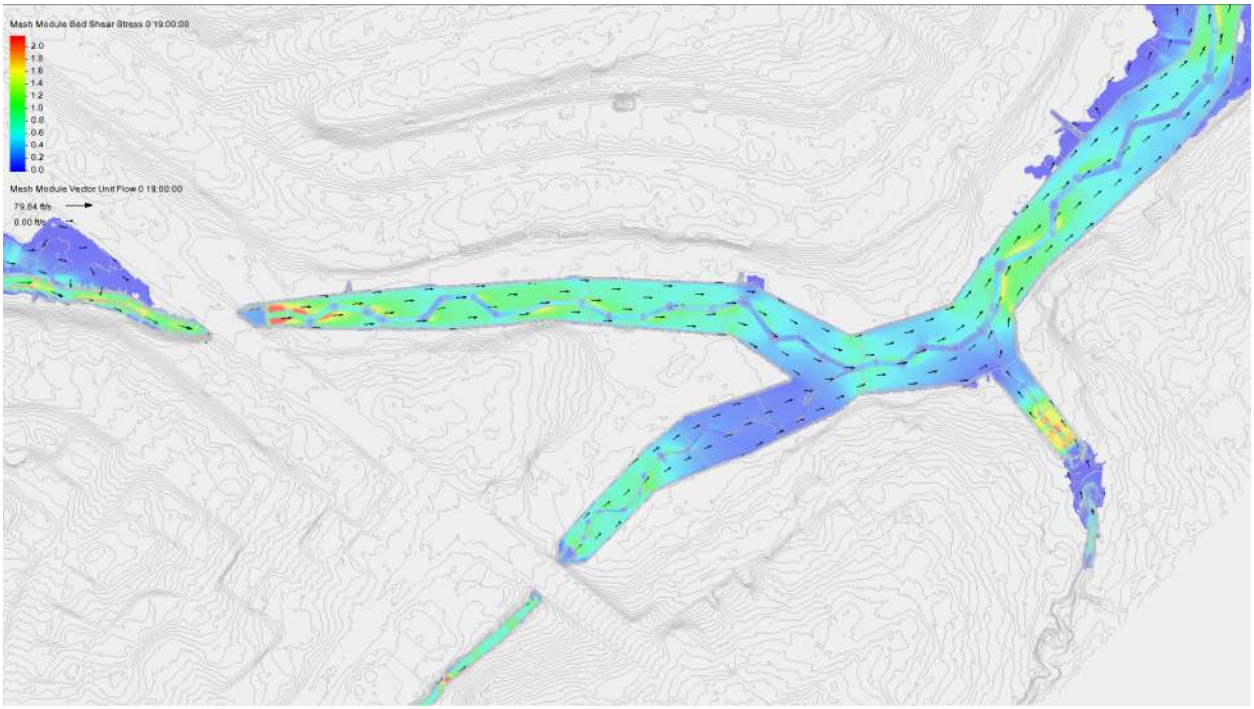


FIGURE 19: SCENARIO 2 UPPER REACH PROPOSED CONDITIONS – 10 YEAR STORM

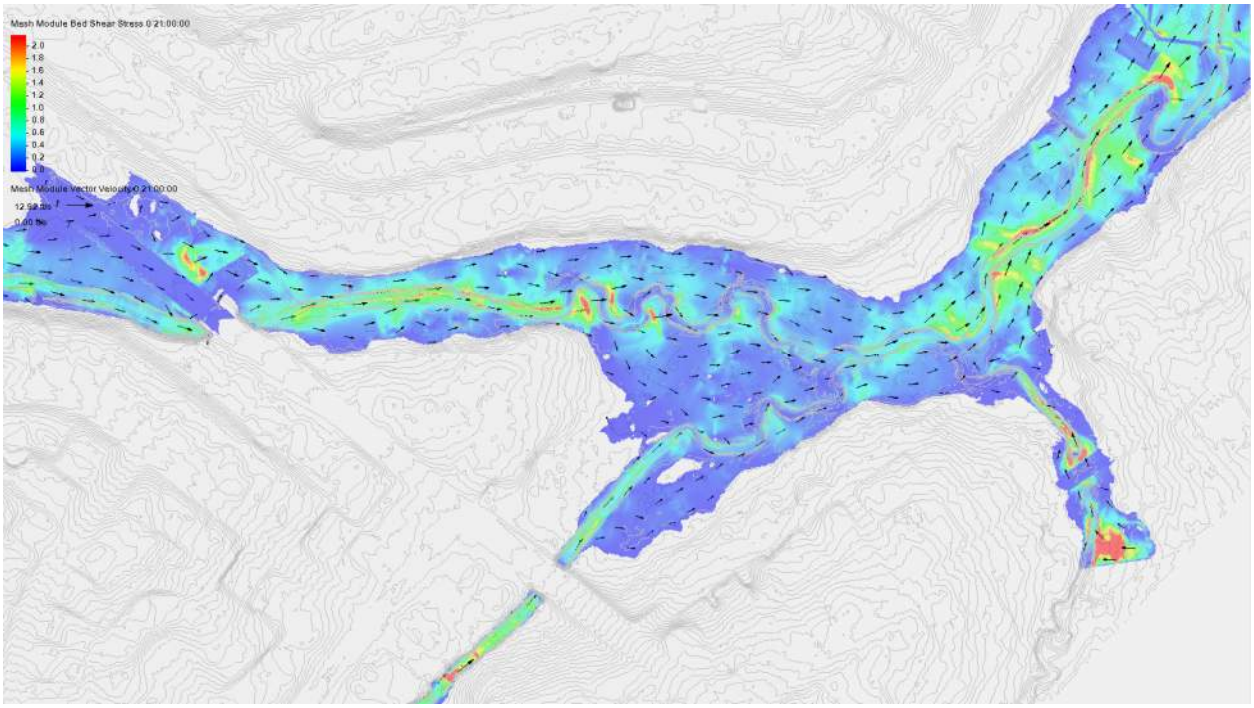


FIGURE 20: SCENARIO 2 UPPER REACH EXISTING CONDITIONS – 100 YEAR STORM

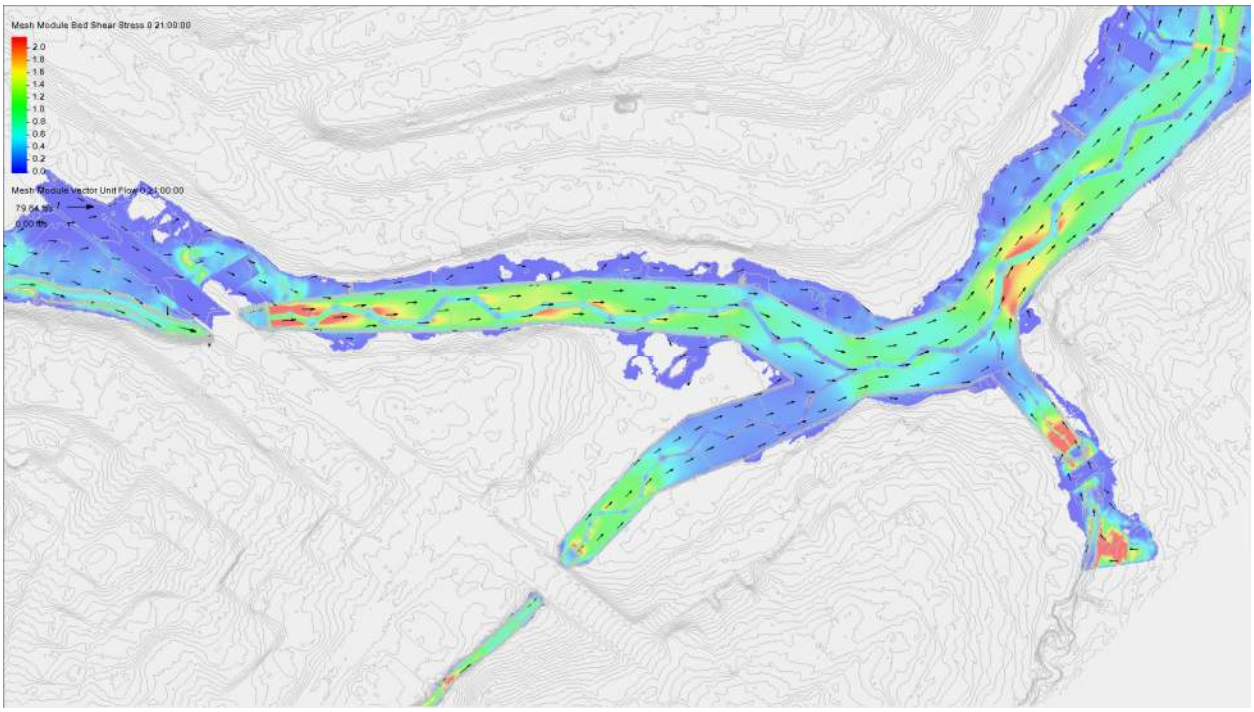


FIGURE 21: SCENARIO 2 UPPER REACH PROPOSED CONDITIONS – 100 YEAR STORM

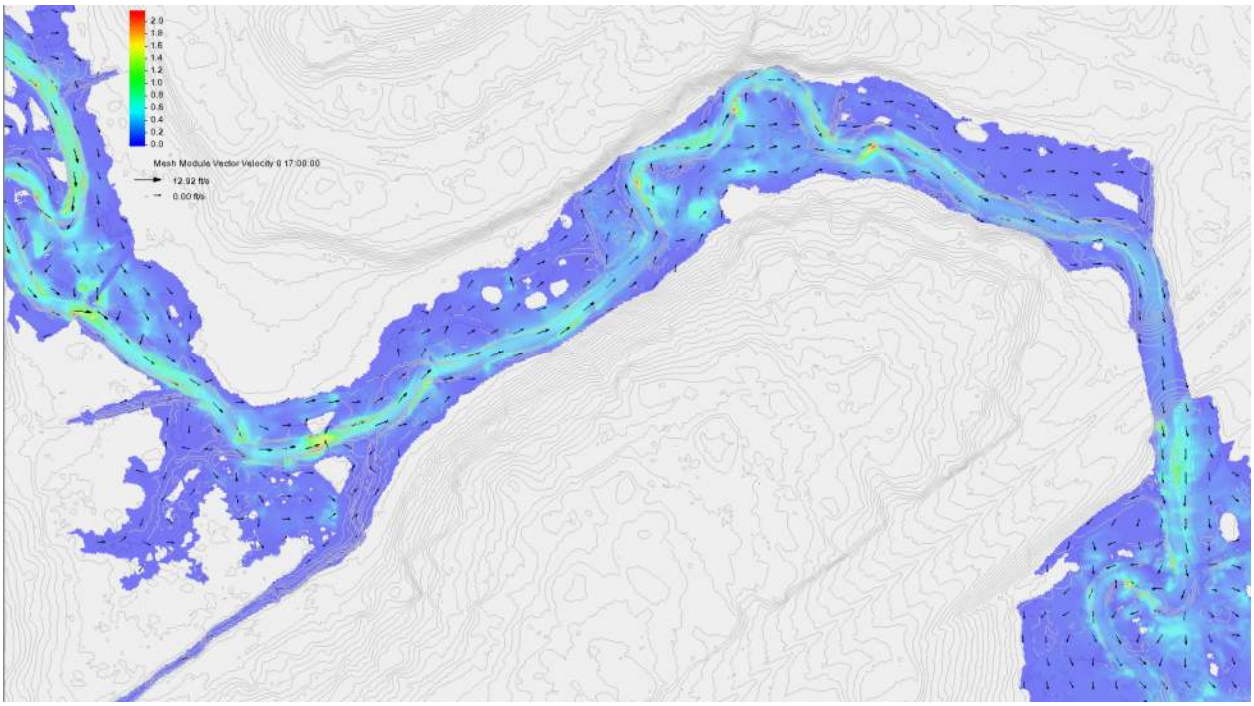


FIGURE 22: SCENARIO 2 LOWER REACH EXISTING CONDITIONS – 2 YEAR STORM

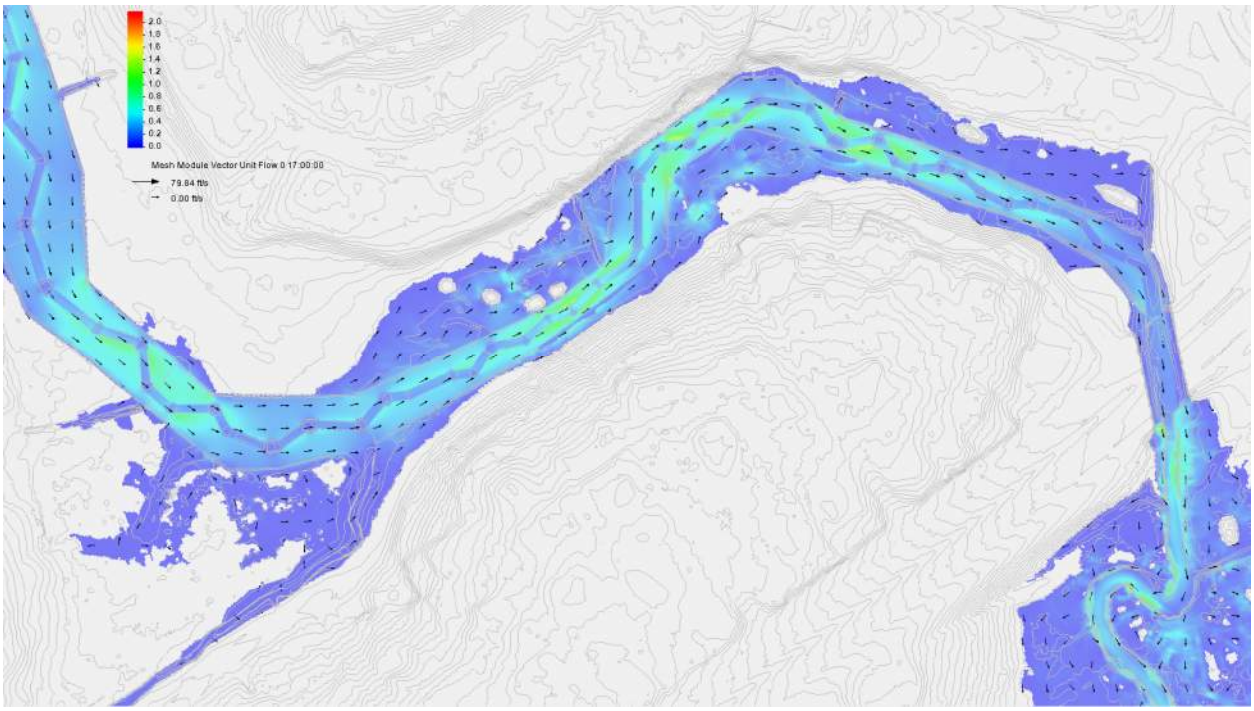


FIGURE 23: SCENARIO 2 LOWER REACH PROPOSED CONDITIONS – 2 YEAR STORM

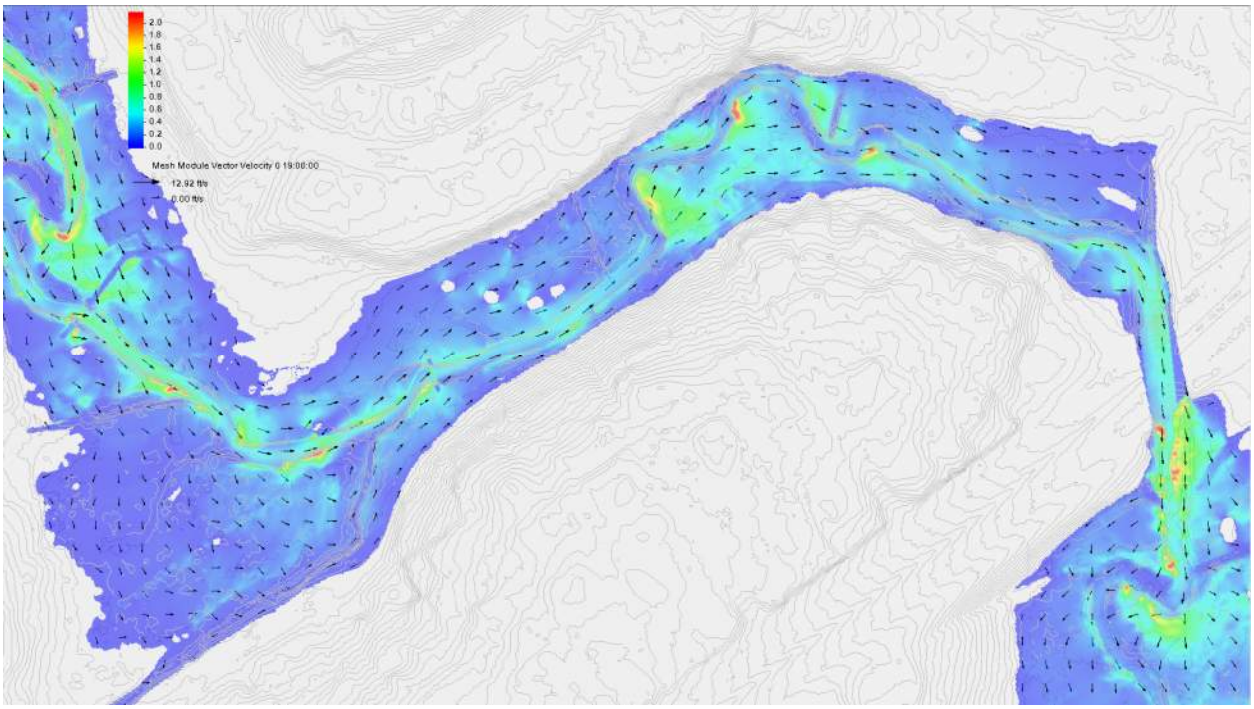


FIGURE 24: SCENARIO 2 LOWER REACH EXISTING CONDITIONS – 10 YEAR STORM

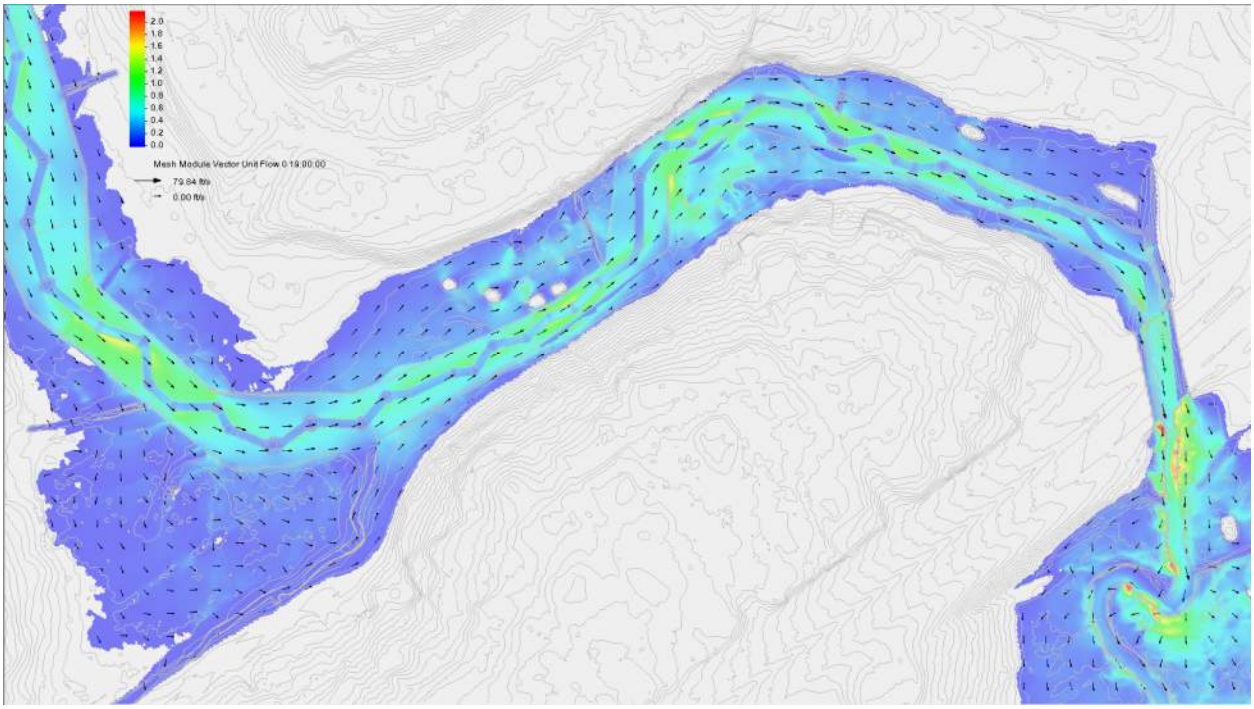


FIGURE 25: SCENARIO 2 LOWER REACH PROPOSED CONDITIONS – 10 YEAR STORM

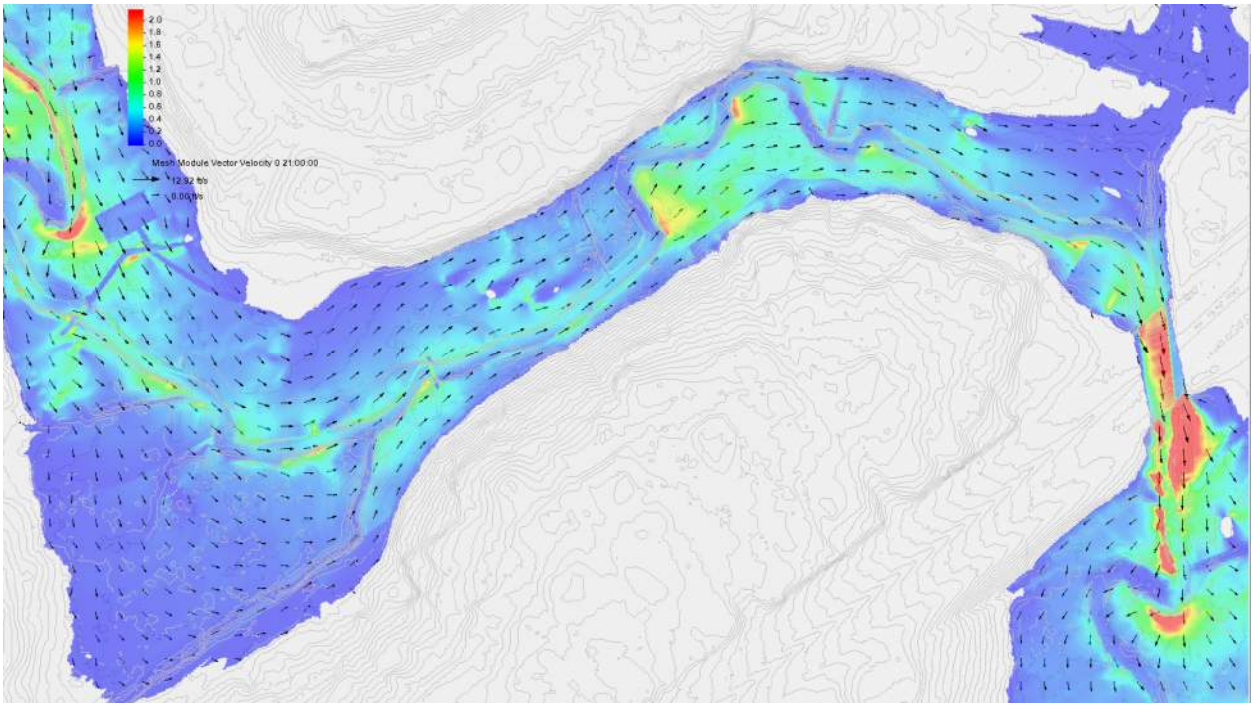


FIGURE 26: SCENARIO 2 LOWER REACH EXISTING CONDITIONS – 100 YEAR STORM

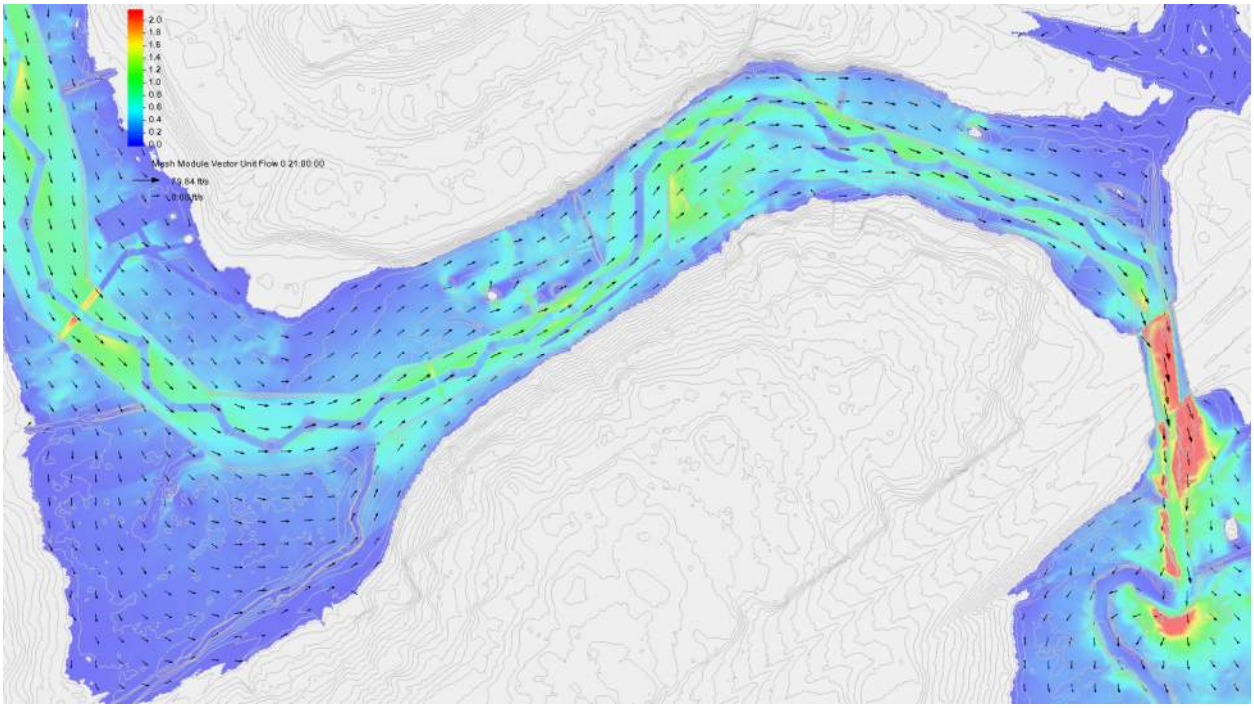


FIGURE 27: SCENARIO 2 LOWER REACH PROPOSED CONDITIONS – 100 YEAR STORM

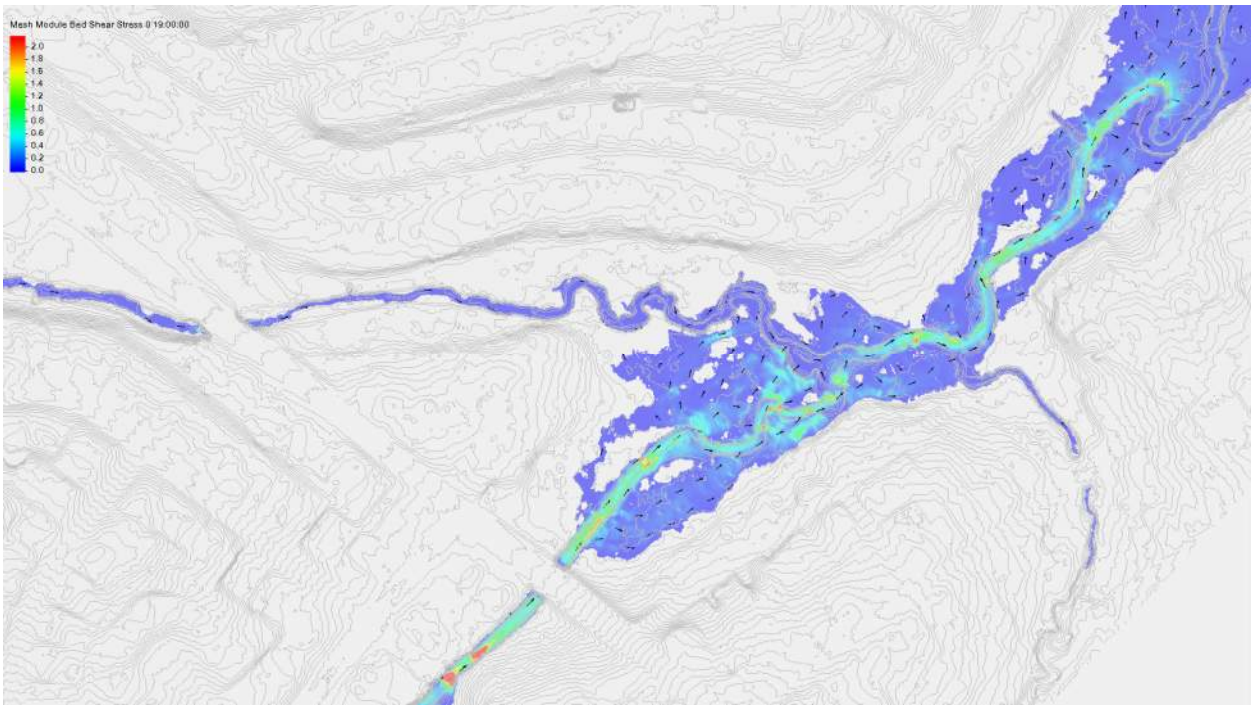


FIGURE 28: SCENARIO 3 UPPER REACH EXISTING CONDITIONS – 2 YEAR STORM

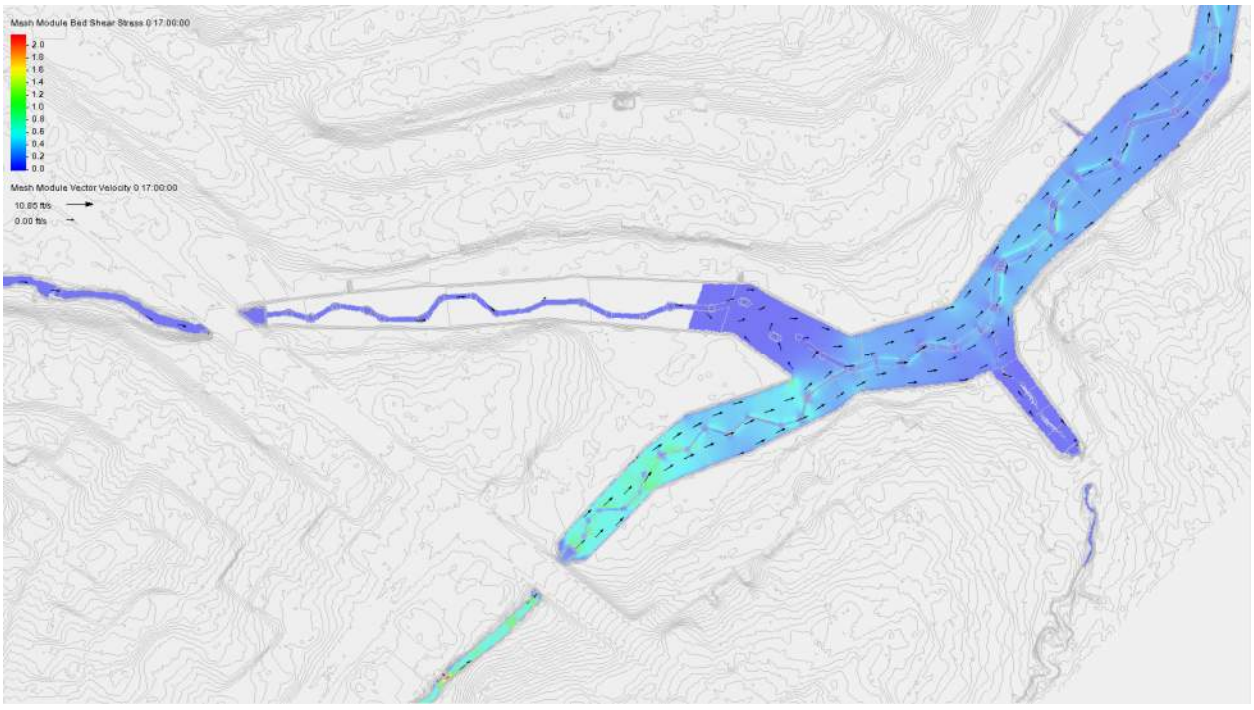


FIGURE 29: SCENARIO 3 PROPOSED CONDITIONS – 2 YEAR STORM

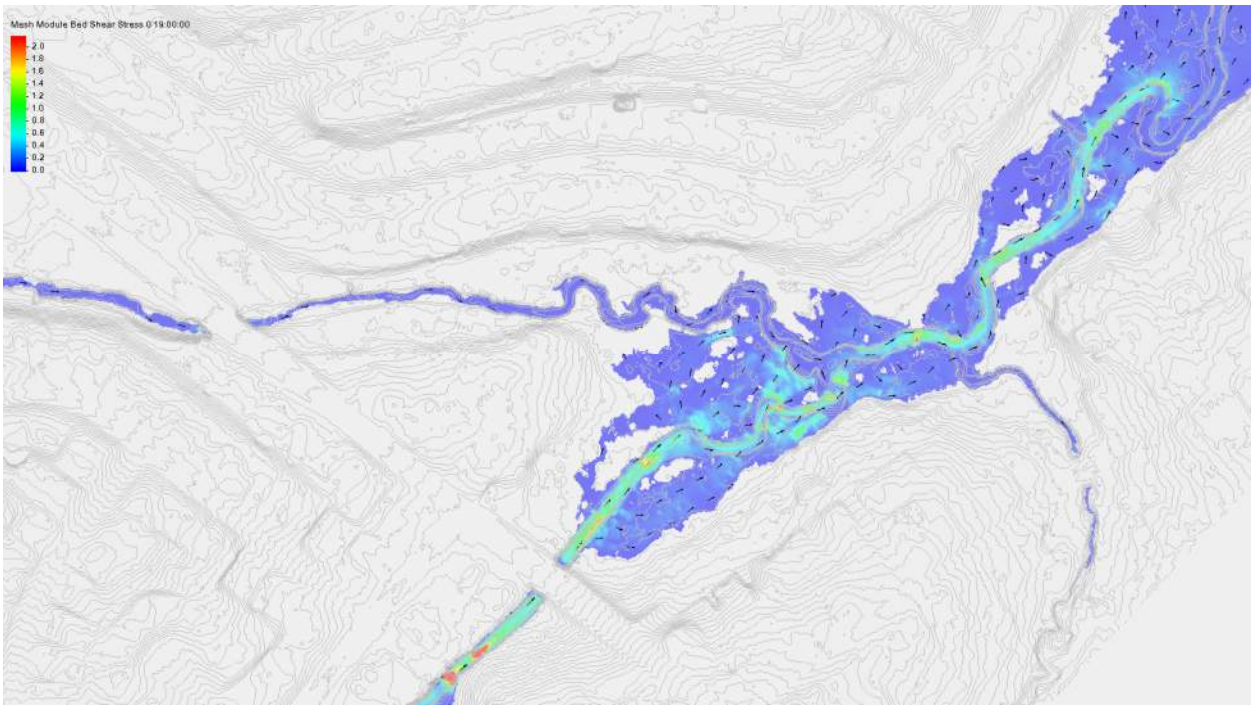


FIGURE 30: SCENARIO 3 EXISTING CONDITIONS – 10 YEAR STORM

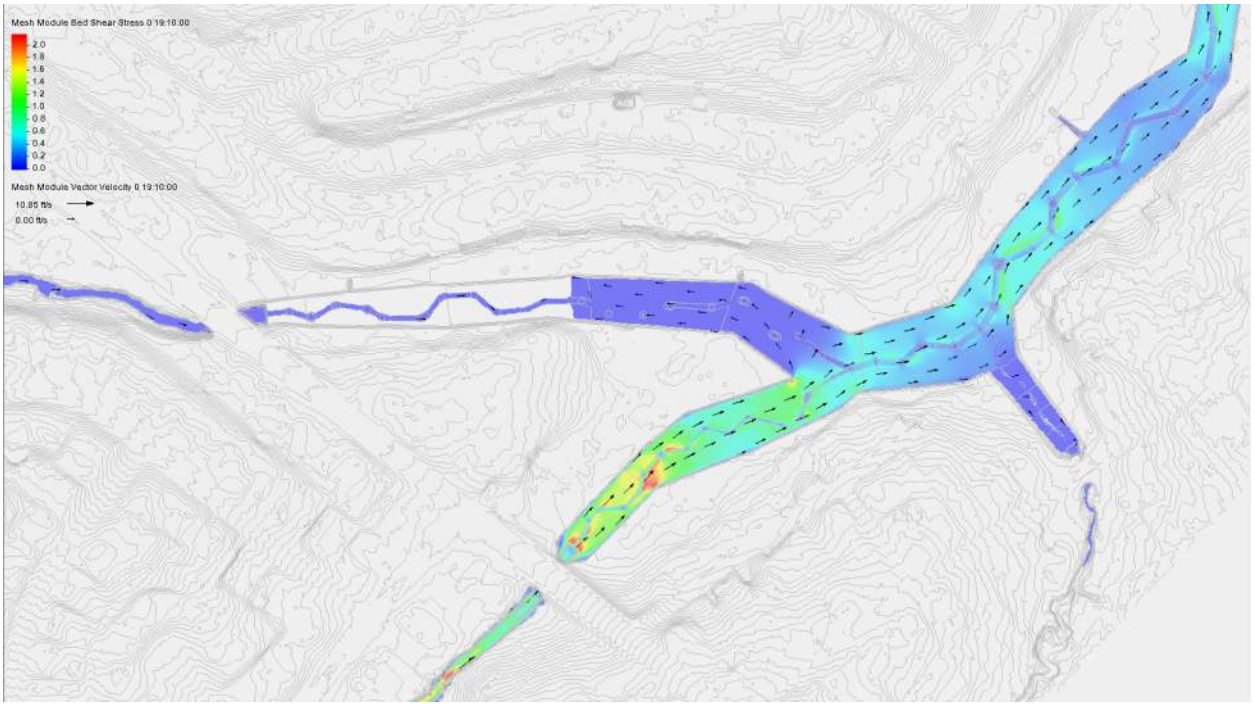


FIGURE 31: SCENARIO 3 PROPOSED CONDITIONS – 10 YEAR STORM

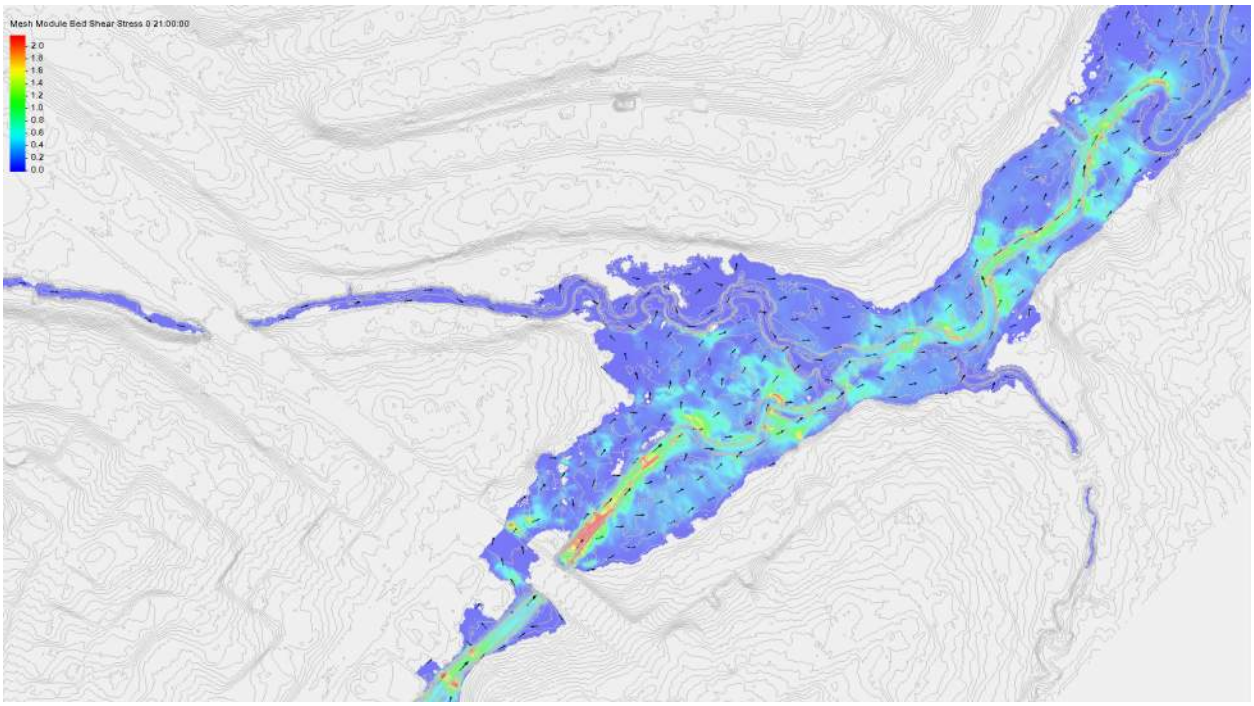


FIGURE 32: SCENARIO 3 EXISTING CONDITIONS – 100 YEAR STORM

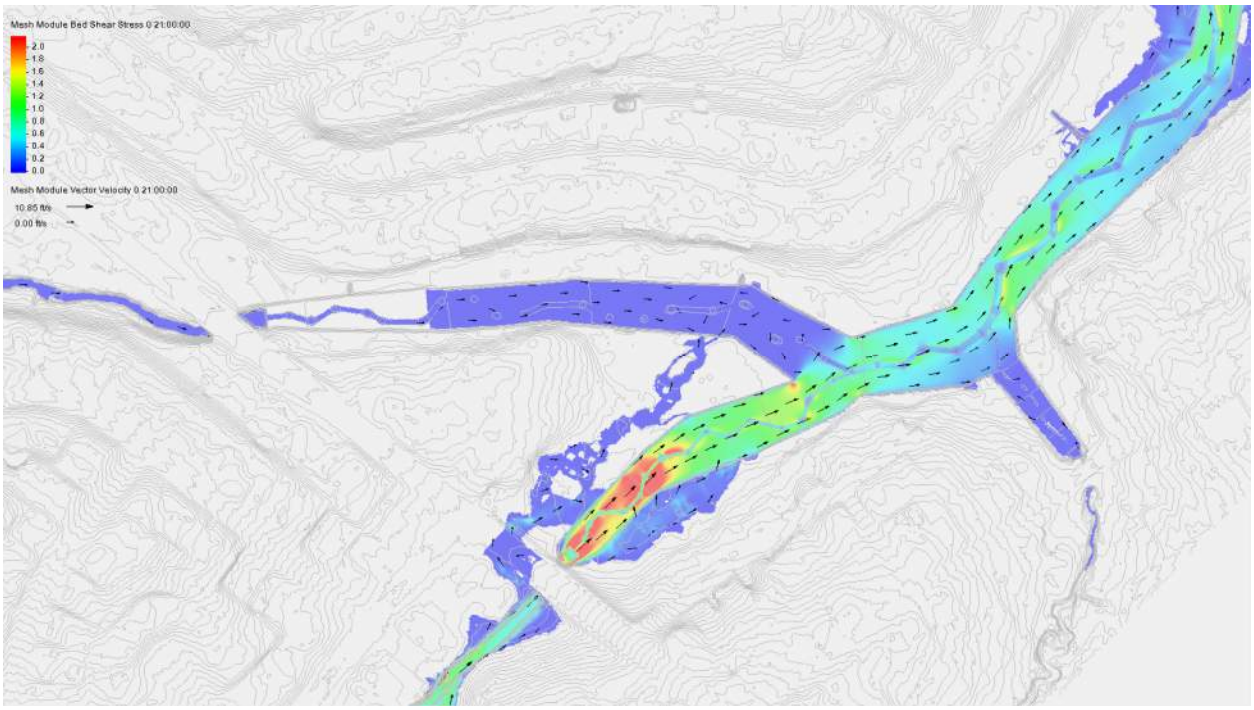


FIGURE 33: SCENARIO 3 PROPOSED CONDITIONS – 100 YEAR STORM

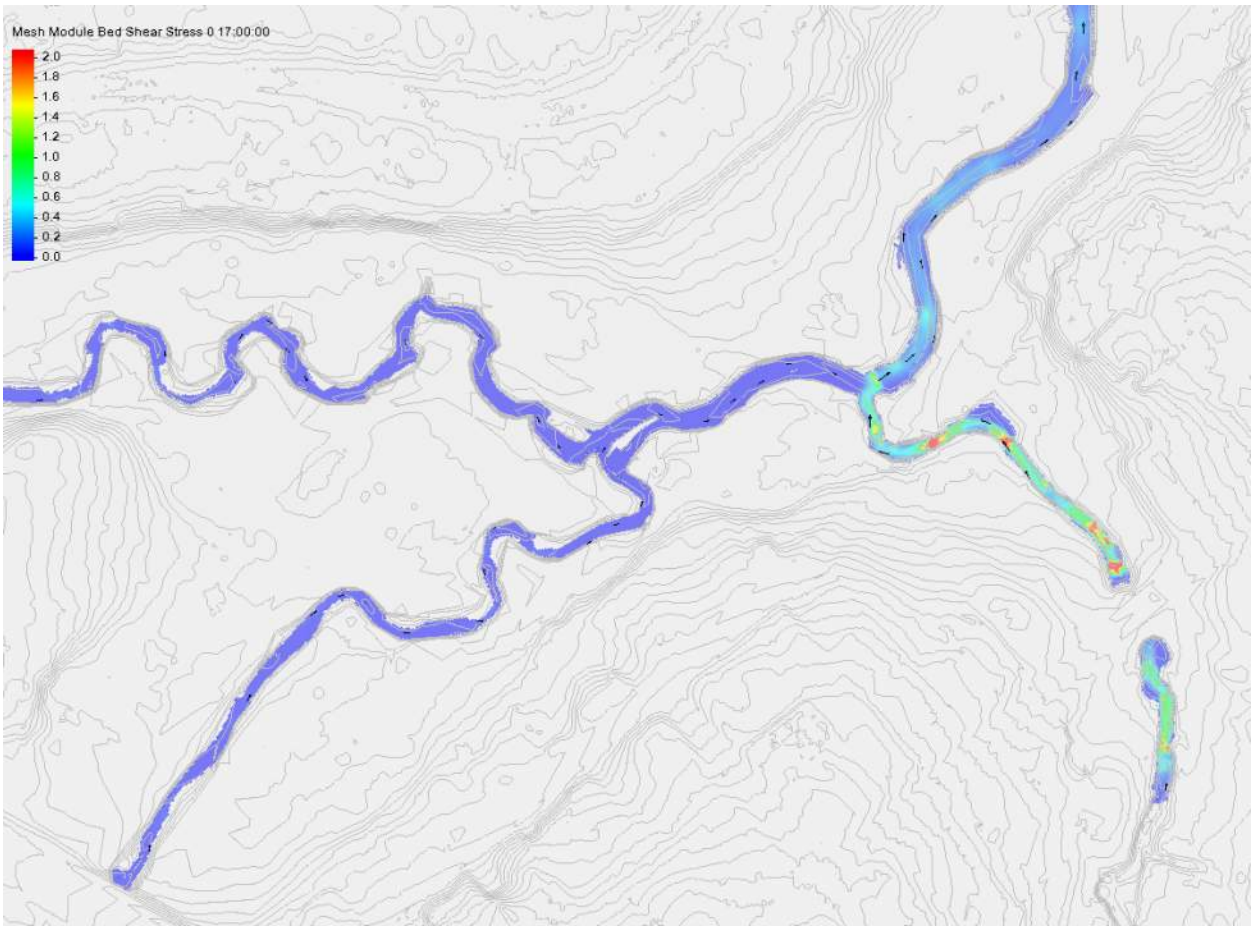


FIGURE 34: SCENARIO 4 EXISTING CONDITIONS – 2 YEAR STORM

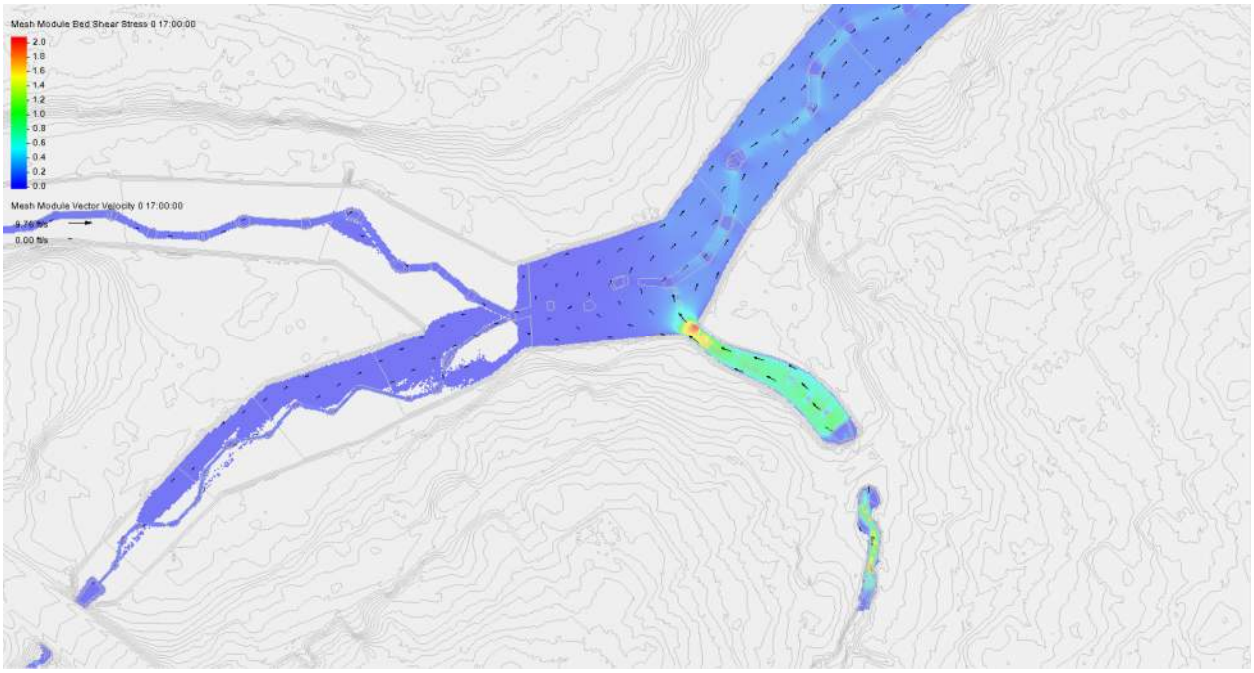


FIGURE 35: SCENARIO 4 PROPOSED CONDITIONS – 2 YEAR STORM

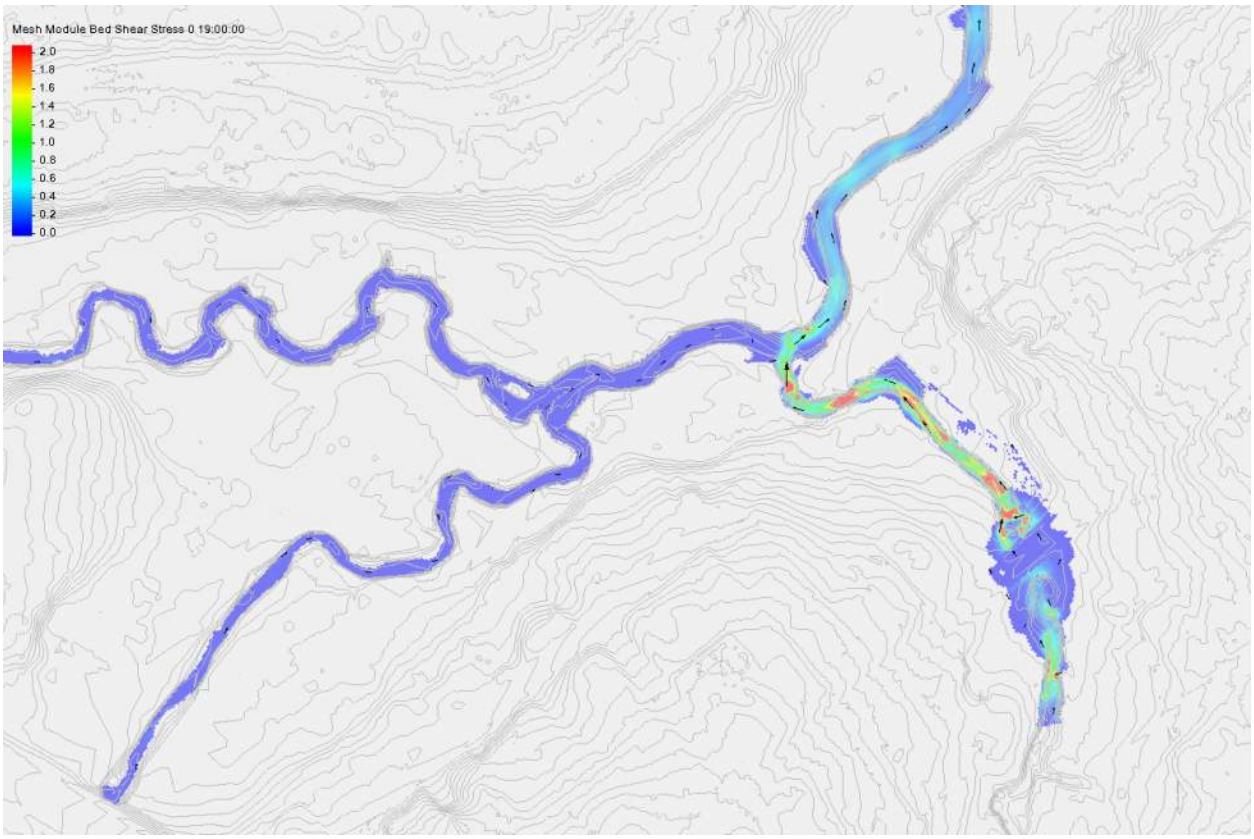


FIGURE 36: SCENARIO 4 EXISTING CONDITIONS – 10 YEAR STORM

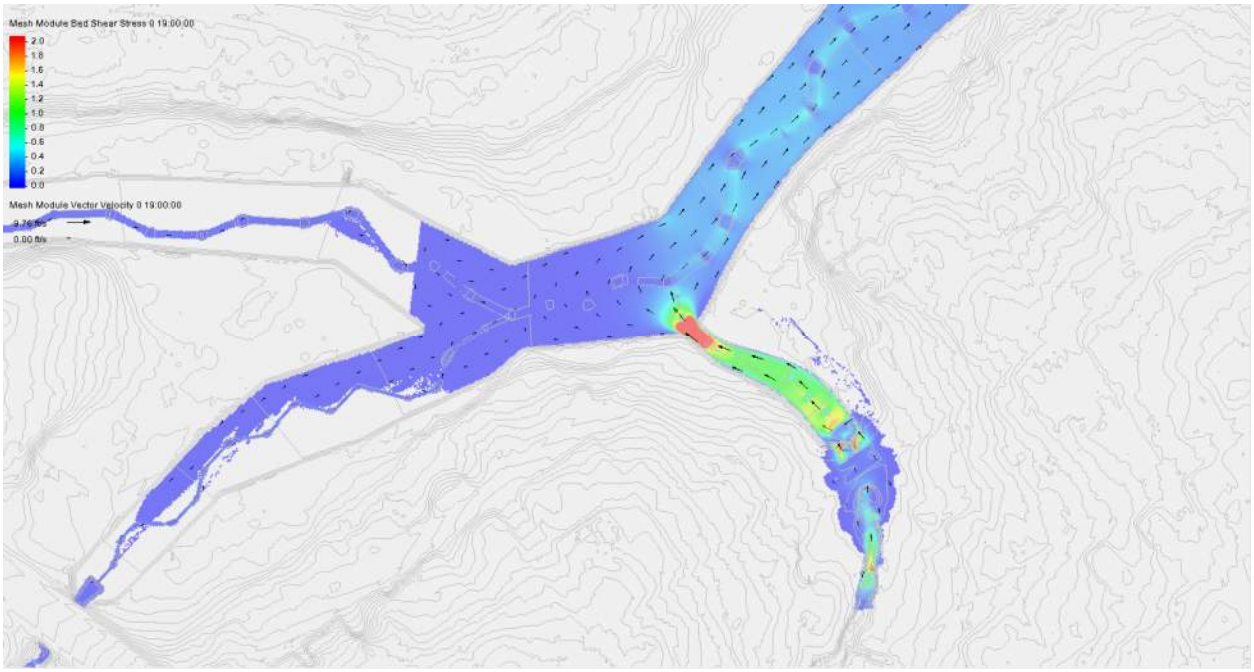


FIGURE 37: SCENARIO 4 PROPOSED CONDITIONS – 10 YEAR STORM

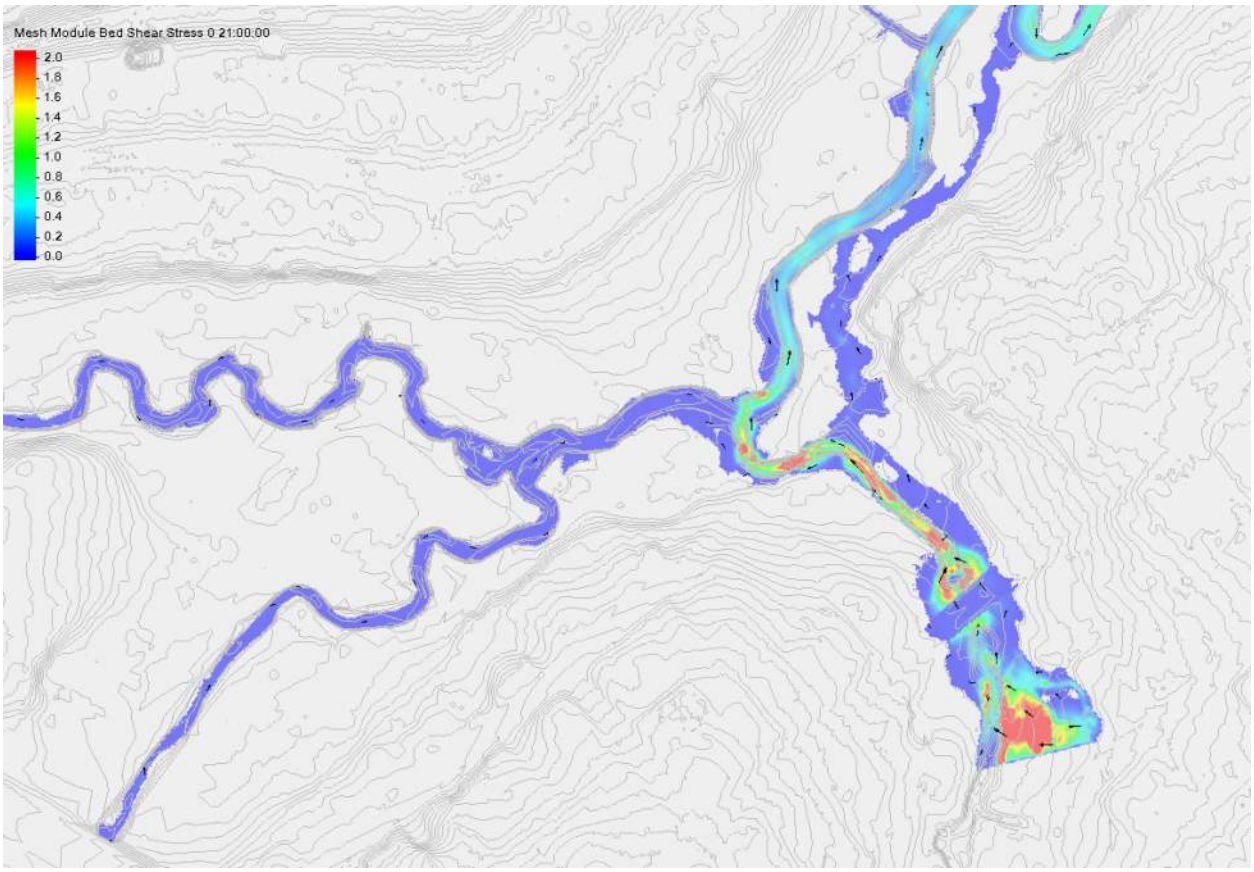


FIGURE 38: SCENARIO 4 EXISTING CONDITIONS – 100 YEAR STORM

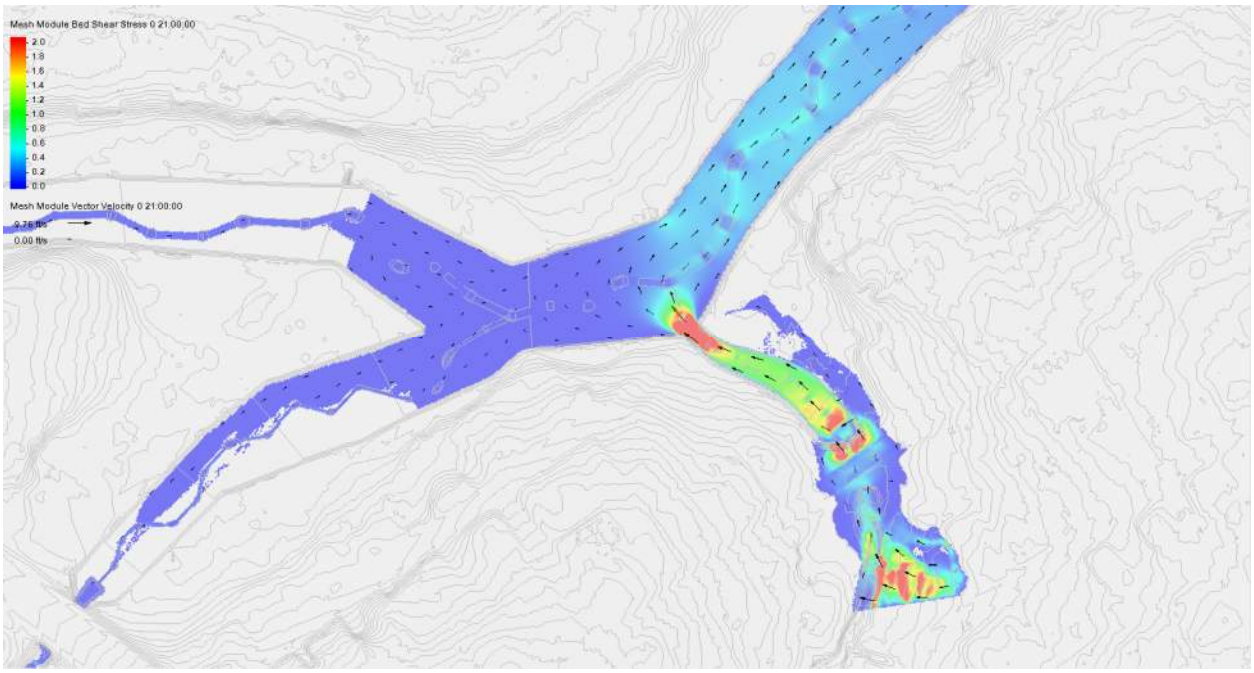


FIGURE 39: SCENARIO 4 PROPOSED CONDITIONS – 100 YEAR STORM

Section 4). The proposed conditions model output shows a significant improvement over existing conditions regarding channel shear stresses. Proposed conditions model outputs show floodplain shear stresses in the 2-3 psf for select areas, particularly just downstream of the box culverts conveying flows under Faulkland Road for Little Mill Creek and Tributary 1, just downstream of the proposed energy dissipation pool for Tributary 2, and the downstream limits of Tributary 2 at the constriction point between Tributary 2 and Little Mill Creek's floodplain. Therefore, in addition to vegetative establishments, R-5 rock underlayment is proposed in these select areas to provide long-term grade control. The proposed underlayment extends the full extent of the proposed floodplain and up the proposed side slopes two vertical feet. Additionally, constructed riffles will be armored with imported material and buried logs will be placed at the head and tail of the riffles in these locations. R-5 rock underlayment is also proposed in the vicinity of the new pedestrian bridges, extending 10-feet upstream and downstream of the bridges. The proposed conditions model shows shear stresses of approximately 2 psf or less under the bridges; however, the underlayment will help resist forces due to potential pressure flow under the bridges during larger storm events and to provide additional long-term stability for the concrete abutments.

The proposed conditions model generally shows low shear stresses in the proposed channel (0.5 psf or less); however, since it is likely impossible to keep all particles static under varying flow conditions, armored riffles are proposed where the utilities cross the floodplain and channel and for the riffles beneath the proposed bridges. This provides additional protection for sensitive infrastructure while providing a natural habitat on the surface that seamlessly ties in with the project.

The benefits of a wider restored floodplain can be seen approximately half-way between Tributary 2 and the upstream pedestrian bridge where most flood flows are conveyed in the restored floodplain at less than 1 psf. However, to further ensure long-term stability is achieved, floodplain log sills and corresponding channel logs are located at every 1.0' of vertical drop should instability arise.

In the lower reach of the project, from approximately the downstream pedestrian bridge to Centre Road, the proposed restored floodplain is very limited due to avoidance of impacts to existing sanitary sewer manhole infrastructure. Therefore, during larger storm events, flows escape the restored floodplain limits and access the high terraced floodplain. This reduces hydraulic conveyance through the restored floodplain, thus reducing stresses and the need for long-term grade control measures. Additionally, low chord of the Centre Road is at a relatively low elevation, contributing to backwater effects at the end of the project limits. This also impacts water surface elevations and contributes to 100-year water surface elevations reaching Wagoner Drive and the adjacent residential community.

11. FUNCTION BASED ASSESSMENT

The recommended integrated stream and wetland floodplain complex serves to restore as many lost hydrologic, hydraulic, geomorphic and ecological functions as is feasible given the extent of historic and modern impacts within the watershed and the project reach while protecting sanitary sewer infrastructure. The selected restoration approach serves to improve functional uplift to the greatest extent possible as follows:

- Hydrology: Impairments to the hydrologic conditions mainly stem from urban development of the watershed. This has resulted in shorter times of concentration and higher runoff curve

numbers yielding higher discharges with more intense peaks to the open channel system. Once the watershed runoff reaches the open channels, most of the active channels are incised and disconnected from adjacent floodplains and therefore high velocities, pollutant loads, and runoff volumes are largely retained and transmitted to the downstream receiving waters. The proposed design approach will serve to enhance hydrologic functions by the creation of a riparian wetland floodplain systems where base flow residence time can be increased within a created densely vegetated hyporheic zone. Frequent and non-frequent flood flows are designed to spread across a riparian wetland zone where vegetative filtering, ponding, and infiltration potential are enhanced.

- Hydraulics: Impairments to hydraulic conveyance include high channel incision that conveys large discharges from the watershed within the stream banks. The area targeted for stabilization has a channel that exhibits erosive conditions. The proposed restoration approach improves hydraulic and hydrodynamic functions by reducing erosive forces as a function of boundary shear stress and velocity for the full range flow events up to and including the 100-year storm event to the extent feasible. The created riparian wetland floodplain area is designed to spread runoff-producing storm events over a wide and highly attached floodplain area such that the vegetation rooting system and surface roughness provide the primary means to resist erosive forces. Imported streambed material is proposed throughout the proposed floodplain to protect from erosion should the vegetative layer fail in any areas.
- Geomorphology: The targeted area for stabilization has a natural channel system that is incised with routine near vertical banks composed of fine and erodible sediments. The recommended design approach improves in-stream geomorphic stability by conveying flood events within a highly attached floodplain area rather than within an oversized stream channel. In-channel flows are designed to, at minimum convey base flow and threshold discharges to create or maintain aquatic life and passage needs. The sediment supply reach upstream of the project consists of actively degrading concrete channels and near vertical banks which range from 3-5 feet tall in most areas. The project will allow for deposition and storage of sediment from the upstream reach during most storm events so the need for transporting significant bed load sediment is not necessary. Therefore, the channel design will focus on enhancing water quality and habitat by the creation of an riparian wetland system. In-stream and floodplain grade control will use imported streambed material and logs control structures harvested on-site.
- Water Quality/Chemistry: Existing impairments to water quality/chemistry include the urbanized areas of the watershed, and a highly impaired hyporheic zone by modern sediment infill of the streambed and bank. The recommended restoration strategies provide the means to improved water quality by creating a sediment and nutrient sink within the watershed, which may also contribute to the overall health of downstream waters. Additionally, surface water runoff for both base flow and flood flows entering the restoration site from the Little Mill Creek and its tributaries and from stormwater outfalls within the restoration site itself will be filtered through the created riparian wetland system and hyporheic exchange zone.
- Ecology: Similar to the reasons listed above for water quality/chemistry, existing impairments to ecology are due to the urbanized areas of the watershed producing elevated runoff conditions, modern sediment infill, and a highly degraded hyporheic zone. Aquatic and terrestrial ecology will

be enhanced by the development of a riparian wetland floodplain system and a channel network that stores and conveys base flow in a sustainable manner for the long-term. The floodplain wetland system will create conditions that promote long-term stability, habitat diversity, and greatly enhance conditions of hydrologic connectivity of base flow, groundwater and flood flows to a densely vegetated riparian root system and hyporheic zone resulting in improved water quality for wildlife and habitat. The restoration approach will focus on maintaining native substrate gravel materials where present for the long-term to provide sustainable habitat for macroinvertebrate populations, rather than armoring the existing deeply incised channels in-place typically flushing out native gravel materials on a routine flood flow basis. The design approach will also focus on creating conditions that retain organic carbon sources from the watershed (e.g., leaf litter, twigs, branches, logs) along the channel boundaries and riparian wetland floodplain areas. Retaining sources of organic carbon within the restored reaches provides an abundant food source for macroinvertebrates and promotes improved nutrient processing in the hyporheic zone.

The design team believes the integrated stream and wetland floodplain restoration approach is the most sustainable and environmentally beneficial restoration approach for this project and is highly consistent with the natural way streams and floodplains evolved within the Piedmont physiographic province during the Holocene period prior to European settlement. This design approach has been developed to specifically restore and/or enhance as many lost functions as is reasonably feasible in conjunction with significant historic and modern impacts to the watershed and project site itself. Additionally, this restoration approach corresponds well with the *EPA's Principles for Ecological Restoration of Aquatic Resources Guidance (EPA841-F-00-003).* This EPA guidance document focuses on achieving multiple ecological benefits by restoring ecological integrity, natural structure and function of native species, addressing causes of degradation, and designing for self-sustainability using a multi-disciplinary team, natural fixes and anticipated future morphological changes. This EPA language matches up well with the series of studies performed to date and restoration design strategy.

11.1 Functional Assessment Parameters

A stream functions pyramid was developed by Harman et al (2012) to separate stream functions into a hierarchy of categories, including, Level 1 – Hydrology, Level 2 – Hydraulics, Level 3 – Geomorphology, Level 4 – Physiochemical, and Level 5 – Biology. It should be noted that this report assesses Water Quality/Chemistry for Level 4 and Ecology for Level 5 of the functional pyramid, as these functions relate better to the integrated stream and wetland complex systems that are being created for this project. Additionally, these targeted functions relate better to the physical surroundings of the restoration site. The key functional assessment parameters for the proposed design approach, and that meet the project's goals and objectives, have been identified and discussed below, referencing the pyramid categories. Measurement metrics for each function have been identified. Although many of the functions discussed will affect the Water Quality/Chemistry (Level 4) and Ecology (Level 5) properties of the stream, baseline data is not available to quantify uplift between pre- and post-restoration conditions. Measurement metrics for these categories are to observe the post-restoration only. A function assessment parameter summary is included in Table 22.

11.1.1 Stream and Floodplain Functions

Channel and Wetland Floodplain Flow Exchange (Level 1 – Hydrology, with effects on Level 2 – Hydraulics, Level 3 – Geomorphology, Level 4 – Water Quality/Chemistry, and Level 5 – Ecology): The most significant functional objective for stream restoration is the hydrodynamic balance function (Fischenich, 2006, and referenced by Harman et al). It was identified as having the greatest effect on other functions and supports all other functions listed in the framework, either directly or indirectly. For this reason, we recommend maximizing the frequency of connection to a wetland floodplain during runoff. Our assessment and design process focused specifically on achieving long-term stability by finding the hydrodynamic balance within today's watershed conditions and site constraints. The proper hydrodynamic balance to achieve long-term stability and promote high functional uplift is directly related to frequency of channel and floodplain flow exchange. The presence of a frequently inundated floodplain will promote regular exchange of water from the channel to the floodplain, enhance riparian wetland vegetation sustainability, encourage redoximorphic features and other indicators of hydric soils, and improve filtering of nutrient and sediments within the hydrophytic vegetation. Runoff generating flow events are frequently exchanged between channel and floodplain to distribute and retain water, nutrients, and carbon and support riparian wetlands by frequent inundation. The design approach also targets the removal of the high clay content soils (legacy sediments) around the restored channel and floodplain boundaries, which will promote increased hyporheic exchange. The measurement metric to assess success and/or impairments includes:

- Observations and photo-documentation of floodplain flow patterns, rack lines, and inundation markings following runoff events.

Riparian Wetland Floodplain Stability (Level 2 – Hydraulics, with effects on Level 3 – Geomorphology, Level 4 – Water Quality/Chemistry, and Level 5 – Ecology): Similar to channel and floodplain flow exchange parameter above, achieving the proper hydrodynamic balance is critically important to the creation of a stable restored wetland floodplain system. The floodplain design has been greatly informed by 2D hydrodynamic modeling through the evaluation of shear stress, velocity and velocity vectors which yielded a sustainable grading approach and to incorporate floodplain controls to help prevent significant scour of the floodplain surface during large flood events. The floodplain design allows for riparian wetland establishment and retention and processing of organic matter during frequent flood events. The measurement metric to assess success and/or impairments includes:

- Observations and photo-documentation of floodplain scour, wetland vegetation, and organic material accumulation on floodplain.

Channel Stability (Level 3 – Geomorphology, with effects on Level 1 – Hydrology, Level 2 – Hydraulics, Level 4 – Water Quality/Chemistry, and Level 5 – Ecology): Similar to channel and floodplain flow exchange and floodplain stability parameters above, achieving the proper hydrodynamic balance is also critically important to the creation of a stable restored channel. The stream channel design has been informed by 2D hydrodynamic modeling. The model allowed the evaluation of shear stress, velocity and velocity vectors resulting in a sustainable approach to help prevent significant streambed scour or bank erosion within the channel, and to incorporate rock and log controls where needed to protect the channel during large flood events. The design has focused on minimizing bank stress sufficiently to prevent significant bank erosion, and to maintain vegetative cover during large flood events. The measurement metric to assess success and/or impairments include:

- Observations and photo-documentation of bed controls, bank erosion, bank vegetation, and retention of channel bed controls

TABLE 22: FUNCTIONAL ASSESSMENT PARAMETERS

Level and Category	Parameter	Measurement Method	Pre-Restoration Condition		Post-Restoration Condition Goal	
			Value	Rating	Value	Rating
1 Hydrology	Channel and Floodplain Bench Flow Exchange	Observations and photo-documentation of floodplain flow patterns, rack lines and inundation markings following runoff events	Poor	Not Functioning	Restored Function	Designed to Function
	Hyporheic Flow Exchange	Perform wetland auger borings during site observations and prepare photo-documentation of sustained channel flow and groundwater saturation of restored floodplain root zone during prolonged periods	Moderate	Functioning at Risk	Restored Function	Designed to Function
2 Hydraulics	Floodplain Stability	Observations and photo documentation of floodplain scour, wetland vegetation, and organic material accumulation on the floodplain	Poor	Not Functioning	Moderate	Functioning at Risk
3 Geomorphology	Channel Stability	Observations and photo documentation of bed controls, bank erosion, bank vegetation, and retention of channel bed controls	Poor	Not Functioning	Restored Function	Designed to Function
4 Water Quality/Chemistry	Sediment and Organic Carbon Retention	Observations and photo documentation of sediment and organic carbon retention	Poor	Not Functioning	Moderate	Functioning at Risk
5 Ecology	Biodiversity	Observations and photo documentation of aquatic and riparian flora and fauna	Poor	Not Functioning	Moderate	Functioning at Risk

12. POLLUTANT LOAD REMOVAL EFFICIENCIES

Removing high stream banks that are subject to erosive forces immediately removes a source of sediment and nutrients from the project site. The high flows occurring during storm events cause excessive erosion of stream banks and stream beds, leading to the degraded stream channel conditions. The high storm flows transport this sediment downstream to the Christina River. TMDL credits were calculated using the Expert Panel Report methodology using Protocol 1 (Credit for Prevented Sediment during Storm Flow), Protocol 2 (Credit for In-Stream and Riparian Nutrient Processing within the Hyporheic Zone during Base Flow), Protocol 3 (Credit for Floodplain Reconnection Volume), and the approved alternative buffer planting methodology. Alternative buffer planting credits are based on proposed lowland forest planting with meadow establishment within Woodland Run Park for areas outside of the stream/floodplain restoration. The stream/floodplain restoration limits were excluded from the buffer planting crediting to not double count crediting. The lowland forest plantings with meadow establishment were divided into riparian and non-riparian buffer plantings where riparian buffer plantings occur within 100-ft of a perennial stream and non-riparian buffer plantings occur outside of the 100-ft perennial stream buffer. Buffer plantings are calculated based on the acreage of land cover conversion. The total calculated credits were also converted into Equivalent Impervious Acres (EIA). Tables 23 and 24 summarizes the computed credits and EIA and detailed credit computations are included in Appendix J.

TABLE 23: SUMMARY OF PROTOCOLS 1, 2, AND 3 RESTORATION CREDITS

Methodology	TSS (tons/year)	TP (pounds/year)	TN (pounds/year)
Expert Panel Protocol 1	115.5	59.7	163.7
Expert Panel Protocol 2	n/a	n/a	643.4
Expert Panel Protocol 3	7.9	83.5	1,936.1
Project Total	**123.5**	**143.1**	**2743.2**
Equivalent Impervious Acres	**82.2**		

TABLE 24: SUMMARY OF BUFFER PLANTING CREDITS

Methodology	New Forest Planting Area (Ac)	EIA per Acre of Land	EIA Credits
Non-Riparian Forest Planting	1.3	1.1	1.4
Riparian Forest Planting	2.7	1.5	4.1
Equivalent Impervious Acres	**5.5**		

13. REFERENCES

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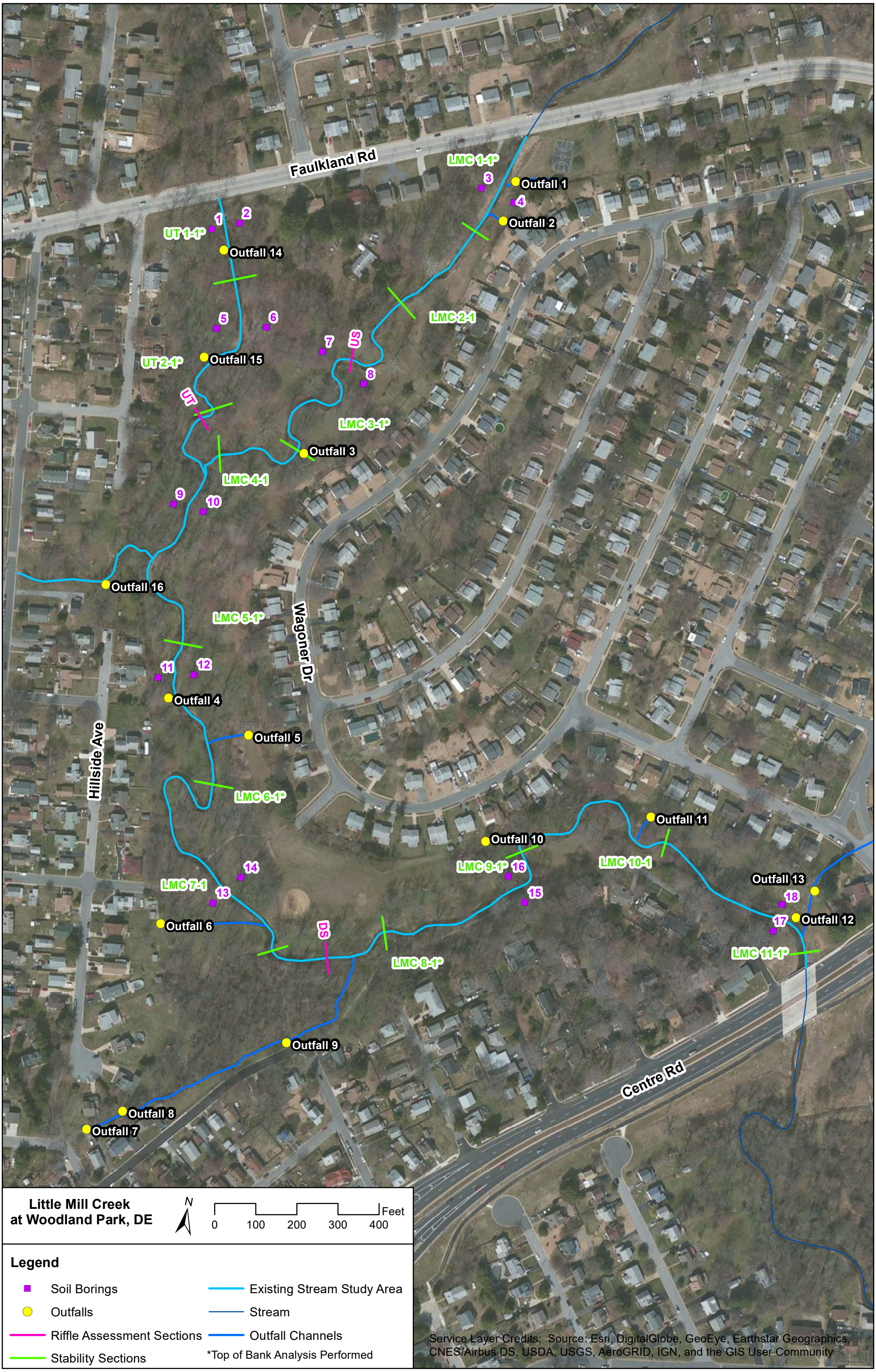
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APPENDIX A
DATA COLLECTION MAP

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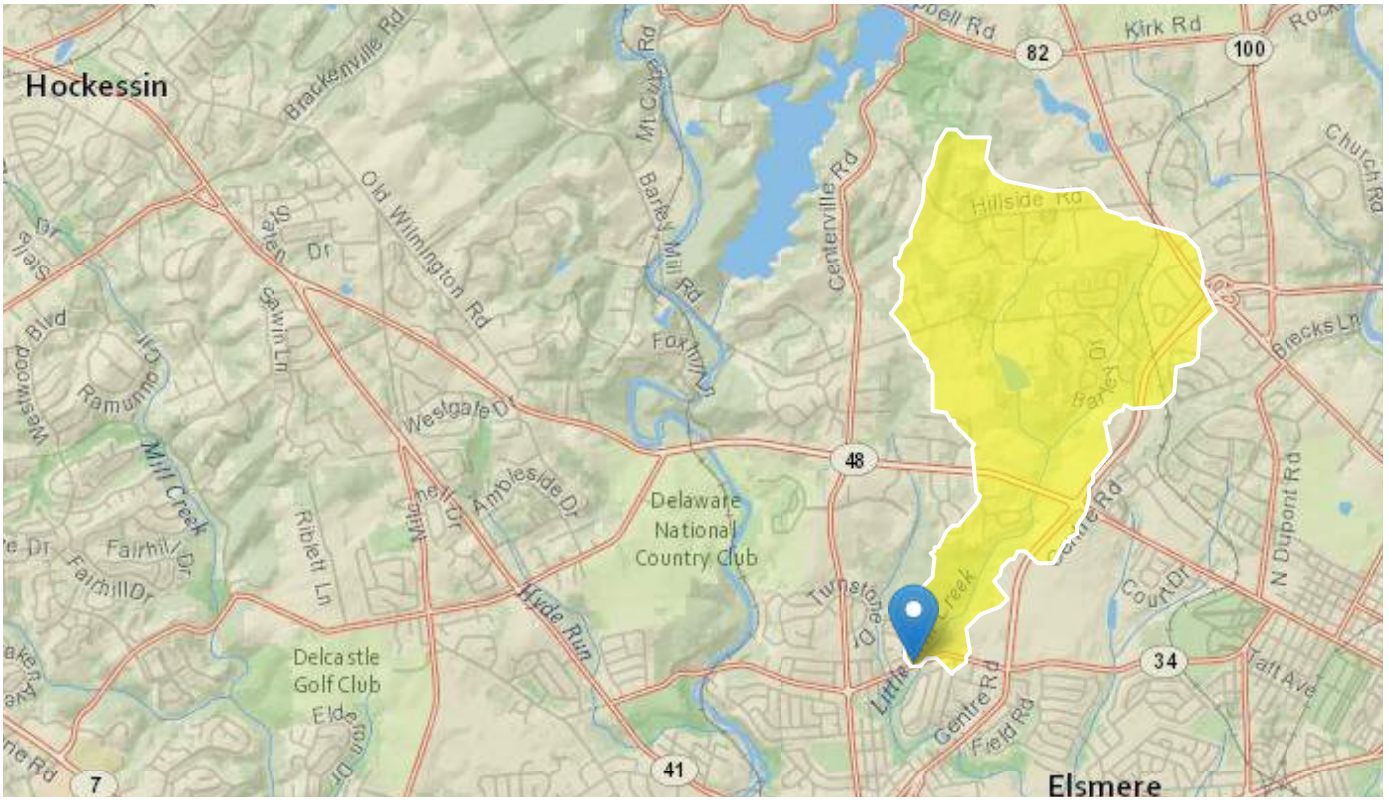

Faulkland Rd
LMC 1-1*
3
Outfall 1
4
Outfall 2
1
2
UT 1-1*
Outfall 14
LMC 2-1
5
6
7
US
8
UT 2-1*
Outfall 15
UT
LMC 3-1*
Outfall 3
LMC 4-1
9
10
Outfall 16
LMC 5-1*
Wagoner Dr
11
12
Outfall 4
Outfall 5
Hillside Ave
LMC 6-1*
Outfall 11
Outfall 10
LMC 9-1*
16
LMC 10-1
14
LMC 7-1
13
15
Outfall 13
18
17
Outfall 12
Outfall 6
DS
LMC 8-1*
LMC 11-1*
Outfall 9
Centre Rd
Outfall 8
Outfall 7
Little Mill Creek
at Woodland Park, DE
N
0
100
200
300
400
Feet
Legend
Soil Borings
Outfalls
Riffle Assessment Sections
Stability Sections
Existing Stream Study Area
Stream
Outfall Channels
*Top of Bank Analysis Performed
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

APPENDIX B
HYDROLOGIC ANALYSIS

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StreamStats Report -- Little Mill Creek at Faulkland Road

Region ID: DE
Workspace ID: DE20220111141520936000
Clicked Point (Latitude, Longitude): 39.74803, -75.61834
Time: 2022-01-11 09:15:39 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1.88	square miles
FOREST	Percentage of area covered by forest	22.2078	percent
SOILA	Percentage of area of Hydrologic Soil Type A	4.3785	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	6.2399	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.9251	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.66	percent

Parameter Code	Parameter Description	Value	Unit
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	45	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	9.16	percent

Peak-Flow Statistics Parameters [Piedmont Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.88	square miles	0.31	319
FOREST	Percent Forest	22.2078	percent	4.07	84.9
SOILA	Percent Hydrologic Soil Type A	4.3785	percent	0	7.22
IMPNLCD01	Percent Impervious NLCD2001	6.2399	percent	0.1	38.3
STORNHD	Percent Storage from NHD	0.9251	percent	0	2.92

Peak-Flow Statistics Flow Report [Piedmont Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	ASEp	Equiv. Yrs.
50-percent AEP flood	314	ft^3/s	195	505	28.9	28.9	4.1
20-percent AEP flood	538	ft^3/s	337	858	28.1	28.1	6.7
10-percent AEP flood	655	ft^3/s	389	1100	29.9	29.9	8.4
4-percent AEP flood	863	ft^3/s	503	1480	31	31	11.3
2-percent AEP flood	1020	ft^3/s	576	1800	32.7	32.7	12.7
1-percent AEP flood	1190	ft^3/s	647	2190	35.1	35.1	13.5
0.5-percent AEP flood	1360	ft^3/s	706	2620	38	38	13.8
0.2-percent AEP flood	1600	ft^3/s	777	3290	48.3	48.3	13.7

Peak-Flow Statistics Citations

Ries, K.G., III, and Dillow, J.J.A.,2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p. (http://pubs.usgs.gov/sir/2006/5146/)

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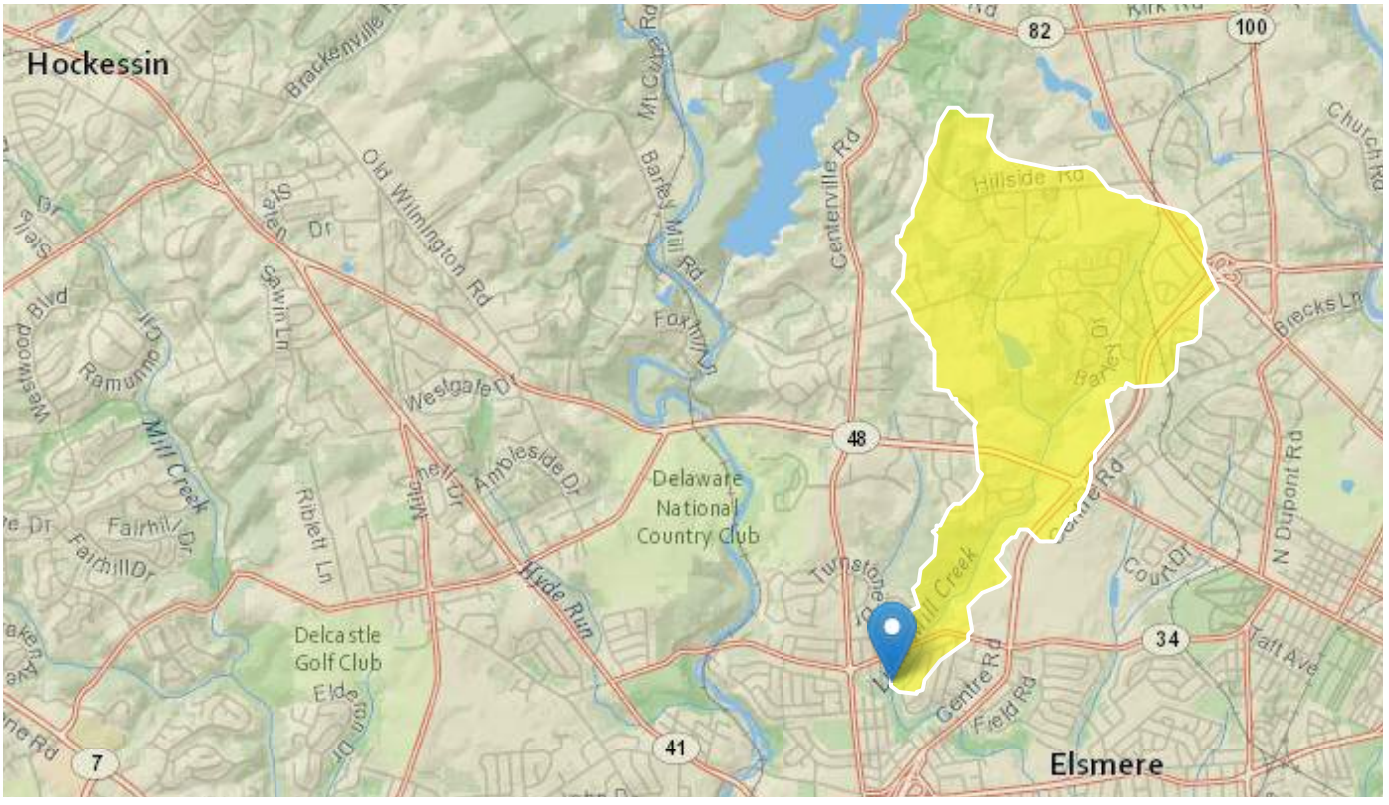
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Application Version: 4.6.2
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

StreamStats Report -- Little Mill Creek Upstream of Tributary 1

Region ID: DE
Workspace ID: DE20220111180535404000
Clicked Point (Latitude, Longitude): 39.74552, -75.62044
Time: 2022-01-11 13:05:54 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1.92	square miles
FOREST	Percentage of area covered by forest	21.6919	percent
SOILA	Percentage of area of Hydrologic Soil Type A	4.422	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	6.566	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.9036	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.65	percent

Parameter Code	Parameter Description	Value	Unit
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	46	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	9.54	percent

Peak-Flow Statistics Parameters [Piedmont Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.92	square miles	0.31	319
FOREST	Percent Forest	21.6919	percent	4.07	84.9
SOILA	Percent Hydrologic Soil Type A	4.422	percent	0	7.22
IMPNLCD01	Percent Impervious NLCD2001	6.566	percent	0.1	38.3
STORNHD	Percent Storage from NHD	0.9036	percent	0	2.92

Peak-Flow Statistics Flow Report [Piedmont Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	ASEp	Equiv. Yrs.
50-percent AEP flood	324	ft^3/s	201	521	28.9	28.9	4.1
20-percent AEP flood	551	ft^3/s	346	879	28.1	28.1	6.7
10-percent AEP flood	674	ft^3/s	401	1130	29.9	29.9	8.4
4-percent AEP flood	888	ft^3/s	518	1520	31	31	11.3
2-percent AEP flood	1050	ft^3/s	594	1850	32.7	32.7	12.7
1-percent AEP flood	1230	ft^3/s	670	2260	35.1	35.1	13.5
0.5-percent AEP flood	1400	ft^3/s	728	2690	38	38	13.8
0.2-percent AEP flood	1640	ft^3/s	799	3370	48.3	48.3	13.7

Peak-Flow Statistics Citations

Ries, K.G., III, and Dillow, J.J.A.,2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p. (http://pubs.usgs.gov/sir/2006/5146/)

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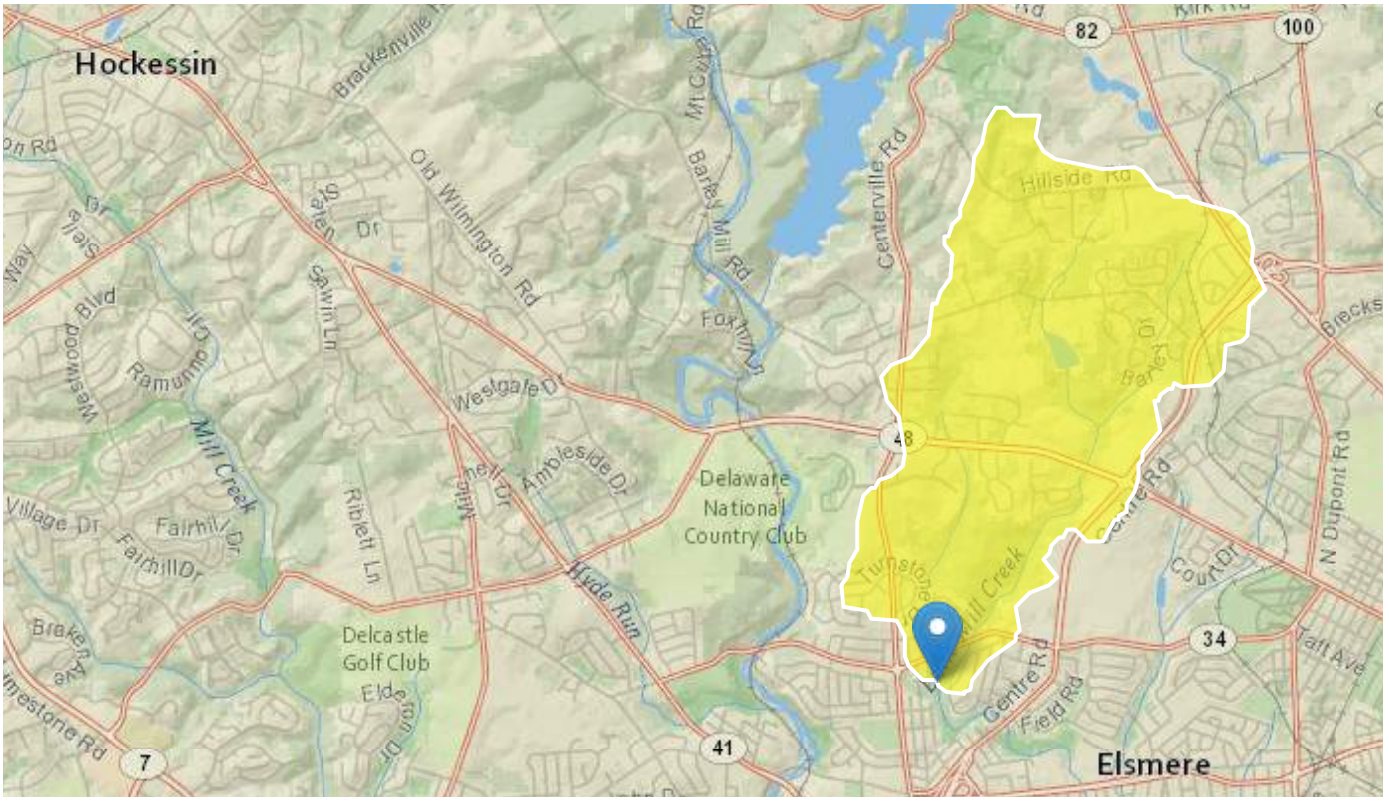
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USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.6.2
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

StreamStats Report -- Confluence of Little Mill Creek and Tributary 1

Region ID: DE
Workspace ID: DE20220111180300099000
Clicked Point (Latitude, Longitude): 39.74551, -75.62053
Time: 2022-01-11 13:03:19 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.57	percent
DRNAREA	Area that drains to a point on a stream	2.7	square miles
FOREST	Percentage of area covered by forest	21.7526	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	8.2038	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	51.1	percent

Parameter Code	Parameter Description	Value	Unit
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	11.8	percent
SOILA	Percentage of area of Hydrologic Soil Type A	4.9469	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.6441	percent

Peak-Flow Statistics Parameters [Piedmont Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.7	square miles	0.31	319
FOREST	Percent Forest	21.7526	percent	4.07	84.9
SOILA	Percent Hydrologic Soil Type A	4.9469	percent	0	7.22
IMPNLCD01	Percent Impervious NLCD2001	8.2038	percent	0.1	38.3
STORNHD	Percent Storage from NHD	0.6441	percent	0	2.92

Peak-Flow Statistics Flow Report [Piedmont Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	ASEp	Equiv. Yrs.
50-percent AEP flood	408	ft^3/s	254	655	28.9	28.9	4.1
20-percent AEP flood	676	ft^3/s	426	1070	28.1	28.1	6.7
10-percent AEP flood	891	ft^3/s	542	1460	29.9	29.9	8.4
4-percent AEP flood	1190	ft^3/s	711	1990	31	31	11.3
2-percent AEP flood	1430	ft^3/s	831	2460	32.7	32.7	12.7
1-percent AEP flood	1690	ft^3/s	947	3020	35.1	35.1	13.5
0.5-percent AEP flood	1950	ft^3/s	1050	3640	38	38	13.8
0.2-percent AEP flood	2330	ft^3/s	1170	4630	48.3	48.3	13.7

Peak-Flow Statistics Citations

Ries, K.G., III, and Dillow, J.J.A.,2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p. (http://pubs.usgs.gov/sir/2006/5146/)

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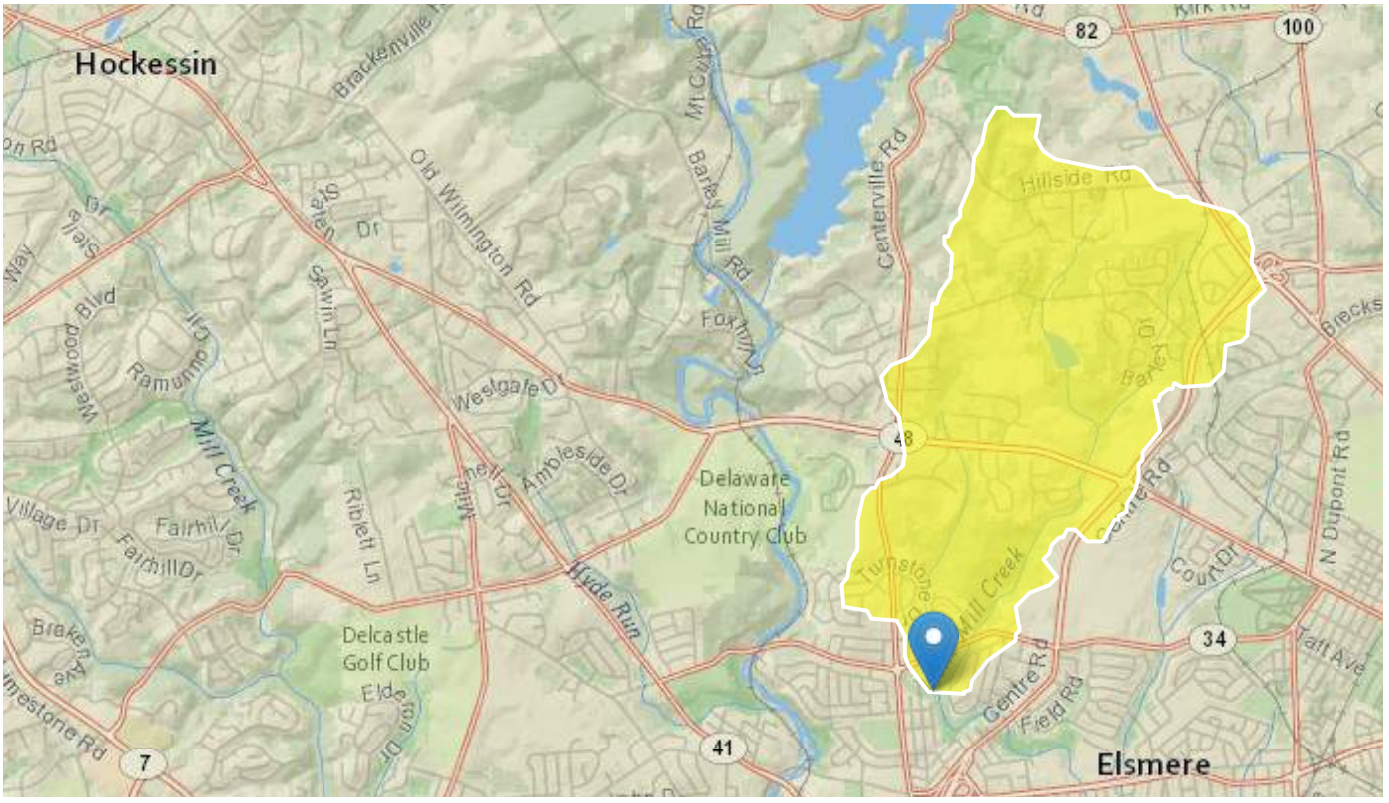
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Application Version: 4.6.2
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

StreamStats Report -- Little Mill Creek Upstream of Tributary 2

Region ID: DE
Workspace ID: DE20220111180951258000
Clicked Point (Latitude, Longitude): 39.74478, -75.62089
Time: 2022-01-11 13:10:10 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.7	square miles
FOREST	Percentage of area covered by forest	21.7156	percent
SOILA	Percentage of area of Hydrologic Soil Type A	4.9491	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	8.2208	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.643	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.57	percent

Parameter Code	Parameter Description	Value	Unit
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	51.1	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	11.8	percent

Peak-Flow Statistics Parameters [Piedmont Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.7	square miles	0.31	319
FOREST	Percent Forest	21.7156	percent	4.07	84.9
SOILA	Percent Hydrologic Soil Type A	4.9491	percent	0	7.22
IMPNLCD01	Percent Impervious NLCD2001	8.2208	percent	0.1	38.3
STORNHD	Percent Storage from NHD	0.643	percent	0	2.92

Peak-Flow Statistics Flow Report [Piedmont Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	ASEp	Equiv. Yrs.
50-percent AEP flood	408	ft^3/s	254	655	28.9	28.9	4.1
20-percent AEP flood	676	ft^3/s	426	1070	28.1	28.1	6.7
10-percent AEP flood	892	ft^3/s	543	1470	29.9	29.9	8.4
4-percent AEP flood	1190	ft^3/s	711	1990	31	31	11.3
2-percent AEP flood	1430	ft^3/s	831	2460	32.7	32.7	12.7
1-percent AEP flood	1690	ft^3/s	947	3020	35.1	35.1	13.5
0.5-percent AEP flood	1950	ft^3/s	1050	3640	38	38	13.8
0.2-percent AEP flood	2330	ft^3/s	1170	4630	48.3	48.3	13.7

Peak-Flow Statistics Citations

Ries, K.G., III, and Dillow, J.J.A.,2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p. (http://pubs.usgs.gov/sir/2006/5146/)

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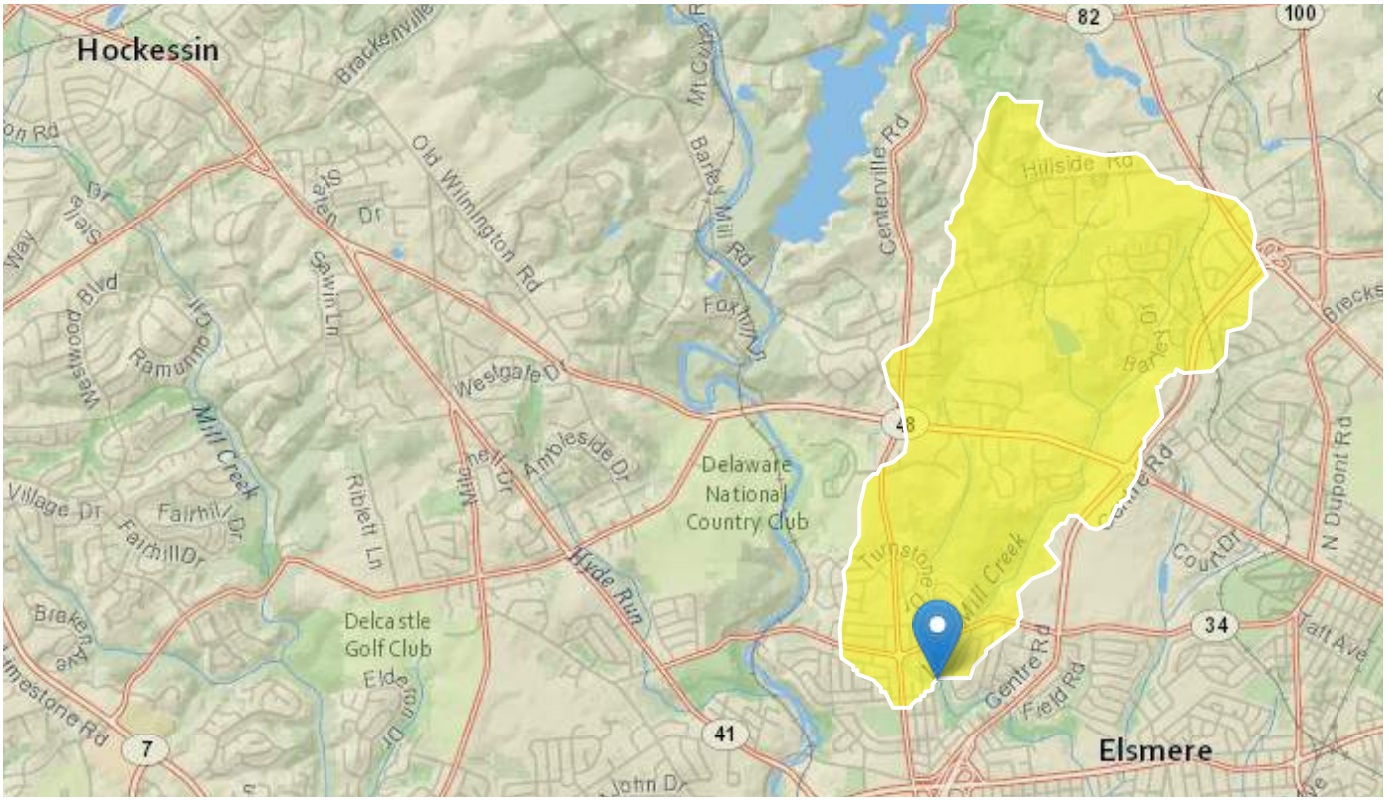
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Application Version: 4.6.2
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

StreamStats Report -- Confluence of Little Mill Creek and Tributary 2

Region ID: DE
Workspace ID: DE20220111181505035000
Clicked Point (Latitude, Longitude): 39.74472, -75.62081
Time: 2022-01-11 13:15:24 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.5	percent
DRNAREA	Area that drains to a point on a stream	2.84	square miles
FOREST	Percentage of area covered by forest	20.6855	percent
SOILA	Percentage of area of Hydrologic Soil Type A	5.0108	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	9.2931	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.6125	percent

Parameter Code	Parameter Description	Value	Unit
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	53.4	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	12.9	percent

Peak-Flow Statistics Parameters [Piedmont Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.84	square miles	0.31	319
FOREST	Percent Forest	20.6855	percent	4.07	84.9
SOILA	Percent Hydrologic Soil Type A	5.0108	percent	0	7.22
IMPNLCD01	Percent Impervious NLCD2001	9.2931	percent	0.1	38.3
STORNHD	Percent Storage from NHD	0.6125	percent	0	2.92

Peak-Flow Statistics Flow Report [Piedmont Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	ASEp	Equiv. Yrs.
50-percent AEP flood	437	ft^3/s	272	701	28.9	28.9	4.1
20-percent AEP flood	717	ft^3/s	452	1140	28.1	28.1	6.7
10-percent AEP flood	948	ft^3/s	578	1550	29.9	29.9	8.4
4-percent AEP flood	1270	ft^3/s	760	2120	31	31	11.3
2-percent AEP flood	1520	ft^3/s	885	2610	32.7	32.7	12.7
1-percent AEP flood	1800	ft^3/s	1010	3210	35.1	35.1	13.5
0.5-percent AEP flood	2070	ft^3/s	1110	3850	38	38	13.8
0.2-percent AEP flood	2480	ft^3/s	1250	4910	48.3	48.3	13.7

Peak-Flow Statistics Citations

Ries, K.G., III, and Dillow, J.J.A.,2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p. (http://pubs.usgs.gov/sir/2006/5146/)

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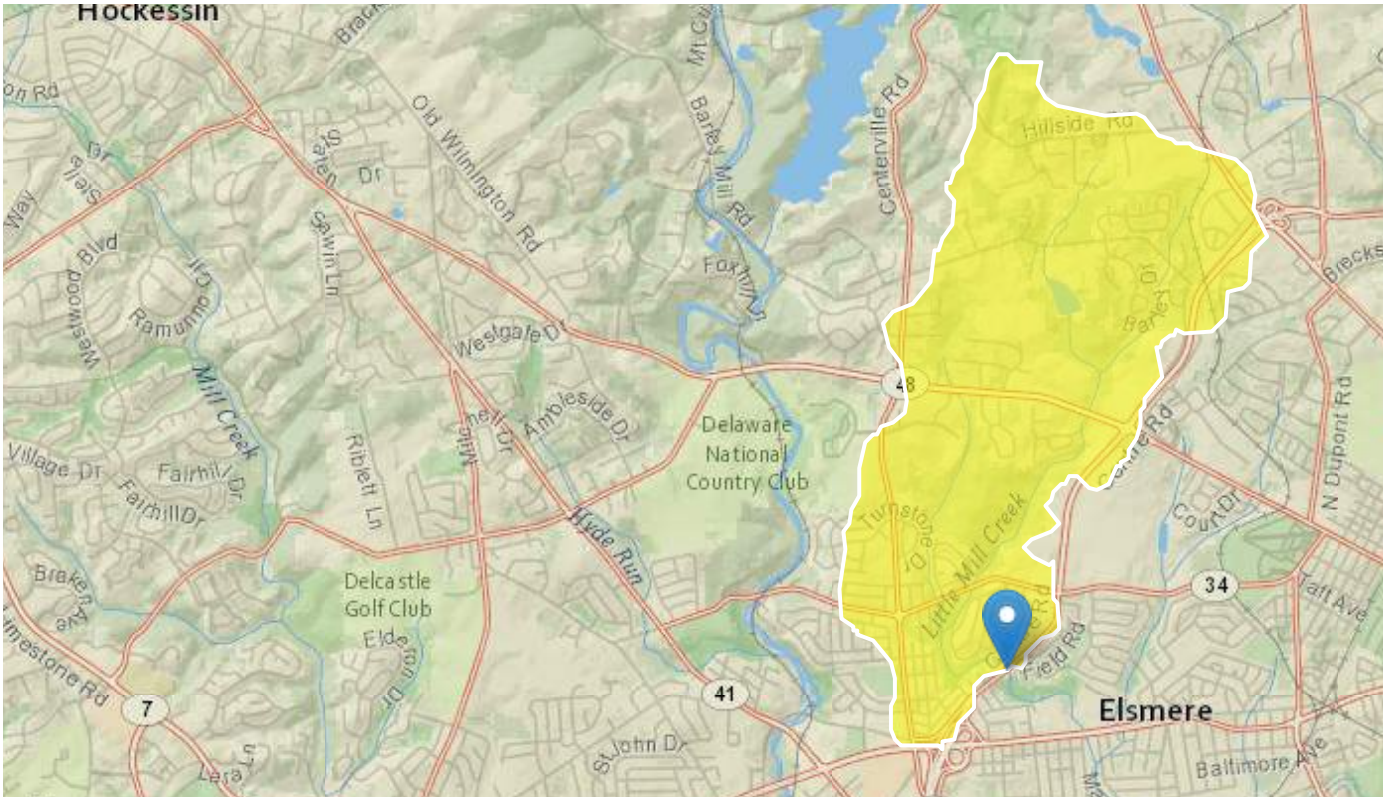
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Application Version: 4.6.2
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

StreamStats Report -- Little Mill Creek at Centre Road

Region ID: DE
Workspace ID: DE20220111181733695000
Clicked Point (Latitude, Longitude): 39.74275, -75.61471
Time: 2022-01-11 13:17:53 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.4	percent
DRNAREA	Area that drains to a point on a stream	3.12	square miles
FOREST	Percentage of area covered by forest	18.7891	percent
SOILA	Percentage of area of Hydrologic Soil Type A	5.1244	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	11.2773	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.5564	percent

Parameter Code	Parameter Description	Value	Unit
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	57.1	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	14.9	percent

Peak-Flow Statistics Parameters [Piedmont Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	3.12	square miles	0.31	319
FOREST	Percent Forest	18.7891	percent	4.07	84.9
SOILA	Percent Hydrologic Soil Type A	5.1244	percent	0	7.22
IMPNLCD01	Percent Impervious NLCD2001	11.2773	percent	0.1	38.3
STORNHD	Percent Storage from NHD	0.5564	percent	0	2.92

Peak-Flow Statistics Flow Report [Piedmont Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	ASEp	Equiv. Yrs.
50-percent AEP flood	497	ft^3/s	310	798	28.9	28.9	4.1
20-percent AEP flood	800	ft^3/s	505	1270	28.1	28.1	6.7
10-percent AEP flood	1070	ft^3/s	655	1750	29.9	29.9	8.4
4-percent AEP flood	1420	ft^3/s	853	2360	31	31	11.3
2-percent AEP flood	1700	ft^3/s	994	2910	32.7	32.7	12.7
1-percent AEP flood	2010	ft^3/s	1130	3560	35.1	35.1	13.5
0.5-percent AEP flood	2320	ft^3/s	1250	4300	38	38	13.8
0.2-percent AEP flood	2780	ft^3/s	1410	5480	48.3	48.3	13.7

Peak-Flow Statistics Citations

Ries, K.G., III, and Dillow, J.J.A.,2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p. (http://pubs.usgs.gov/sir/2006/5146/)

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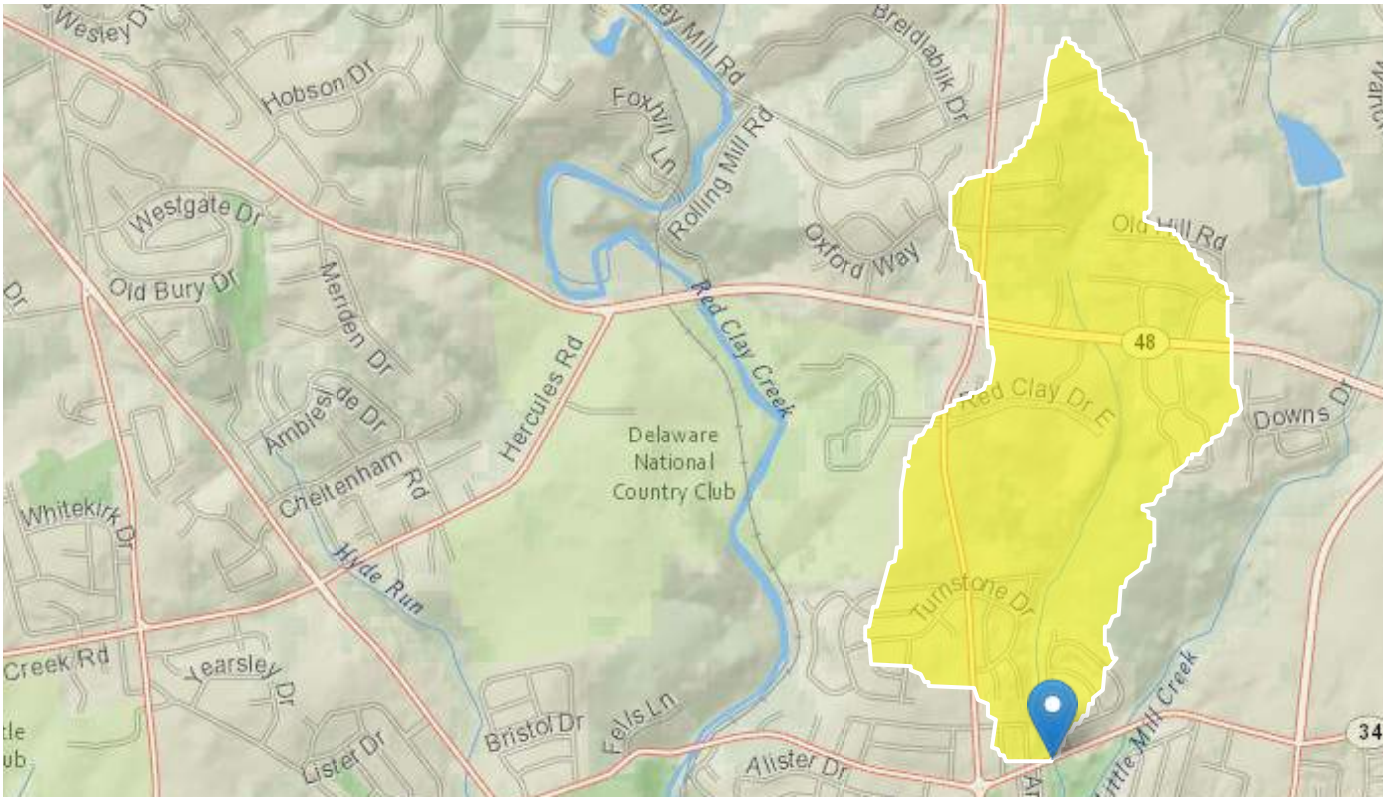
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Application Version: 4.6.2
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

StreamStats Report -- Tributary 1 at Faulkland Road

Region ID: DE
Workspace ID: DE20220111172716232000
Clicked Point (Latitude, Longitude): 39.74726, -75.62087
Time: 2022-01-11 12:27:36 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.75	square miles
FOREST	Percentage of area covered by forest	22.4742	percent
SOILA	Percentage of area of Hydrologic Soil Type A	6	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	11.9553	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.41	percent

Parameter Code	Parameter Description	Value	Unit
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	63.3	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	17.1	percent

Peak-Flow Statistics Parameters [Piedmont Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.75	square miles	0.31	319
FOREST	Percent Forest	22.4742	percent	4.07	84.9
SOILA	Percent Hydrologic Soil Type A	6	percent	0	7.22
IMPNLCD01	Percent Impervious NLCD2001	11.9553	percent	0.1	38.3
STORNHD	Percent Storage from NHD	0	percent	0	2.92

Peak-Flow Statistics Flow Report [Piedmont Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	ASEp	Equiv. Yrs.
50-percent AEP flood	167	ft^3/s	100	278	28.9	28.9	4.1
20-percent AEP flood	274	ft^3/s	168	448	28.1	28.1	6.7
10-percent AEP flood	440	ft^3/s	263	737	29.9	29.9	8.4
4-percent AEP flood	619	ft^3/s	362	1060	31	31	11.3
2-percent AEP flood	767	ft^3/s	435	1350	32.7	32.7	12.7
1-percent AEP flood	936	ft^3/s	510	1720	35.1	35.1	13.5
0.5-percent AEP flood	1110	ft^3/s	578	2130	38	38	13.8
0.2-percent AEP flood	1390	ft^3/s	678	2850	48.3	48.3	13.7

Peak-Flow Statistics Citations

Ries, K.G., III, and Dillow, J.J.A.,2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p. (http://pubs.usgs.gov/sir/2006/5146/)

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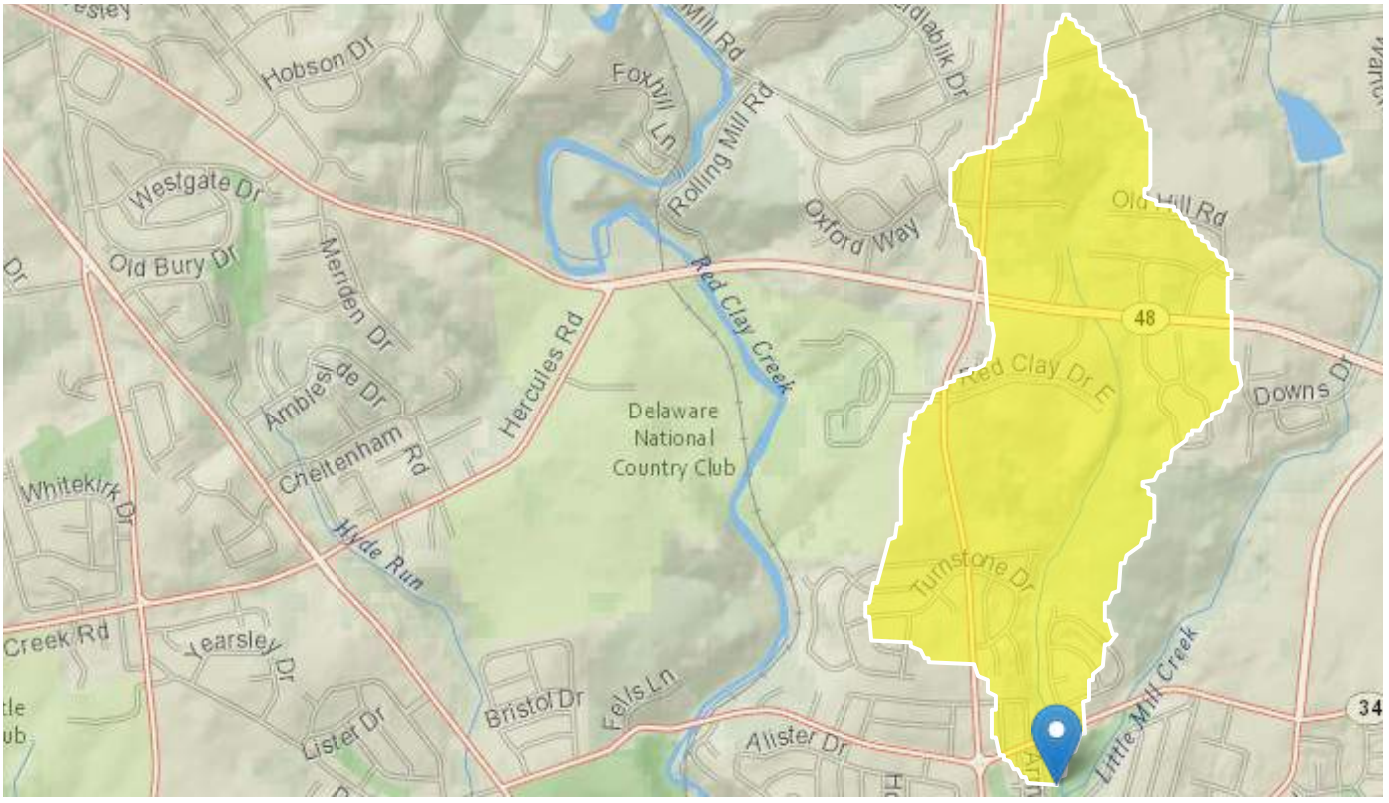
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Application Version: 4.6.2
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

StreamStats Report -- Tributary 1 Upstream of Little Mill Creek

Region ID: DE
Workspace ID: DE20220111180752384000
Clicked Point (Latitude, Longitude): 39.74561, -75.62063
Time: 2022-01-11 13:08:11 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.77	square miles
FOREST	Percentage of area covered by forest	21.9054	percent
SOILA	Percentage of area of Hydrologic Soil Type A	6	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	12.2709	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.38	percent

Parameter Code	Parameter Description	Value	Unit
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	63.7	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	17.4	percent

Peak-Flow Statistics Parameters [Piedmont Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.77	square miles	0.31	319
FOREST	Percent Forest	21.9054	percent	4.07	84.9
SOILA	Percent Hydrologic Soil Type A	6	percent	0	7.22
IMPNLCD01	Percent Impervious NLCD2001	12.2709	percent	0.1	38.3
STORNHD	Percent Storage from NHD	0	percent	0	2.92

Peak-Flow Statistics Flow Report [Piedmont Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	ASEp	Equiv. Yrs.
50-percent AEP flood	173	ft^3/s	104	287	28.9	28.9	4.1
20-percent AEP flood	283	ft^3/s	173	462	28.1	28.1	6.7
10-percent AEP flood	453	ft^3/s	271	758	29.9	29.9	8.4
4-percent AEP flood	636	ft^3/s	372	1090	31	31	11.3
2-percent AEP flood	787	ft^3/s	447	1390	32.7	32.7	12.7
1-percent AEP flood	961	ft^3/s	525	1760	35.1	35.1	13.5
0.5-percent AEP flood	1140	ft^3/s	595	2190	38	38	13.8
0.2-percent AEP flood	1420	ft^3/s	694	2910	48.3	48.3	13.7

Peak-Flow Statistics Citations

Ries, K.G., III, and Dillow, J.J.A.,2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p. (http://pubs.usgs.gov/sir/2006/5146/)

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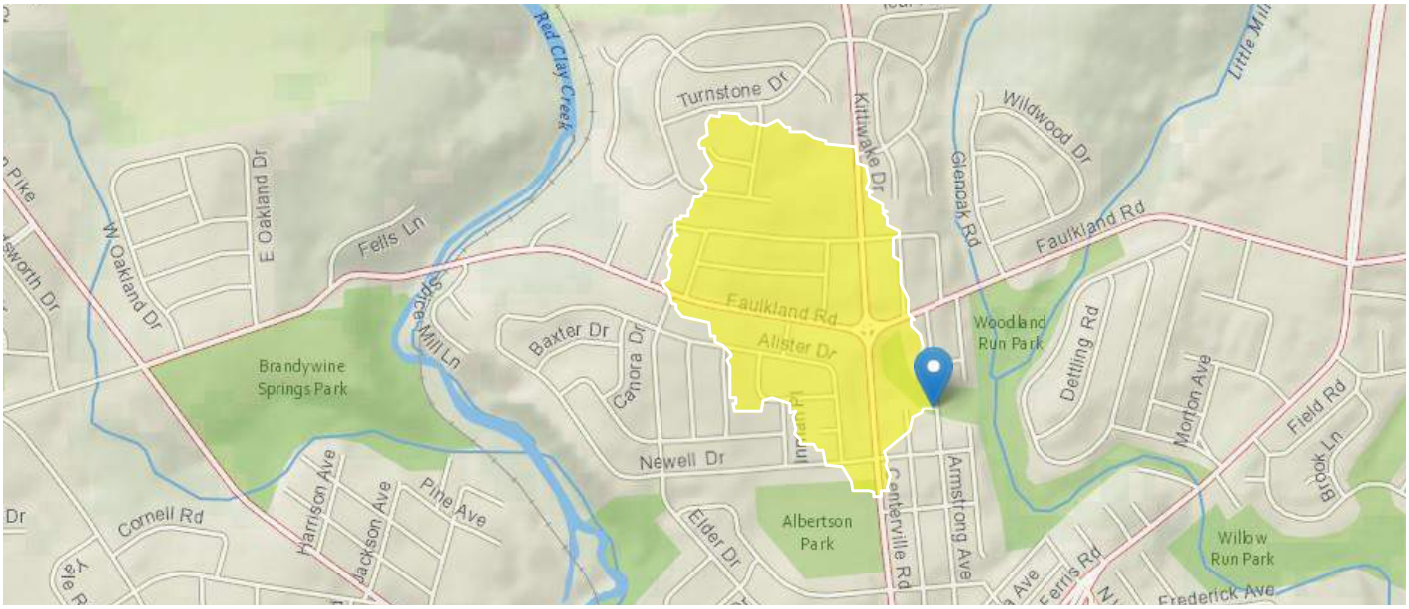
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Application Version: 4.6.2
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

StreamStats Report Tributary 2 at Armstrong Avenue

Region ID: DE
Workspace ID: DE20250128124832373000
Clicked Point (Latitude, Longitude): 39.74461, -75.62213
Time: 2025-01-28 07:48:57 -0500



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM3M	Mean basin slope computed from 3 meter digital elevation model, in percent	5.97	percent
DRNAREA	Area that drains to a point on a stream	0.14	square miles
IMPERV	Percentage of impervious area	34.2	percent
SOILD	Percentage of area of Hydrologic Soil Type D	0	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [DE Peakflow Piedmont 2022 5005]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
BSLDEM3M	Mean basin slope from 3 meter dem	5.97	percent	4.7	17.4
DRNAREA	Drainage Area	0.14	square miles	0.4	318.5
IMPERV	Percent Impervious	34.2	percent	0.7	40.2
SOILD	Percent Hydrologic Soil Type D	0	percent	0	38.8
STORNHD	Percent Storage from NHD	0	percent	0	6

Peak-Flow Statistics Disclaimers [DE Peakflow Piedmont 2022 5005]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [DE Peakflow Piedmont 2022 5005]

Statistic	Value	Unit
50-percent AEP flood	87.9	ft^3/s
20-percent AEP flood	151	ft^3/s
10-percent AEP flood	202	ft^3/s
4-percent AEP flood	276	ft^3/s
2-percent AEP flood	250	ft^3/s
1-percent AEP flood	295	ft^3/s
0.5-percent AEP flood	340	ft^3/s
0.2-percent AEP flood	405	ft^3/s

Peak-Flow Statistics Citations

John C. Hammond, Edward J. Doheny, Jonathan J.A. Dillow, Mark R. Nardi, Peter A. Steeves, and Daniel L. Warner2021, Peak-Flow and Low-Flow Magnitude Estimates at Defined Frequencies and Durations for Nontidal Streams in Delaware, U.S. Geological Survey Scientific Ivestigations Report 2022-5005 (https://pubs.er.usgs.gov/publication/sir20225005)

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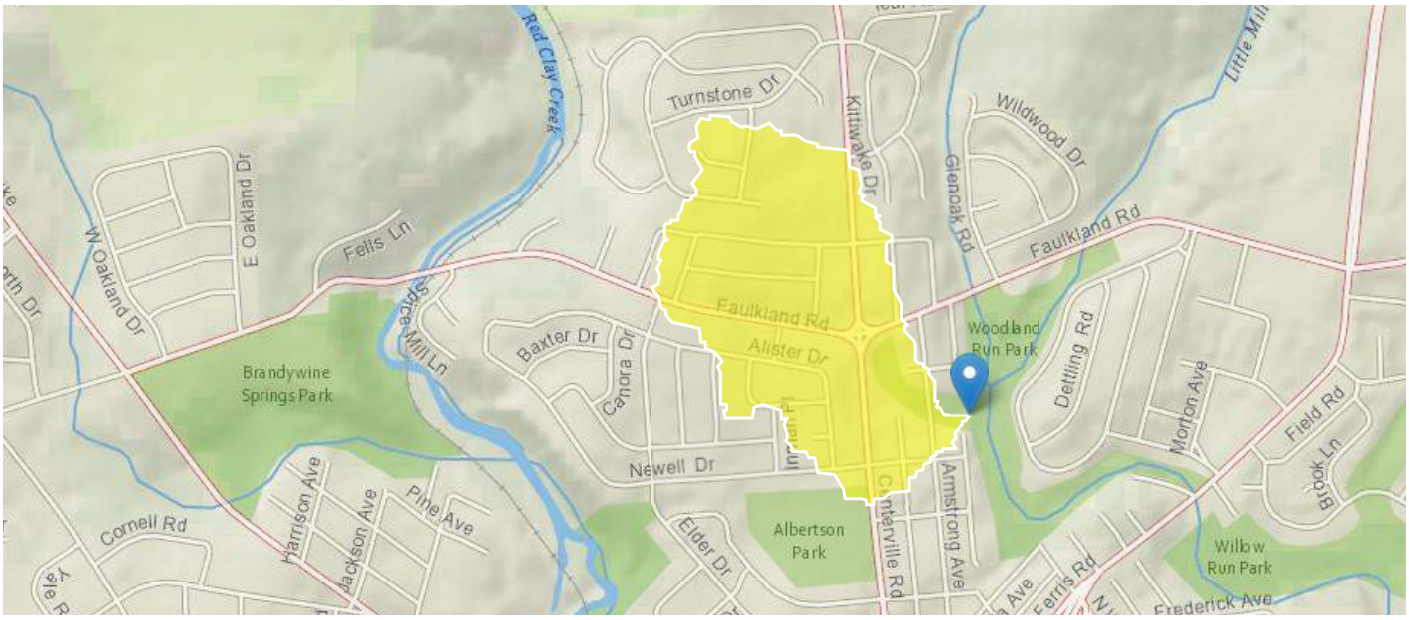
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Application Version: 4.26.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

StreamStats Report Tributary 2 Upstream of Little Mill Creek

Region ID: DE
Workspace ID: DE20250129170102548000
Clicked Point (Latitude, Longitude): 39.74461, -75.62091
Time: 2025-01-29 12:01:48 -0500



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM3M	Mean basin slope computed from 3 meter digital elevation model, in percent	5.95	percent
DRNAREA	Area that drains to a point on a stream	0.15	square miles
IMPERV	Percentage of impervious area	34.3	percent
SOILD	Percentage of area of Hydrologic Soil Type D	0	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [DE Peakflow Piedmont 2022 5005]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
BSLDEM3M	Mean basin slope from 3 meter dem	5.95	percent	4.7	17.4
DRNAREA	Drainage Area	0.15	square miles	0.4	318.5
IMPERV	Percent Impervious	34.3	percent	0.7	40.2
SOILD	Percent Hydrologic Soil Type D	0	percent	0	38.8
STORNHD	Percent Storage from NHD	0	percent	0	6

Peak-Flow Statistics Disclaimers [DE Peakflow Piedmont 2022 5005]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [DE Peakflow Piedmont 2022 5005]

Statistic	Value	Unit
50-percent AEP flood	92.8	ft^3/s
20-percent AEP flood	159	ft^3/s
10-percent AEP flood	213	ft^3/s
4-percent AEP flood	291	ft^3/s
2-percent AEP flood	262	ft^3/s
1-percent AEP flood	308	ft^3/s
0.5-percent AEP flood	356	ft^3/s
0.2-percent AEP flood	424	ft^3/s

Peak-Flow Statistics Citations

John C. Hammond, Edward J. Doheny, Jonathan J.A. Dillow, Mark R. Nardi, Peter A. Steeves, and Daniel L. Warner2021, Peak-Flow and Low-Flow Magnitude Estimates at Defined Frequencies and Durations for Nontidal Streams in Delaware, U.S. Geological Survey Scientific Ivestigations Report 2022-5005 (https://pubs.er.usgs.gov/publication/sir20225005)

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Application Version: 4.26.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

APPENDIX C
NATURAL RESOURCES INVENTORY MEMO

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700 East Pratt Street, Suite 500
Baltimore, MD 21202
Phone 410.728.2900
www.rkk.com

MEMORANDUM

Date: April 25, 2025

To: New Castle County (NCC)

From: Karl Hellmann – RK&K

CC: Tara Cutillo & Justin Reel – RK&K

Re: Little Mill Creek Restoration at Woodland Park – Natural Resources Inventory

EXECUTIVE SUMMARY

On behalf of New Castle County (NCC), RK&K conducted a Natural Resources Inventory (NRI), including a wetland and waterway delineation, walk-through forest stand characterization, and individual tree inventory within the Little Mill Creek Restoration at Woodland Park project study area in New Castle County, Delaware (**Appendix A, Figures 1 & 2**). The restoration project entails restoring a section of Little Mill Creek and several tributaries within Woodland Park from Faulkland Road downstream to Centre Road (SR 141). The proposed restoration includes approximately 4,815 linear feet of the mainstem, 1,215 linear feet of tributary channels, and 1,870 linear feet of outfall channels.

RK&K Environmental scientists conducted the NRI field work on November 17th, and December 1st and 13th, 2022. RK&K identified one palustrine emergent wetland (PEM), seven Waters of the U.S., six forest stands, 22 specimen trees and nine stand-alone trees within the project study area. Any proposed impacts to wetlands, waters, or subaqueous lands will require coordination with the US Army Corps of Engineers (USACE) and Department of Natural Resources and Environmental Control (DNREC). Impacts to forest stands and specimen trees will require coordination with NCC Department of Land Use.

Supplemental information supporting the NRI is included in **Appendices A** through **F**, as follows:

Appendix A: Figures
Appendix B: Agency Correspondence
Appendix C: Datasheets
Appendix D: Photographic Documentation
Appendix E: Tree Inventory Table
Appendix F: Natural Resources Inventory (NRI) Plan

BACKGROUND INFORMATION

RK&K environmental scientists conducted a desktop investigation of mapped information prior to beginning the field investigation. The desktop investigation of the available mapped information

identified site topography; vegetative cover; tidal and non-tidal waters and wetlands; 100-year floodplains; and hydric and highly erodible soils. Mapped resources reviewed for this project include:

- The United States Geologic Survey (USGS) Topographic Quadrangle Mapping
- The United States Department of Agriculture, Natural Resource Conservation Service (USDA-NRCS) *Web Soil Survey (WSS) for New Castle County, Delaware*
- US Fish and Wildlife Service, National Wetlands Inventory (NWI)
- Delaware Department of Natural Resources and Environmental Control (DNREC) Tidal and Nontidal Wetlands Mapping
- Federal Emergency Management Agency (FEMA) 100-year Floodplain

Desktop investigation results are summarized below:

Geology and Topography

The Little Mill Creek Restoration at Woodland Park is located in New Castle County, DE (**Appendix A, Figure 1**), within the Eastern Mountains and Piedmont physiographic province. The Eastern Mountains and Piedmont physiographic province is composed of hard, crystalline igneous and metamorphic rocks, and extends from the inner edge of the Coastal Plain westward to Catoctin Mountain, the eastern boundary of the Blue Ridge Province. Bedrock in the eastern part of the Piedmont consists of schist, gneiss, gabbro, and other highly metamorphosed sedimentary and igneous rocks of probable volcanic origin. The rocks of the western part of the Piedmont are diverse and include phyllite, slate, marble, and moderately to slightly metamorphosed volcanic rocks. Gently undulating plains underlain by un-metamorphosed bedrock of triassic red shale, siltstone, and sandstone occur in three areas in the western Piedmont. Elevations within the project study area range from 80 to 102 feet above sea level (**Appendix A, Figure 3 & 4**).

Soils

The USDA-NRCS Web Soil Survey for New Castle County, Delaware identified five mapped soil units within the project study area (**Appendix A, Figure 4**). Four highly erodible soils were identified within the project study area, as shown in **Table 1** below. Three non-hydric soil units, one predominantly non-hydric soil unit, and one partially hydric soil unit was mapped within the project study area.

Table 1. Soil Map Units within the Project Study Area

Map Unit Symbol	Map Unit Name	K-factor (Whole Soil) *	Drainage Class	Hydric Rating**	
DcB	Delanco-Codorus-Hatboro complex, 0 to 8 percent slopes, flooded	.37 (HE)	Moderately well drained	25	Predominantly Non-Hydric
ErB	Elsinboro-Delanco-Urban land complex, 0 to 8 percent slopes	.49 (HE)	Well drained	0	Non-Hydric
GhB	Glenelg-Wheaton-Urban land complex, 0 to 8 percent slopes	.28	Well drained	0	Non-Hydric
Hw	Hatboro-Codorus complex, 0 to 3 percent slopes, frequently flooded	.37 (HE)	Poorly drained	50	Partially Hydric
NxB	Neshaminy-Urban land complex, 0 to 8 percent slopes	.37 (HE)	Well drained	0	Non-Hydric

**Erodibility Coefficient – Value assigned to soil types by NRCS. K > 0.35 are considered to be highly erodible (HE) soils.*

***Hydric Rating – Value is based on the percentage of hydric soils within the soil type. Non-hydric soils have a value of 0, predominantly non-hydric soils have a value between 0 and 33, partially hydric soils have a value between 33 and 66, predominantly hydric soils have a value between 66 and 99, and hydric soils have a value of 100.*

Wetlands and Waters of the United States

The project is located in the Brandywine-Christina (02040205) 8-digit watershed. DNREC mapping identified Little Mill Creek (R4SBC) and Little Falls Creek (R4SBC) within the project study area. NWI mapping identified one stream (R4SBC) within the project study area (**Appendix A, Figure 5**).

100-Year Floodplain

The lower half of the project study area falls within the 100-year floodplain according to Federal Emergency Management Agency (FEMA) GIS data for New Castle County (**Appendix A, Figure 5**). Most of the lower half of the project study area is in Zone AE (Base Flood Elevations determined) and the upper half is within Zone A (Special Flood Hazard Area). Part of the project study area is in Zone X with a 0.2% chance of annual flood hazard.

Rare, Threatened, and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPAC) was used to generate a species list for the project on January 15, 2025. The tricolored bat (*Perimyotis subflavus*) and monarch butterfly (*Danaus plexippus*) were identified on the species list. The monarch butterfly and tricolored bat are candidate and proposed endangered species, respectively, and therefore do not currently have Section 7 requirements. The Northern Long-eared Bat and Tricolored Bat Range-wide Determination Key was also completed for the project on January 15, 2025, resulting in a determination of "May Affect". However, no further coordination with USFWS is anticipated for the tricolored bat considering the species is currently not listed and there is no winter habitat for hibernating bats within the project study area. The USFWS species list is included in **Appendix B**.

On November 30, 2022, the National Oceanic and Atmospheric Administration (NOAA) Endangered Species Act (ESA) Section 7 Mapper and Essential Fish Habitat (EFH) Mapper were used to determine if ESA-listed species, critical habitat, or essential fish habitat is located within the project study area. Based on the Section 7 and EFH Mapper, no ESA-listed species, critical habitat, or essential fish habitat were identified within the project study area. The Section 7 and EFH Mapper results are included in **Appendix B**.

An email requesting information on the presence of rare, threatened, or endangered species within the project study area was sent to the Delaware Department of Natural Resources and Environmental Control (DNREC) on February 21, 2023. A response was received on March 23, 2023, stating that there are currently no records of state-rare or federally listed plans, animals or natural communities within the project study area. At present, the project does not lie within a State Natural Heritage site, nor does it lie within a Delaware National Estuarine Research Reserve. Although there is no bog turtle habitat within the study area, Little Mill Creek connects known bog turtle habitats. Due to the stream being a potential migration corridor between habitats, DNREC requests that heavy machinery be kept a minimum of 100 feet away from stream/wetland habitats between March 1st and November 14th. If these conditions cannot be met, a qualified bog turtle surveyor may be required to monitor construction activities. The division of Fish and Wildlife does not have fish community data for the project study area; however, it is unlikely that habitat occurs in the project site that would support anadromous fish species. No time of year restrictions or other measures are required for these species or for resident gamefish species.

Cultural Resources

A letter requesting review of cultural resources within the project study area was sent to the State Historic Preservation Office (SHPO) on March 15, 2023. SHPO responded in a letter dated September 4, 2024, stating that no historic properties or cultural resources will be affected by the project. There are three known historic properties adjacent to the area of potential effect (APE) that will not be impacted by the project and there is one known archeological site adjacent to the APE, however the site was destroyed by existing residential development. Agency correspondence documents can be found in **Appendix B**.

WETLAND DELINEATION – FIELD INVESTIGATION

Methods

A team of two environmental scientists delineated waters of the U.S., including wetlands, within the project study area, and completed the applicable data form for each delineated feature. Each delineated feature was given a unique identifier and photographed. Boundary points were identified for each wetland feature, marked with pink flagging, and numbered consecutively. Wetland boundary point positions were located in the field using a sub-meter GPS unit, and all waterway boundaries were delineated using traditional field survey.

Wetlands were delineated in accordance with the *U.S. Army Corps of Engineers Wetlands Delineation Manual, Y-87-I* (Environmental Laboratory, 1987), U. S. Army Corps of Engineers. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Piedmont Plateau Region Version 2.0,* ed. J.F. Berkowitz, J.S. Wakeley, R.W. Lichvar, C.V. Noble. ERDC/EL TR-12-9. Vicksburg, MS: U.S. Army Engineer Research and Development Center. Routine wetland determination methods with onsite inspection were used to determine the presence of wetlands in the project study area.

Waters of the U.S., other than wetlands, were delineated using the limits defined in 33 C.F.R. § 328 at the time of delineation. The boundaries of non-tidal waters of the U.S. other than wetlands were set at the ordinary high-water mark (OHW). The OHW was determined in the field using physical characteristics established by the fluctuations of water (e.g., change in plant community, changes in the soil character, shelving) in accordance with U.S. Army Corps of Engineers Regulatory Guidance Letter No. 05-05.

Results

RK&K conducted a wetland and waterway delineation within the project study area on November 17th and December 13th, 2022. Seven waterways and one palustrine emergent wetland were identified within the project study area. Summary information on each delineated feature is included in **Tables 2** and **3**. Datasheets and photographs of each delineated feature are included in **Appendices C** and **D**, respectively, and the locations of the delineated features are displayed on the FSD Plans in **Appendix F**.

Table 2. Waterway Features within the Project Study Area

Feature ID	Hydrologic Class	Upstream Connectivity	Downstream Connectivity	Length (LF)	Area (SF)	NRI Plan Map #
WUS-A	Perennial	Outside of Study Area	Outside of Study Area	10,697	95,584	1 - 5
WUS-B	Perennial	Outside of Study Area	WUS-A	941	3,354	3
WUS-C	Intermittent	Outside of Study Area	WUS-A	509	1,059	3 - 4
WUS-D	Perennial	Outside of Study Area	WUS-A	365	925	4
WUS-F	Perennial	Outside of Study Area	WUS-A	1,690	4,928	4
WUS-I	Intermittent	Culvert Outfall	WUS-A	142	113	5
WUS-M	Perennial	Outside of Study Area	WUS-A	2,018	13,076	1-2

Table 3. Wetlands within the Project Study Area

Feature ID	NWI Classification	Hydrologic Connectivity	Area (SF)	NRI Plan Map #
WET-E	PEM	WUS - D	1,094	4

FOREST STAND CHARACTERIZATION & TREE INVENTORY – FIELD INVESTIGATION

Methods

RK&K conducted a walkthrough forest stand characterization within the project study area. Forest stands were identified and delineated in accordance with the New Castle County Code Chapter 40 Amendment, January 26, 2021 that defines a forest as "*An area covered by canopy of trees, covering a continuous land area of at least 1.0 acre or greater in size. Forests do not include trees planted and grown for commercial purposes, and do not include canopy cover over existing structures.*" Forest stands were characterized based on community type, successional stage, and overall condition. Stands were visually assessed, and data collected for each forest stand included size class, dominant canopy species, common understory and herbaceous species, presence and abundance of invasive species, and overall condition.

A tree inventory was conducted within the project study area in accordance with the New Castle County Code Chapter 40 Amendment, January 26, 2021. All individual or groups of trees with a DBH (diameter at breast height) equal to or greater than 16 inches (including specimen trees) located outside forested areas were inventoried. The County Code defines Specimen trees as "Trees listed in the State Big Trees Program, or trees in good health that are not in woodland but have diameters in excess of twenty-four (24) inches DBH. The tree species, DBH, and condition were recorded for each of the inventoried trees. The condition of the tree was assessed by an ocular estimation of growth form, visible signs of decay, live crown ratio, and indications of disease or insect infestation. Each inventoried tree was numbered consecutively. Data obtained from the field reconnaissance was collected with an iPad and the tree locations were inventoried with a GPS unit with sub-meter accuracy.

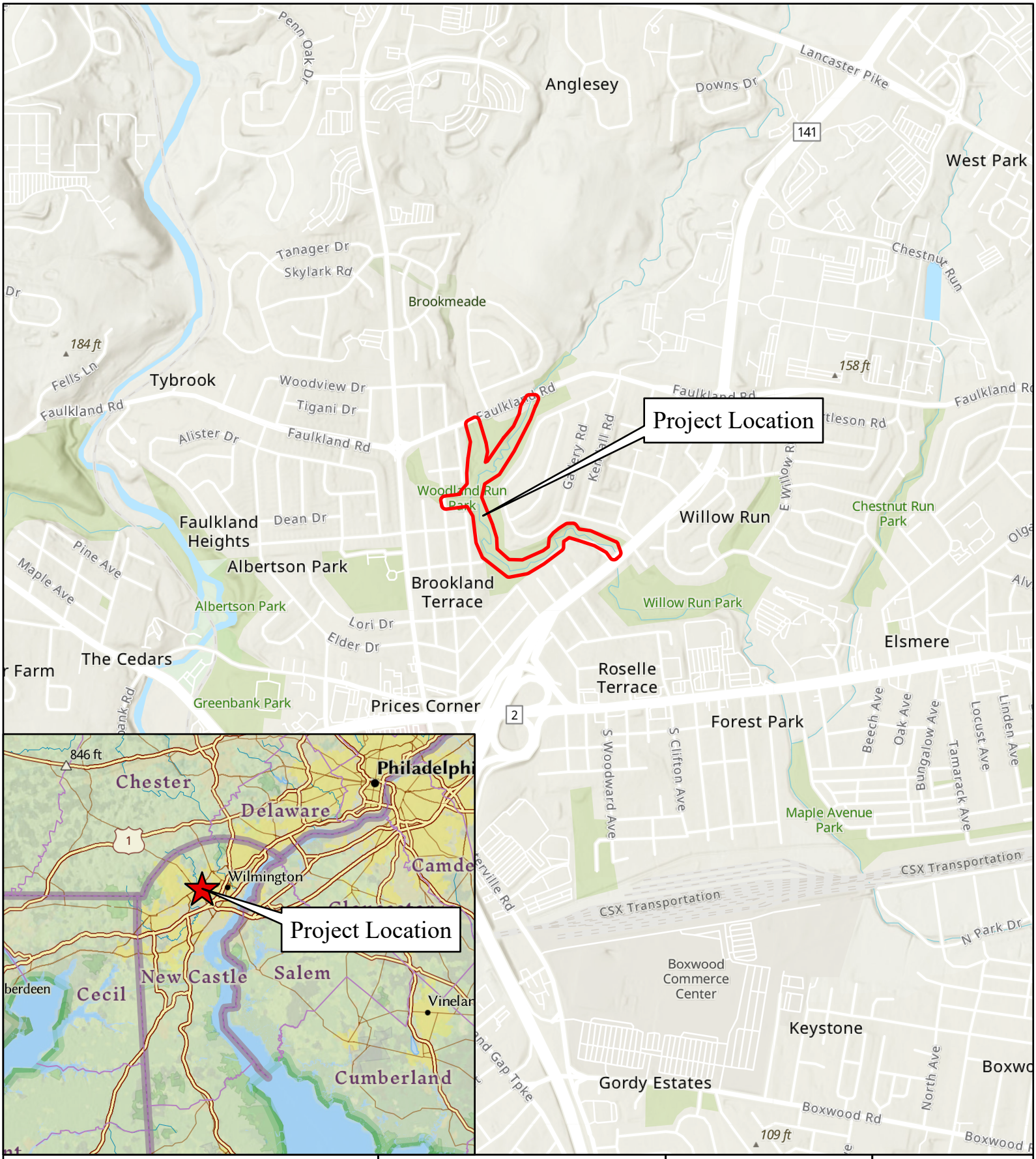
Results

RK&K conducted a walkthrough forest stand characterization and tree inventory within the project study area on December 1st and 13th, 2022. Six forest stands, nine stand-alone trees, and twenty-two specimen trees were identified within or directly adjacent to the project study area and are shown on the NRI Plans in **Appendix F.** Forest stand characterization results are summarized in **Table 4** on the following page. Photographs of each forest stand are included in **Appendix D** and a Tree Inventory Table is included in **Appendix E**.

Table 4. Forest Stands within the Project Study Area

Stand ID	Forest Association	Size Class (DBH)	Dominant Canopy Species	Common Understory Species	Common Herbaceous Species	Invasive Cover	Condition	Acreage in Study Area	NRI Plan Sheet #
FS1	Sycamore-Green Ash-Box Elder-Silver Maple	20-30	Green ash, red maple	Wineberry, spicebush, bush honeysuckle, multi-flora rose	Tall fescue, ground ivy, wild onion, English ivy, calico aster	High	Fair/Poor	5.40	1 – 3
FS2	Beech-Sugar Maple	20-30	American beech, green ash, black cherry	American holly, multi-flora rose, burning bush, spicebush	English ivy, Japanese honeysuckle, wild onion	High	Fair	0.45	4
FS3	Northern Red Oak	12-20	Northern red oak, tulip poplar	American beech, sweet cherry, burning bush, bush honeysuckle	English ivy, Christmas fern, Pachysandra	High	Fair	0.73	4 - 5
FS4	Silver maple-Sycamore	20-30	Silver maple, black walnut	Paper mulberry, privet, multi-flora rose, green briar, bush honeysuckle	English ivy, tall fescue, Japanese knotweed, ground ivy	High	Fair/Poor	0.82	5
FS5	Red Maple	20-30	Red maple, American sycamore, silver maple, green ash	Multi-flora rose, wineberry	Tall fescue, wild onion, English ivy, poison ivy, Japanese honeysuckle	High	Fair/Poor	2.49	1 - 2
FS6	Sycamore-Green Ash-Box Elder-Silver Maple	20-30	Green ash	Wineberry, bush honeysuckle, multi-flora rose	Tall fescue, ground ivy, wild onion, English ivy	High	Poor	4.16	3 - 5

Appendix A – Figures



Little Mill Creek Restoration at Woodland Park

Figure 1. Vicinity Map

Wilmington, DE

Legend

Project Study Area

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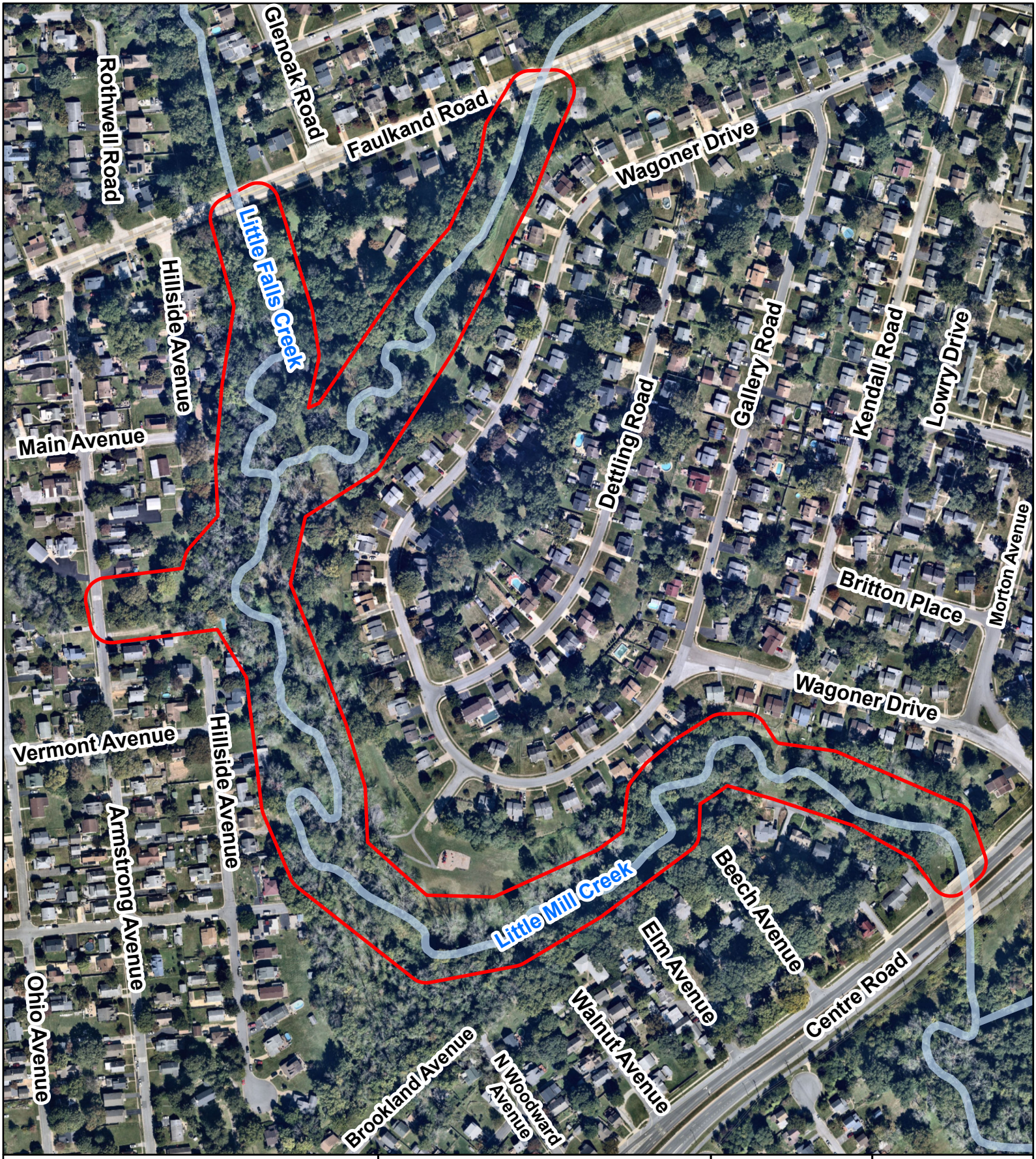
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1 inch = 1,500 feet

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Figure 2. Location Map

Wilmington, DE

Legend

Project Study Area

Streams

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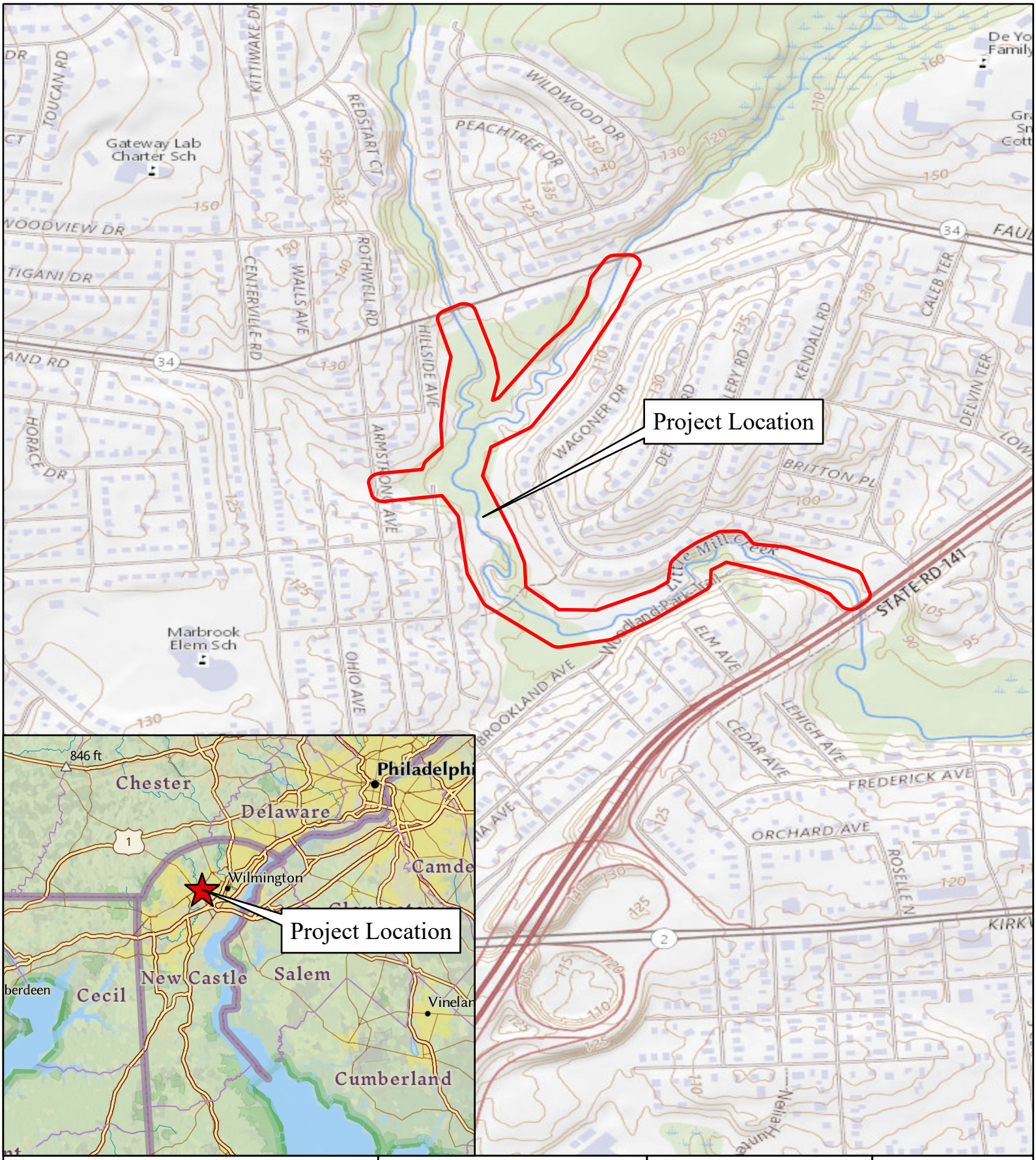
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1 inch = 300 feet

New Castle County 1673 Delaware

RK&K



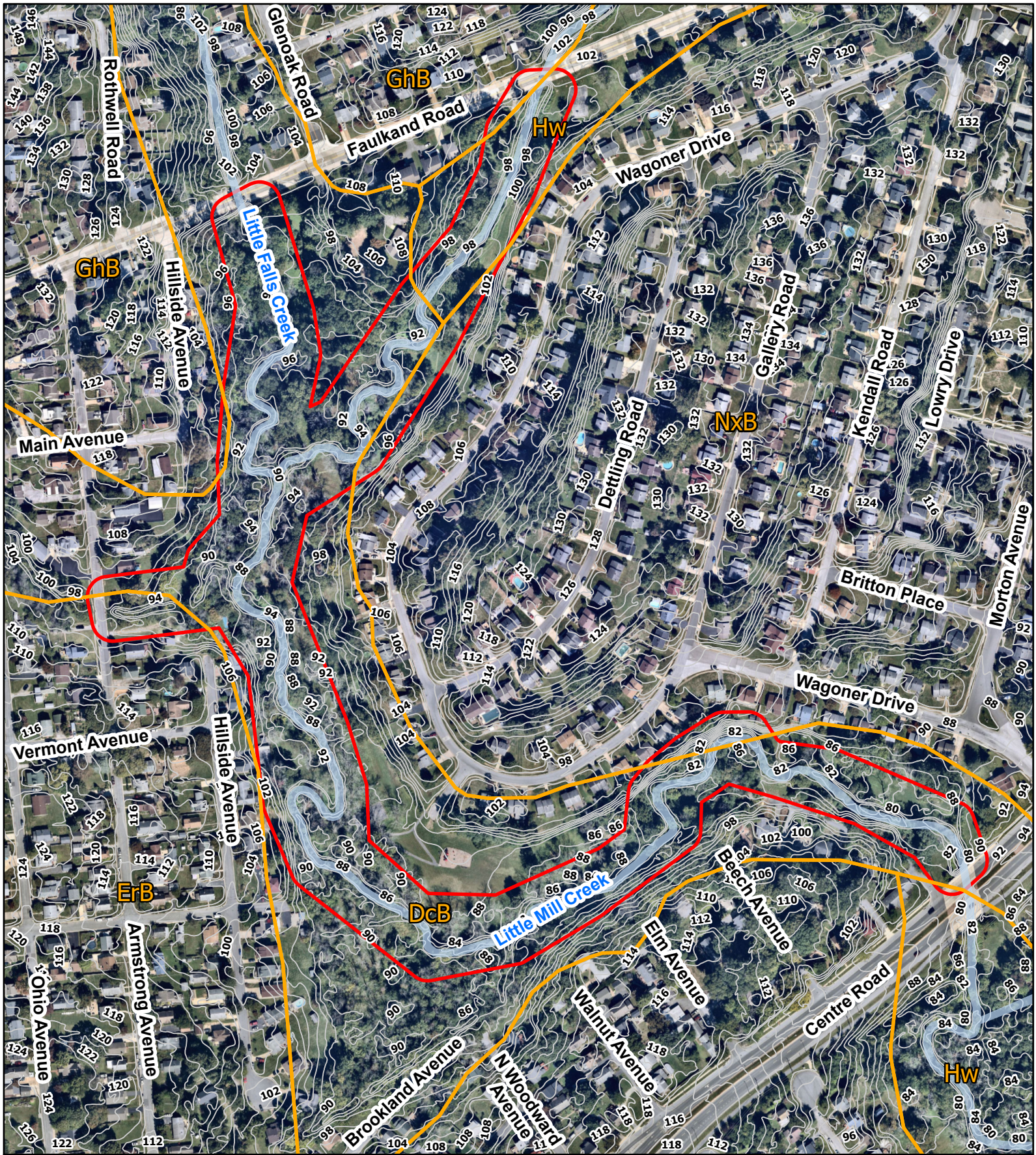
Little Mill Creek Restoration at Woodland Park

Figure 3. USGS Topo Map

Wilmington, DE

Legend

Project Study Area



Little Mill Creek Restoration at Woodland Park

Figure 4. Soils and Topography Map

Wilmington, DE

Legend

- Project Study Area
- Streams
- 2 ft Contours
- Soil Boundaries

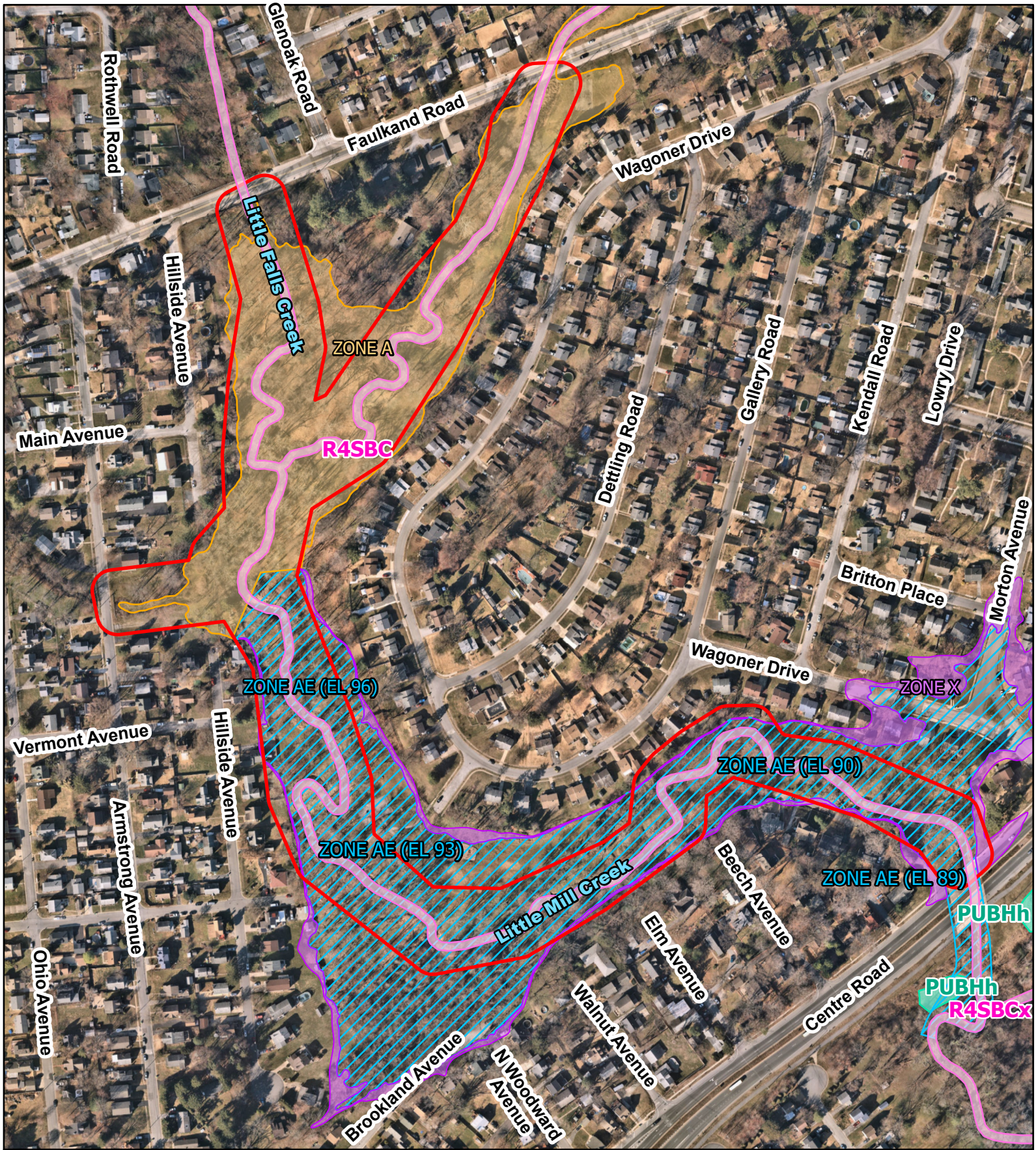
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1 inch = 300 feet

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Figure 5. Environmental Features Map

Wilmington, DE

Legend

- Project Study Area
- DNREC Wetlands and Waters
- NWI Wetlands and Waters
- FEMA Flood Zone AE
- FEMA Flood Zone A
- FEMA Flood Zone X

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1 inch = 300 feet

New Castle County 1673 Delaware

RK&K

Appendix B – Agency Correspondence

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF FISH & WILDLIFE
RICHARDSON & ROBBINS BUILDING
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

DIRECTOR'S OFFICE

PHONE
(302) 739-9910

March 23, 2023

Christina Kundrat
700 East Pratt Street
Suite 500
Baltimore, MD 21202

Re: RK&K 2023 Little Mill Creek Restoration, Tax Parcel # 0703510042

Dear Christina:

Thank you for contacting the Species Conservation and Research Program (SCRP) about information on rare, threatened and endangered species, unique natural communities, and other significant natural resources as they relate to the above referenced project.

State Natural Heritage Site
A review of our database indicates that there are currently no records of state-rare or federally listed plants, animals or natural communities at this project site. As a result, at present, this project does not lie within a State Natural Heritage Site, nor does it lie within a Delaware National Estuarine Research Reserve which are two criteria used to identify "Designated Critical Resource Waters" in the Army Corps of Engineers (ACOE) Nationwide Permit General Condition No. 22. A copy of this letter shall be included in any permit application or pre-construction notification submitted to the Army Corps of Engineers for activities on this property.

Bog Turtle
The following comments have been developed in coordination with the U.S. Fish and Wildlife Service:

A review of our database and GIS revealed that there is no habitat within the project limits that would support the federally-listed threatened bog turtle (*Glyptemys muhlenbergii*).

Although there is no bog turtle habitat at this project site, Little Mill Creek connects known bog turtle habitats. Because this stream is a potential migration corridor between habitats, we request that heavy machinery is kept a minimum 100 ft away from stream/wetland habitats between March 1st and November 14th (please note that this time restriction is standard for the bog turtle activity season when work is proposed near known bog turtle populations). As long as these

conditions are met, we determine that there will be no impact to bog turtles. If these conditions cannot be met, a qualified bog turtle surveyor may be required to monitor construction activities.

Please contact Nate Nazdrowicz at Nathan.Nazdrowicz@delaware.gov or (302) 735-8688 for further guidance.

Fisheries
The Division of Fish and Wildlife does not have fish community data for the project location. However, it is unlikely that habitat occurs in the project site that would support anadromous fish species. No time of year restrictions or other measures are requested for these species or for resident gamefish species.

We are continually updating our records on Delaware's rare, threatened and endangered species, unique natural communities and other significant natural resources. If the start of the project is delayed more than a year past the date of this letter, please contact us again for the latest information.

Please feel free to contact me with any questions or if you require additional information.

Sincerely,



Danielle Ellis
Environmental Review Coordinator
Phone: (302) 223-2446
6180 Hay Point Landing Road
Smyrna, DE 19977

(See invoice on next page)

INVOICE - PAYMENT DUE

It is our policy to charge a fee for this environmental review service. This letter constitutes an invoice for $35.00 ($35.00/hour for a minimum of one hour). Please make your check payable to "Delaware Division of Fish and Wildlife" and submit to:

DE Division of Fish and Wildlife
97 Commerce Way
Suite 106
Dover, DE 19901
ATTN: DFW Fiscal

In order for us to properly process your payment, you must reference "RK&K 2023 Little Mill Creek Restoration**" on your check.**

cc: Division of Fish and Wildlife Fiscal (dnrec_dfw_payroll@delaware.gov); Code to 72900
Kathleen Cullen, USFWS (Kathleen_Cullen@fws.gov)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127

In Reply Refer To: 01/15/2025 16:04:08 UTC
Project Code: 2025-0042488
Project Name: Little Mill Creek Restoration at Woodland Park

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
(410) 573-4599

PROJECT SUMMARY

Project Code: 2025-0042488

Project Name: Little Mill Creek Restoration at Woodland Park

Project Type: Restoration / Enhancement of Waterbody

Project Description: New Castle County (NCC) identified the restoration of Little Mill Creek and tributaries within Woodland Park as a project to provide ecological enhancement, support the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, and help meet pollutant load reductions associated with the Christina River Total Maximum Daily Load (TMDL). The project includes Little Mill Creek and its tributaries beginning at Faulkland Road and extending downstream to Centre Road (SR 141). The project entails restoring 4,814 linear feet of Little Mill Creek and 3,085 linear feet of adjacent tributaries within Woodland Run Park. The design consists of an integrated stream and wetland restoration approach that will lower the existing stream banks and adjacent floodplain to create a stream/floodplain system that is highly connected to groundwater as the existing floodplain width, potentially usable land, and property limits allow.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.7448282,-75.62060317328928,14z



Counties: New Castle County, Delaware

ENDANGERED SPECIES ACT SPECIES

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

RIVERINE

- R4SBC

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: George Carney
Address: 700 East Pratt Street, Suite 500
City: Baltimore
State: MD
Zip: 21202
Email gcarney@rkk.com
Phone: 4102947780

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127

In Reply Refer To: 01/15/2025 16:10:29 UTC
Project code: 2025-0042488
Project Name: Little Mill Creek Restoration at Woodland Park

Federal Nexus: yes
Federal Action Agency (if applicable): Army Corps of Engineers

Subject: Technical assistance for 'Little Mill Creek Restoration at Woodland Park'

Dear George Carney:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on January 15, 2025, for 'Little Mill Creek Restoration at Woodland Park' (here forward, Project). This project has been assigned Project Code 2025-0042488 and all future correspondence should clearly reference this number. **Please carefully review this letter. Your Endangered Species Act (Act) requirements are not complete.**

Ensuring Accurate Determinations When Using IPaC

The Service developed the IPaC system and associated species' determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into IPaC must accurately represent the full scope and details of the Project. **Failure to accurately represent or implement the Project as detailed in IPaC or the Northern Long-eared Bat and Tricolored Bat Range-wide Determination Key (Dkey), invalidates this letter.**

Determination for the Northern Long-Eared Bat and Tricolored Bat

Based on your IPaC submission and a standing analysis completed by the Service, you determined the proposed Project will have the following effect determinations:

Species	Listing Status	Determination
Tricolored Bat (*Perimyotis subflavus*)	Proposed Endangered	May affect

Other Species and Critical Habitat that May be Present in the Action Area

The IPaC-assisted determination key for the northern long-eared bat and tricolored bat does not apply to the following ESA-protected species and/or critical habitat that also may occur in your Action area:

- Monarch Butterfly *Danaus plexippus* Proposed Threatened

You may coordinate with our Office to determine whether the Action may cause prohibited take of the species listed above.

Conclusion

Consultation with the Service is not complete. Further consultation or coordination with the Service is necessary for those species or designated critical habitats with a determination of "May Affect." A "May Affect" determination in this key indicates that the project, as entered, is not consistent with the questions in the key. Not all projects that reach a "May Affect" determination are anticipated to result in adverse impacts to listed species. These projects may result in a "No Effect", "May Affect, Not Likely to Adversely Affect", or "May Affect, Likely to Adversely Affect" determination depending on the details of the project. Please contact our Chesapeake Bay Ecological Services Field Office to discuss methods to avoid or minimize potential adverse effects to those species or designated critical habitats.

Federal agencies must consult with U.S. Fish and Wildlife Service under section 7(a)(2) of the Endangered Species Act (ESA) when an action *may affect* a listed species. Tricolored bat is proposed for listing as endangered under the ESA, but not yet listed. For actions that may affect a proposed species, agencies cannot consult, but they can *confer* under the authority of section 7(a)(4) of the ESA. Such conferences can follow the procedures for a consultation and be adopted as such if and when the proposed species is listed. Should the tricolored bat be listed, agencies must review projects that are not yet complete, or projects with ongoing effects within the tricolored bat range that previously received a NE or NLAA determination from the key to confirm that the determination is still accurate. Projects that receive a may affect determination for tricolored bat through the key, should contact the appropriate Ecological Services Field Office if they want to conference on this species.

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

Little Mill Creek Restoration at Woodland Park

2. Description

The following description was provided for the project 'Little Mill Creek Restoration at Woodland Park':

> New Castle County (NCC) identified the restoration of Little Mill Creek and tributaries within Woodland Park as a project to provide ecological enhancement, support the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, and help meet pollutant load reductions associated with the Christina River Total Maximum Daily Load (TMDL). The project includes Little Mill Creek and its tributaries beginning at Faulkland Road and extending downstream to Centre Road (SR 141). The project entails restoring 4,814 linear feet of Little Mill Creek and 3,085 linear feet of adjacent tributaries within Woodland Run Park. The design consists of an integrated stream and wetland restoration approach that will lower the existing stream banks and adjacent floodplain to create a stream/floodplain system that is highly connected to groundwater as the existing floodplain width, potentially usable land, and property limits allow.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.7448282,-75.62060317328928,14z



DETERMINATION KEY RESULT

Based on the answers provided, the proposed Action is consistent with a determination of “may affect” for a least one species covered by this determination key.

QUALIFICATION INTERVIEW

1. Does the proposed project include, or is it reasonably certain to cause, intentional take of listed bats or any other listed species?

   Note: Intentional take is defined as take that is the intended result of a project. Intentional take could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered or proposed species?

   No

2. Is the action area wholly within Zone 2 of the year-round active area for northern long-eared bat and/or tricolored bat?

   Automatically answered
   No

3. Does the action area intersect Zone 1 of the year-round active area for northern long-eared bat and/or tricolored bat?

   Automatically answered
   No

4. Does any component of the action involve leasing, construction or operation of wind turbines? Answer 'yes' if the activities considered are conducted with the intention of gathering survey information to inform the leasing, construction, or operation of wind turbines.

   Note: For federal actions, answer ‘yes’ if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

   No

5. Is the proposed action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   Yes

6. Is the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), or Federal Transit Administration (FTA) funding or authorizing the proposed action, in whole or in part?

   No

7. Are you an employee of the federal action agency or have you been officially designated in writing by the agency as its designated non-federal representative for the purposes of Endangered Species Act Section 7 informal consultation per 50 CFR § 402.08?

   Note: This key may be used for federal actions and for non-federal actions to facilitate section 7 consultation and to help determine whether an incidental take permit may be needed, respectively. This question is for information purposes only.

   No

8. Is the lead federal action agency the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC)? Is the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC) funding or authorizing the proposed action, in whole or in part?

   No

9. Is the lead federal action agency the Federal Energy Regulatory Commission (FERC)?

   No

10. [Semantic] Is the action area located within 0.5 miles of a known bat hibernaculum?

    Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency.

    Automatically answered
    No

11. Does the action area contain any winter roosts or caves (or associated sinkholes, fissures, or other karst features), mines, rocky outcroppings, or tunnels that could provide habitat for hibernating bats?

    No

12. Will the action cause effects to a bridge?

    Note: Covered bridges should be considered as bridges in this question.

    No

13. Will the action result in effects to a culvert or tunnel at any time of year?

    Yes

14. Does the culvert or tunnel equal or exceed 23 feet (7.0 meters) in length?

    Yes

15. Do the interior dimensions of the culvert or tunnel **equal or exceed 3.0 feet (0.9 meters) in height (minimum height for tricolored bat)**?

    No

16. Are trees present within 1000 feet of the action area?

    Note: If there are trees within the action area that are of a sufficient size to be potential roosts for bats answer "Yes". If unsure, additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    Yes

17. Does the action include the intentional exclusion of bats from a building or structure?

    Note: Exclusion is conducted to deny bats' entry or reentry into a building. To be effective and to avoid harming bats, it should be done according to established standards. If your action includes bat exclusion and you are unsure whether northern long-eared bats or tricolored bats are present, answer "Yes." Answer "No" if there are no signs of bat use in the building/structure. If unsure, contact your local Ecological Services Field Office to help assess whether northern long-eared bats or tricolored bats may be present. Contact a Nuisance Wildlife Control Operator (NWCO) for help in how to exclude bats from a structure safely without causing harm to the bats (to find a NWCO certified in bat standards, search the Internet using the search term "National Wildlife Control Operators Association bats"). Also see the White-Nose Syndrome Response Team's guide for bat control in structures.

    No

18. Does the action involve removal, modification, or maintenance of a human-made structure (barn, house, or other building) **known or suspected to contain roosting bats?**

    No

19. Will the action cause construction of one or more new roads open to the public?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

20. Will the action include or cause any construction or other activity that is reasonably certain to increase average daily traffic permanently or temporarily on one or more existing roads?

    Note: For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.). .

    No

21. Will the action include or cause any construction or other activity that is reasonably certain to increase the number of travel lanes on an existing thoroughfare?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

22. Will the proposed Action involve the creation of a new water-borne contaminant source (e.g., leachate pond, pits containing chemicals that are not NSF/ANSI 60 compliant)?

    Note: For information regarding NSF/ANSI 60 please visit https://www.nsf.org/knowledge-library/nsf-ansi-standard-60-drinking-water-treatment-chemicals-health-effects

    No

23. Will the proposed action involve the creation of a new point source discharge from a facility other than a water treatment plant or storm water system?

    No

24. Will the action include drilling or blasting?

    No

25. Will the action involve military training (e.g., smoke operations, obscurant operations, exploding munitions, artillery fire, range use, helicopter or fixed wing aircraft use)?

    No

26. Will the proposed action involve the use of herbicides or other pesticides other than herbicides (e.g., fungicides, insecticides, or rodenticides)?

    No

27. Will the action include or cause activities that are reasonably certain to cause chronic or intense nighttime noise (above current levels of ambient noise in the area) in suitable summer habitat for the northern long-eared bat or tricolored bat during the active season?

    Chronic noise is noise that is continuous or occurs repeatedly again and again for a long time. Sources of chronic or intense noise that could cause adverse effects to bats may include, but are not limited to: road traffic; trains; aircraft; industrial activities; gas compressor stations; loud music; crowds; oil and gas extraction; construction; and mining.

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    No

28. Does the action include, or is it reasonably certain to cause, the use of permanent or temporary artificial lighting within 1000 feet of suitable northern long-eared bat or tricolored bat roosting habitat?

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    No

29. Will the action include tree cutting or other means of knocking down or bringing down trees, tree topping, or tree trimming?

    Yes

30. Will the proposed action occur exclusively in an already established and currently maintained utility right-of-way?

    No

31. Does the action include emergency cutting or trimming of hazard trees in order to remove an imminent threat to human safety or property? See hazard tree note at the bottom of the key for text that will be added to response letters

    Note: A "hazard tree" is a tree that is an immediate threat to lives, public health and safety, or improved property.

    No

32. Does the project intersect with the 0- 9.9% forest density category?

    Automatically answered
    No

33. Does the project intersect with the 10.0- 19.9% forest density category map?

    Automatically answered
    Yes

34. Does the project intersect with the 20.0- 29.9% forest density category map?

    Automatically answered
    No

35. Does the project intersect with the 30.0- 100% forest density category map?

    Automatically answered
    No

36. Will the action cause trees to be cut, knocked down, or otherwise brought down across an area greater than 5 acres in total extent?

    Yes

37. Does the action area intersect the tricolored bat species list area?

    Automatically answered
    Yes

38. [Semantic] Is the action area located within 0.25 miles of a culvert that is known to be occupied by northern long-eared or tricolored bats?

    Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency.

    Automatically answered
    No

39. Has a presence/probable absence bat survey targeting the tricolored bat and following the Service's Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines been conducted within the project area?

    No

40. Is suitable summer habitat for the tricolored bat present within 1000 feet of project activities?
    (If unsure, answer ""Yes."")

    Note: If there are trees within the action area that may provide potential roosts for tricolored bats (e.g., clusters of leaves in live and dead deciduous trees, Spanish moss (Tillandsia usneoides), clusters of dead pine needles of large live pines) answer ""Yes."" For a complete definition of suitable summer habitat for the tricolored bat, please see Appendix A in the Service's Range-wide Indiana Bat and Northern long-eared Bat Survey Guidelines.

    Yes

41. Do you have any documents that you want to include with this submission?

    No

PROJECT QUESTIONNAIRE

Enter the extent of the action area (in acres) from which trees will be removed - round up to the nearest tenth of an acre. For this question, include the entire area where tree removal will take place, even if some live or dead trees will be left standing.

14.81

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: George Carney
Address: 700 East Pratt Street, Suite 500
City: Baltimore
State: MD
Zip: 21202
Email gcarney@rkk.com
Phone: 4102947780

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

NOAA FISHERIES
National Oceanic and Atmospheric Administration

QR code Share link

☰ MENU

Essential Fish Habitat Mapper

New England / Mid-Atlantic

? View Content

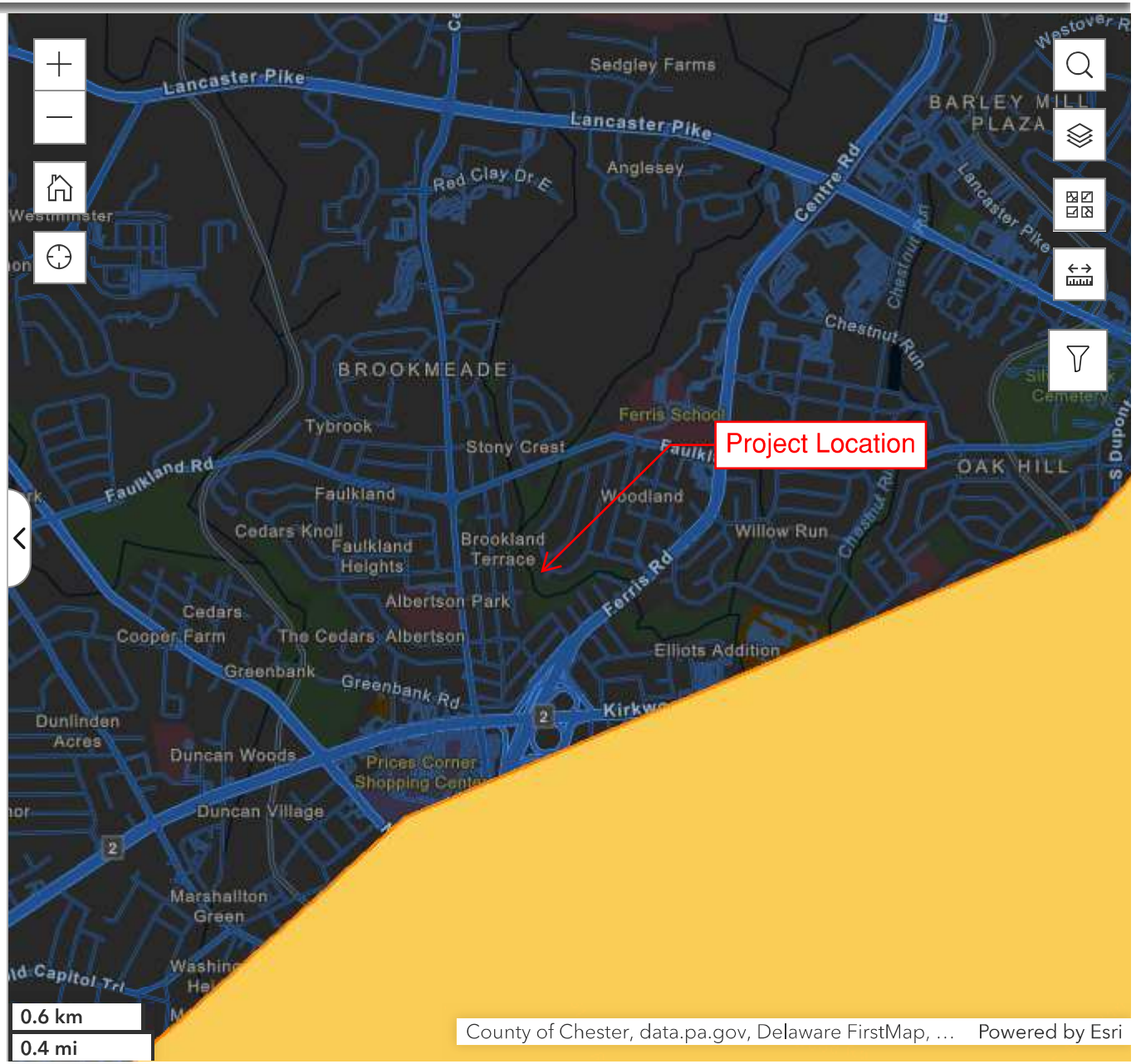
Essential Fish Habitat

New England / Mid-Atlantic EFH Species

Atlantic salmon EFH

Highly Migratory Species EFH

Choose Another Council Generate Report



HCA
DELAWARE HISTORICAL & CULTURAL AFFAIRS

Delaware Division of Historical & Cultural Affairs
29 N. State St., Dover, Delaware 19901
Tel. (302) 736-7400 | Fax. (302) 739-5660
history.delaware.gov

September 4, 2024

Karen Hutchins-Keim
RK&K
110 S. Poplar Street, Suite 102
Wilmington, DE 19801

Subject: **Little Mill Creek Restoration at Woodland Park**
SHPO Project No. 2024.03.15.09

Dear Ms. Hutchins-Keim:

We understand from your letter that the applicant, New Castle County, is seeking a permit from the US Army Corps of Engineers (USACOE) for the proposed undertaking along the Little Mill Creek in Woodland Park. The applicant is proposing to restore 8,4949 linear feet of the stream to minimize erosion. Because of the need for authorization from the USACOE, the project is subject to compliance with Section 106 of the National Historic Preservation Act of 1966 (as amended).

There are three known historic properties within or immediately adjacent to the area of potential effect (APE). Bridge 143 (N13579) was previously determined not eligible for the National Register of Historic Places (NRHP). The remaining two structures are both dwellings (N14246; N14247) that have not been evaluated for their eligibility. Due to the limited nature of the proposed, there is no anticipated impact to these properties. There is one known archaeological site adjacent to the APE. However, the site (N14015) was destroyed by existing residential development. Historic aerials show the APE has been previously disturbed by existing residential development so there is low potential for any intact archaeological sites.

Our Office finds there to be No Historic Properties Affected by the proposed undertaking. Please feel free to contact me if you have any questions at (302) 736-7431 or sarah.carr@delaware.gov.

Sincerely,

Sarah Carr
Cultural Preservation Specialist
cc: Gwen Davis, Deputy SHPO

Appendix C – Datasheets

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** A	**Stream Order:** 1
Date: 11/17/22	**State:** DE	**Photos:** 9249 - 9250	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☐ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Maintain of stream Restoration Little Mill Creek			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity –	Upstream: Outside Study Area	Downstream: Outside Study Area	Adjacent/Abutting: Features B-M

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)			Substrate						Vegetation Cover Type (MBSS)
☒	Natural Channel Shape	Width: 15'-20'	☒	Silts	☒	Sands	☐	Muck	RB: Forest
☐	Artificial (man-made)	Depth: 2"-24"	☒	Cobbles	☒	Gravel	☒	Other:	
☐	Manipulated (man-altered)	Bank Erosion/stability:	☐	Bedrock	☒	Concrete		Rip-Rap	
☐	Other:	Moderate to Severe	Side slope: ☒ ≥1:1 ☐ 2:1 ☐ 3:1 ☐ ≤4:1						LB: Forest
Notes:									

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain		0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought			Normal		Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☒	Sediment deposition	☒	Sediment sorting
☐	No	☐	Changes in the character of soil	☒	Water staining	☒	Scour
		☐	Shelving	☒	Presence of flood litter/debris	☒	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☒	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☒	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** B	**Stream Order:** II
Date: 11/17/22	**State:** DE	**Photos:** 9252 – 9251	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☒ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Flowing during site visit. Deep Pools – 24"			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity –	Upstream: Outfall	Downstream: Waters A	Adjacent/Abutting: None

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)			Substrate						Vegetation Cover Type (MBSS)
☒	Natural Channel Shape	Width: 8'-10'	☒	Silts	☒	Sands	☐	Muck	RB: Forest
☐	Artificial (man-made)	Depth: 2"-24"	☒	Cobbles	☒	Gravel	☒	Other:	
☐	Manipulated (man-altered)	Bank Erosion/stability:	☐	Bedrock	☒	Concrete		Rip-Rap	
☐	Other:	Moderate erosion	Side slope: ☒ ≥1:1 ☐ 2:1 ☐ 3:1 ☐ ≤4:1						LB: Forest
Notes:									

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain	☐	0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☒	Sediment deposition	☒	Sediment sorting
☐	No	☐	Changes in the character of soil	☒	Water staining	☒	Scour
		☐	Shelving	☒	Presence of flood litter/debris	☒	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☐	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☒	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** C	**Stream Order:** II
Date: 11/17/22	**State:** DE	**Photos:** 9255-9256	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☒ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☐ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Standing water in channel Incised – dry portions of VS channel 1-3'			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity – Upstream: Outside Study Area Downstream: Waters A Adjacent/Abutting: Wetland E

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)		Substrate			Vegetation Cover Type (MBSS)
☐ Natural Channel Shape	Width: 1'-3'	☒ Silts	☒ Sands	☐ Muck	RB: Forest & Mowed Lawn
☐ Artificial (man-made)	Depth: 0"-6"	☒ Cobbles	☒ Gravel	☐ Other:	
☒ Manipulated (man-altered)	Bank Erosion/stability:	☐ Bedrock	☐ Concrete		LB: Forest & Mowed Lawn
☐ Other:	Minor erosion	Side slope: ☒ ≥1:1 ☒ 2:1 ☐ 3:1 ☐ ≤4:1			
Notes:					

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain		0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☐	Sediment deposition	☐	Sediment sorting
☐	No	☐	Changes in the character of soil	☒	Water staining	☒	Scour
		☐	Shelving	☒	Presence of flood litter/debris	☐	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☐	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☐	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** D	**Stream Order:** II
Date: 11/17/22	**State:** DE	**Photos:** 9257-9258	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☒ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Shallow Flowing water Drains large seep wetland outside SA. Intercepts groundwater			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity – Upstream: Outside Study Area Downstream: Waters A Adjacent/Abutting: wetland E

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)			Substrate						Vegetation Cover Type (MBSS)
☒	Natural Channel Shape	Width: 2'-3'	☐	Silts	☐	Sands	☒	Muck	RB: Forest
☐	Artificial (man-made)	Depth: 1'-3'	☐	Cobbles	☐	Gravel	☐	Other:	
☐	Manipulated (man-altered)	Bank Erosion/stability:	☐	Bedrock	☐	Concrete			LB: Forest & Mowed Lawn
☐	Other:	Minor erosion	Side slope: ☐ ≥1:1 ☐ 2:1 ☒ 3:1 ☒ ≤4:1						
Notes:									

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain		0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☐	Sediment deposition	☐	Sediment sorting
☐	No	☒	Changes in the character of soil	☒	Water staining	☒	Scour
		☒	Shelving	☐	Presence of flood litter/debris	☒	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☒	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☐	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek Restoration		**Feature ID:** F	**Stream Order:** II
Date: 11/17/22	**State:** DE	**Photos:** 9263-9264	
Crew: KJH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☒ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Standing water throughout channel			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity –	Upstream: Outside Study Area	Downstream: Waters A	Adjacent/Abutting: None

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)			Substrate						Vegetation Cover Type (MBSS)
☐	Natural Channel Shape	Width: 3'-6'	☒	Silts	☒	Sands	☒	Muck	RB: Forest & mowed lawn
☐	Artificial (man-made)	Depth: 4"-6"	☒	Cobbles	☒	Gravel	☐	Other:	
☒	Manipulated (man-altered)	Bank Erosion/stability: minor to moderate	☐	Bedrock	☐	Concrete			LB: Forest
☐	Other:		Side slope: ☒ ≥1:1 ☐ 2:1 ☐ 3:1 ☐ ≤4:1						
Notes:									

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Nov Year: 2022												
☒	No rain	☐	0-0.5								☒					
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☒	Sediment deposition	☒	Sediment sorting
☐	No	☐	Changes in the character of soil	☒	Water staining	☒	Scour
		☒	Shelving	☒	Presence of flood litter/debris	☒	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☒	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☐	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek		**Feature ID:** I	**Stream Order:**
Date: 12/13/22	**State:** DE	**Photos:** 9359 - 9360	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☐ RPW – Perennial (Flowing year round)	☒ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Water in most of reach. No rain previous night. Few dry areas			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity –	Upstream: Storm drain outlet	Downstream: Waters A	Adjacent/Abutting: None

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)		Substrate				Vegetation Cover Type (MBSS)
☐ Natural Channel Shape	Width: 1'-4'	☒ Silts	☐ Sands	☐ Muck		RB: Mowed Lawn
☐ Artificial (man-made)	Depth: 0-6"	☒ Cobbles	☐ Gravel	☐ Other:		
☒ Manipulated (man-altered)	Bank Erosion/stability:	☐ Bedrock	☐ Concrete			
☐ Other:	Minor erosion	Side slope: ☒ ≥1:1 ☐ 2:1 ☐ 3:1 ☐ ≤4:1				LB: Mowed Lawn
Notes:						

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Dec Year: 2022												
☒	No rain	☐	0-0.5									☒				
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks		Ordinary High Water Mark					
☒	Yes	☐	Clear, natural line impressed on the bank	☐	Sediment deposition	☐	Sediment sorting
☐	No	☐	Changes in the character of soil	☐	Water staining	☒	Scour
		☐	Shelving	☒	Presence of flood litter/debris	☐	Observed/predicted flow events
		☒	Vegetation matted down, bent, or absent	☐	Destruction of terrestrial veg.	☐	Abrupt change in plant community
		☒	Leaf litter disturbed	☒	Presence of wrack line	☐	Other:

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line		Mean High Water Mark indicated by:		Chemical Characteristics	
☐	Oil or scum line along shore objects	☐	Survey to available datum	☐	Water is clear
☐	Fine shell or debris deposits (foreshore)	☐	Physical markings	☐	Water is discolored
☐	Physical markings/characteristics	☐	Vegetation lines/changes in types	☐	Oily film
☐	Tidal gauges			☐	Other:
Notes:					

Waters of the U.S. Data Sheet

Project: Little Mill Creek		**Feature ID:** M	**Stream Order:** II
Date: 12/13/22	**State:** DE	**Photos:** 9375-9376	
Crew: KSH, AB	**County:** New Castle	**Last Flag Number:** NA	

Feature Hydrologic Class (check one):

Tidal	Perennial	Intermittent (SNE)	Ephemeral (SNE)
☐ TNW (Subject to ebb and flow)	☐ TNW – Perennial (Flowing year round)	☐ RPW – Flow ≥ 3 months	☐ Non-RPW draining uplands
	☒ RPW – Perennial (Flowing year round)	☐ Non-RPW – Flow < 3 months	☐ Non-RPW erosional feature
			☐ Non-RPW with abutting wetland
			☐ Non-RPW with adjacent wetland
Describe rational for hydrologic class: Little Falls Creek Water throughout channel			☐ Non-RPW wetland adjacent or abutting upstream (outside of study area)

Hydrologic Connectivity – Upstream: outside study Area Downstream: Waters A Adjacent/Abutting: None

Feature Description: ***(check all that apply)***

Shape (with respect to OHW)		Substrate			Vegetation Cover Type (MBSS)
☒ Natural Channel Shape	Width: 10-15'	☒ Silts	☒ Sands	☐ Muck	RB: Forest
☐ Artificial (man-made)	Depth: 4"-12"	☒ Cobbles	☒ Gravel	☐ Other:	
☐ Manipulated (man-altered)	Bank Erosion/stability: Minor erosion	☐ Bedrock	☐ Concrete		LB: Forest
☐ Other:		Side slope: ☒ ≥1:1 ☒ 2:1 ☐ 3:1 ☐ ≤4:1			
Notes:					

Weather/Precipitation Conditions:

During Field Visit		Inches of Rain Within Last Week		Monthly Drought Condition NCDC Regional PDSI http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php Month: Dec Year: 2022												
☒	No rain	☐	0-0.5									☒				
☐	Light rain	☒	0.5-1	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
☐	Heavy Rain	☐	>1	Severe Drought			Moderate Drought		Normal			Moderately Wet		Severely Wet		

Non-tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

Bed and Banks	Ordinary High Water Mark			
☒ Yes	☐ Clear, natural line impressed on the bank	☒ Sediment deposition	☒ Sediment sorting	
☐ No	☐ Changes in the character of soil	☒ Water staining	☒ Scour	
	☒ Shelving	☒ Presence of flood litter/debris	☒ Observed/predicted flow events	
	☒ Vegetation matted down, bent, or absent	☐ Destruction of terrestrial veg.	☐ Abrupt change in plant community	
	☒ Leaf litter disturbed	☐ Presence of wrack line	☐ Other:	

Tidal tributary has: ***(check all that apply; include photos for each & list photo #)***

High Tide Line	Mean High Water Mark indicated by:	Chemical Characteristics
☐ Oil or scum line along shore objects	☐ Survey to available datum	☐ Water is clear
☐ Fine shell or debris deposits (foreshore)	☐ Physical markings	☐ Water is discolored
☐ Physical markings/characteristics	☐ Vegetation lines/changes in types	☐ Oily film
☐ Tidal gauges		☐ Other:
Notes:		

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Little Mill Creek Restoration City/County: New Castle County Sampling Date: 11/17/22

Applicant/Owner: New Castle County State: DE Sampling Point: WET-E

Investigator(s): KUH/AB Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain depression Local relief (concave, convex, none): concave Slope (%):

Subregion (LRR or MLRA): LRR Lat: 39.742361 Long: -75.619509 Datum: NAD83

Soil Map Unit Name: DeB - Delanco-Colonia-Hatboro complex, 0-8% slopes NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** Yes X No ____
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	

Remarks:

Photos 9259 - 9260

Rained previous night 11/16

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1-4 in
Water Table Present?	Yes X	No ____	Depth (inches): 0 in
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0 in

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Rained previous night 11/16

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: WE1-E

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5 x 10 ft)			
1. Persicaria sagittata	60	Y	OBL
2. Persicaria maculosa	10	N	FACW
3. Microstegium vimineum	5	N	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	75 = Total Cover		

50% of total cover: 37.5 20% of total cover: 15

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- X 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Rained previous night 11/16

SOIL

Sampling Point: WET-E

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	10 YR 4/2	80	2.5 YR 4/6	20	C	M+PL	Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No _____

Remarks:

Rained previous night 11/11

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Little Mill Creek Restoration City/County: New Castle County Sampling Date: 11/17/22

Applicant/Owner: New Castle County State: DE Sampling Point: UPL-1

Investigator(s): KJH/AB Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain depression Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR Lat: 39.743558 Long: -75.620406 Datum: NAD83

Soil Map Unit Name: DcB - Delanco-Woodstown-Hatboro complex, 0-8 % slopes NWI classification: upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

Photos 9253 + 9254

* Rain night before 11/16 Mowed - disturbed vegetation

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No _____ Depth (inches): 2 in

Water Table Present? Yes X No _____ Depth (inches): 0 in

Saturation Present? (includes capillary fringe) Yes X No _____ Depth (inches): 0 in

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Rained previous night 11/16

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: UPL - 1

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Herb Stratum (Plot size: 5 ft r)			
1. Potentilla simplex	50	Y	FACU
2. Persicaria maculosa	30	Y	FACW
3. Lysimachia nummularia	10	N	FACW
4. Ficaria verna	10	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	
FACW species	40	x 2 =	80
FAC species	10	x 3 =	30
FACU species	50	x 4 =	200
UPL species	0	x 5 =	0
Column Totals:	100 (A)		310 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

rained previous night on 11/16

Vegetation has been mowed – maintained lawn

SOIL

Sampling Point: UPL-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	10 YR 3/3	100					Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

Rained night before 11/16/22

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Little Mill Creek Restoration City/County: New Castle County Sampling Date: 11/17/22

Applicant/Owner: New Castle County State: DE Sampling Point: UPL-E

Investigator(s): KJH / AB Section, Township, Range:

Landform (hillslope, terrace, etc.): Stream berm Local relief (concave, convex, none): convex Slope (%): 0-2%

Subregion (LRR or MLRA): LRR Lat: 39.742405 Long: -75.61941 Datum: NAD83

Soil Map Unit Name: DcB - Delanco - Cordrey - Harbor complex, 0-8% slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation X, Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes X	No	

Remarks:

Photo 9201 No hydric soils

Rained previous night 11/16 * vegetation has been mowed + maintained

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	No X	Depth (inches):
Water Table Present?	Yes	No X	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	No X	Depth (inches):

Wetland Hydrology Present? Yes X No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Rained previous night 11/16

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: UPL-E

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Herb Stratum (Plot size: 10 ft r)			
1. Microstegium vimineum	90	Y	FAC
2. Glechoma hederacea	5	N	FACU
3. Dichanthelium clandestinum	2	N	UPL
4. Helianthus occidentalis	2	N	UPL
5. Boehmeria cylindrica	5	N	FACW
6.			
7.			
8.			
9.			
10.			
11.			
	104 = Total Cover		
50% of total cover: 52	20% of total cover: 21		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Rained previous night 11/16

SOIL

Sampling Point: VPL - E

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 3/4	100					Silt Loam	
13-18	10YR 3/4	90	5YR 4/6	10	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

No hydric soils - redox under 12 inches, matrix too brown

Rained previous night 11/16

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Little Mill Creek Restoration City/County: New Castle County Sampling Date: 11/17/22

Applicant/Owner: New Castle County State: DE Sampling Point: UPL-11

Investigator(s): KJH/AB Section, Township, Range:

Landform (hillslope, terrace, etc.): stream berm Local relief (concave, convex, none): convex Slope (%): 0-2

Subregion (LRR or MLRA): LRR Lat: 39.743455 Long: -75.615693 Datum: NAD83

Soil Map Unit Name: DcB - Delanco - Cordova - Hatboro Complex, 0-8% slopes NWI classification: upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____ No _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____ No _____	
Wetland Hydrology Present?	Yes _____ No X	

Remarks:

Rained previous night 11/16 Mowed area - disturbed vegetation Photo 9271

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____ No X	Depth (inches): _____
Water Table Present?	Yes _____ No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____ No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Rained previous night 11/16

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: UPL - H

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5 Ft)			
1. Festuca arundinacea	50	Y	FACW
2. Fragaria vesca	30	Y	FACU
3. Persicaria maculosa	10	N	FACW
4. Glechoma hederacea	10	N	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

50% of total cover: 50 20% of total cover: 20

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species 10	x 2 = 20
FAC species _____	x 3 = _____
FACU species 90	x 4 = 360
UPL species _____	x 5 = _____
Column Totals: 100 (A)	380 (B)

Prevalence Index = B/A = 3.8

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

Mowed area - Disturbed vegetation

Rained previous night 11/16

SOIL

Sampling Point: UPL-H

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 4/2	100					Silt Loam	
13-17	2.5Y 4/2	90	5YR 4/6	10	C	M	Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
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- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

Redox under 12 inches - no hydric soils

Rained previous night 11/16

Appendix D – Photographic Record

Waters of the U.S.



WUS-A – Perennial RPW (Little Mill Creek)



WUS-B – Perennial RPW



WUS-C – Intermittent RPW



WUS-D – Perennial RPW



WUS-F – Perennial RPW



WUS-I – Intermittent Non-RPW



WUS-M – Perennial RPW (Little Falls Creek)

Wetlands



WET-E – PEM

Forest Stands



FS1 – Sycamore-Green Ash-Box Elder Silver Maple Forest Association



FS2 – Beech-Sugar Maple Forest Association



FS3 – Northern Red Oak Forest Association



FS4 – Silver Maple-Sycamore Forest Association



FS5 – Red Maple Forest Association



FS6 – Sycamore-Green Ash-Box Elder Silver Maple Forest Association

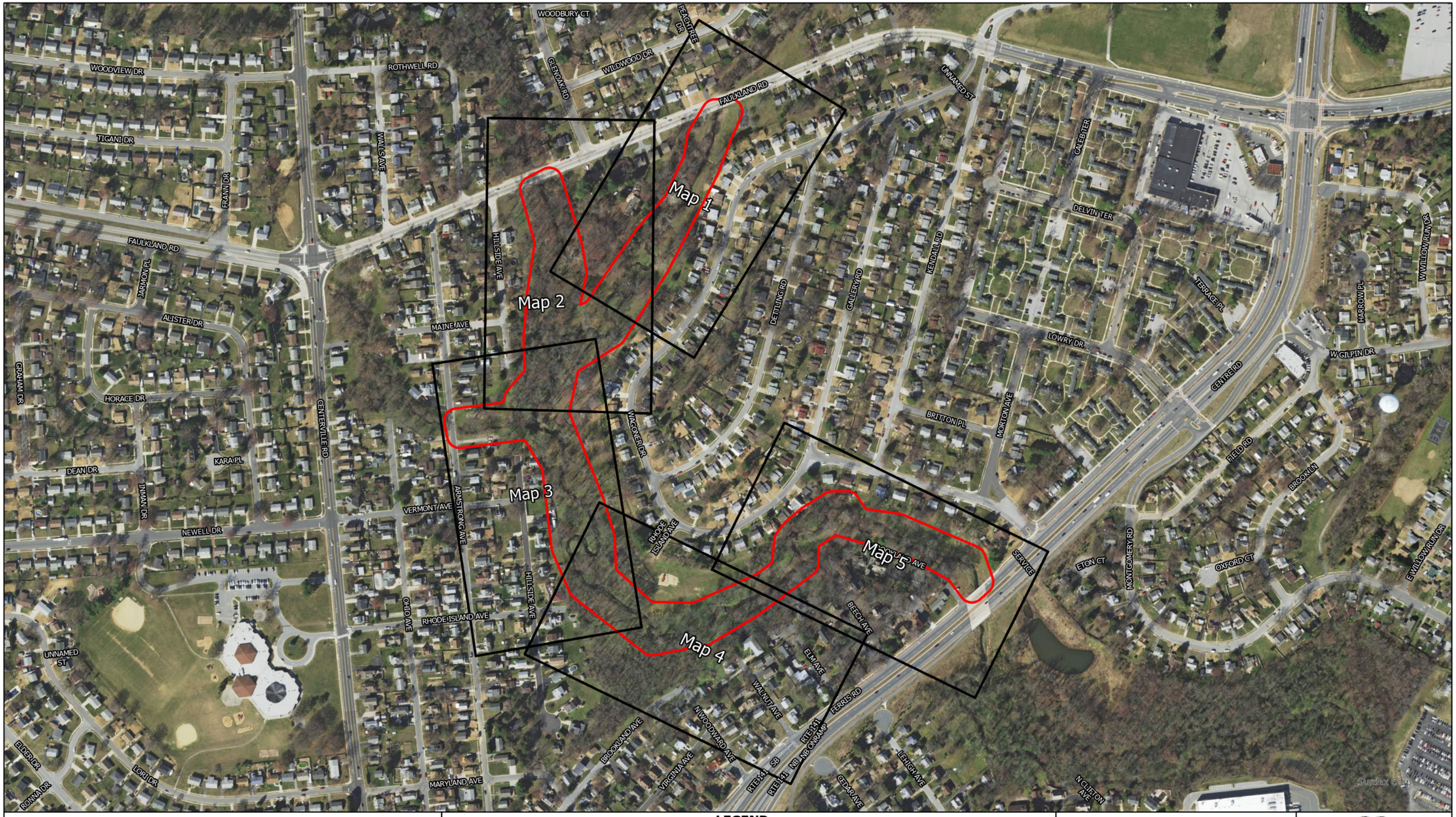
Appendix E – Tree Inventory Table

Little Mill Creek Restoration at Woodland Park - Tree Inventory Table

Tree ID	Scientific Name	Common Name	DBH	Condition	Comments
T1*	*Acer rubrum*	Red maple	34	Good/Fair	Included bark. Exposed roots. Splits above DBH. Trunk cavity.
T2*	*Quercus palustris*	Pin oak	34	Good/Fair	Dead wood.
T3	*Salix nigra*	Black willow	16	Fair/Poor	Severe lean. Extensive deadwood. Moderate vines.
T4*	*Acer saccharinum*	Silver maple	41	Fair	Included bark. Dead wood. Base decay.
T5	*Fraxinus pennsylvanica*	Green ash	21	Good/Fair	Dead wood.
T6*	*Fraxinus pennsylvanica*	Green ash	25	Good/Fair	Dead wood.
T7*	*Fraxinus pennsylvanica*	Green ash	24	Good/Fair	Dead wood. Lean. Moderate vines.
T8*	*Fraxinus pennsylvanica*	Green ash	30	Good/Fair	Vines. Dead wood.
T9*	*Fraxinus pennsylvanica*	Green ash	29	Fair/Poor	Extensive dead wood.
T10*	*Fraxinus pennsylvanica*	Green ash	34	Poor	Moderate vines. Broken leader. Dead wood.
T11*	*Acer saccharinum*	Silver maple	50	Good/Fair	Included bark. Growing against fence. Multi-stem. Dead wood.
T12*	*Acer saccharinum*	Silver maple	49	Good	Included bark. Multi-stem. Growing into fence.
T13	*Fraxinus pennsylvanica*	Green ash	18	Good/Fair	Heavy vines. Dead wood.
T14	*Fraxinus pennsylvanica*	Green ash	19	Fair/Poor	Extensive deadwood.
T15	*Fraxinus pennsylvanica*	Green ash	19	Good/Fair	Dead wood.
T16*	*Juglans nigra*	Black walnut	31	Fair	Dead wood. Broken leader.
T17*	*Quercus palustris*	Pin oak	36	Good	Dead wood.
T18*	*Quercus palustris*	Pin oak	35	Good	Minor vines. Dead wood.
T19	*Quercus palustris*	Pin oak	22	Good/Fair	Heavy vines. Sparse canopy.
T20*	*Quercus palustris*	Pin oak	29	Good	Dead wood.
T21*	*Quercus palustris*	Pin oak	34	Good	Dead wood.
T22*	*Quercus palustris*	Pin oak	34	Good	Vines. Dead wood.
T23	*Fraxinus pennsylvanica*	Green ash	19	Good/Fair	Dead wood. Growing into power lines.
T24*	*Liriodendron tulipifera*	Tulip poplar	25	Good	Included bark.
T25	*Juglans nigra*	Black walnut	22	Fair	Utility pruning. Exposed roots. Trunk wound.
T26*	*Quercus palustris*	Pin oak	42	Good/Fair	Pruned. Exposed roots.
T27	*Acer saccharinum*	Silver maple	16	Fair/Poor	Twin trunk 14in. Broken leaders. Lean. Exposed roots.
T28*	*Liriodendron tulipifera*	Tulip poplar	27	Good/Fair	Water sprouts.
T29*	*Acer rubrum*	Red maple	33	Good/Fair	Included bark. Trunk wound.
T30*	*Acer rubrum*	Red maple	28	Fair	Large trunk cavity. Broken branches.
T31*	*Fraxinus pennsylvanica*	Green ash	36	Fair	Vines. Dead wood. Large broken branches.

* Specimen Tree ($\geq$24.01 " DBH)

Appendix F – Natural Resources Inventory (NRI) Plan



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Key Map

LEGEND

Project Study Area

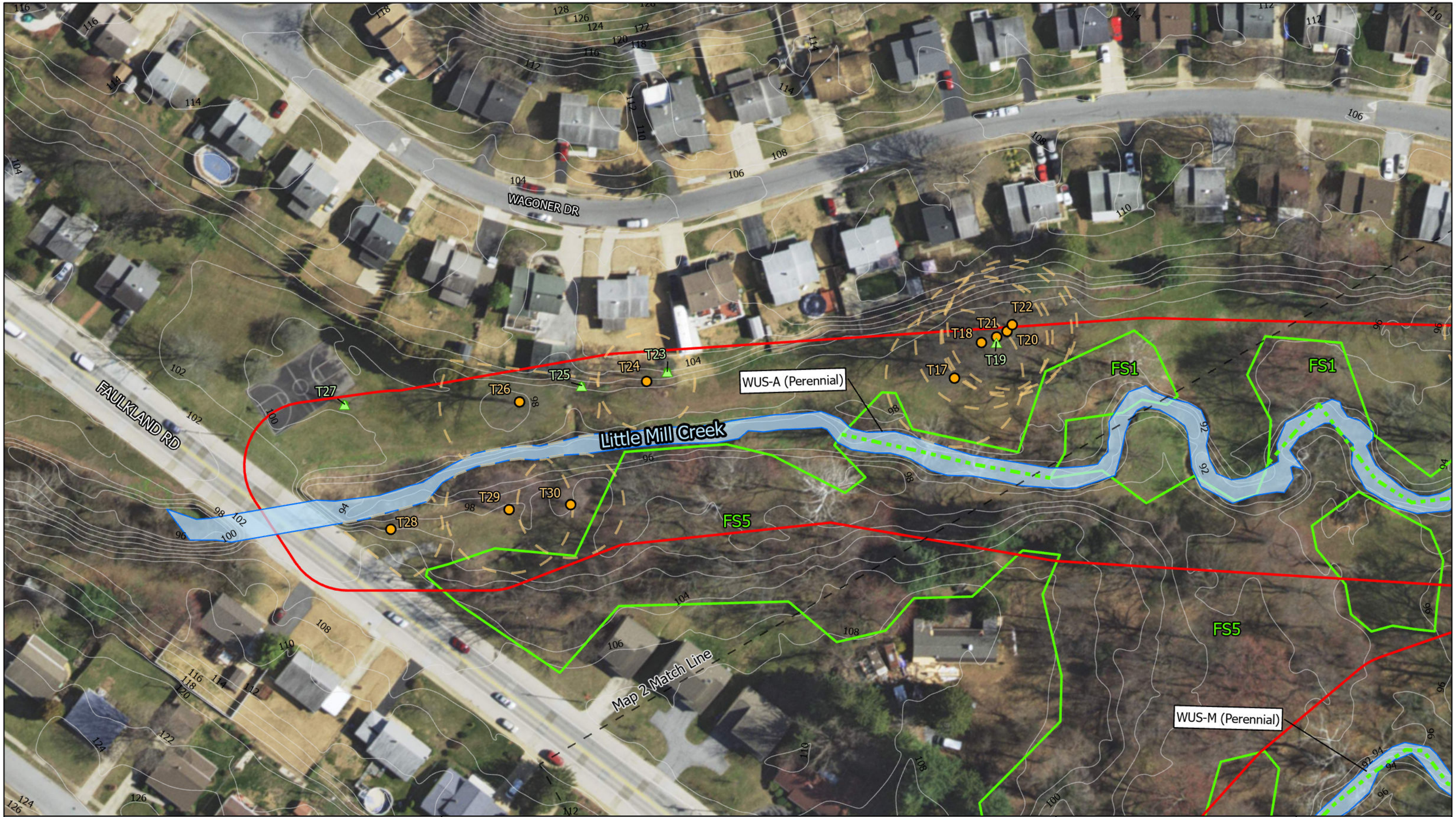
0 175 350 Feet

1 inch = 350 feet

N

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 1 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
- Critical Root Zones
- Stand Alone Trees
- Forest Stand Breaks
- Forest Stand Boundary
- 2' Contours

0 35 70 Feet

1 inch = 70 feet

N

New Castle County 1673 Delaware

RK&K

Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 2 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
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- Stand Alone Trees
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- Forest Stand Boundary
- 2' Contours

0 35 70 Feet

1 inch = 70 feet

RK&K



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 3 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
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- Stand Alone Trees
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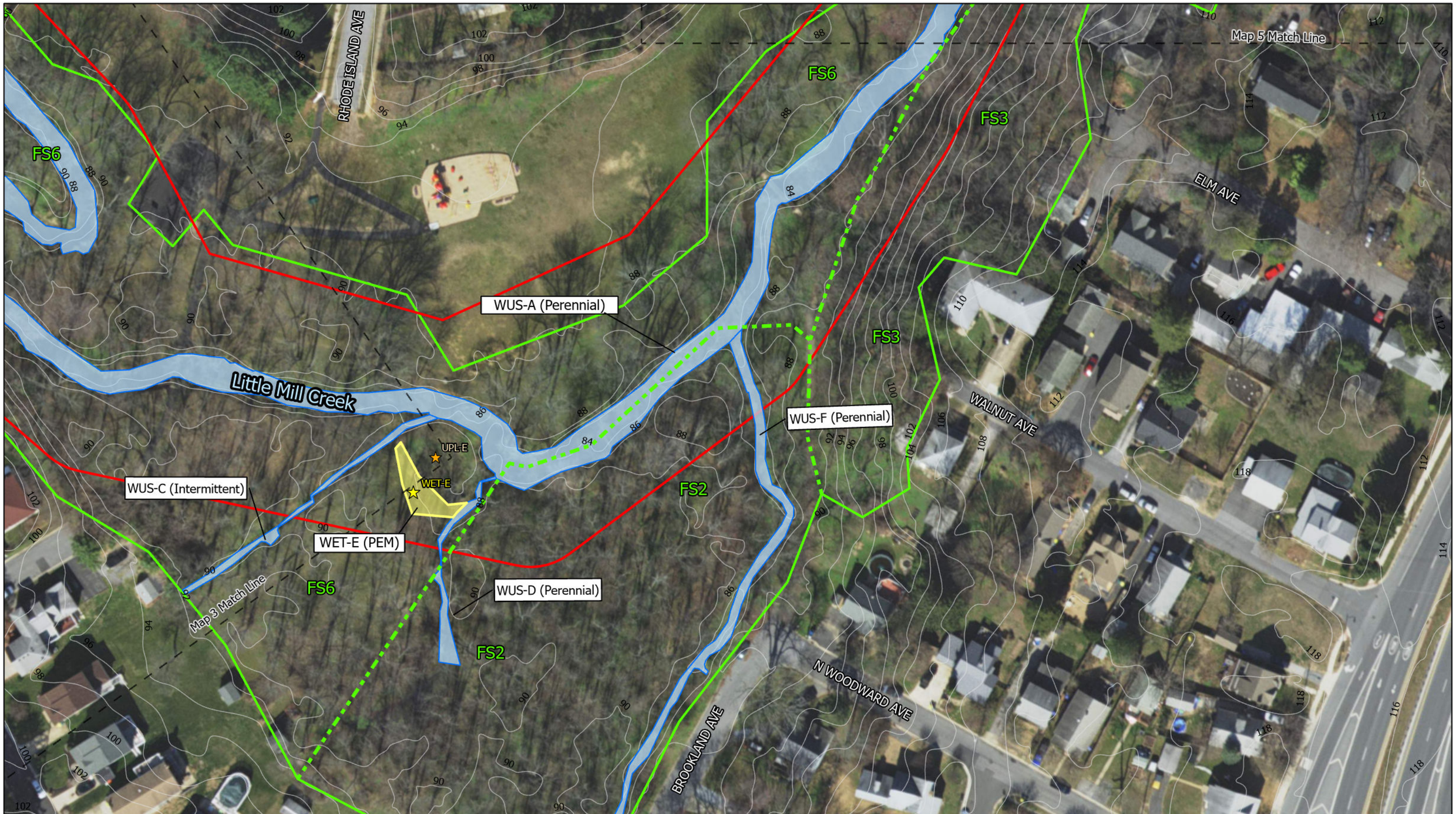
0 35 70 Feet

1 inch = 70 feet

N

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 4 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
- Critical Root Zones
- Stand Alone Trees
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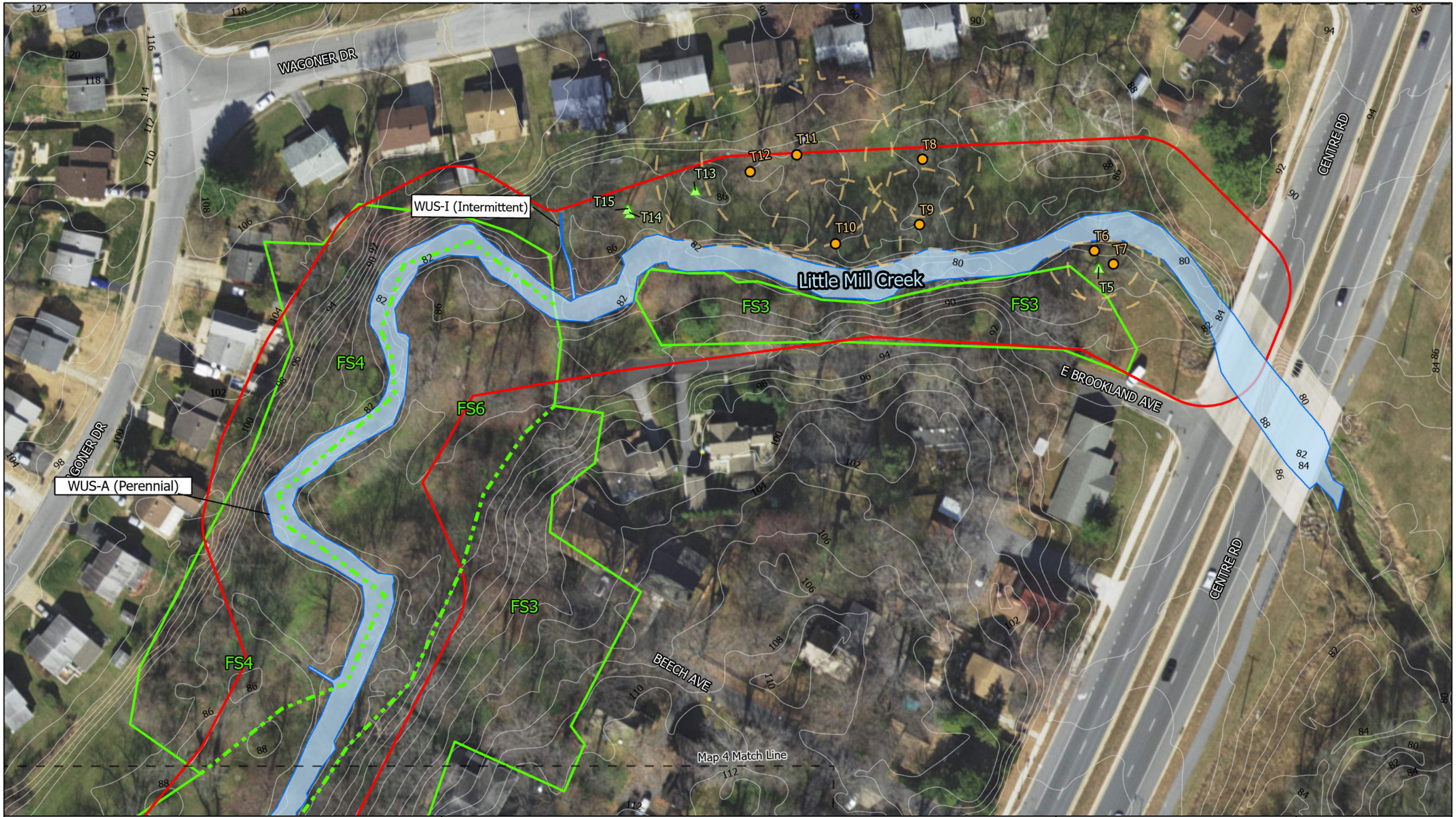
0 35 70 Feet

1 inch = 70 feet

N

New Castle County 1673 Delaware

RK&K



Little Mill Creek Restoration at Woodland Park

Natural Resources Inventory (NRI) Plan

September 2024

Map 5 of 5

LEGEND

- Project Study Area
- Wetland Plot Points
- Wetlands
- Upland Plot Points
- Waterways
- Specimen Trees
- Critical Root Zones
- Stand Alone Trees
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- Forest Stand Boundary
- 2' Contours

0 35 70 Feet

1 inch = 70 feet

N

New Castle County 1673 Delaware

RK&K

APPENDIX D
TREE INVENTORY TABLE

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Little Mill Creek Restoration at Woodland Park - Tree Inventory Table

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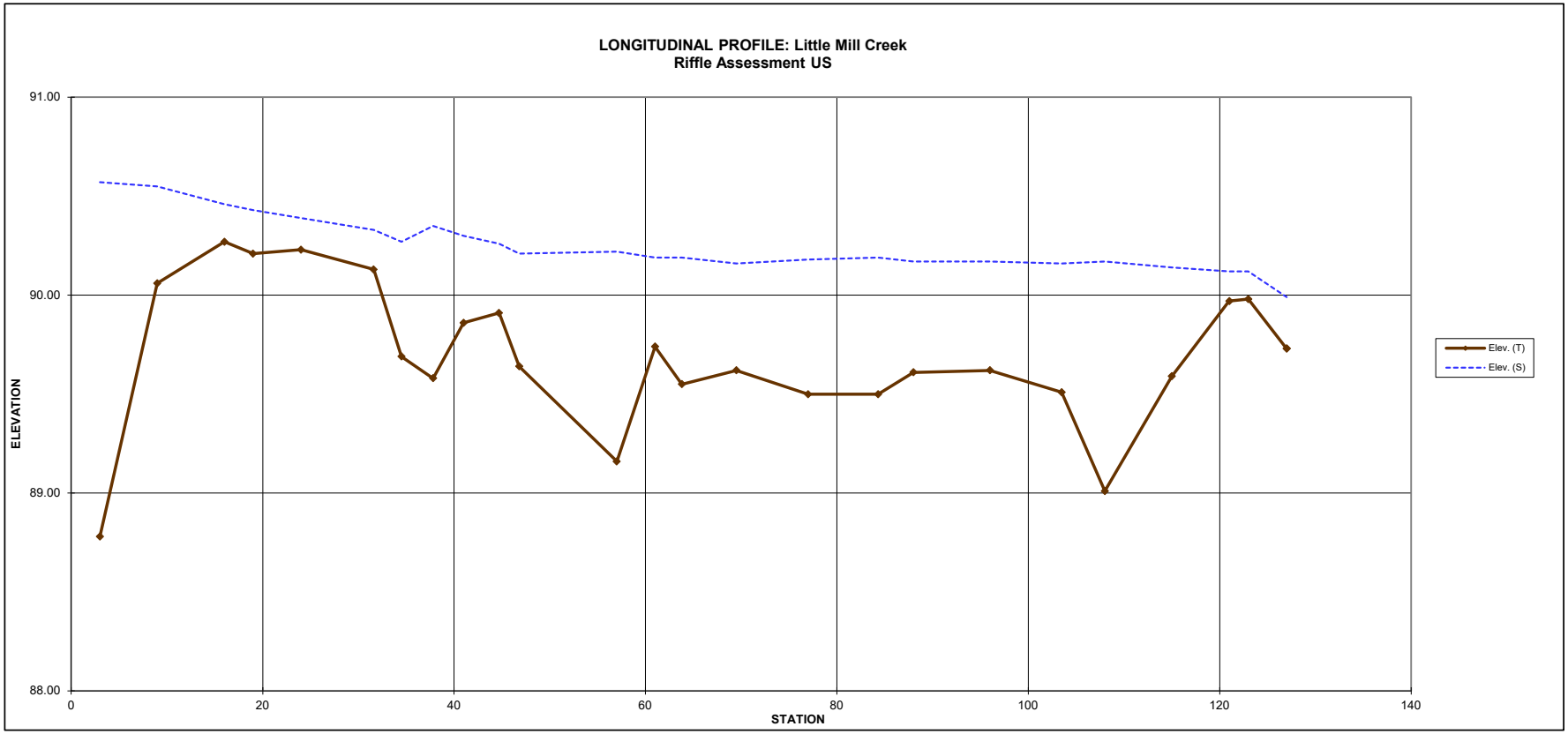
* Specimen Tree ($\geq$24.01 " DBH)

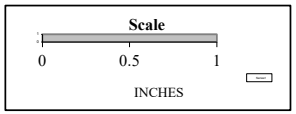
APPENDIX E
ASSESSMENT REACH ANALYSIS DATA

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Little Mill Creek - Riffle Assessment Profile US - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			Date: 12/16/21							
Rc* at BM			0										
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc1	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**				**Elev. (T)**	**Elev. (S)**	**Elev. (BF)**	**Elev. (TB)**
3.0	3	11.22	9.43					0		88.78	90.57	100.00	100.00
9.0	9.00	9.94	9.45					0		90.06	90.55	100.00	100.00
16.0	16.00	9.73	9.54			Head of Riffle		0		90.27	90.46	100.00	100.00
19.0	19.00	9.79	9.57					0		90.21	90.43	100.00	100.00
24.0	24.00	9.77	9.61					0		90.23	90.39	100.00	100.00
31.6	31.60	9.87	9.67			Run		0		90.13	90.33	100.00	100.00
34.5	34.50	10.31	9.73					0		89.69	90.27	100.00	100.00
37.8	37.80	10.42	9.65			D Max		0		89.58	90.35	100.00	100.00
41.0	41.00	10.14	9.70			Glide		0		89.86	90.30	100.00	100.00
44.7	44.70	10.09	9.74					0		89.91	90.26	100.00	100.00
46.8	46.80	10.36	9.79					0		89.64	90.21	100.00	100.00
57.0	57.00	10.84	9.78					0		89.16	90.22	100.00	100.00
61.0	61.00	10.26	9.81					0		89.74	90.19	100.00	100.00
63.8	63.80	10.45	9.81					0		89.55	90.19	100.00	100.00
69.5	69.50	10.38	9.84					0		89.62	90.16	100.00	100.00
77.0	77.00	10.50	9.82					0		89.50	90.18	100.00	100.00
84.3	84.30	10.50	9.81					0		89.50	90.19	100.00	100.00
88.0	88.00	10.39	9.83					0		89.61	90.17	100.00	100.00
96.0	96.00	10.38	9.83					0		89.62	90.17	100.00	100.00
103.5	103.50	10.49	9.84					0		89.51	90.16	100.00	100.00
108.0	108.00	10.99	9.83					0		89.01	90.17	100.00	100.00
115.0	115.00	10.41	9.86					0		89.59	90.14	100.00	100.00
121.0	121.00	10.03	9.88			Head of Riffle		0		89.97	90.12	100.00	100.00
123.0	123.00	10.02	9.88					0		89.98	90.12	100.00	100.00
127.0	127.00	10.27	10.01					0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	127.00							0		89.73	89.99	100.00	100.00
	0.00							0		89.73	89.99	100.00	100.00
	0.00							0		89.73	89.99	100.00	100.00
	0.00							0		89.73	89.99	100.00	100.00
	0.00							0		89.73	89.99	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged WS Slope	**=**	**0.00468**	**ft/ft**
Head of Riffle to Head of Riffle WS Slope	**=**	**0.00377**	**ft/ft**
Assessment Riffle WS Slope	**=**	**0.00973**	**ft/ft**

Little Mill Creek - Riffle Assessment US @ STA. XX

REACH ID:	**LMC-Assessment US**	**Date: 12/16/21**
Reference Base Elevation:		100
Enter Rod Reading at Base Elevation:		0
Diagonal Camline Used:	(yes = 1, no =	0
Convert English(0) to Metric (1):		0
Bankfull Elev. (from Column M)		90.89
Water Surface Elev. (from Column M)		90.53

Adj. Readng
(Rci)
R+TPc
& Camline

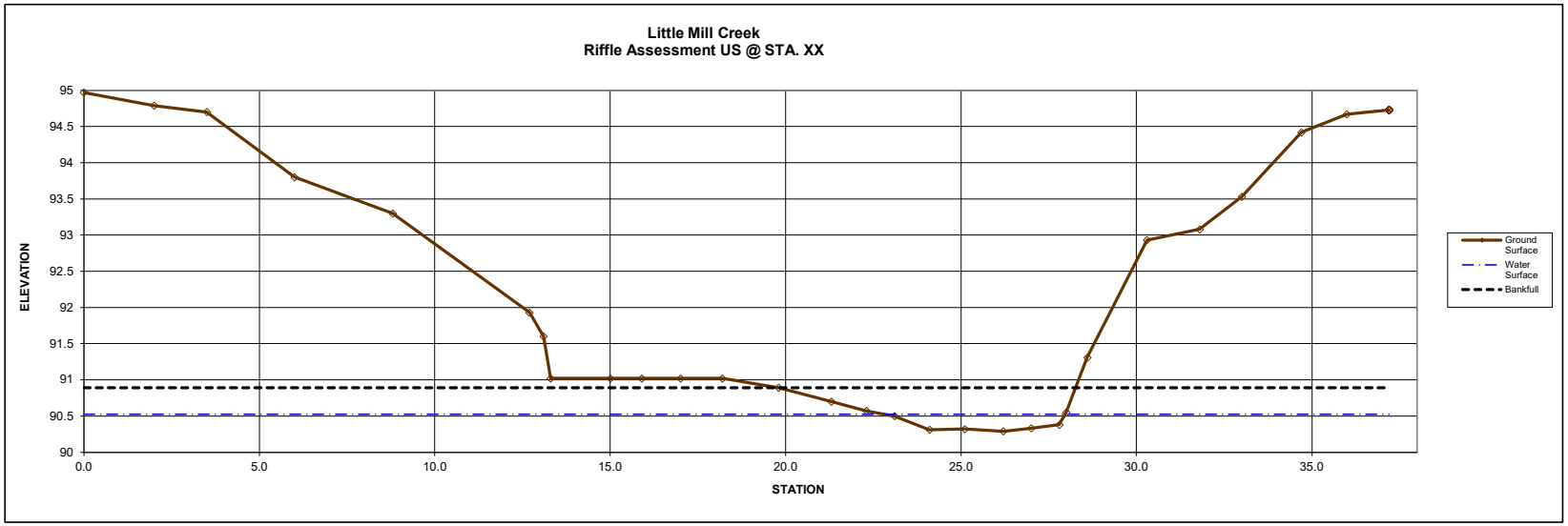
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	90.89	Slope (ft/ft)	0.0068	L.Pin Sta.	0.0
B. Width =	8.5	Mannings "n"	0.035	R.Pin Sta.	37.2
W/d =	21.04	D84 (mm) measured	23.1	L.Pin Rod	94.97
F.P.Width	15.7	Velocity (ft/s) Manning's)	1.84	R.Pin Rod	94.7
Entrenchment	1.85	Velocity (ft/s) via. (U/U*)	2.07	Tape Angle (deg.	0.4
B. Area =	3.4	Froud #	0.53		
B. Depth=	0.40	Discharge (cu ft/s)	6.3	Rc Meas.	
Max Depth	0.60	Shear Stress (lb/sq ft)	0.16	Chord	
W. Per=	9.1	CX Power (ft lb/s)	2.7	m	
H.Radius=	0.37	CX Power (watts)	3.6	Rc Calc.	
SS L Bank* =	0.48	Critical size (mm)	11.8	Rc/B. Width**	
SS R Bank* =	1.11	D84 predicted (mm)	7.2		
Shape Factor:	0.20	Flow Type	Subcritical Flow		

*Based on $HRad_{nb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pa Sta X	FP Width R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	5.03	LEP/OG	5.03	94.97	5.03	0.00	1	0	0.00	0.00		0	)
2.0	2.0	5.21		5.21	94.8	5.21	0.00	1	0	0.00	0.00	0.0	0	Above B F
3.5	3.5	5.30		5.30	94.7	5.30	0.00	1	0	0.00	0.00	0.0	0	Above B F
6.0	6.0	6.20		6.20	93.8	6.20	0.00	1	0	0.00	0.00	0.0	0	Above B F
8.8	8.8	6.70		6.70	93.3	6.70	0.00	1	0	0.00	0.00	0.0	0	Above B F
12.7	12.7	8.07		8.07	91.9	8.07	0.00	1	0	0.00	0.00	0.0	0	Above B F
13.1	13.1	8.40		8.40	91.6	8.40	0.00	1	0	0.00	0.16	0.0	0	Above B F
13.3	13.3	8.98		8.98	91.0	8.98	0.00	0	0	0.00	1.70	0.0	0	Above B F
15.0	15.0	8.98		8.98	91.0	8.98	0.00	0	0	0.00	0.90	0.0	0	Above B F
15.9	15.9	8.98		8.98	91.0	8.98	0.00	0	0	0.00	1.10	0.0	0	Above B F
17.0	17.0	8.98		8.98	91.0	8.98	0.00	0	0	0.00	1.20	0.0	0	Above B F
18.2	18.2	8.98	BFF	8.98	91.0	8.98	0.00	0	0	0.00	1.60	0.0	0	Above B F
19.8	19.8	9.11		9.11	90.9	9.11	1.50	0	0	0.00	1.50	0.0	0	Within B F
21.3	21.3	9.30		9.30	90.7	9.30	1.00	0	0	0.00	1.00	0.1	0	Within B F
22.3	22.3	9.43		9.43	90.6	9.43	0.80	0	0	0.00	0.80	0.3	0.40	Within B F
23.1	23.1	9.50	L-EOW	9.50	90.5	9.50	1.00	0	0	0.00	1.00	0.3	0.00	Within B F
24.1	24.1	9.69		9.69	90.3	9.69	1.00	0	0	0.00	1.00	0.5	0.00	Within B F
25.1	25.1	9.68		9.68	90.3	9.69	1.10	0	0	0.00	1.10	0.6	0.00	Within B F
26.2	26.2	9.71		9.71	90.3	9.71	0.80	0	0	0.00	0.80	0.6	0.00	Within B F
27.0	27.0	9.67		9.67	90.3	9.71	0.80	0	0	0.00	0.80	0.5	0.00	Within B F
27.8	27.8	9.62		9.62	90.4	9.71	0.20	0	0	0.00	0.20	0.4	0.00	Within B F
28.0	28.0	9.45	R-EOW	9.45	90.6	9.71	0.27	0	0	0.00	0.60	0.1	0.00	Within B F
28.6	28.6	8.69		8.69	91.3	9.71	0.00	0	1	####	0.19	0.0	0.00	Above B F
30.3	30.3	7.07		7.07	92.9	9.71	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
31.8	31.8	6.92		6.92	93.1	9.71	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
33.0	33.0	6.47		6.47	93.5	9.71	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
34.7	34.7	5.58		5.58	94.4	9.71	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
36.0	36.0	5.33		5.33	94.7	9.71	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
37.2	37.2	5.27	REP/OG	5.27	94.7	9.71	0.00	0	1	0.00	0.00	0.0	0.00	Above B F



Scale
0 0.5 1
INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	90.89
Bank Full Width	8.47
Bank Full Depth	0.40
Maximum Depth	0.60
Bank Full Area	3.4
Hydraulic Radius	0.37
Wetted Perimeter	9.1
Width/Depth Ratio	21.0
Flood Prone Width	15.7
Entrenchment	1.85
Stream Type	
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0068
Manning's n	0.0345
Velocity (ft./s)	1.84
Froud #	0.53
Discharge (cu ft/s)	6.3
Shear Stress (lb/sq ft)	0.16
CX Power (ft lb/s)	2.7
Critical Size (mm)	11.8
Flow Type	Subcritical Flow
Rec. Interval	

PEBBLE COUNT: Riffle Assessment Reach

XS US

PARTICLE	Type	Size (mm)	Riffles Total	Pools Total	Combined	Combined %	Cumulative	% Cumulative
silt/clay		**0.06**	0		0	0.00	0	0.00
very fine	sand	**0.13**	0		0	0.00	0	0.00
fine	sand	**0.25**	0		0	0.00	0	0.00
medium	sand	**0.50**	0		0	0.00	0	0.00
coarse	sand	**1.00**	0		0	0.00	0	0.00
very coarse	sand	**2**	4		4	1.57	4	1.57
very fine	gravel	**3**	15		15	5.91	19	7.48
fine	gravel	**6**	13		13	5.12	32	12.60
fine	gravel	**8**	38		38	14.96	70	27.56
medium	gravel	**11**	44		44	17.32	114	44.88
medium	gravel	**16**	41		41	16.14	155	61.02
coarse	gravel	**23**	58		58	22.83	213	83.86
coarse	gravel	**32**	29		29	11.42	242	95.28
very coarse	gravel	**45**	9		9	3.54	251	98.82
very coarse	gravel	**64**	3		3	1.18	254	100.00
small	cobble	**90**	0		0	0.00	254	100.00
small	cobble	**128**	0		0	0.00	254	100.00
large	cobble	**180**	0		0	0.00	254	100.00
large	cobble	**256**	0		0	0.00	254	100.00
small	boulder	**362**	0		0	0.00	254	100.00
small	boulder	**512**	0		0	0.00	254	100.00
medium	boulder	**724**	0		0	0.00	254	100.00
very large	boulder	**1024**	0		0	0.00	254	100.00
bedrock		**2048**	0		0	0.00	254	100.00
Totals			254	0	254			

D(16) =	**6.5**
D(35) =	**9.3**
D(50) =	**12.6**
D(84) =	**23.1**
D(95) =	**31.8**
D(100) =	**64.0**

CHART # 1: CUMULATIVE PEBBLE COUNT
RIFFLE ASSESSMENT REACH 1

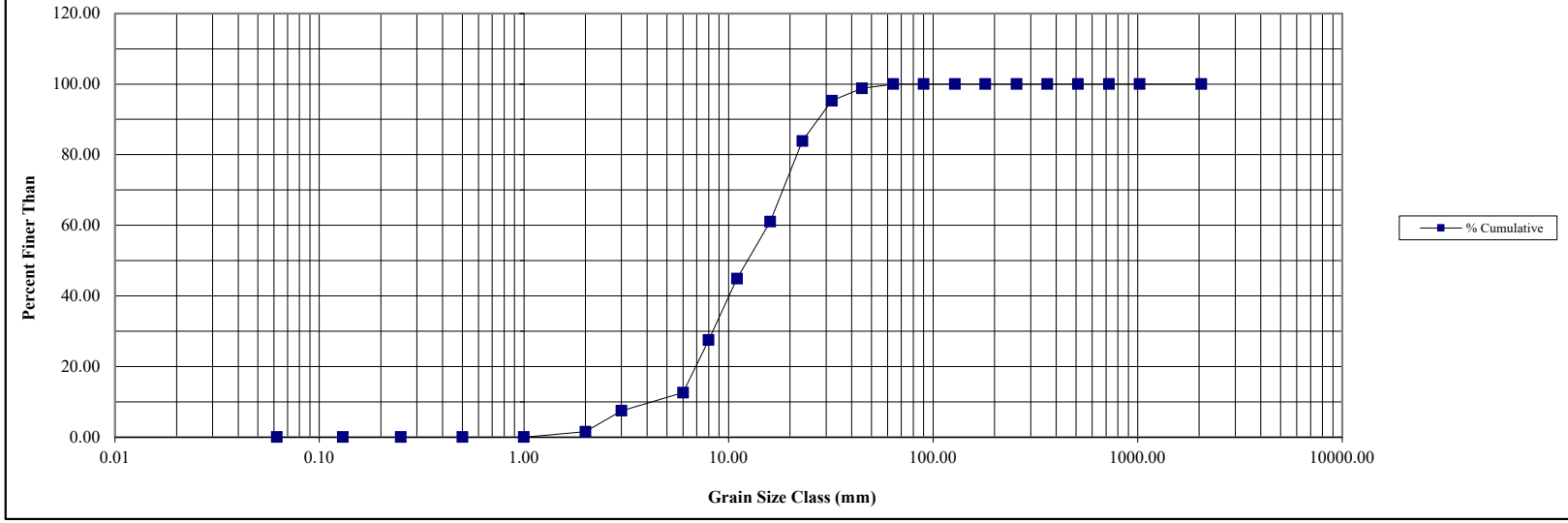
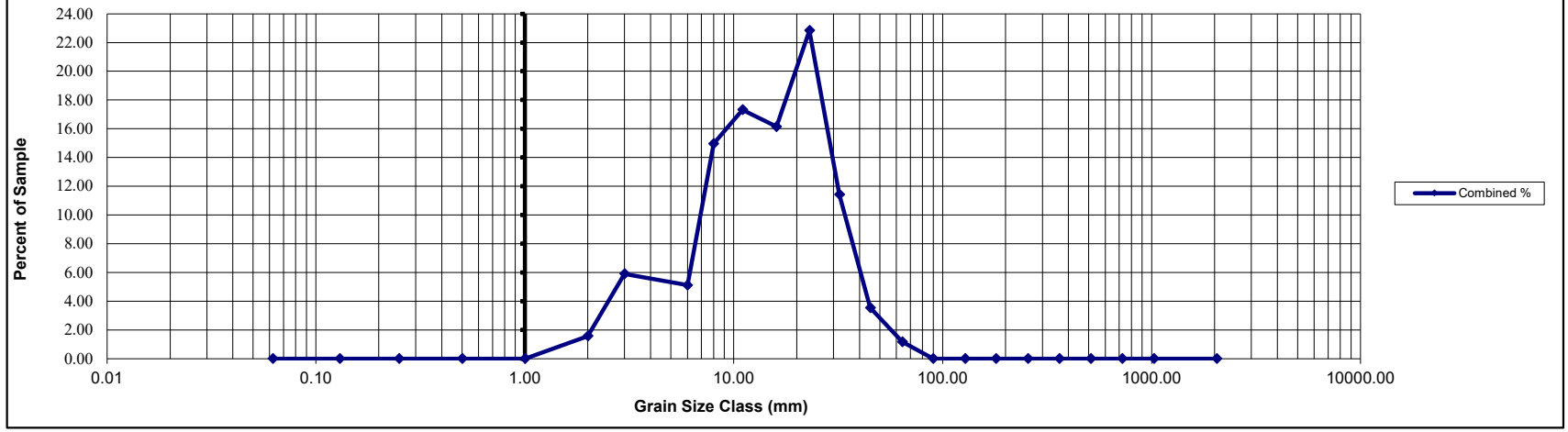
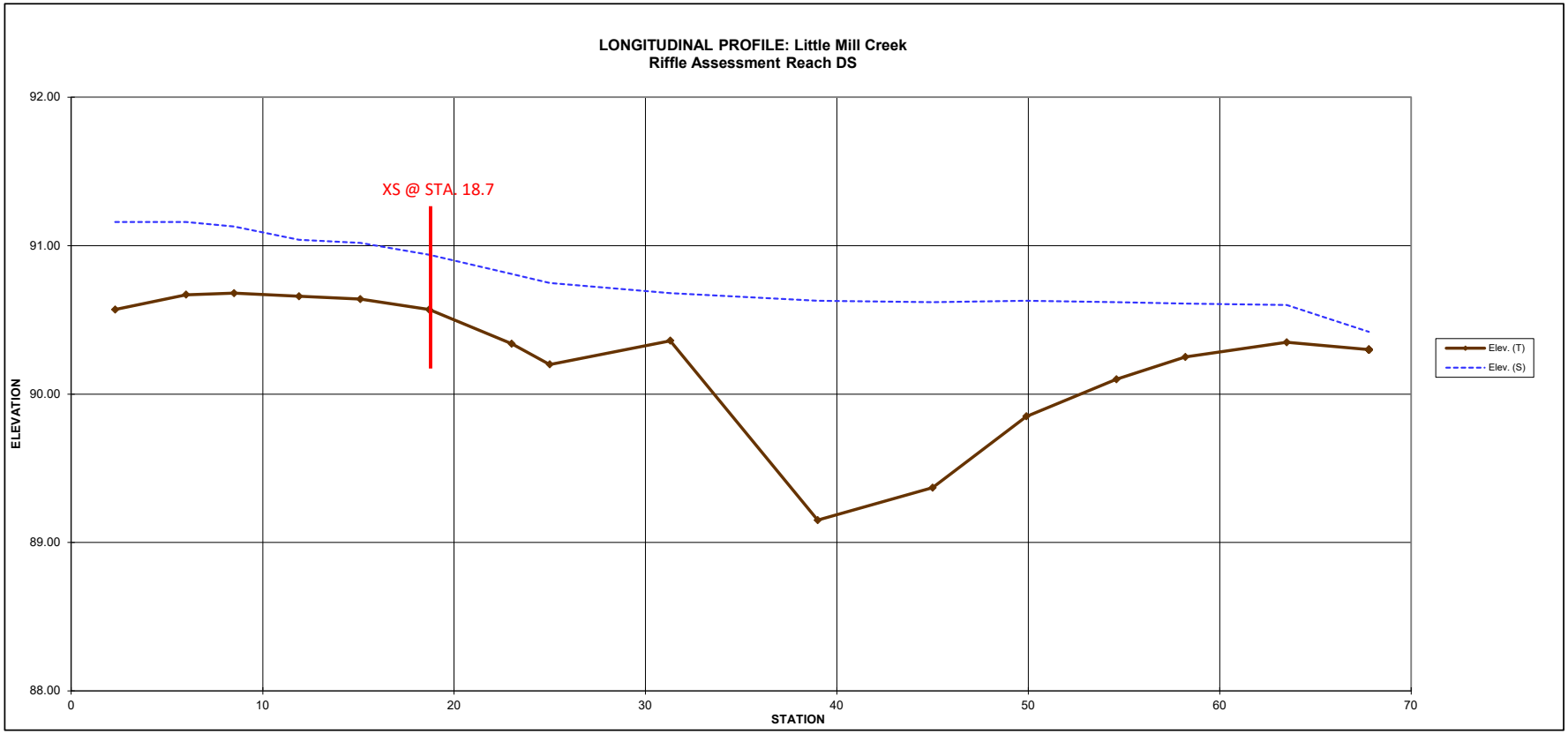


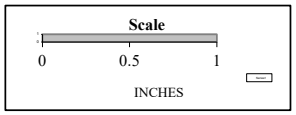
CHART # 2: RIFFLE and/or POOL PARTICLE SIZE DISTRIBUTION
RIFFLE ASSESSMENT REACH 1



Little Mill Creek - Riffle Assessment Profile DS - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			Date: 12/22/21							
Rc* at BM			0										
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc1	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**				**Elev. (T)**	**Elev. (S)**	**Elev. (BF)**	**Elev. (TB)**
2.3	2.3	9.43	8.84					0		90.57	91.16	100.00	100.00
6.0	6.00	9.33	8.84					0		90.67	91.16	100.00	100.00
8.5	8.50	9.32	8.87					0		90.68	91.13	100.00	100.00
11.9	11.90	9.34	8.96					0		90.66	91.04	100.00	100.00
15.1	15.10	9.36	8.98					0		90.64	91.02	100.00	100.00
18.7	18.70	9.43	9.06			XS		0		90.57	90.94	100.00	100.00
23.0	23.00	9.66	9.19					0		90.34	90.81	100.00	100.00
25.0	25.00	9.80	9.25					0		90.20	90.75	100.00	100.00
31.3	31.30	9.64	9.32					0		90.36	90.68	100.00	100.00
39.0	39.00	10.85	9.37					0		89.15	90.63	100.00	100.00
45.0	45.00	10.63	9.38					0		89.37	90.62	100.00	100.00
49.9	49.90	10.15	9.37					0		89.85	90.63	100.00	100.00
54.6	54.60	9.90	9.38					0		90.10	90.62	100.00	100.00
58.2	58.20	9.75	9.39					0		90.25	90.61	100.00	100.00
63.5	63.50	9.65	9.40					0		90.35	90.60	100.00	100.00
67.8	67.80	9.70	9.58					0		90.30	90.42	100.00	100.00
	67.80	





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged WS Slope	**=**	**0.01130**	**ft/ft**
Head of Riffle to Head of Riffle WS Slope	**=**	**0.00964**	**ft/ft**
Assessment Riffle WS Slope	**=**	**0.02303**	**ft/ft**

Little Mill Creek - Riffle Assessment DS @ STA. 18.7

REACH ID:	**LMC-Assessment DS**	**Date: 12/22/21**
Reference Base Elevation:		100
Enter Rod Reading at Base Elevation:		0
Diagonal Camline Used:	(yes = 1, no =	0
Convert English(0) to Metric (1):		0
Bankfull Elev. (from Column M)		91.13
Water Surface Elev. (from Column M)		90.93

Adj. Readng (Rcl) R+TPc & Camline

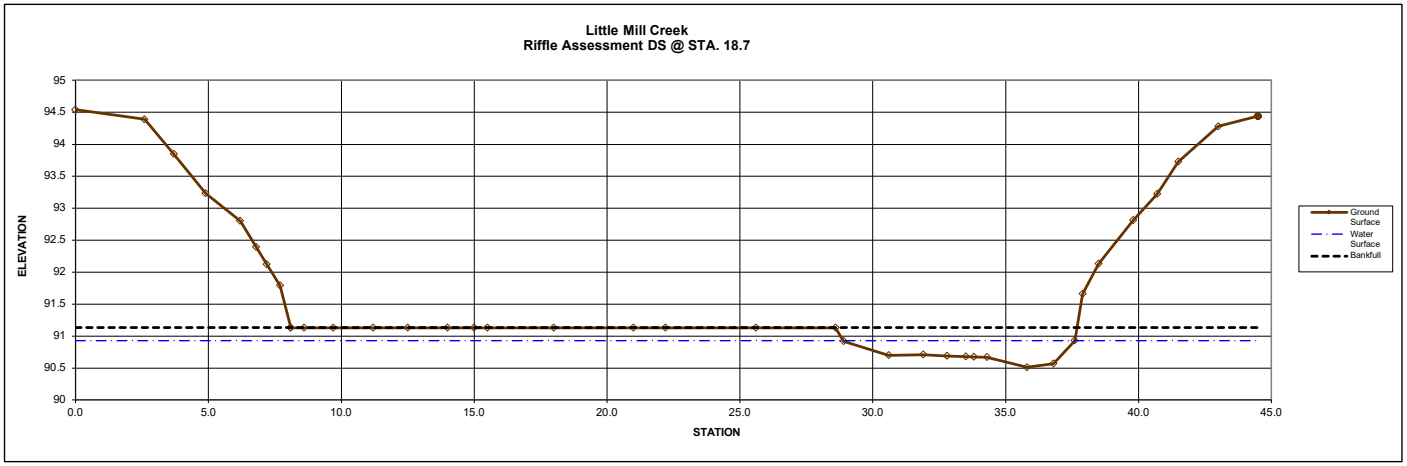
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	91.13	Slope (ft/ft)	0.016	L.Pin Sta.	0.0
B. Width =	9.1	Mannings "n"	0.048	R.Pin Sta.	44.5
W/d =	21.13	D84 (mm) measured	51.1	L.Pin Rod	94.54
F.P.Width	30.3	Velocity (ft/s) Manning's)	2.10	R.Pin Rod	94.4
Entrenchment	3.34	Velocity (ft/s) via. (U/U*)	2.42	Tape Angle (deg	0.1
B. Area =	3.9	Froud #	0.59		
B. Depth=	0.43	Discharge (cu ft/s)	8.2	Rc Meas.	
Max Depth	0.62	Shear Stress (lb/sq ft)	0.39	Chord	
W. Per=	9.9	CX Power (ft lb/s)	8.2	m	
H.Radius=	0.39	CX Power (watts)	11.1	Rc Calc.	
SS L Bank* =	0.83	Critical size (mm)	31.6	Rc/B. Width**	
SS R Bank* =	1.02	D84 predicted (mm)	26.5		
Shape Factor:	0.20	Flow Type	Subcritical Flow		

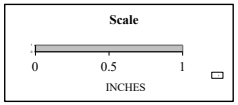
*Based on $HRad_{bf}$ (within the nearest 1/3 of Wbf) / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP P Sta X	FP Width R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	5.46		5.46	94.54	5.46	0.00	1	0	0.00	0.00		0	)
2.6	2.6	5.61		5.61	94.4	5.61	0.00	1	0	0.00	0.00	0.0	0	Above B F
3.7	3.7	6.15		6.15	93.9	6.15	0.00	1	0	0.00	0.00	0.0	0	Above B F
4.9	4.9	6.77		6.77	93.2	6.77	0.00	1	0	0.00	0.00	0.0	0	Above B F
6.2	6.2	7.20		7.20	92.8	7.20	0.00	1	0	0.00	0.00	0.0	0	Above B F
6.8	6.8	7.61		7.61	92.4	7.61	0.00	1	0	0.00	0.00	0.0	0	Above B F
7.2	7.2	7.88		7.88	92.1	7.88	0.00	1	0	0.00	0.00	0.0	0	Above B F
7.7	7.7	8.21		8.21	91.8	8.21	0.00	1	0	0.00	0.38	0.0	0	Above B F
8.1	8.1	8.87	L-EOW	8.87	91.1	8.87	0.00	0	0	0.00	0.00	0.0	0	Above B F
8.1	8.1	8.87		8.87	91.1	8.87	0.00	0	0	0.00	0.50	0.0	0	Above B F
8.6	8.6	8.87		8.87	91.1	8.87	0.00	0	0	0.00	1.10	0.0	0	Above B F
9.7	9.7	8.87		8.87	91.1	8.87	0.00	0	0	0.00	1.50	0.0	0	Above B F
11.2	11.2	8.87	EOW	8.87	91.1	8.87	0.00	0	0	0.00	1.30	0.0	0	Above B F
12.5	12.5	8.87		8.87	91.1	8.87	0.00	0	0	0.00	1.50	0.0	0	Above B F
14.0	14.0	8.87		8.87	91.1	8.87	0.00	0	0	0.00	1.00	0.0	0	Above B F
15.0	15.0	8.87		8.87	91.1	8.87	0.00	0	0	0.00	0.50	0.0	0	Above B F
15.5	15.5	8.87	BFF	8.87	91.1	8.87	0.00	0	0	0.00	2.50	0.0	0	Above B F
18.0	18.0	8.87		8.87	91.1	8.87	0.00	0	0	0.00	3.00	0.0	0	Above B F
21.0	21.0	8.87		8.87	91.1	8.87	0.00	0	0	0.00	1.20	0.0	0	Above B F
22.2	22.2	8.87		8.87	91.1	8.87	0.00	0	0	0.00	3.40	0.0	0	Above B F
25.6	25.6	8.87	Approx BFF Edit	8.87	91.1	8.87	0.00	0	0	0.00	3.00	0.0	0	Above B F
28.6	28.6	8.87		8.87	91.1	8.87	0.30	0	0	0.00	0.30	0.0	0	Within B F
28.9	28.9	9.08	EOW	9.08	90.9	9.08	1.70	0	0	0.00	1.70	0.0	0	Within B F
30.6	30.6	9.30		9.30	90.7	9.30	1.30	0	0	0.00	1.30	0.5	0.79	Within B F
31.9	31.9	9.29		9.29	90.7	9.30	0.90	0	0	0.00	0.90	0.6	0.00	Within B F
32.8	32.8	9.31		9.31	90.7	9.31	0.70	0	0	0.00	0.70	0.4	0.00	Within B F
33.5	33.5	9.32		9.32	90.7	9.32	0.30	0	0	0.00	0.30	0.3	0.00	Within B F
33.8	33.8	9.09		9.33	90.7	9.33	0.50	0	0	0.00	0.50	0.1	0.00	Within B F
34.3	34.3	9.33		9.33	90.7	9.33	1.50	0	0	0.00	1.50	0.2	0.00	Within B F
35.8	35.8	9.49		9.49	90.5	9.49	1.00	0	0	0.00	1.00	0.8	0.00	Within B F
36.8	36.8	9.43		9.43	90.6	9.49	0.80	0	0	0.00	0.80	0.6	0.00	Within B F
37.6	37.6	9.07	R-EOW	9.07	90.9	9.49	0.08	0	0	0.00	0.30	0.3	0.00	Within B F
37.9	37.9	8.34		8.34	91.7	9.49	0.00	0	1	####	0.11	0.0	0.00	Above B F
38.5	38.5	7.87		7.87	92.1	9.49	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
39.8	39.8	7.19		7.19	92.8	9.49	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
40.7	40.7	6.78		6.78	93.2	9.49	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
41.5	41.5	6.27		6.27	93.7	9.49	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
43.0	43.0	5.72		5.72	94.3	9.49	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
44.5	44.5	5.56		5.56	94.4	9.49	0.00	0	1	0.00	0.00	0.0	0.00	Above B F





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	91.13
Bank Full Width	9.08
Bank Full Depth	0.43
Maximum Depth	0.62
Bank Full Area	3.9
Hydraulic Radius	0.39
Wetted Perimeter	9.9
Width/Depth Ratio	21.1
Flood Prone Width	30.3
Entrenchment	3.34
Stream Type	
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0160
Manning's n	0.048
Velocity (ft./s)	2.10
Froud #	0.59
Discharge (cu ft/s)	8.2
Shear Stress (lb/sq ft)	0.39
CX Power (ft lb/s)	8.2
Critical Size (mm)	31.6
Flow Type	Subcritical Flow
Rec. Interval	

PEBBLE COUNT: Riffle Assessment Reach

XS DS

PARTICLE	Type	Size (mm)	Riffles Total	Pools Total	Combined	Combined %	Cumulative	% Cumulative
silt/clay		**0.06**	0		0	0.00	0	0.00
very fine	sand	**0.13**	0		0	0.00	0	0.00
fine	sand	**0.25**	0		0	0.00	0	0.00
medium	sand	**0.50**	3		3	1.26	3	1.26
coarse	sand	**1.00**	0		0	0.00	3	1.26
very coarse	sand	**2**	0		0	0.00	3	1.26
very fine	gravel	**3**	0		0	0.00	3	1.26
fine	gravel	**6**	2		2	0.84	5	2.09
fine	gravel	**8**	1		1	0.42	6	2.51
medium	gravel	**11**	8		8	3.35	14	5.86
medium	gravel	**16**	13		13	5.44	27	11.30
coarse	gravel	**23**	38		38	15.90	65	27.20
coarse	gravel	**32**	62		62	25.94	127	53.14
very coarse	gravel	**45**	60		60	25.10	187	78.24
very coarse	gravel	**64**	43		43	17.99	230	96.23
small	cobble	**90**	8		8	3.35	238	99.58
small	cobble	**128**	1		1	0.42	239	100.00
large	cobble	**180**	0		0	0.00	239	100.00
large	cobble	**256**	0		0	0.00	239	100.00
small	boulder	**362**	0		0	0.00	239	100.00
small	boulder	**512**	0		0	0.00	239	100.00
medium	boulder	**724**	0		0	0.00	239	100.00
very large	boulder	**1024**	0		0	0.00	239	100.00
bedrock		**2048**	0		0	0.00	239	100.00
Totals			239	0	239			

D(16) =	**18.1**
D(35) =	**25.7**
D(50) =	**30.9**
D(84) =	**51.1**
D(95) =	**62.7**
D(100) =	**128.0**

CHART # 1: CUMULATIVE PEBBLE COUNT
RIFFLE ASSESSMENT REACH 1

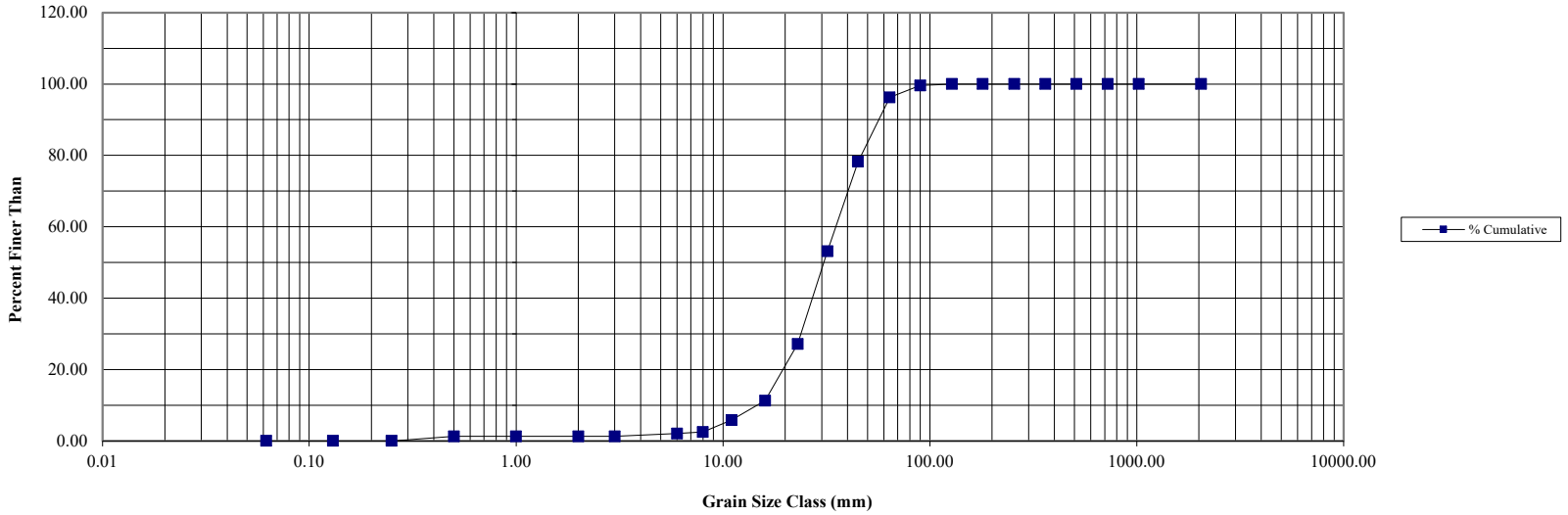
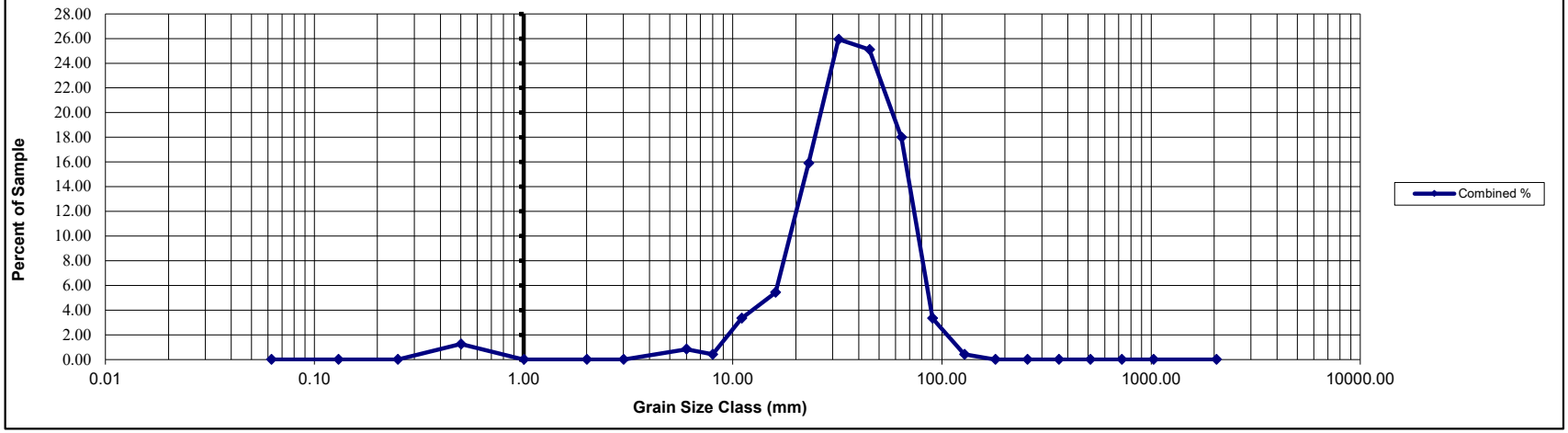
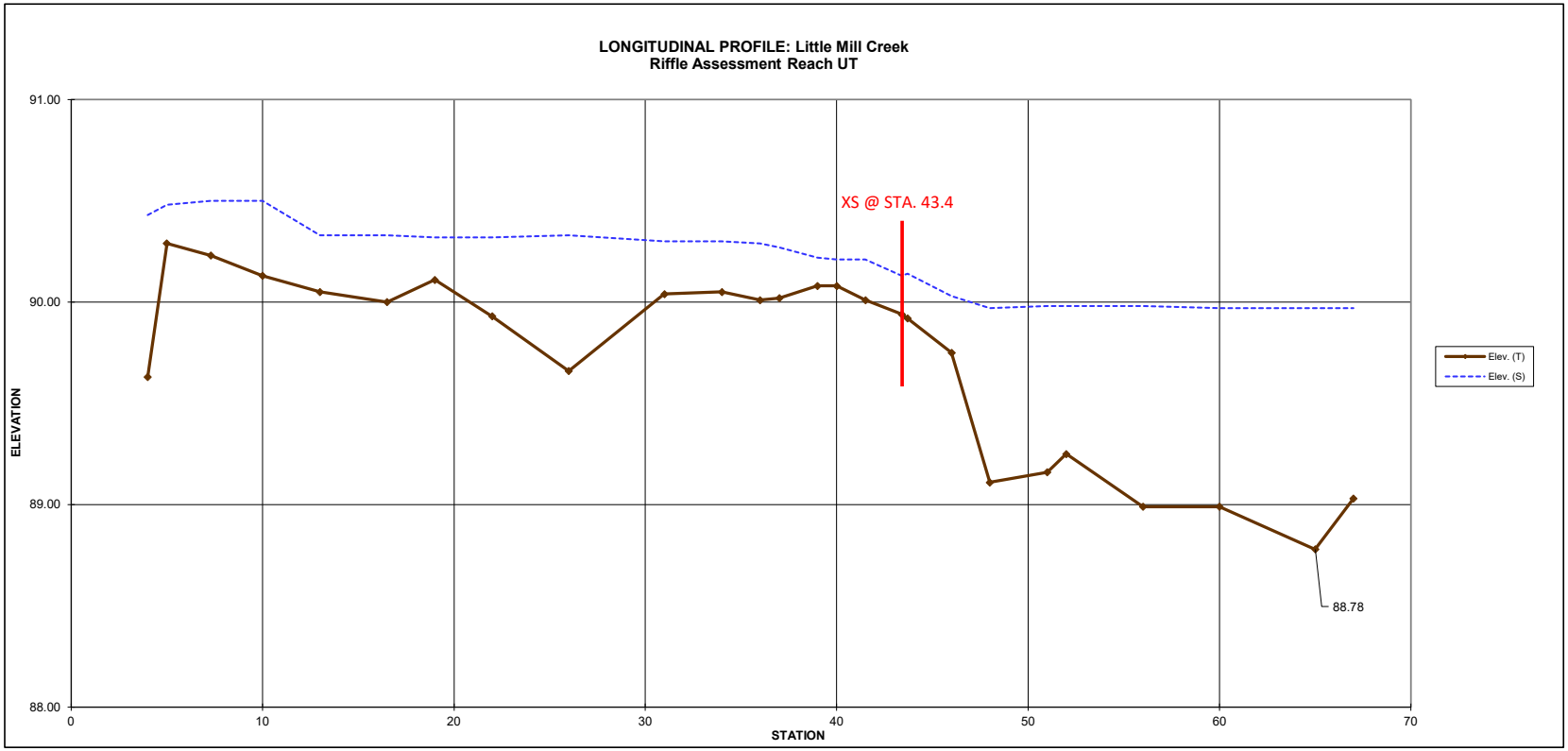


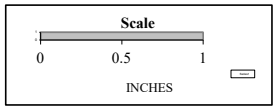
CHART # 2: RIFFLE and/or POOL PARTICLE SIZE DISTRIBUTION
RIFFLE ASSESSMENT REACH 1



Little Mill Creek - Riffle Assessment Profile UT - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:		100			Date: 12/22/21							
Rc* at BM		0										
Convert English(0) to Metric (1):		0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc1	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**				**Elev. (T)**	**Elev. (S)**	**Elev. (BF)**	**Elev. (TB)**
4.0	4	10.37	9.57					0		89.63	90.43	100.00	100.00
5.0	5.00	9.71	9.52					0		90.29	90.48	100.00	100.00
7.3	7.30	9.77	9.5					0		90.23	90.50	100.00	100.00
10.0	10.00	9.87	9.5					0		90.13	90.50	100.00	100.00
13.0	13.00	9.95	9.67					0		90.05	90.33	100.00	100.00
16.5	16.50	10.00	9.67					0		90.00	90.33	100.00	100.00
19.0	19.00	9.89	9.68					0		90.11	90.32	100.00	100.00
22.0	22.00	10.07	9.68					0		89.93	90.32	100.00	100.00
26.0	26.00	10.34	9.67					0		89.66	90.33	100.00	100.00
31.0	31.00	9.96	9.7					0		90.04	90.30	100.00	100.00
34.0	34.00	9.95	9.7					0		90.05	90.30	100.00	100.00
36.0	36.00	9.99	9.71					0		90.01	90.29	100.00	100.00
37.0	37.00	9.98	9.73					0		90.02	90.27	100.00	100.00
39.0	39.00	9.92	9.78					0		90.08	90.22	100.00	100.00
40.0	40.00	9.92	9.79					0		90.08	90.21	100.00	100.00
41.5	41.50	9.99	9.79					0		90.01	90.21	100.00	100.00
43.4	43.40	10.06	9.87			XS		0		89.94	90.13	100.00	100.00
43.7	43.70	10.08	9.86					0		89.92	90.14	100.00	100.00
46.0	46.00	10.25	9.97					0		89.75	90.03	100.00	100.00
48.0	48.00	10.89	10.03					0		89.11	89.97	100.00	100.00
51.0	51.00	10.84	10.02					0		89.16	89.98	100.00	100.00
52.0	52.00	10.75	10.02					0		89.25	89.98	100.00	100.00
56.0	56.00	11.01	10.02					0		88.99	89.98	100.00	100.00
60.0	60.00	11.01	10.03					0		88.99	89.97	100.00	100.00
65.0	65.00	11.22	10.03					0		88.78	89.97	100.00	100.00
67.0	67.00	10.97	10.03					0		89.03	89.97	100.00	100.00
73.0	73.00	10.66	10.02					0		89.34	89.98	100.00	100.00
77.0	77.00	10.49	10.03					0		89.51	89.97	100.00	100.00
82.0	82.00	10.39	10.03					0		89.61	89.97	100.00	100.00
85.0	85.00	10.32	10.04					0		89.68	89.96	100.00	100.00
87.0	87.00	10.26	10.05					0		89.74	89.95	100.00	100.00
89.0	89.00	10.28	10.05					0		89.72	89.95	100.00	100.00
91.5	91.50	10.34	10.05					0		89.66	89.95	100.00	100.00
93.0	93.00	10.36	10.06					0		89.64	89.94	100.00	100.00
97.0	97.00	10.33	10.08					0		89.67	89.92	100.00	100.00
100.0	100.00	10.38	10.09					0		89.62	89.91	100.00	100.00
104.0	104.00	10.35	10.09					0		89.65	89.91	100.00	100.00
108.0	108.00	10.39	10.14					0		89.61	89.86	100.00	100.00
112.0	112.00	10.42	10.2					0		89.58	89.80	100.00	100.00
120.0	120.00	10.45	10.18					0		89.55	89.82	100.00	100.00
125.0	125.00	10.85	10.18					0		89.15	89.82	100.00	100.00
130.0	130.00	10.37	10.25			Debris Jam		0		89.63	89.75	100.00	100.00
133.0	133.00	10.71	10.4					0		89.29	89.60	100.00	100.00
136.0	136.00	11.21	10.43					0		88.79	89.57	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged WS Slope	**=**	**0.00652**	**ft/ft**
Head of Riffle to Head of Riffle WS Slope	**=**	**0.00720**	**ft/ft**
Assessment Riffle WS Slope	**=**	**0.03692**	**ft/ft**

0.01688

Little Mill Creek - Riffle Assessment UT @ STA. 43.4

REACH ID:	**LMC-Assessment UT**	**Date: 12/22/21**
Reference Base Elevation:		100
Enter Rod Reading at Base Elevation:		0
Diagonal Camline Used:	(yes = 1, no	0
Convert English(0) to Metric (1):		0
Bankfull Elev. (from Column M)		90.18
Water Surface Elev. (from Column M)		90.06

Adj. Readng
(Rci)
R+TPc
& Camline

Geometry (English Units)		**Hydraulics** (English Units)		**Other**			
B elev =	90.18	Slope (ft/ft)	0.021	L.Pin Sta.	0.0	R/D84	1.4092438
B. Width =	10.8	Mannings "n"	0.071	R.Pin Sta.	31.0	u/u*	3.6732616
W/d =	60.18	D84 (mm) measured	37.8	L.Pin Rod	94.16	n	0.045
F.P.Width	12.8	Velocity (ft/s) Manning's)	0.95	R.Pin Rod	94.8		
Entrenchment	1.18	Velocity (ft/s) via. (U/U*)	1.41	Tape Angle (deg	1.2		
B. Area =	1.9	Froud #	0.40				
B. Depth=	0.18	Discharge (cu ft/s)	1.8	Rc Meas.			
Max Depth	0.28	Shear Stress (lb/sq ft)	0.23	Chord			
W. Per=	11.2	CX Power (ft lb/s)	2.4	m			
H.Radius=	0.17	CX Power (watts)	3.3	Rc Calc.			
SS L Bank* =	0.45	Critical size (mm)	17.6	Rc/B. Width**			
SS R Bank* =	1.26	D84 predicted (mm)	29.5				
Shape Factor:	0.13	Flow Type	Subcritical Flow				

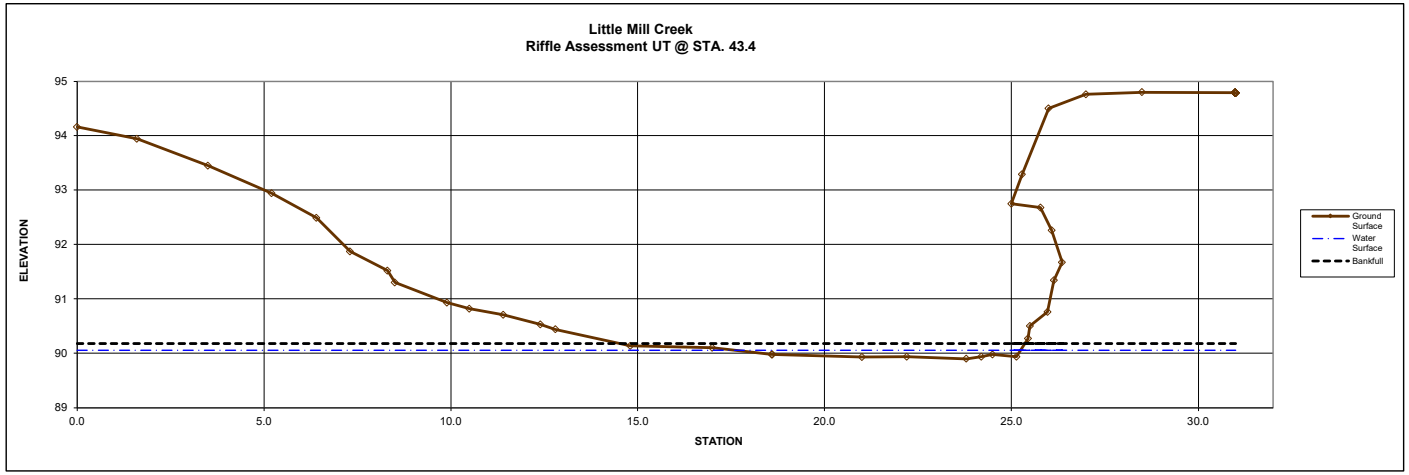
*Based on $HRad_{lb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I
0.0	0.0	5.84		5.84	94.16
1.6	1.6	6.06		6.06	93.9
3.5	3.5	6.55		6.55	93.5
5.2	5.2	7.06		7.06	92.9
6.4	6.4	7.51		7.51	92.5
7.3	7.3	8.13		8.13	91.9
8.3	8.3	8.48		8.48	91.5
8.5	8.5	8.70		8.70	91.3
9.9	9.9	9.07		9.07	90.9
10.5	10.5	9.18		9.18	90.8
11.4	11.4	9.29	BFF	9.29	90.7
12.4	12.4	9.47		9.47	90.5
12.8	12.8	9.56		9.56	90.4
14.8	14.8	9.86	EOW	9.86	90.1
17.0	17.0	9.90		9.90	90.1
18.6	18.6	10.02		10.02	90.0
18.6				0.00	90.0
18.6				0.00	90.0
21.0	21.0	10.07		10.07	89.9
22.2	22.2	10.06	TOE	10.06	89.9
23.8	23.8	10.10		10.10	89.9
24.2	24.2	10.06	Toe Pin (at Elev. 9.41)	10.06	89.9
24.5	24.5	10.02	EOW	10.02	90.0
25.1	25.1	10.06		10.06	89.9
25.4	25.5	9.73		9.73	90.3
25.5	25.5	9.50		9.50	90.5
26.0	26.0	9.24		9.24	90.8
26.1	26.1	8.66		8.66	91.3
26.4	26.4	8.33		8.33	91.7
26.1	26.1	7.74		7.74	92.3
25.8	25.8	7.32		7.32	92.7
25.0	25.0	7.25		7.25	92.8
25.3	25.3	6.71		6.71	93.3
26.0	26.0	5.50		5.50	94.5
27.0	27.0	5.24		5.24	94.8
28.5	28.5	5.20		5.20	94.8
31.0	31.0	5.21		5.21	94.8

Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP P: Sta	FP Width X R	Bnk	Area (old)	Partial LNB Se	Invert Segment is:
5.84	0.00	1	0	0.00	0.00		0	0	)
6.06	0.00	1	0	0.00	0.00	0.0	0		Above B F
6.55	0.00	1	0	0.00	0.00	0.0	0		Above B F
7.06	0.00	1	0	0.00	0.00	0.0	0		Above B F
7.51	0.00	1	0	0.00	0.00	0.0	0		Above B F
8.13	0.00	1	0	0.00	0.00	0.0	0		Above B F
8.48	0.00	1	0	0.00	0.00	0.0	0		Above B F
8.70	0.00	1	0	0.00	0.00	0.0	0		Above B F
9.07	0.00	1	0	0.00	0.00	0.0	0		Above B F
9.18	0.00	1	0	0.00	0.00	0.0	0		Above B F
9.29	0.00	1	0	0.00	0.00	0.0	0		Above B F
9.47	0.00	1	0	0.00	0.09	0.0	0		Above B F
9.56	0.27	0	0	0.00	2.00	0.0	0		Within B F
9.86	2.20	0	0	0.00	2.20	0.0	0		Within B F
9.90	1.60	0	0	0.00	1.60	0.1	0.72		Within B F
10.02	0.00	0	0	0.00	0.00	0.2	0.00		Above B F
10.02	0.00	0	0	0.00	0.00	0.0	0.00		Above B F
10.02	2.40	0	0	0.00	2.40	0.0	0.00		Within B F
10.07	1.20	0	0	0.00	1.20	0.5	0.00		Within B F
10.07	1.60	0	0	0.00	1.60	0.3	0.00		Within B F
10.10	0.40	0	0	0.00	0.40	0.4	0.00		Within B F
10.10	0.30	0	0	0.00	0.30	0.1	0.00		Within B F
10.10	0.64	0	0	0.00	0.64	0.1	0.00		Within B F
10.10	0.23	0	0	0.00	0.31	0.1	0.00		Within B F
10.10	0.00	0	1	####	0.04	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F
10.10	0.00	0	1	0.00	0.00	0.0	0.00		Above B F



Scale
0 0.5 1
INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	90.18
Bank Full Width	10.83
Bank Full Depth	0.18
Maximum Depth	0.28
Bank Full Area	1.9
Hydraulic Radius	0.17
Wetted Perimeter	11.2
Width/Depth Ratio	60.2
Flood Prone Width	12.8
Entrenchment	1.18
Stream Type	
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0210
Manning's n	0.071
Velocity (ft./s)	0.95
Froud #	0.40
Discharge (cu ft/s)	1.8
Shear Stress (lb/sq ft)	0.23
CX Power (ft lb/s)	2.4
Critical Size (mm)	17.6
Flow Type	Subcritical Flow
Rec. Interval	

PEBBLE COUNT: Riffle Assessment Reach

XS UT

PARTICLE	Type	Size (mm)	Riffles Total	Pools Total	Combined	Combined %	Cumulative	% Cumulative
silt/clay		**0.06**	0		0	0.00	0	0.00
very fine	sand	**0.13**	0		0	0.00	0	0.00
fine	sand	**0.25**	0		0	0.00	0	0.00
medium	sand	**0.50**	2		2	0.89	2	0.89
coarse	sand	**1.00**	4		4	1.79	6	2.68
very coarse	sand	**2**	1		1	0.45	7	3.13
very fine	gravel	**3**	8		8	3.57	15	6.70
fine	gravel	**6**	13		13	5.80	28	12.50
fine	gravel	**8**	18		18	8.04	46	20.54
medium	gravel	**11**	26		26	11.61	72	32.14
medium	gravel	**16**	29		29	12.95	101	45.09
coarse	gravel	**23**	32		32	14.29	133	59.38
coarse	gravel	**32**	41		41	18.30	174	77.68
very coarse	gravel	**45**	32		32	14.29	206	91.96
very coarse	gravel	**64**	14		14	6.25	220	98.21
small	cobble	**90**	3		3	1.34	223	99.55
small	cobble	**128**	1		1	0.45	224	100.00
large	cobble	**180**	0		0	0.00	224	100.00
large	cobble	**256**	0		0	0.00	224	100.00
small	boulder	**362**	0		0	0.00	224	100.00
small	boulder	**512**	0		0	0.00	224	100.00
medium	boulder	**724**	0		0	0.00	224	100.00
very large	boulder	**1024**	0		0	0.00	224	100.00
bedrock		**2048**	0		0	0.00	224	100.00
Totals			224	0	224			

D(16) =	**6.9**
D(35) =	**12.1**
D(50) =	**18.4**
D(84) =	**37.8**
D(95) =	**54.2**
D(100) =	**128.0**

CHART # 1: CUMULATIVE PEBBLE COUNT
RIFFLE ASSESSMENT REACH 1

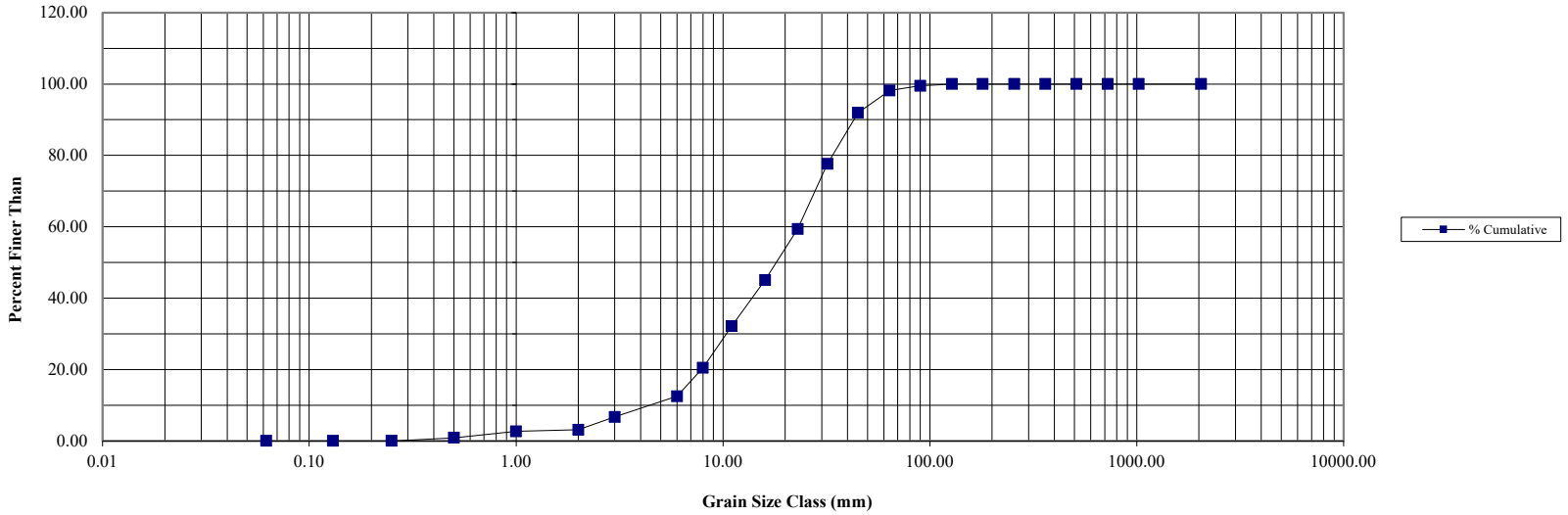
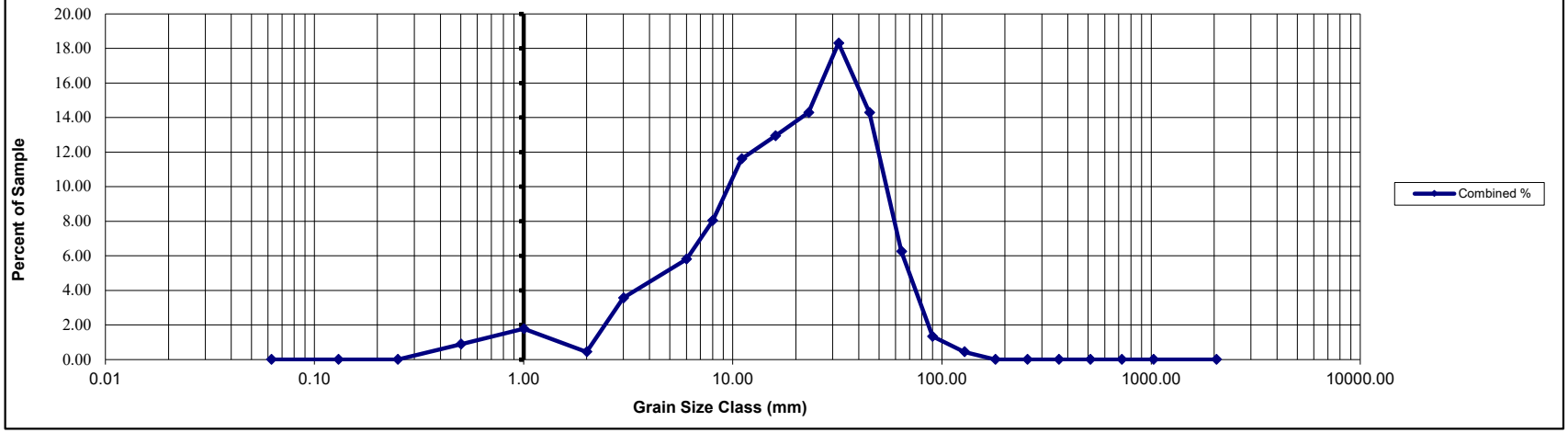


CHART # 2: RIFFLE and/or POOL PARTICLE SIZE DISTRIBUTION
RIFFLE ASSESSMENT REACH 1



Sediment Transport Analysis
Andrews Methodology

Project:	**Little Mill Creek**		
Reach:	**Riffle Assessment 1-1**		
D(50) Riffle:	12.6	mm	
D(50) Bar/Sub:	n/a	mm	
Mobile Size (Di):	11.6	mm =	0.038 ft.
Slope:	0.0065	ft/ft	Range: 0.00377 to 0.00973

Andrews 1984 Methodology		*Andrews 1995 Methodology*	
Tc* (1984)	**Tc (1984)**	**Tc* (1995)**	**Tc (1995)**
#VALUE!	#VALUE! lb/sf	0.04082	0.16 lb/sf
Depth (1984)		**Depth (1995)**	
#VALUE! ft.		0.39 ft.	

Andrews 1984 Methodology:

Tc* = 0.0834 x [(D50(riffle) / D50(bar)]^-0.872
Tc = Tc* x 1.65 x 62.4 x Di
Depth = (Tc* x 1.65 x Di) / Slope

Andrews 1995 Methodology:

Tc* = 0.0376 x [(Di / D50(riffle)]^-0.994
Tc = Tc* x 1.65 x 62.4 x Di
Depth = (Tc* x 1.65 x Di) / Slope

Sediment Transport Analysis
Andrews Methodology

Project:	**Little Mill Creek**		
Reach:	**Riffle Assessment 1-1**		
D(50) Riffle:	30.9	mm	
D(50) Bar/Sub:	n/a	mm	
Mobile Size (Di):	29.9	mm =	0.098 ft.
Slope:	0.016	ft/ft	Range: 0.00964 to 0.02303

Andrews 1984 Methodology		*Andrews 1995 Methodology*	
Tc* (1984)	**Tc (1984)**	**Tc* (1995)**	**Tc (1995)**
#VALUE!	#VALUE! lb/sf	0.03885	0.39 lb/sf

Depth (1984)	**Depth (1995)**
#VALUE! ft.	0.39 ft.

Andrews 1984 Methodology:

Tc* = 0.0834 x [(D50(riffle) / D50(bar)]^-0.872
Tc = Tc* x 1.65 x 62.4 x Di
Depth = (Tc* x 1.65 x Di) / Slope

Andrews 1995 Methodology:

Tc* = 0.0376 x [(Di / D50(riffle)]^-0.994
Tc = Tc* x 1.65 x 62.4 x Di
Depth = (Tc* x 1.65 x Di) / Slope

Sediment Transport Analysis
Andrews Methodology

Project:	**Little Mill Creek**		
Reach:	**Riffle Assessment 1-1**		
D(50) Riffle:	18.4	mm	
D(50) Bar/Sub:	n/a	mm	
Mobile Size (Di):	17.4	mm =	0.057 ft.
Slope:	0.021	ft/ft	Range: 0.00613 to 0.03692

Andrews 1984 Methodology		*Andrews 1995 Methodology*	
Tc* (1984)	**Tc (1984)**	**Tc* (1995)**	**Tc (1995)**
#VALUE!	#VALUE! lb/sf	0.03975	0.23 lb/sf
Depth (1984)		**Depth (1995)**	
#VALUE! ft.		0.18 ft.	

Andrews 1984 Methodology:

Tc* = 0.0834 x [(D50(riffle) / D50(bar)]^-0.872
Tc = Tc* x 1.65 x 62.4 x Di
Depth = (Tc* x 1.65 x Di) / Slope

Andrews 1995 Methodology:

Tc* = 0.0376 x [(Di / D50(riffle)]^-0.994
Tc = Tc* x 1.65 x 62.4 x Di
Depth = (Tc* x 1.65 x Di) / Slope

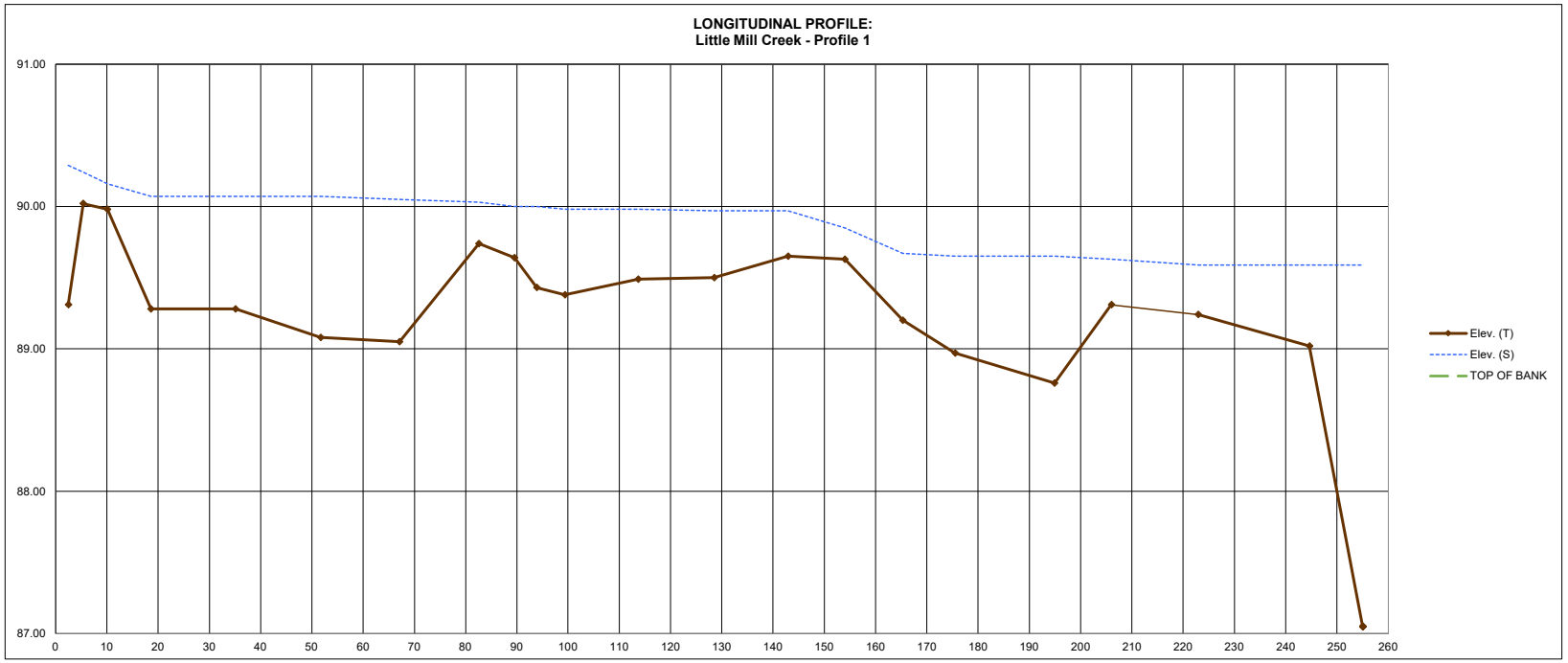
APPENDIX F
CHANNEL STABILITY DATA

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Little Mill Creek (Profile 1) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/16/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP Cc (TPc) (TPc1	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
2.5	2.5	10.69	9.71					0	0	89.31	90.29	100.00	100.00
5.4	5.40	9.98	9.76			Riffle		0		90.02	90.24	100.00	100.00
10.1	10.10	10.02	9.84					0		89.98	90.16	100.00	100.00
18.6	18.60	10.72	9.93					0		89.28	90.07	100.00	100.00
35.1	35.10	10.72	9.93					0		89.28	90.07	100.00	100.00
51.7	51.70	10.92	9.93					0		89.08	90.07	100.00	100.00
67.1	67.10	10.95	9.95					0		89.05	90.05	100.00	100.00
82.6	82.60	10.26	9.97			Riffle		0		89.74	90.03	100.00	100.00
89.5	89.50	10.36	10.00					0		89.64	90.00	100.00	100.00
93.9	93.90	10.57	10.00					0		89.43	90.00	100.00	100.00
99.4	99.40	10.62	10.02			XS STA 30.6		0		89.38	89.98	100.00	100.00
113.7	113.70	10.51	10.02					0		89.49	89.98	100.00	100.00
128.5	128.50	10.50	10.03					0		89.50	89.97	100.00	100.00
142.9	142.90	10.35	10.03			Riffle		0		89.65	89.97	100.00	100.00
154.0	154.00	10.37	10.15					0		89.63	89.85	100.00	100.00
165.3	165.30	10.80	10.33					0		89.20	89.67	100.00	100.00
175.5	175.50	11.03	10.35					0		88.97	89.65	100.00	100.00
194.9	194.90	11.24	10.35					0		88.76	89.65	100.00	100.00
206.0	206.00	10.69	10.37			Riffle		0		89.31	89.63	100.00	100.00
223.0	223.00	10.76	10.41					0		89.24	89.59	100.00	100.00
244.6	244.60	10.98	10.41					0		89.02	89.59	100.00	100.00
255.0	255.00	12.95	10.41					0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00
	255.00							0		87.05	89.59	100.00	100.00

LONGITUDINAL PROFILE:
Little Mill Creek - Profile 1



Scale
0 0.5 1
INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = 0.002772 ft/ft
Near Bank Slope 0.0030 ft/ft

Little Mill Creek - Cross Section 1-1 @ STA. 99

REACH ID:	**LMC 1-1**		**Date: 12/16/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.2
Water Surface Elev. (from Column M)			90.1

check

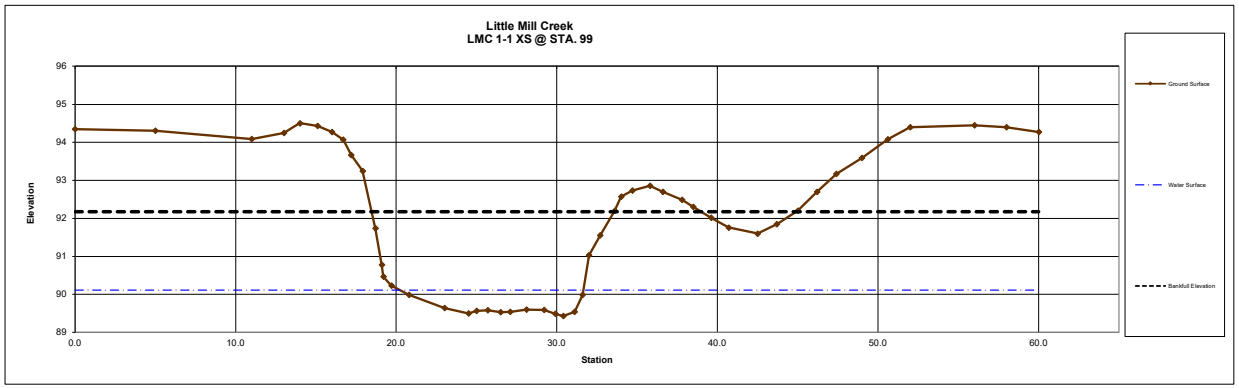
Adj. Reading
(Rci)
R+TPc
& Camline

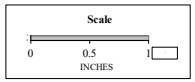
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	92.17	Slope (ft/ft)	0.00277	L.Pin Sta.	0.0
B. Width =	21.0	Mannings "n"	0.0251	R.Pin Sta.	60.0
W/d =	12.62	D84 (mm) measured	23.1	L.Pin Rod	94.35
F.P.Width	60.0	Velocity (ft/s) Manning's)	3.92	R.Pin Rod	94.3
Entrenchment	2.86	Velocity (ft/s) via. (U/U*)	3.79	Tape Angle (deg.)	0.1
B. Area =	34.9	Froud #	0.58		
B. Depth=	1.66	Discharge (cu ft/s)	136.6	Rc Meas.	
Max Depth	2.74	Shear Stress (lb/sq ft)	0.24	Chord	
W. Per=	24.7	CX Power (ft lb/s)	23.6	m	
H.Radius=	1.41	CX Power (watts)	32.0	Rc Calc.	
SS L Bank* =	1.17	Critical size (mm)	18.8	Rc/B. Width**	
SS R Bank* =	0.19	D84 predicted (mm)	5.3		
Shape Factor:	0.24	Flow Type	Subcritical Flow		

*Based on $HRad_{adj}$ within the nearest 1/3 of Wbf/ $HRad_{bf}$ **Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	i	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pa Sta	FP Width X R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	5.65	Next to Pin	5.65	94.35		5.65	0.00	0	0	0.00	5.00		0	
5.0	5.0	5.69		5.69	94.3		5.69	0.00	0	0	0.00	6.00	0.0	0	Above B F
11.0	11.0	5.91		5.91	94.1		5.91	0.00	0	0	0.00	2.00	0.0	0	Above B F
13.0	13.0	5.75		5.75	94.3		5.91	0.00	0	0	0.00	1.00	0.0	0	Above B F
14.0	14.0	5.5		5.50	94.5		5.91	0.00	0	0	0.00	1.10	0.0	0	Above B F
15.1	15.1	5.57	TOB	5.57	94.4		5.91	0.00	0	0	0.00	0.90	0.0	0	Above B F
16.0	16.0	5.73		5.73	94.3		5.91	0.00	0	0	0.00	0.70	0.0	0	Above B F
16.7	16.7	5.93		5.93	94.1		5.93	0.00	0	0	0.00	0.50	0.0	0	Above B F
17.2	17.2	6.33		6.33	93.7		6.33	0.00	0	0	0.00	0.70	0.0	0	Above B F
17.9	17.9	6.75		6.75	93.3		6.75	0.23	0	0	0.00	0.80	0.0	0	Within B F
18.7	18.7	8.26		8.26	91.7		8.26	0.40	0	0	0.00	0.40	0.0	0	Within B F
19.1	19.1	9.22		9.22	90.8		9.22	0.10	0	0	0.00	0.10	0.4	0	Within B F
19.2	19.2	9.53		9.53	90.5		9.53	0.50	0	0	0.00	0.50	0.2	0	Within B F
19.7	19.7	9.77	EOW	9.77	90.2		9.77	1.10	0	0	0.00	1.10	0.9	0	Within B F
20.8	20.8	10.01		10.01	90.0		10.01	2.20	0	0	0.00	2.20	2.3	0	Within B F
23.0	23.0	10.36		10.36	89.6		10.36	1.50	0	0	0.00	1.50	5.2	0	Within B F
24.5	24.5	10.5		10.50	89.5		10.50	0.50	0	0	0.00	0.50	3.9	0	Within B F
25.0	25.0	10.43		10.43	89.6		10.50	0.70	0	0	0.00	0.70	1.3	0.66	Within B F
25.7	25.7	10.42		10.42	89.6		10.50	0.80	0	0	0.00	0.80	1.8	0.00	Within B F
26.5	26.5	10.47		10.47	89.5		10.50	0.60	0	0	0.00	0.60	2.1	0.00	Within B F
27.1	27.1	10.46		10.46	89.5		10.50	1.00	0	0	0.00	1.00	1.6	0.00	Within B F
28.1	28.1	10.4		10.40	89.6		10.50	1.10	0	0	0.00	1.10	2.6	0.00	Within B F
29.2	29.2	10.41		10.41	89.6		10.50	0.70	0	0	0.00	0.70	2.8	0.00	Within B F
29.9	29.9	10.51		10.51	89.5		10.51	0.50	0	0	0.00	0.50	1.8	0.00	Within B F
30.4	30.4	10.57		10.57	89.4		10.57	0.70	0	0	0.00	0.70	1.4	0.00	Within B F
31.1	31.1	10.46		10.46	89.5		10.57	0.50	0	0	0.00	0.50	1.9	0.00	Within B F
31.6	31.6	10.01	EOW	10.01	90.0		10.57	0.40	0	0	0.00	0.40	1.2	0.00	Within B F
32.0	32.0	8.97		8.97	91.0		10.57	0.70	0	0	0.00	0.70	0.7	0.00	Within B F
32.7	32.7	8.45		8.45	91.6		10.57	0.86	0	0	0.00	0.90	0.6	0.00	Within B F
33.6	33.6	7.8		7.80	92.2		10.57	0.00	0	0	0.00	0.40	0.3	0.00	Above B F
34.0	34.0	7.43		7.43	92.6		10.57	0.00	0	0	0.00	0.70	0.0	0.00	Above B F
34.7	34.7	7.27	TOB	7.27	92.7		10.57	0.00	0	0	0.00	1.10	0.0	0.00	Above B F
35.8	35.8	7.14		7.14	92.9		10.57	0.00	0	0	0.00	0.80	0.0	0.00	Above B F
36.6	36.6	7.3		7.30	92.7		10.57	0.00	0	0	0.00	1.20	0.0	0.00	Above B F
37.8	37.8	7.51		7.51	92.5		10.57	0.00	0	0	0.00	0.70	0.0	0.00	Above B F
38.5	38.5	7.7		7.70	92.3		10.57	0.59	0	0	0.00	1.10	0.0	0.00	Within B F
39.6	39.6	7.98		7.98	92.0		10.57	1.10	0	0	0.00	1.10	0.0	0.00	Within B F
40.7	40.7	8.24		8.24	91.8		10.57	1.80	0	0	0.00	1.80	0.3	0.00	Within B F
42.5	42.5	8.4		8.40	91.6		10.57	1.20	0	0	0.00	1.20	0.9	0.00	Within B F
43.7	43.7	8.15		8.15	91.9		10.57	1.19	0	0	0.00	1.30	0.5	0.00	Within B F
45.0	45.0	7.8		7.80	92.2		10.57	0.00	0	0	0.00	1.20	0.2	0.00	Above B F
46.2	46.2	7.3		7.30	92.7		10.57	0.00	0	0	0.00	1.20	0.0	0.00	Above B F
47.4	47.4	6.83		6.83	93.2		10.57	0.00	0	0	0.00	1.60	0.0	0.00	Above B F
49.0	49.0	6.41		6.41	93.6		10.57	0.00	0	0	0.00	1.60	0.0	0.00	Above B F
50.6	50.6	5.92		5.92	94.1		10.57	0.00	0	0	0.00	1.40	0.0	0.00	Above B F
52.0	52.0	5.6		5.60	94.4		10.57	0.00	0	0	0.00	4.00	0.0	0.00	Above B F
56.0	56.0	5.55		5.55	94.5		10.57	0.00	0	0	0.00	2.00	0.0	0.00	Above B F
58.0	58.0	5.6		5.60	94.4		10.57	0.00	0	0	0.00	2.00	0.0	0.00	Above B F
60.0	60.0	5.73	Next to Pin	5.73	94.3		10.57	0.00	0	0	0.00	0.00	0.0	0.00	Above B F





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

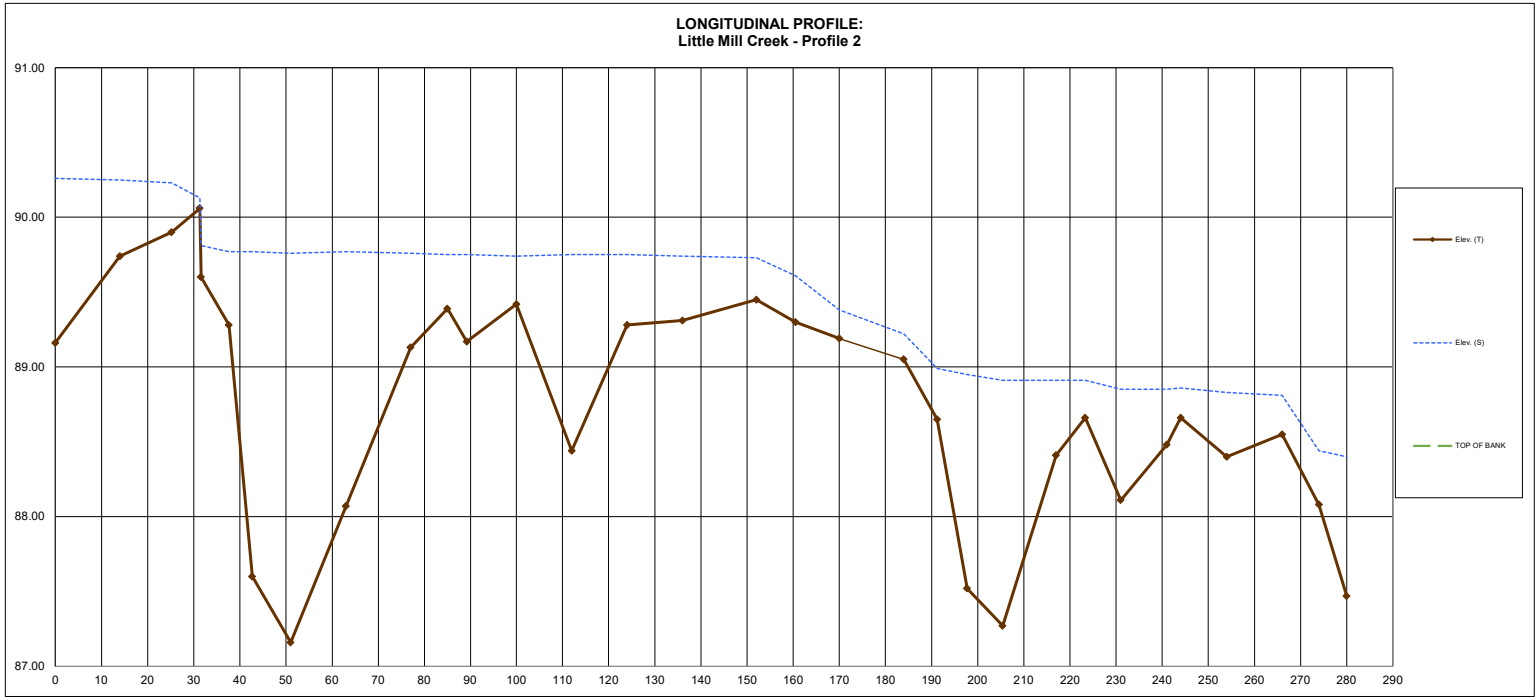
GEOMETRY	
Bank Full Elevation	92.17
Bank Full Width	20.97
Bank Full Depth	1.66
Maximum Depth	2.74
Bank Full Area	34.9
Hydraulic Radius	1.41
Wetted Perimeter	24.7
Width/Depth Ratio	12.6
Flood Prone Width	60.0
Entrenchment	
Stream Type	F4/C4
Rc	

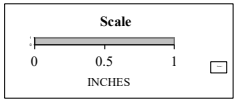
English Units

HYDRAULICS	
Slope (ft/ft)	0.0028
Manning's n	0.0251
Velocity (ft./s)	3.92
Froud #	0.58
Discharge (cu ft/s)	136.6
Shear Stress (lb/sq ft)	0.24
CX Power (ft lb/s)	23.6
Critical Size (mm)	18.8
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 2) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/17/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	10.84	9.74					0	0	89.16	90.26	100.00	100.00
14.0	14.00	10.26	9.75					0		89.74	90.25	100.00	100.00
25.2	25.20	10.10	9.77					0		89.90	90.23	100.00	100.00
31.3	31.30	9.94	9.87			Sewer Encasement		0		90.06	90.13	100.00	100.00
31.6	31.60	10.40	10.19			Sewer Encasement		0		89.60	89.81	100.00	100.00
37.6	37.60	10.72	10.23					0		89.28	89.77	100.00	100.00
42.7	42.70	12.40	10.23					0		87.60	89.77	100.00	100.00
51.0	51.00	12.84	10.24					0		87.16	89.76	100.00	100.00
63.0	63.00	11.93	10.23					0		88.07	89.77	100.00	100.00
77.0	77.00	10.87	10.24					0		89.13	89.76	100.00	100.00
85.0	85.00	10.61	10.25					0		89.39	89.75	100.00	100.00
89.2	89.20	10.83	10.25			XS STA 32.2		0		89.17	89.75	100.00	100.00
100.0	100.00	10.58	10.26					0		89.42	89.74	100.00	100.00
112.0	112.00	11.56	10.25					0		88.44	89.75	100.00	100.00
124.0	124.00	10.72	10.25					0		89.28	89.75	100.00	100.00
136.0	136.00	10.69	10.26					0		89.31	89.74	100.00	100.00
152.0	152.00	10.55	10.27					0		89.45	89.73	100.00	100.00
160.5	160.50	10.70	10.39					0		89.30	89.61	100.00	100.00
170.0	170.00	10.81	10.62					0		89.19	89.38	100.00	100.00
184.0	184.00	10.95	10.78					0		89.05	89.22	100.00	100.00
191.2	191.20	11.35	11.01					0		88.65	88.99	100.00	100.00
197.7	197.70	12.48	11.05					0		87.52	88.95	100.00	100.00
205.4	205.40	12.73	11.09					0		87.27	88.91	100.00	100.00
217.0	217.00	11.59	11.09					0		88.41	88.91	100.00	100.00
223.3	223.30	11.34	11.09					0		88.66	88.91	100.00	100.00
231.0	231.00	11.89	11.15					0		88.11	88.85	100.00	100.00
241.0	241.00	11.52	11.15					0		88.48	88.85	100.00	100.00
244.0	244.00	11.34	11.14					0		88.66	88.86	100.00	100.00
254.0	254.00	11.60	11.17					0		88.40	88.83	100.00	100.00
266.0	266.00	11.45	11.19					0		88.55	88.81	100.00	100.00
274.0	274.00	11.92	11.56					0		88.08	88.44	100.00	100.00
280.0	280.00	12.53	11.60					0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00
	280.00							0		87.47	88.40	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.006354 ft/ft**
Near Bank Slope **0.003314 ft/ft**

Little Mill Creek - Cross Section 2-1 @ STA. 89

REACH ID:	**LMC 2-1**		**Date: 12/17/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.4
Water Surface Elev. (from Column M)			91.0

Adj. Readng
(Rci)
R+TPc
& Camline

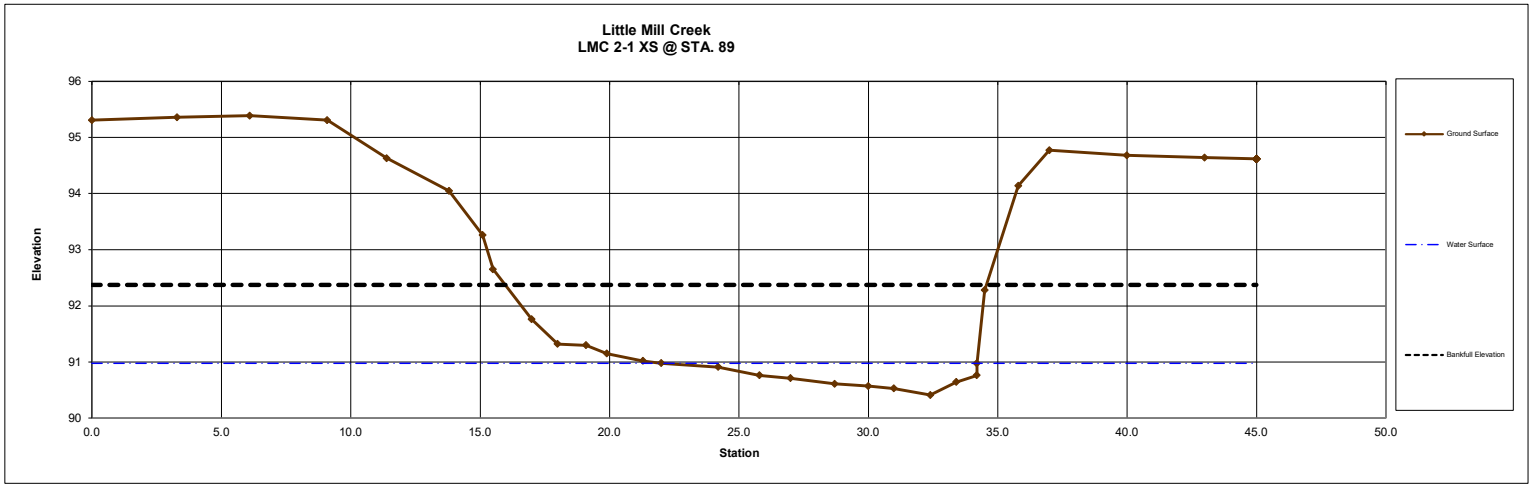
Geometry (English Units)		**Hydraulics** (English Units)			**Other**	
B elev =	92.37	Slope (ft/ft)		0.00635	L.Pin Sta.	0.0
B. Width =	18.6	Mannings "n"		0.02605	R.Pin Sta.	45.0
W/d =	12.96	D84 (mm) measured		23.1	L.Pin Rod	95.31
F.P.Width	23.5	Velocity (ft/s) Manning's)		5.15	R.Pin Rod	94.6
Entrenchment	1.27	Velocity (ft/s) via. (U/U*)		5.05	Tape Angle (deg.	0.9
B. Area =	26.7	Froud #		0.83		
B. Depth=	1.43	Discharge (cu ft/s)		137.4	Rc Meas.	
Max Depth	1.96	Shear Stress (lb/sq ft)		0.48	Chord	
W. Per=	22.1	CX Power (ft lb/s)		54.5	m	
H.Radius=	1.205	CX Power (watts)		73.9	Rc Calc.	
SS L Bank* =	0.78	Critical size (mm)		38.9	Rc/B. Width**	
SS R Bank* =	0.96	D84 predicted (mm)		5.8		
Shape Factor:	0.23	Flow Type	Subcritical Flow			

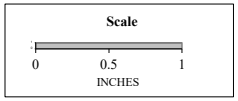
*Based on $HRad_{bb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Partia Sta	FP Width X R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	4.69	Next to Pin	4.69	95.31	4.69	0.00	1	0	0.00	0.00		0	
3.3	3.3	4.64		4.64	95.4	4.69	0.00	1	0	0.00	0.00	0.0	0	Above B F
6.1	6.1	4.61		4.61	95.4	4.69	0.00	1	0	0.00	0.00	0.0	0	Above B F
9.1	9.1	4.69		4.69	95.3	4.69	0.00	1	0	0.00	0.00	0.0	0	Above B F
11.4	11.4	5.37		5.37	94.6	5.37	0.00	1	0	0.00	1.18	0.0	0	Above B F
13.8	13.8	5.95		5.95	94.1	5.95	0.00	0	0	0.00	1.30	0.0	0	Above B F
15.1	15.1	6.74		6.74	93.3	6.74	0.00	0	0	0.00	0.40	0.0	0	Above B F
15.5	15.5	7.35		7.35	92.7	7.35	1.03	0	0	0.00	1.50	0.0	0	Within B F
17.0	17.0	8.24		8.24	91.8	8.24	1.00	0	0	0.00	1.00	0.0	0	Within B F
18.0	18.0	8.68		8.68	91.3	8.68	1.10	0	0	0.00	1.10	0.8	0	Within B F
19.1	19.1	8.70		8.70	91.3	8.70	0.80	0	0	0.00	0.80	1.2	0	Within B F
19.9	19.9	8.85		8.85	91.2	8.85	1.40	0	0	0.00	1.40	0.9	0	Within B F
21.3	21.3	8.98		8.98	91.0	8.98	0.70	0	0	0.00	0.70	1.8	0	Within B F
22.0	22.0	9.02	L-EOW	9.02	91.0	9.02	2.20	0	0	0.00	2.20	1.0	0.08	Within B F
24.2	24.2	9.09		9.09	90.9	9.09	1.60	0	0	0.00	1.60	3.1	0.00	Within B F
25.8	25.8	9.24		9.24	90.8	9.24	1.20	0	0	0.00	1.20	2.5	0.00	Within B F
27.0	27.0	9.29		9.29	90.7	9.29	1.70	0	0	0.00	1.70	2.0	0.00	Within B F
28.7	28.7	9.39		9.39	90.6	9.39	1.30	0	0	0.00	1.30	2.9	0.00	Within B F
30.0	30.0	9.43		9.43	90.6	9.43	1.00	0	0	0.00	1.00	2.3	0.00	Within B F
31.0	31.0	9.47		9.47	90.5	9.47	1.40	0	0	0.00	1.40	1.8	0.00	Within B F
32.4	32.4	9.59	Thalweg	9.59	90.4	9.59	1.00	0	0	0.00	1.00	2.7	0.00	Within B F
33.4	33.4	9.36		9.36	90.6	9.59	0.80	0	0	0.00	0.80	1.8	0.00	Within B F
34.2	34.2	9.24		9.24	90.8	9.59	0.00	0	0	0.00	0.00	1.3	0.00	Within B F
34.2	34.2	9.03	R-EOW	9.03	91.0	9.59	0.30	0	0	0.00	0.30	0.0	0.00	Within B F
34.5	34.5	7.72		7.72	92.3	9.59	0.06	0	0	0.00	1.30	0.2	0.00	Within B F
35.8	35.8	5.86		5.86	94.1	9.59	0.00	0	1	36.17	0.37	0.0	0.00	Above B F
37.0	37.0	5.23	R-TOB	5.23	94.8	9.59	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
40.0	40.0	5.32		5.32	94.7	9.59	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
43.0	43.0	5.36		5.36	94.6	9.59	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
45.0	45.0	5.38	Next to Pin	5.38	94.6	9.59	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
45.0				0.00	94.6									
45.0				0.00	94.6									
45.0				0.00	94.6									
45.0				0.00	94.6									





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

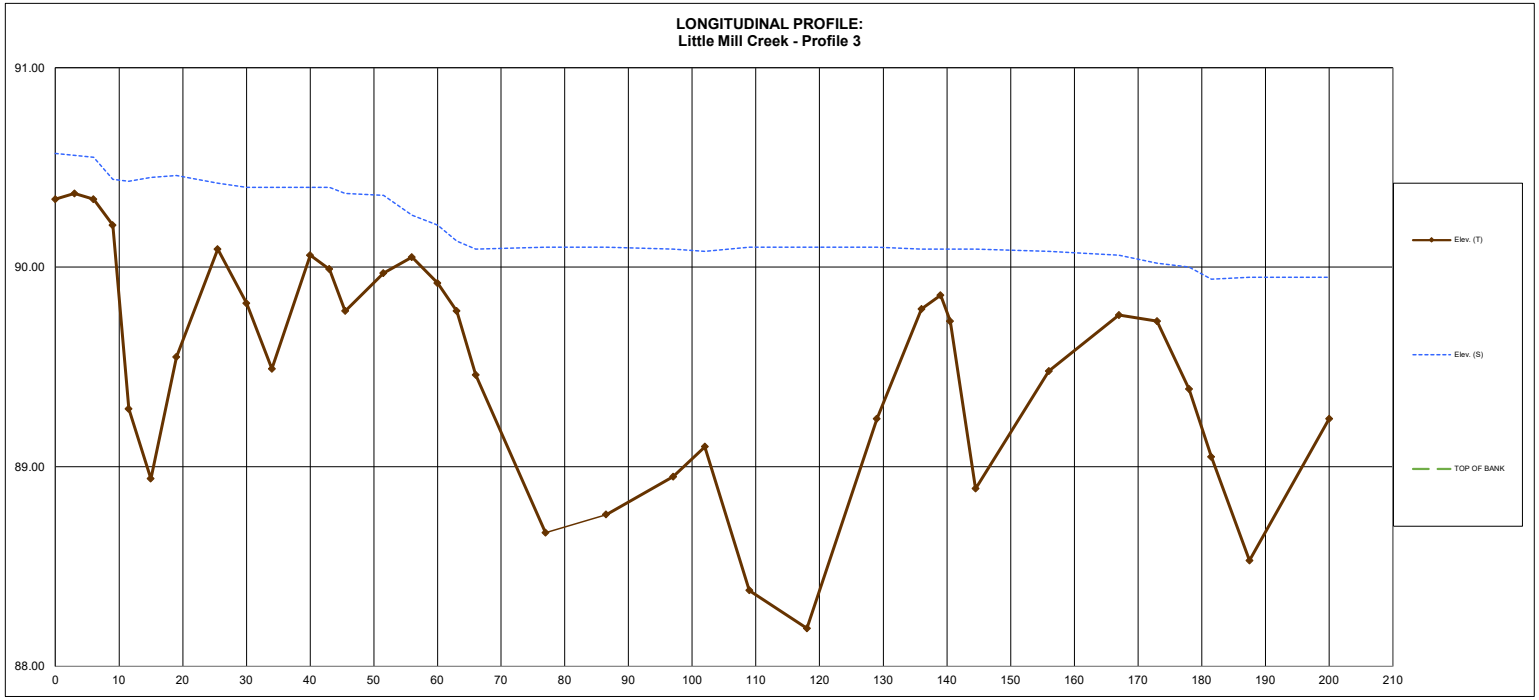
GEOMETRY	
Bank Full Elevation	92.37
Bank Full Width	18.59
Bank Full Depth	1.43
Maximum Depth	1.96
Bank Full Area	26.7
Hydraulic Radius	1.20
Wetted Perimeter	22.1
Width/Depth Ratio	13.0
Flood Prone Width	23.5
Entrenchment	1.27
Stream Type	F4/C4
Rc	

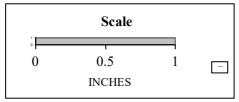
English Units

HYDRAULICS	
Slope (ft/ft)	0.0064
Manning's n	0.02605
Velocity (ft./s)	5.15
Froud #	0.83
Discharge (cu ft/s)	137.37
Shear Stress (lb/sq ft)	0.48
CX Power (ft lb/s)	54.5
Critical Size (mm)	38.9
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 3) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/17/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0		**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	9.66	9.43					0	0		90.34	90.57	100.00	100.00
3.0	3.00	9.63	9.44					0			90.37	90.56	100.00	100.00
6.0	6.00	9.66	9.45					0			90.34	90.55	100.00	100.00
9.0	9.00	9.79	9.56					0			90.21	90.44	100.00	100.00
11.5	11.50	10.71	9.57					0			89.29	90.43	100.00	100.00
15.0	15.00	11.06	9.55					0			88.94	90.45	100.00	100.00
19.0	19.00	10.45	9.54					0			89.55	90.46	100.00	100.00
25.5	25.50	9.91	9.58					0			90.09	90.42	100.00	100.00
30.0	30.00	10.18	9.6					0			89.82	90.40	100.00	100.00
34.0	34.00	10.51	9.6					0			89.49	90.40	100.00	100.00
40.0	40.00	9.94	9.6					0			90.06	90.40	100.00	100.00
43.0	43.00	10.01	9.6					0			89.99	90.40	100.00	100.00
45.5	45.50	10.22	9.63					0			89.78	90.37	100.00	100.00
51.5	51.50	10.03	9.64					0			89.97	90.36	100.00	100.00
56.0	56.00	9.95	9.74			XS STA 17.6		0			90.05	90.26	100.00	100.00
60.0	60.00	10.08	9.79					0			89.92	90.21	100.00	100.00
63.0	63.00	10.22	9.87					0			89.78	90.13	100.00	100.00
66.0	66.00	10.54	9.91					0			89.46	90.09	100.00	100.00
77.0	77.00	11.33	9.9					0			88.67	90.10	100.00	100.00
86.5	86.50	11.24	9.9					0			88.76	90.10	100.00	100.00
97.0	97.00	11.05	9.91					0			88.95	90.09	100.00	100.00
102.0	102.00	10.90	9.92					0			89.10	90.08	100.00	100.00
109.0	109.00	11.62	9.9					0			88.38	90.10	100.00	100.00
118.0	118.00	11.81	9.9					0			88.19	90.10	100.00	100.00
129.0	129.00	10.76	9.9					0			89.24	90.10	100.00	100.00
136.0	136.00	10.21	9.91					0			89.79	90.09	100.00	100.00
139.0	139.00	10.14	9.91					0			89.86	90.09	100.00	100.00
140.5	140.50	10.27	9.91					0			89.73	90.09	100.00	100.00
144.5	144.50	11.11	9.91					0			88.89	90.09	100.00	100.00
156.0	156.00	10.52	9.92					0			89.48	90.08	100.00	100.00
167.0	167.00	10.24	9.94					0			89.76	90.06	100.00	100.00
173.0	173.00	10.27	9.98					0			89.73	90.02	100.00	100.00
178.0	178.00	10.61	10					0			89.39	90.00	100.00	100.00
181.5	181.50	10.95	10.06					0			89.05	89.94	100.00	100.00
187.5	187.50	11.47	10.05					0			88.53	89.95	100.00	100.00
200.0	200.00	10.76	10.05					0			89.24	89.95	100.00	100.00
	200.00							0			89.24	89.95	100.00	100.00
	200.00							0			89.24	89.95	100.00	100.00
	200.00							0			89.24	89.95	100.00	100.00
	200.00							0			89.24	89.95	100.00	100.00
	200.00							0			89.24	89.95	100.00	100.00
	200.00							0			89.24	89.95	100.00	100.00
	200.00							0			89.24	89.95	100.00	100.00
	200.00							0			89.24	89.95	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.003049 ft/ft**

Little Mill Creek - Cross Section 3-1 @ STA. 56

REACH ID:	**LMC 3-1**		**Date: 12/17/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.5
Water Surface Elev. (from Column M)			90.3

check

Adj. Readng
(Rci)
R+TPc
& Camline

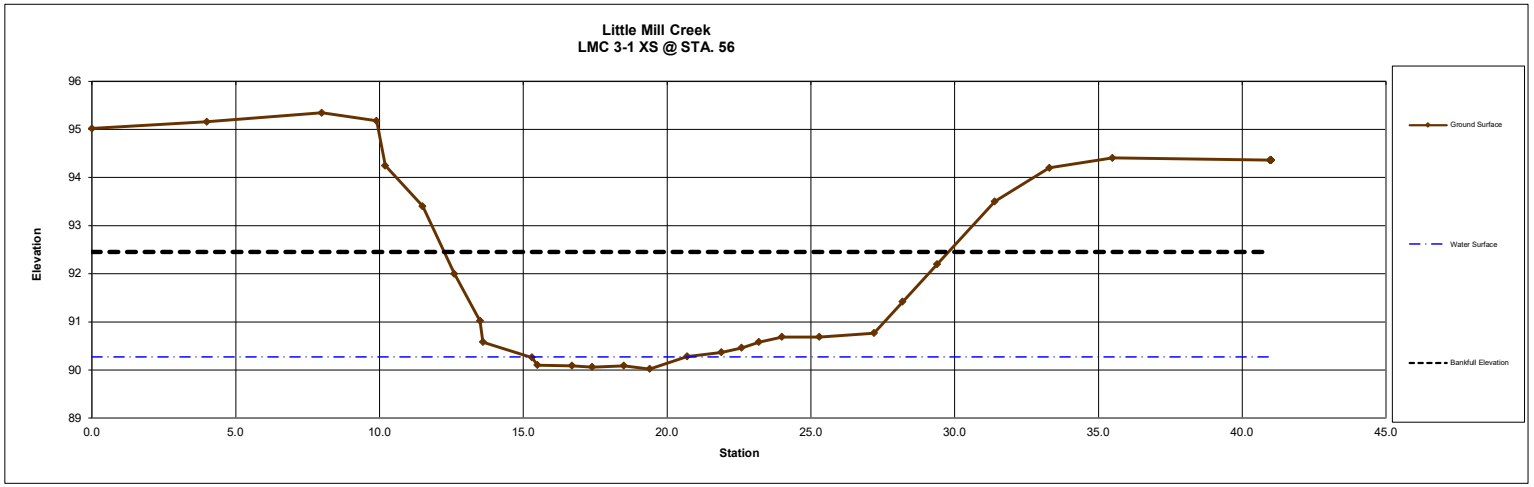
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	92.45	Slope (ft/ft)	0.00305	L.Pin Sta.	0.0
B. Width =	17.5	Mannings "n"	0.0247	R.Pin Sta.	41.0
W/d =	9.74	D84 (mm) measured	23.1	L.Pin Rod	95.02
F.P.Width	31.0	Velocity (ft/s) Manning's)	4.37	R.Pin Rod	94.4
Entrenchment	1.77	Velocity (ft/s) via. (U/U*)	4.13	Tape Angle (deg.	0.9
B. Area =	31.6	Froud #	0.63		
B. Depth=	1.80	Discharge (cu ft/s)	138.1	Rc Meas.	
Max Depth	2.43	Shear Stress (lb/sq ft)	0.29	Chord	
W. Per=	21.0	CX Power (ft lb/s)	26.3	m	
H.Radius=	1.51	CX Power (watts)	35.6	Rc Calc.	
SS L Bank* =	0.95	Critical size (mm)	22.5	Rc/B. Width**	
SS R Bank* =	0.71	D84 predicted (mm)	5.2		
Shape Factor:	0.27	Flow Type	Subcritical Flow		

*Based on $HRad_{nb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr.	Test 1	Entr Tst 2	FP Pa Sta	X R	FP Width Bnk	Area (old)	L. Partial LNB Se	Invert Segment is:
0.0	0.0	4.98	Next to Pin	4.98	95.02	4.98	0.00	1	0		0.00		0.00		0	
4.0	4.0	4.84		4.84	95.2	4.98	0.00	1	0		0.00		0.00	0.0	0	Above B F
8.0	8.0	4.65		4.65	95.4	4.98	0.00	1	0		0.00		0.00	0.0	0	Above B F
9.9	9.9	4.82	L-TOB	4.82	95.2	4.98	0.00	1	0		0.00		0.21	0.0	0	Above B F
10.2	10.2	5.75		5.75	94.3	5.75	0.00	0	0		0.00		1.30	0.0	0	Above B F
11.5	11.5	6.60		6.60	93.4	6.60	0.36	0	0		0.00		1.10	0.0	0	Within B F
12.6	12.6	8.00		8.00	92.0	8.00	0.90	0	0		0.00		0.90	0.0	0	Within B F
13.5	13.5	8.98		8.98	91.0	8.98	0.10	0	0		0.00		0.10	0.8	0	Within B F
13.6	13.6	9.42		9.42	90.6	9.42	1.70	0	0		0.00		1.70	0.2	0	Within B F
15.3	14.3	9.74	L-EOW	9.74	90.3	9.74	0.20	0	0		0.00		0.20	3.5	0	Within B F
15.5	15.5	9.90		9.90	90.1	9.90	1.20	0	0		0.00		1.20	0.5	0	Within B F
16.7	16.7	9.91		9.91	90.1	9.91	0.70	0	0		0.00		0.70	2.8	0	Within B F
17.4	17.4	9.94	Thalweg	9.94	90.1	9.94	1.10	0	0		0.00		1.10	1.7	0.63	Within B F
18.5	18.5	9.91		9.91	90.1	9.94	0.90	0	0		0.00		0.90	2.6	0.00	Within B F
19.4	19.4	9.98		9.98	90.0	9.98	1.30	0	0		0.00		1.30	2.2	0.00	Within B F
20.7	20.7	9.72	R-EOW	9.72	90.3	9.98	1.20	0	0		0.00		1.20	3.0	0.00	Within B F
21.9	21.9	9.63		9.63	90.4	9.98	0.70	0	0		0.00		0.70	2.6	0.00	Within B F
22.6	22.6	9.54		9.54	90.5	9.98	0.60	0	0		0.00		0.60	1.4	0.00	Within B F
23.2	23.2	9.42	BFF	9.42	90.6	9.98	0.80	0	0		0.00		0.80	1.2	0.00	Within B F
24.0	24.0	9.31		9.31	90.7	9.98	1.30	0	0		0.00		1.30	1.5	0.00	Within B F
25.3	25.3	9.31		9.31	90.7	9.98	1.90	0	0		0.00		1.90	2.3	0.00	Within B F
27.2	27.2	9.23		9.23	90.8	9.98	1.00	0	0		0.00		1.00	3.3	0.00	Within B F
28.2	28.2	8.58		8.58	91.4	9.98	1.20	0	0		0.00		1.20	1.4	0.00	Within B F
29.4	29.4	7.80		7.80	92.2	9.98	0.39	0	0		0.00		2.00	0.8	0.00	Within B F
31.4	31.4	6.50		6.50	93.5	9.98	0.00	0	0		0.00		1.90	0.0	0.00	Above B F
33.3	33.3	5.80	R-TOB	5.80	94.2	9.98	0.00	0	0		0.00		2.20	0.0	0.00	Above B F
35.5	35.5	5.59		5.59	94.4	9.98	0.00	0	0		0.00		5.50	0.0	0.00	Above B F
41.0	41.0	5.64	Next to Pin	5.64	94.4	9.98	0.00	0	0		0.00		0.00	0.0	0.00	Above B F
41.0				0.00	94.4											
41.0				0.00	94.4											
41.0				0.00	94.4											
41.0				0.00	94.4											
41.0				0.00	94.4											
41.0				0.00	94.4											



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

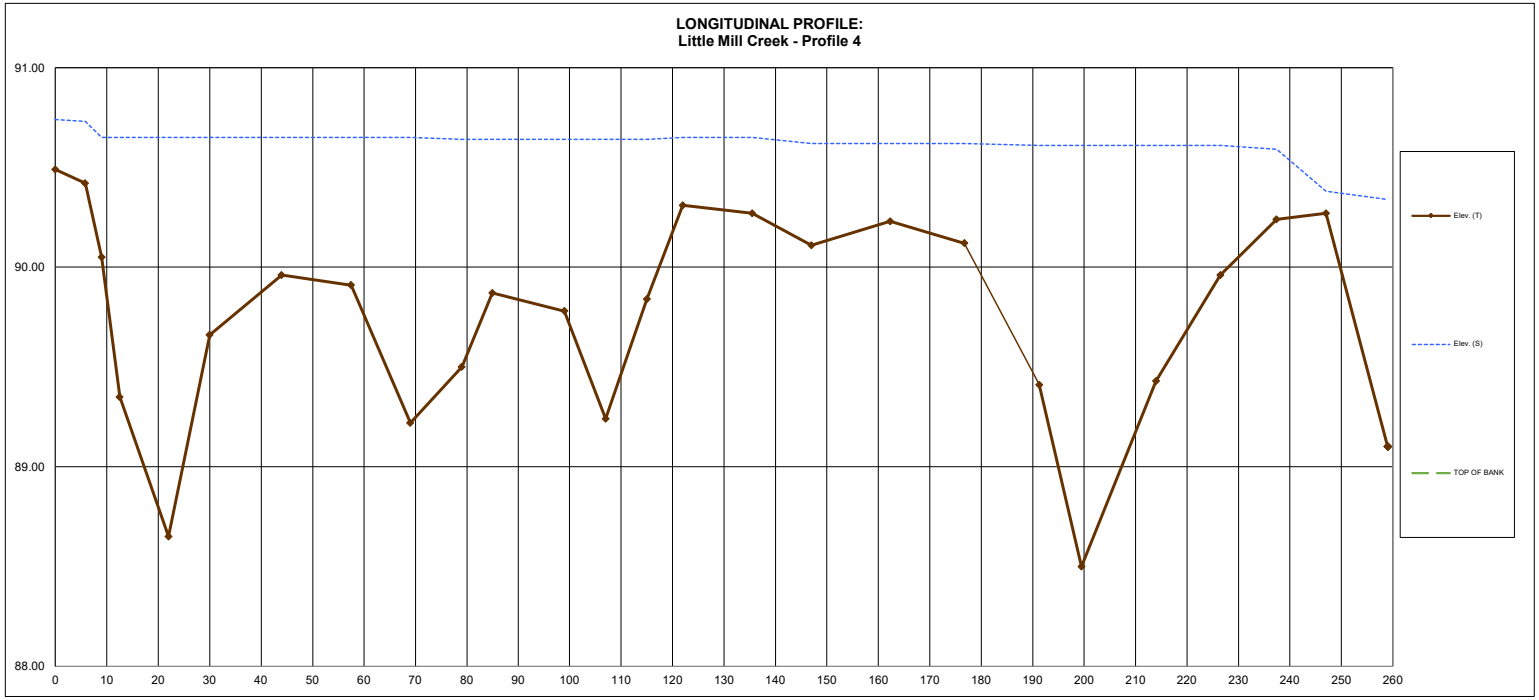
GEOMETRY	
Bank Full Elevation	92.45
Bank Full Width	17.54
Bank Full Depth	1.80
Maximum Depth	2.43
Bank Full Area	31.6
Hydraulic Radius	1.51
Wetted Perimeter	21.0
Width/Depth Ratio	9.7
Flood Prone Width	31.0
Entrenchment	
Stream Type	F4/C4
Rc	

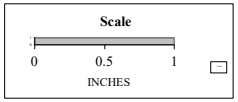
English Units

HYDRAULICS	
Slope (ft/ft)	0.0030
Manning's n	0.0247
Velocity (ft./s)	4.37
Froud #	0.63
Discharge (cu ft/s)	138.09
Shear Stress (lb/sq ft)	0.29
CX Power (ft lb/s)	26.3
Critical Size (mm)	22.5
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 4) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/17/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0		**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	9.51	9.26					0	0		90.49	90.74	100.00	100.00
5.8	5.80	9.58	9.27					0			90.42	90.73	100.00	100.00
9.0	9.00	9.95	9.35					0			90.05	90.65	100.00	100.00
12.5	12.50	10.65	9.35					0			89.35	90.65	100.00	100.00
22.0	22.00	11.35	9.35					0			88.65	90.65	100.00	100.00
30.0	30.00	10.34	9.35					0			89.66	90.65	100.00	100.00
44.0	44.00	10.04	9.35					0			89.96	90.65	100.00	100.00
57.5	57.50	10.09	9.35					0			89.91	90.65	100.00	100.00
69.0	69.00	10.78	9.35					0			89.22	90.65	100.00	100.00
79.0	79.00	10.50	9.36					0			89.50	90.64	100.00	100.00
85.0	85.00	10.13	9.36					0			89.87	90.64	100.00	100.00
99.0	99.00	10.22	9.36					0			89.78	90.64	100.00	100.00
107.0	107.00	10.76	9.36					0			89.24	90.64	100.00	100.00
115.0	115.00	10.16	9.36					0			89.84	90.64	100.00	100.00
122.0	122.00	9.69	9.35					0			90.31	90.65	100.00	100.00
135.5	135.50	9.73	9.35					0			90.27	90.65	100.00	100.00
147.0	147.00	9.89	9.38					0			90.11	90.62	100.00	100.00
162.3	162.30	9.77	9.38			XS STA. 37.3		0			90.23	90.62	100.00	100.00
176.7	176.70	9.88	9.38					0			90.12	90.62	100.00	100.00
191.3	191.30	10.59	9.39					0			89.41	90.61	100.00	100.00
199.5	199.50	11.50	9.39					0			88.50	90.61	100.00	100.00
214.0	214.00	10.57	9.39					0			89.43	90.61	100.00	100.00
226.5	226.50	10.04	9.39					0			89.96	90.61	100.00	100.00
237.4	237.40	9.76	9.41					0			90.24	90.59	100.00	100.00
247.0	247.00	9.73	9.62					0			90.27	90.38	100.00	100.00
259.0	259.00	10.90	9.66					0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00
	259.00							0			89.10	90.34	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope =	**0.001544 ft/ft**
Near Bank Slope	**0.00347 ft/ft**
	0.00120 ft/ft

Little Mill Creek - Cross Section 4-1 @ STA. 37

REACH ID:	**LMC 4-1**		**Date: 12/17/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.7
Water Surface Elev. (from Column M)			90.5

check

Adj. Readng (Rci) R+TPc & Camline

Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	92.69	Slope (ft/ft)	0.00154	L.Pin Sta.	0.0
B. Width =	18.1	Mannings "n"	0.0237	R.Pin Sta.	59.0
W/d =	8.68	D84 (mm) measured	23.1	L.Pin Rod	95.57
F.P.Width	55.4	Velocity (ft/s) Manning's)	3.67	R.Pin Rod	95.0
Entrenchment	3.06	Velocity (ft/s) via. (U/U*)	3.33	Tape Angle (deg.	0.5
B. Area =	37.8	Froud #	0.48		
B. Depth=	2.09	Discharge (cu ft/s)	138.8	Rc Meas.	
Max Depth	2.56	Shear Stress (lb/sq ft)	0.18	Chord	
W. Per=	20.8	CX Power (ft lb/s)	13.3	m	
H.Radius=	1.82	CX Power (watts)	18.1	Rc Calc.	
SS L Bank* =	0.85	Critical size (mm)	13.2	Rc/B. Width**	
SS R Bank* =	0.89	D84 predicted (mm)	4.6		
Shape Factor:	0.30	Flow Type	Subcritical Flow		

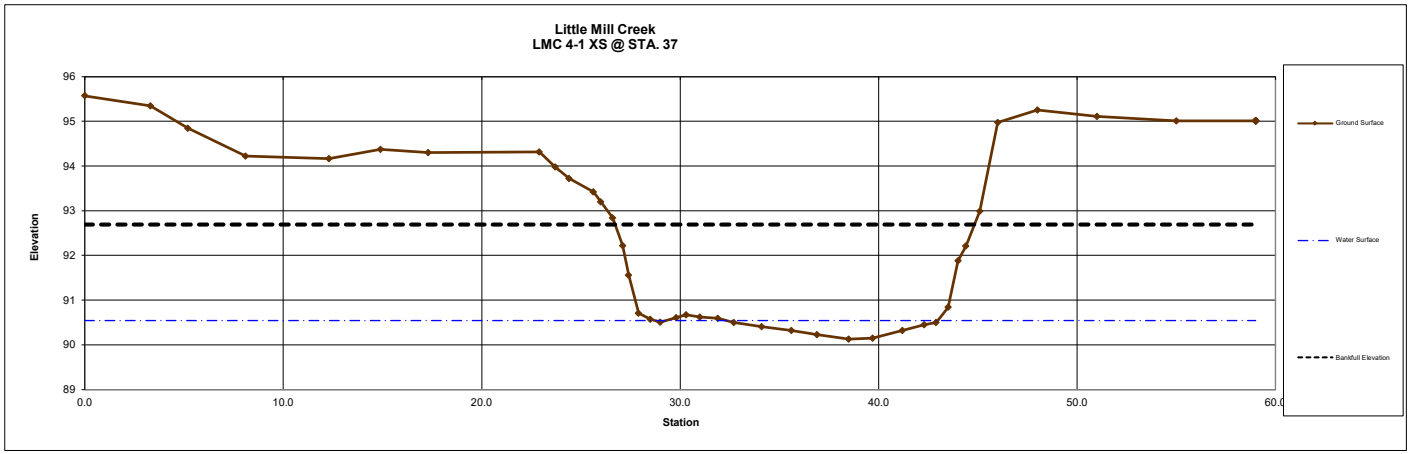
*Based on $HRad_{bf(\text{within the nearest } 1/3 \text{ of } Wbf)}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I
0.0	0.0	4.43	Next to Pin	4.43	95.57
3.3	3.3	4.66		4.66	95.3
5.2	5.2	5.16		5.16	94.8
8.1	8.1	5.78		5.78	94.2
12.3	12.3	5.84		5.84	94.2
14.9	14.9	5.63		5.63	94.4
17.3	17.3	5.70		5.70	94.3
22.9	22.9	5.69		5.69	94.3
23.7	23.7	6.02		6.02	94.0
24.4	24.4	6.28		6.28	93.7
25.6	25.6	6.58		6.58	93.4
26.0	26.0	6.80		6.80	93.2
26.6	26.6	7.16		7.16	92.8
27.1	27.1	7.78		7.78	92.2
27.4	27.4	8.44		8.44	91.6
27.9	27.9	9.29		9.29	90.7
28.5	28.5	9.43		9.43	90.6
29.0	29.0	9.49		9.49	90.5
29.8	29.8	9.39		9.39	90.6
30.3	30.3	9.33		9.33	90.7
31.0	31.0	9.38		9.38	90.6
31.9	31.9	9.41	L-EOW	9.41	90.6
32.7	32.7	9.50		9.50	90.5
34.1	34.1	9.59		9.59	90.4
35.6	35.6	9.68		9.68	90.3
36.9	36.9	9.77		9.77	90.2
38.5	38.5	9.87		9.87	90.1
39.7	39.7	9.85		9.85	90.2
41.2	41.2	9.68		9.68	90.3
42.3	42.3	9.55		9.55	90.5
42.9	42.9	9.50	R-EOW	9.50	90.5
43.5	43.5	9.16		9.16	90.8
44.0	44.0	8.12		8.12	91.9
44.4	44.4	7.79		7.79	92.2
45.1	45.1	7.01		7.01	93.0
46.0	46.0	5.03	R-TOB	5.03	95.0
48.0	48.0	4.75		4.75	95.3
51.0	51.0	4.89		4.89	95.1
55.0	55.0	4.99		4.99	95.0
59.0	59.0	4.99	Next to Pin	4.99	95.0

I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pa Sta X R	FP Width Bnk	Area (old)	Partial LNB Se	Invert Segment is:
	4.43	0.00	1	0	0.00	0.00		0	
	4.66	0.00	1	0	0.00	1.57	0.0	0	Above B F
	5.16	0.00	0	0	0.00	2.90	0.0	0	Above B F
	5.78	0.00	0	0	0.00	4.20	0.0	0	Above B F
	5.84	0.00	0	0	0.00	2.60	0.0	0	Above B F
	5.84	0.00	0	0	0.00	2.40	0.0	0	Above B F
	5.84	0.00	0	0	0.00	5.60	0.0	0	Above B F
	5.84	0.00	0	0	0.00	0.80	0.0	0	Above B F
	6.02	0.00	0	0	0.00	0.70	0.0	0	Above B F
	6.28	0.00	0	0	0.00	1.23	0.0	0	Above B F
	6.58	0.00	0	0	0.00	0.37	0.0	0	Above B F
	6.80	0.00	0	0	0.00	0.60	0.0	0	Above B F
	7.16	0.38	0	0	0.00	0.50	0.0	0	Within B F
	7.78	0.30	0	0	0.00	0.30	0.0	0	Within B F
	8.44	0.50	0	0	0.00	0.50	0.2	0	Within B F
	9.29	0.60	0	0	0.00	0.60	0.8	0	Within B F
	9.43	0.50	0	0	0.00	0.50	1.2	0	Within B F
	9.49	0.80	0	0	0.00	0.80	1.1	0	Within B F
	9.49	0.50	0	0	0.00	0.50	1.7	0	Within B F
	9.49	0.70	0	0	0.00	0.70	1.0	0	Within B F
	9.49	0.90	0	0	0.00	0.90	1.4	0	Within B F
	9.49	0.80	0	0	0.00	0.80	1.9	0	Within B F
	9.50	1.40	0	0	0.00	1.40	1.7	0.04	Within B F
	9.59	1.50	0	0	0.00	1.50	3.1	0.00	Within B F
	9.68	1.30	0	0	0.00	1.30	3.5	0.00	Within B F
	9.77	1.60	0	0	0.00	1.60	3.1	0.00	Within B F
	9.87	1.20	0	0	0.00	1.20	4.0	0.00	Within B F
	9.87	1.50	0	0	0.00	1.50	3.1	0.00	Within B F
	9.87	1.10	0	0	0.00	1.10	3.7	0.00	Within B F
	9.87	0.60	0	0	0.00	0.60	2.5	0.00	Within B F
	9.87	0.60	0	0	0.00	0.60	1.3	0.00	Within B F
	9.87	0.50	0	0	0.00	0.50	1.2	0.00	Within B F
	9.87	0.40	0	0	0.00	0.40	0.7	0.00	Within B F
	9.87	0.43	0	0	0.00	0.70	0.3	0.00	Within B F
	9.87	0.00	0	0	0.00	0.90	0.1	0.00	Above B F
	9.87	0.00	0	0	0.00	2.00	0.0	0.00	Above B F
	9.87	0.00	0	0	0.00	3.00	0.0	0.00	Above B F
	9.87	0.00	0	0	0.00	4.00	0.0	0.00	Above B F
	9.87	0.00	0	0	0.00	4.00	0.0	0.00	Above B F
	9.87	0.00	0	0	0.00	0.00	0.0	0.00	Above B F



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

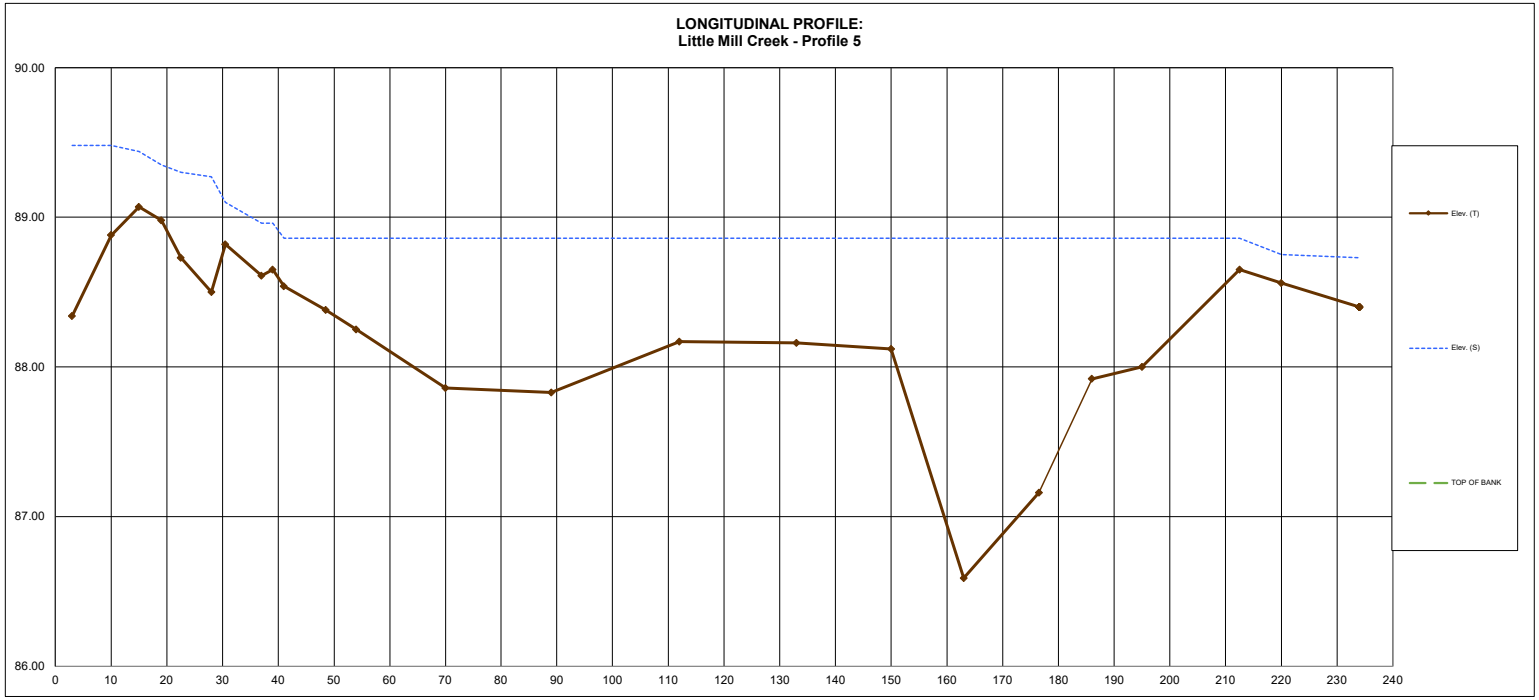
GEOMETRY	
Bank Full Elevation	92.69
Bank Full Width	18.11
Bank Full Depth	2.09
Maximum Depth	2.56
Bank Full Area	37.8
Hydraulic Radius	1.82
Wetted Perimeter	20.8
Width/Depth Ratio	8.7
Flood Prone Width	55.4
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0015
Manning's n	0.0237
Velocity (ft./s)	3.67
Froud #	0.48
Discharge (cu ft/s)	138.81
Shear Stress (lb/sq ft)	0.18
CX Power (ft lb/s)	13.3
Critical Size (mm)	13.2
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 5) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/21/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
3.0	3	11.66	10.52					0	0	88.34	89.48	100.00	100.00
10.0	10.00	11.12	10.52			G		0		88.88	89.48	100.00	100.00
15.0	15.00	10.93	10.56			Riffle		0		89.07	89.44	100.00	100.00
19.0	19.00	11.02	10.65			Mid R		0		88.98	89.35	100.00	100.00
22.5	22.50	11.27	10.70					0		88.73	89.30	100.00	100.00
28.0	28.00	11.50	10.73					0		88.50	89.27	100.00	100.00
30.5	30.50	11.18	10.90			XS		0		88.82	89.10	100.00	100.00
37.0	37.00	11.39	11.04			MDR		0		88.61	88.96	100.00	100.00
39.0	39.00	11.35	11.04			N		0		88.65	88.96	100.00	100.00
41.0	41.00	11.46	11.14			Pool		0		88.54	88.86	100.00	100.00
48.5	48.50	11.62	11.14					0		88.38	88.86	100.00	100.00
54.0	54.00	11.75	11.14					0		88.25	88.86	100.00	100.00
70.0	70.00	12.14	11.14					0		87.86	88.86	100.00	100.00
89.0	89.00	12.17	11.14					0		87.83	88.86	100.00	100.00
112.0	112.00	11.83	11.14					0		88.17	88.86	100.00	100.00
133.0	133.00	11.84	11.14					0		88.16	88.86	100.00	100.00
150.0	150.00	11.88	11.14					0		88.12	88.86	100.00	100.00
163.0	163.00	13.41	11.14					0		86.59	88.86	100.00	100.00
176.5	176.50	12.84	11.14					0		87.16	88.86	100.00	100.00
186.0	186.00	12.08	11.14					0		87.92	88.86	100.00	100.00
195.0	195.00	12.00	11.14					0		88.00	88.86	100.00	100.00
212.5	212.50	11.35	11.14			R		0		88.65	88.86	100.00	100.00
220.0	220.00	11.44	11.25			Mid R		0		88.56	88.75	100.00	100.00
234.0	234.00	11.60	11.27			Mid R		0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00
	234.00							0		88.40	88.73	100.00	100.00



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = 0.002937 ft/ft

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

Little Mill Creek - Cross Section 5-1 @ STA. 31

REACH ID:	**LMC 5-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			91.3
Water Surface Elev. (from Column M)			89.2

check

Adj. Readng
(Rci)
R+TPc
& Camline

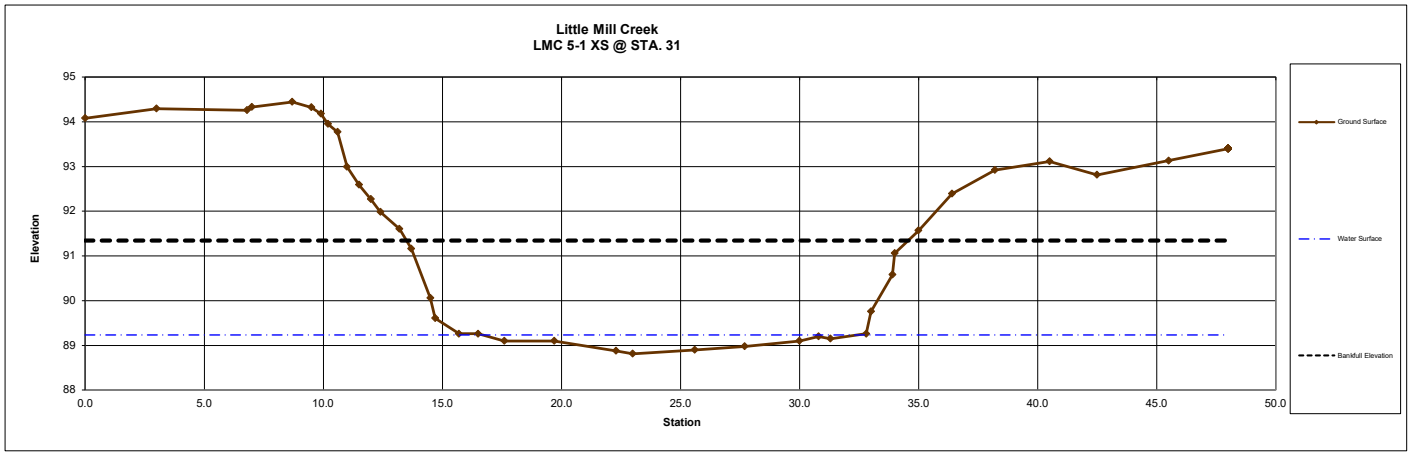
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	91.34	Slope (ft/ft)	0.00294	L.Pin Sta.	0.0
B. Width =	21.0	Mannings "n"	0.0285	R.Pin Sta.	48.0
W/d =	10.13	D84 (mm) measured	51.3	L.Pin Rod	94.08
F.P.Width	37.6	Velocity (ft/s) Manning's)	4.27	R.Pin Rod	93.4
Entrenchment	1.79	Velocity (ft/s) via. (U/U*)	3.82	Tape Angle (deg	0.8
B. Area =	43.7	Froud #	0.55		
B. Depth=	2.08	Discharge (cu ft/s)	186.9	Rc Meas.	
Max Depth	2.53	Shear Stress (lb/sq ft)	0.34	Chord	
W. Per=	23.5	CX Power (ft lb/s)	34.3	m	
H.Radius=	1.86	CX Power (watts)	46.4	Rc Calc.	
SS L Bank* =	0.88	Critical size (mm)	27.0	Rc/B. Width**	
SS R Bank* =	0.86	D84 predicted (mm)	14.3		
Shape Factor:	0.28	Flow Type	Subcritical Flow		

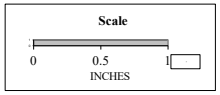
*Based on $HRad_{bf}$ (within the nearest 1/3 of Wbf) / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP P≤ Sta	FP Width X R Bnk	Area (old)	ı. Partial LNB Se	Invert Segment is:
0.0	0.0	5.92	Next to Pin	5.92	94.08	5.92	0.00	1	0	0.00	0.00		0	
3.0	3.0	5.71		5.71	94.3	5.92	0.00	1	0	0.00	0.00	0.0	0	Above B F
6.8	6.8	5.74		5.74	94.3	5.92	0.00	1	0	0.00	0.00	0.0	0	Above B F
7.0	7.0	5.67		5.67	94.3	5.92	0.00	1	0	0.00	0.00	0.0	0	Above B F
8.7	8.7	5.56		5.56	94.4	5.92	0.00	1	0	0.00	0.00	0.0	0	Above B F
9.5	9.5	5.68	L-TOB	5.68	94.3	5.92	0.00	1	0	0.00	0.00	0.0	0	Above B F
9.9	9.9	5.82		5.82	94.2	5.92	0.00	1	0	0.00	0.00	0.0	0	Above B F
10.2	10.2	6.05		6.05	94.0	6.05	0.00	1	0	0.00	0.22	0.0	0	Above B F
10.6	10.6	6.23		6.23	93.8	6.23	0.00	0	0	0.00	0.40	0.0	0	Above B F
11.0	11.0	7.01		7.01	93.0	7.01	0.00	0	0	0.00	0.50	0.0	0	Above B F
11.5	11.5	7.41		7.41	92.6	7.41	0.00	0	0	0.00	0.50	0.0	0	Above B F
12.0	12.0	7.73		7.73	92.3	7.73	0.00	0	0	0.00	0.40	0.0	0	Above B F
12.4	12.4	8.02		8.02	92.0	8.02	0.00	0	0	0.00	0.80	0.0	0	Above B F
13.2	13.2	8.40		8.40	91.6	8.40	0.20	0	0	0.00	0.50	0.0	0	Within B F
13.7	13.7	8.84		8.84	91.2	8.84	0.80	0	0	0.00	0.80	0.0	0	Within B F
14.5	14.5	9.94		9.94	90.1	9.94	0.20	0	0	0.00	0.20	0.6	0	Within B F
14.7	14.7	10.39		10.39	89.6	10.39	1.00	0	0	0.00	1.00	0.3	0	Within B F
15.7	15.7	10.74		10.74	89.3	10.74	0.80	0	0	0.00	0.80	1.9	0	Within B F
16.5	16.5	10.74	L-EOW	10.74	89.3	10.74	1.10	0	0	0.00	1.10	1.7	0	Within B F
17.6	17.6	10.90		10.90	89.1	10.90	2.10	0	0	0.00	2.10	2.4	0	Within B F
19.7	19.7	10.90		10.90	89.1	10.90	2.60	0	0	0.00	2.60	4.7	0.31	Within B F
22.3	22.3	11.12		11.12	88.9	11.12	0.70	0	0	0.00	0.70	6.1	0.00	Within B F
23.0	23.0	11.19	TW	11.19	88.8	11.19	2.60	0	0	0.00	2.60	1.7	0.00	Within B F
25.6	25.6	11.10		11.10	88.9	11.19	2.10	0	0	0.00	2.10	6.5	0.00	Within B F
27.7	27.7	11.02		11.02	89.0	11.19	2.30	0	0	0.00	2.30	5.0	0.00	Within B F
30.0	30.0	10.90		10.90	89.1	11.19	0.80	0	0	0.00	0.80	5.3	0.00	Within B F
30.8	30.8	10.80	R-EOW	10.80	89.2	11.19	0.50	0	0	0.00	0.50	1.8	0.00	Within B F
31.3	31.3	10.85		10.85	89.2	11.19	1.50	0	0	0.00	1.50	1.1	0.00	Within B F
32.8	32.8	10.74		10.74	89.3	11.19	0.20	0	0	0.00	0.20	3.2	0.00	Within B F
33.0	33.0	10.24		10.24	89.8	11.19	0.90	0	0	0.00	0.90	0.4	0.00	Within B F
33.9	33.9	9.42		9.42	90.6	11.19	0.10	0	0	0.00	0.10	1.1	0.00	Within B F
34.0	34.0	8.94		8.94	91.1	11.19	0.55	0	0	0.00	1.00	0.1	0.00	Within B F
35.0	35.0	8.43		8.43	91.6	11.19	0.00	0	0	0.00	1.40	0.0	0.00	Above B F
36.4	36.4	7.61		7.61	92.4	11.19	0.00	0	0	0.00	1.80	0.0	0.00	Above B F
38.2	38.2	7.08		7.08	92.9	11.19	0.00	0	0	0.00	2.30	0.0	0.00	Above B F
40.5	40.5	6.89	R-TOB	6.89	93.1	11.19	0.00	0	0	0.00	2.00	0.0	0.00	Above B F
42.5	42.5	7.19		7.19	92.8	11.19	0.00	0	0	0.00	3.00	0.0	0.00	Above B F
45.5	45.5	6.87		6.87	93.1	11.19	0.00	0	0	0.00	2.50	0.0	0.00	Above B F
48.0	48.0	6.60	Next to Pin	6.60	93.4	11.19	0.00	0	0	0.00	0.00	0.0	0.00	Above B F





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

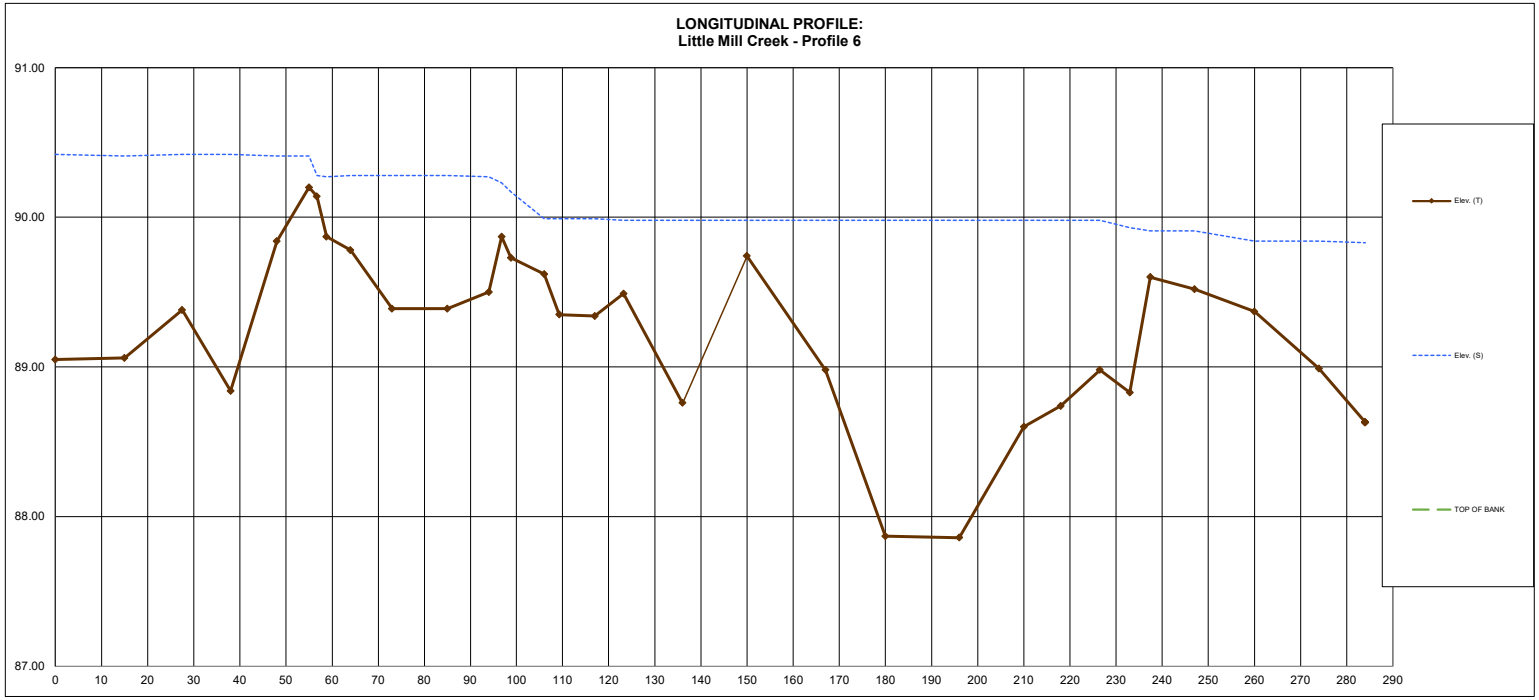
GEOMETRY	
Bank Full Elevation	91.34
Bank Full Width	21.05
Bank Full Depth	2.08
Maximum Depth	2.53
Bank Full Area	43.7
Hydraulic Radius	1.86
Wetted Perimeter	23.5
Width/Depth Ratio	10.1
Flood Prone Width	37.6
Entrenchment	
Stream Type	F4/C4
Rc	

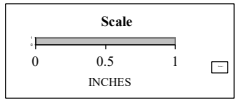
English Units

HYDRAULICS	
Slope (ft/ft)	0.0029
Manning's n	0.0285
Velocity (ft./s)	4.27
Froud #	0.55
Discharge (cu ft/s)	186.93
Shear Stress (lb/sq ft)	0.34
CX Power (ft lb/s)	34.3
Critical Size (mm)	27.0
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 6) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:		100			12/21/2021							
Rc* at BM												
Convert English(0) to Metric (1):		0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	10.95	9.58					0	0	89.05	90.42	100.00	100.00
15.0	15.00	10.94	9.59					0		89.06	90.41	100.00	100.00
27.5	27.50	10.62	9.58					0		89.38	90.42	100.00	100.00
38.0	38.00	11.16	9.58					0		88.84	90.42	100.00	100.00
48.0	48.00	10.16	9.59					0		89.84	90.41	100.00	100.00
55.0	55.00	9.80	9.59					0		90.20	90.41	100.00	100.00
56.7	56.70	9.86	9.72					0		90.14	90.28	100.00	100.00
58.8	58.80	10.13	9.73					0		89.87	90.27	100.00	100.00
64.0	64.00	10.22	9.72					0		89.78	90.28	100.00	100.00
73.0	73.00	10.61	9.72					0		89.39	90.28	100.00	100.00
85.0	85.00	10.61	9.72					0		89.39	90.28	100.00	100.00
94.0	94.00	10.50	9.73					0		89.50	90.27	100.00	100.00
96.8	96.80	10.13	9.77					0		89.87	90.23	100.00	100.00
98.8	98.80	10.27	9.83					0		89.73	90.17	100.00	100.00
106.0	106.00	10.38	10.01					0		89.62	89.99	100.00	100.00
109.3	109.30	10.65	10.01			XS STA 35		0		89.35	89.99	100.00	100.00
117.0	117.00	10.66	10.01					0		89.34	89.99	100.00	100.00
123.2	123.20	10.51	10.02					0		89.49	89.98	100.00	100.00
136.0	136.00	11.24	10.02					0		88.76	89.98	100.00	100.00
150.0	150.00	10.26	10.02					0		89.74	89.98	100.00	100.00
167.0	167.00	11.02	10.02					0		88.98	89.98	100.00	100.00
180.0	180.00	12.13	10.02					0		87.87	89.98	100.00	100.00
196.0	196.00	12.14	10.02					0		87.86	89.98	100.00	100.00
210.0	210.00	11.40	10.02					0		88.60	89.98	100.00	100.00
218.0	218.00	11.26	10.02					0		88.74	89.98	100.00	100.00
226.5	226.50	11.02	10.02					0		88.98	89.98	100.00	100.00
233.0	233.00	11.17	10.07					0		88.83	89.93	100.00	100.00
237.4	237.40	10.40	10.09					0		89.60	89.91	100.00	100.00
247.0	247.00	10.48	10.09					0		89.52	89.91	100.00	100.00
260.0	260.00	10.63	10.16					0		89.37	89.84	100.00	100.00
274.0	274.00	11.01	10.16					0		88.99	89.84	100.00	100.00
284.0	284.00	11.37	10.17					0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00
	284.00							0		88.63	89.83	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.002048 ft/ft**

Little Mill Creek - Cross Section 6-1 @ STA. 109

REACH ID:	**LMC 6-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.4
Water Surface Elev. (from Column M)			90.0

check

Adj. Readng
(Rci)
R+TPc
& Camline

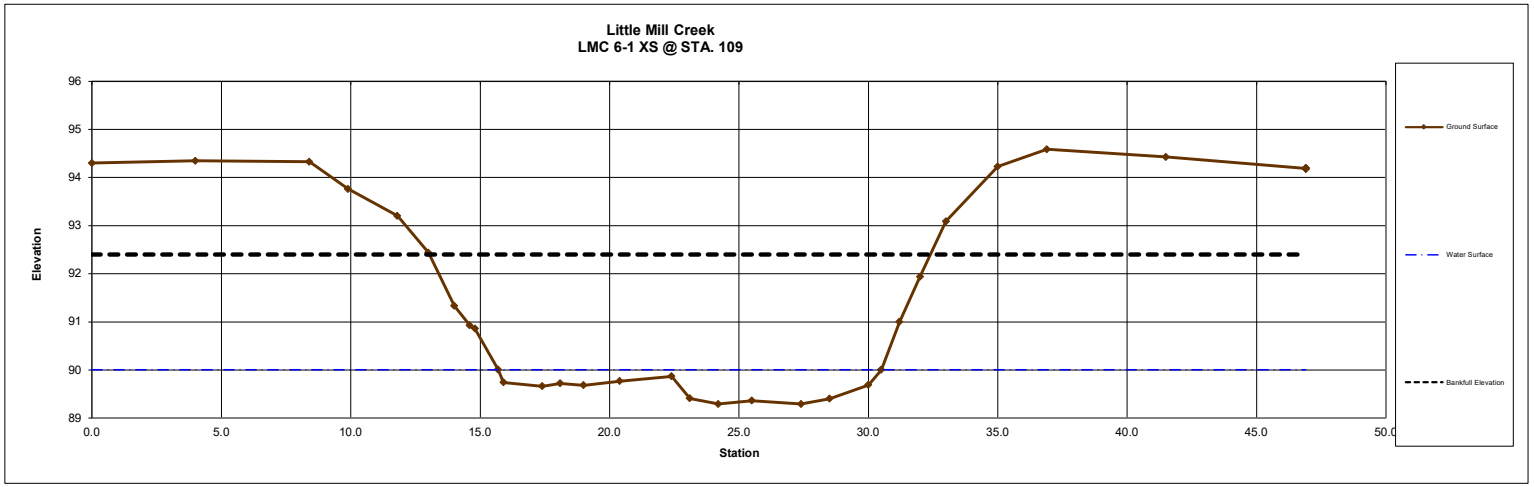
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	92.40	Slope (ft/ft)	0.00205	L.Pin Sta.	0.0
B. Width =	19.4	Mannings "n"	0.0276	R.Pin Sta.	46.9
W/d =	7.92	D84 (mm) measured	51.3	L.Pin Rod	94.3
F.P.Width	46.9	Velocity (ft/s) Manning's)	4.00	R.Pin Rod	94.2
Entrenchment	2.42	Velocity (ft/s) via. (U/U*)	3.53	Tape Angle (deg.	0.1
B. Area =	47.3	Froud #	0.49		
B. Depth=	2.45	Discharge (cu ft/s)	189.3	Rc Meas.	
Max Depth	3.11	Shear Stress (lb/sq ft)	0.27	Chord	
W. Per=	22.5	CX Power (ft lb/s)	24.2	m	
H.Radius=	2.10	CX Power (watts)	32.8	Rc Calc.	
SS L Bank* =	0.85	Critical size (mm)	20.9	Rc/B. Width**	
SS R Bank* =	0.88	D84 predicted (mm)	14.0		
Shape Factor:	0.31	Flow Type	Subcritical Flow		

*Based on $HRad_{bb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr.	Test 1	Entr Tst 2	FP Pa Sta	FP Width X R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	5.70	Next to Pin	5.70	94.3	5.70	0.00	0	0	0.00	4.00		0		
4.0	4.0	5.65		5.65	94.4	5.70	0.00	0	0	0.00	4.40	0.0	0		Above B F
8.4	8.4	5.67	L-TOB	5.67	94.3	5.70	0.00	0	0	0.00	1.50	0.0	0		Above B F
9.9	9.9	6.24		6.24	93.8	6.24	0.00	0	0	0.00	1.90	0.0	0		Above B F
11.8	11.8	6.80		6.80	93.2	6.80	0.00	0	0	0.00	1.20	0.0	0		Above B F
13.0	13.0	7.56		7.56	92.4	7.56	0.96	0	0	0.00	1.00	0.0	0		Within B F
14.0	14.0	8.67		8.67	91.3	8.67	0.60	0	0	0.00	0.60	0.0	0		Within B F
14.6	14.6	9.07		9.07	90.9	9.07	0.20	0	0	0.00	0.20	0.8	0		Within B F
14.8	14.8	9.14		9.14	90.9	9.14	0.90	0	0	0.00	0.90	0.3	0		Within B F
15.7	15.7	9.99	L-EOW	9.99	90.0	9.99	0.20	0	0	0.00	0.20	1.8	0		Within B F
15.9	15.9	10.26		10.26	89.7	10.26	1.50	0	0	0.00	1.50	0.5	0		Within B F
17.4	17.4	10.34		10.34	89.7	10.34	0.70	0	0	0.00	0.70	4.0	0		Within B F
18.1	18.1	10.28		10.28	89.7	10.34	0.90	0	0	0.00	0.90	1.9	0		Within B F
19.0	19.0	10.32		10.32	89.7	10.34	1.40	0	0	0.00	1.40	2.4	0.35		Within B F
20.4	20.4	10.23		10.23	89.8	10.34	2.00	0	0	0.00	2.00	3.7	0.00		Within B F
22.4	22.4	10.13		10.13	89.9	10.34	0.70	0	0	0.00	0.70	5.2	0.00		Within B F
23.1	23.1	10.59		10.59	89.4	10.59	1.10	0	0	0.00	1.10	1.9	0.00		Within B F
24.2	24.2	10.71		10.71	89.3	10.71	1.30	0	0	0.00	1.30	3.4	0.00		Within B F
25.5	25.5	10.64		10.64	89.4	10.71	1.90	0	0	0.00	1.90	4.0	0.00		Within B F
27.4	27.4	10.71		10.71	89.3	10.71	1.10	0	0	0.00	1.10	5.8	0.00		Within B F
28.5	28.5	10.60		10.60	89.4	10.71	1.50	0	0	0.00	1.50	3.4	0.00		Within B F
30.0	30.0	10.31		10.31	89.7	10.71	0.50	0	0	0.00	0.50	4.3	0.00		Within B F
30.5	30.5	10.00	R-EOW	10.00	90.0	10.71	0.70	0	0	0.00	0.70	1.3	0.00		Within B F
31.2	31.2	9.00		9.00	91.0	10.71	0.80	0	0	0.00	0.80	1.3	0.00		Within B F
32.0	32.0	8.06		8.06	91.9	10.71	0.40	0	0	0.00	1.00	0.7	0.00		Within B F
33.0	33.0	6.91		6.91	93.1	10.71	0.00	0	0	0.00	2.00	0.0	0.00		Above B F
35.0	35.0	5.77		5.77	94.2	10.71	0.00	0	0	0.00	1.90	0.0	0.00		Above B F
36.9	36.9	5.41		5.41	94.6	10.71	0.00	0	0	0.00	4.60	0.0	0.00		Above B F
41.5	41.5	5.57		5.57	94.4	10.71	0.00	0	0	0.00	5.40	0.0	0.00		Above B F
46.9	46.9	5.81	Next to Pin	5.81	94.2	10.71	0.00	0	0	0.00	0.00	0.0	0.00		Above B F
46.9				0.00	94.2										
46.9				0.00	94.2										
46.9				0.00	94.2										
46.9				0.00	94.2										



Scale
0 0.5 1
INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

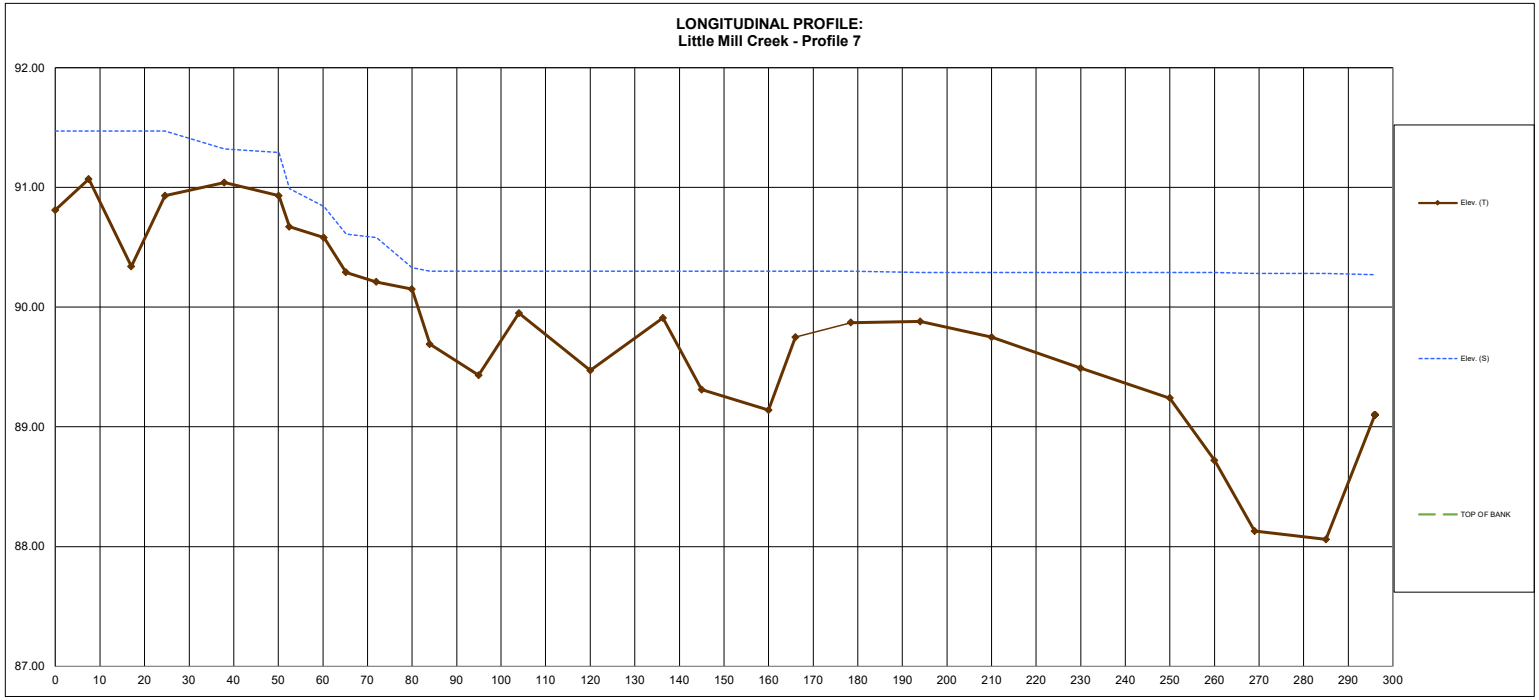
GEOMETRY	
Bank Full Elevation	92.40
Bank Full Width	19.36
Bank Full Depth	2.45
Maximum Depth	3.11
Bank Full Area	47.3
Hydraulic Radius	2.10
Wetted Perimeter	22.5
Width/Depth Ratio	7.9
Flood Prone Width	46.9
Entrenchment	
Stream Type	F4/C4
Rc	

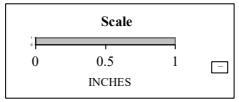
English Units

HYDRAULICS	
Slope (ft/ft)	0.0020
Manning's n	0.0276
Velocity (ft./s)	4.00
Froud #	0.49
Discharge (cu ft/s)	189.31
Shear Stress (lb/sq ft)	0.27
CX Power (ft lb/s)	24.2
Critical Size (mm)	20.9
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 7) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:		100			12/21/2021							
Rc* at BM												
Convert English(0) to Metric (1):		0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	9.19	8.53					0	0	90.81	91.47	100.00	100.00
7.5	7.50	8.93	8.53					0		91.07	91.47	100.00	100.00
17.0	17.00	9.66	8.53			US of Bridge		0		90.34	91.47	100.00	100.00
24.6	24.60	9.07	8.53			DS of Bridge		0		90.93	91.47	100.00	100.00
37.9	37.90	8.96	8.68					0		91.04	91.32	100.00	100.00
50.1	50.10	9.07	8.71					0		90.93	91.29	100.00	100.00
52.5	52.50	9.33	9.01					0		90.67	90.99	100.00	100.00
60.2	60.20	9.42	9.16					0		90.58	90.84	100.00	100.00
65.2	65.20	9.71	9.39					0		90.29	90.61	100.00	100.00
72.0	72.00	9.79	9.42					0		90.21	90.58	100.00	100.00
80.0	80.00	9.85	9.67					0		90.15	90.33	100.00	100.00
84.0	84.00	10.31	9.7					0		89.69	90.30	100.00	100.00
95.0	95.00	10.57	9.7					0		89.43	90.30	100.00	100.00
104.0	104.00	10.05	9.7					0		89.95	90.30	100.00	100.00
120.0	120.00	10.53	9.7					0		89.47	90.30	100.00	100.00
136.3	136.30	10.09	9.7					0		89.91	90.30	100.00	100.00
145.0	145.00	10.69	9.7					0		89.31	90.30	100.00	100.00
160.0	160.00	10.86	9.7					0		89.14	90.30	100.00	100.00
166.0	166.00	10.25	9.7					0		89.75	90.30	100.00	100.00
178.5	178.50	10.13	9.7			XS		0		89.87	90.30	100.00	100.00
194.0	194.00	10.12	9.71					0		89.88	90.29	100.00	100.00
210.0	210.00	10.25	9.71					0		89.75	90.29	100.00	100.00
230.0	230.00	10.51	9.71					0		89.49	90.29	100.00	100.00
250.0	250.00	10.76	9.71					0		89.24	90.29	100.00	100.00
260.0	260.00	11.28	9.71					0		88.72	90.29	100.00	100.00
269.0	269.00	11.87	9.72					0		88.13	90.28	100.00	100.00
285.0	285.00	11.94	9.72					0		88.06	90.28	100.00	100.00
296.0	296.00	10.9	9.73					0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00
	296.00							0		89.10	90.27	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.006598 ft/ft**

Little Mill Creek - Cross Section 7-1 @ STA. 179

REACH ID:	**LMC 7-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no :	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.0
Water Surface Elev. (from Column M)			90.3

Adj. Readng
(Rci)
R+TPc
& Camline

check

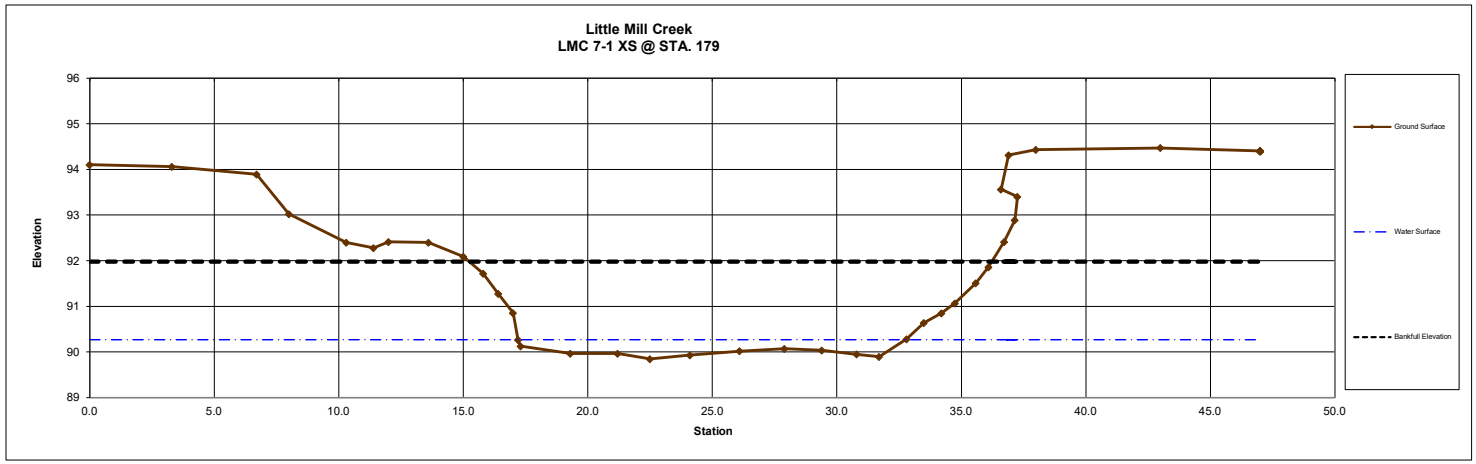
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	91.98	Slope (ft/ft)	0.0066	L.Pin Sta.	0.0
B. Width =	21.0	Mannings "n"	0.0299	R.Pin Sta.	47.0
W/d =	12.45	D84 (mm) measured	51.3	L.Pin Rod	94.1
F.P.Width	36.8	Velocity (ft/s) Manning's)	5.42	R.Pin Rod	94.4
Entrenchment	1.75	Velocity (ft/s) via. (U/U*)	4.99	Tape Angle (deg.	0.4
B. Area =	35.4	Froud #	0.77		
B. Depth=	1.69	Discharge (cu ft/s)	191.56	Rc Meas.	
Max Depth	2.13	Shear Stress (lb/sq ft)	0.64	Chord	
W. Per=	22.8	CX Power (ft lb/s)	78.9	m	
H.Radius=	1.55	CX Power (watts)	106.9	Rc Calc.	
SS L Bank* =	0.91	Critical size (mm)	53.4	Rc/B. Width**	
SS R Bank* =	0.84	D84 predicted (mm)	15.0		
Shape Factor:	0.26	Flow Type	Subcritical Flow		

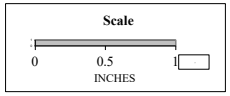
*Based on $HRad_{lob(within\ the\ nearest\ 1/3\ of\ Wbf)}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP P Sta	FP Width X R Bnk	Area (old)	Partial LNB	Invert Segment is:
0.0	0.0	5.90	Next to Pin	5.90	94.1	5.90	0.00	0	0	0.00	3.30		0	
3.3	3.3	5.94		5.94	94.1	5.94	0.00	0	0	0.00	3.40	0.0	0	Above B F
6.7	6.7	6.11		6.11	93.9	6.11	0.00	0	0	0.00	1.30	0.0	0	Above B F
8.0	8.0	6.98		6.98	93.0	6.98	0.00	0	0	0.00	2.30	0.0	0	Above B F
10.3	10.3	7.60		7.60	92.4	7.60	0.00	0	0	0.00	1.10	0.0	0	Above B F
11.4	11.4	7.72		7.72	92.3	7.72	0.00	0	0	0.00	0.60	0.0	0	Above B F
12.0	12.0	7.59		7.59	92.4	7.72	0.00	0	0	0.00	1.60	0.0	0	Above B F
13.6	13.6	7.60		7.60	92.4	7.72	0.00	0	0	0.00	1.40	0.0	0	Above B F
15.0	15.0	7.91	L-TOB	7.91	92.1	7.91	0.56	0	0	0.00	0.80	0.0	0	Within B F
15.8	15.8	8.28		8.28	91.7	8.28	0.60	0	0	0.00	0.60	0.0	0	Within B F
16.4	16.4	8.72		8.72	91.3	8.72	0.60	0	0	0.00	0.60	0.3	0	Within B F
17.0	17.0	9.14		9.14	90.9	9.14	0.20	0	0	0.00	0.20	0.5	0	Within B F
17.2	17.2	9.73	L-EOW	9.73	90.3	9.73	0.10	0	0	0.00	0.10	0.3	0	Within B F
17.3	17.3	9.87		9.87	90.1	9.87	2.00	0	0	0.00	2.00	0.2	0	Within B F
19.3	19.3	10.03		10.03	90.0	10.03	1.90	0	0	0.00	1.90	3.9	0	Within B F
21.2	21.2	10.03		10.03	90.0	10.03	1.30	0	0	0.00	1.30	3.8	0.80	Within B F
22.5	22.5	10.15		10.15	89.9	10.15	1.60	0	0	0.00	1.60	2.7	0.00	Within B F
24.1	24.1	10.07		10.07	89.9	10.15	2.00	0	0	0.00	2.00	3.3	0.00	Within B F
26.1	26.1	9.98		9.98	90.0	10.15	1.80	0	0	0.00	1.80	4.0	0.00	Within B F
27.9	27.9	9.93		9.93	90.1	10.15	1.50	0	0	0.00	1.50	3.5	0.00	Within B F
29.4	29.4	9.96		9.96	90.0	10.15	1.40	0	0	0.00	1.40	2.9	0.00	Within B F
30.8	30.8	10.05		10.05	90.0	10.15	0.90	0	0	0.00	0.90	2.8	0.00	Within B F
31.7	31.7	10.10		10.10	89.9	10.15	1.10	0	0	0.00	1.10	1.8	0.00	Within B F
32.8	32.8	9.72	R-EOW	9.72	90.3	10.15	0.70	0	0	0.00	0.70	2.1	0.00	Within B F
33.5	33.5	9.36		9.36	90.6	10.15	0.70	0	0	0.00	0.70	1.1	0.00	Within B F
34.2	34.2	9.15		9.15	90.9	10.15	0.54	0	0	0.00	0.54	0.9	0.00	Within B F
34.7	34.7	8.93	Toe Pin, bank profile	8.93	91.1	10.15	0.84	0	0	0.00	0.84	0.6	0.00	Within B F
35.6	35.6	8.49		8.49	91.5	10.15	0.51	0	0	0.00	0.51	0.6	0.00	Within B F
36.1	36.1	8.14		8.14	91.9	10.15	0.14	0	0	0.00	0.63	0.1	0.00	Within B F
36.7	36.7	7.59		7.59	92.4	10.15	0.00	0	0	0.00	0.43	0.0	0.00	Above B F
37.1	37.2	7.11		7.11	92.9	10.15	0.00	0	0	0.00	0.10	0.0	0.00	Above B F
37.2	37.3	6.60		6.60	93.4	10.15	0.00	0	0	0.00	-0.65	0.0	0.00	Above B F
36.6	36.6	6.44		6.44	93.6	10.15	0.00	0	1	####	0.22	0.0	0.00	Above B F
36.9	36.9	5.69		5.69	94.3	10.15	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
38.0	38.0	5.57		5.57	94.4	10.15	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
43.0	43.0	5.53		5.53	94.5	10.15	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
47.0	47.0	5.60	Next to Pin	5.60	94.4	10.15	0.00	0	1	0.00	0.00	0.0	0.00	Above B F





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

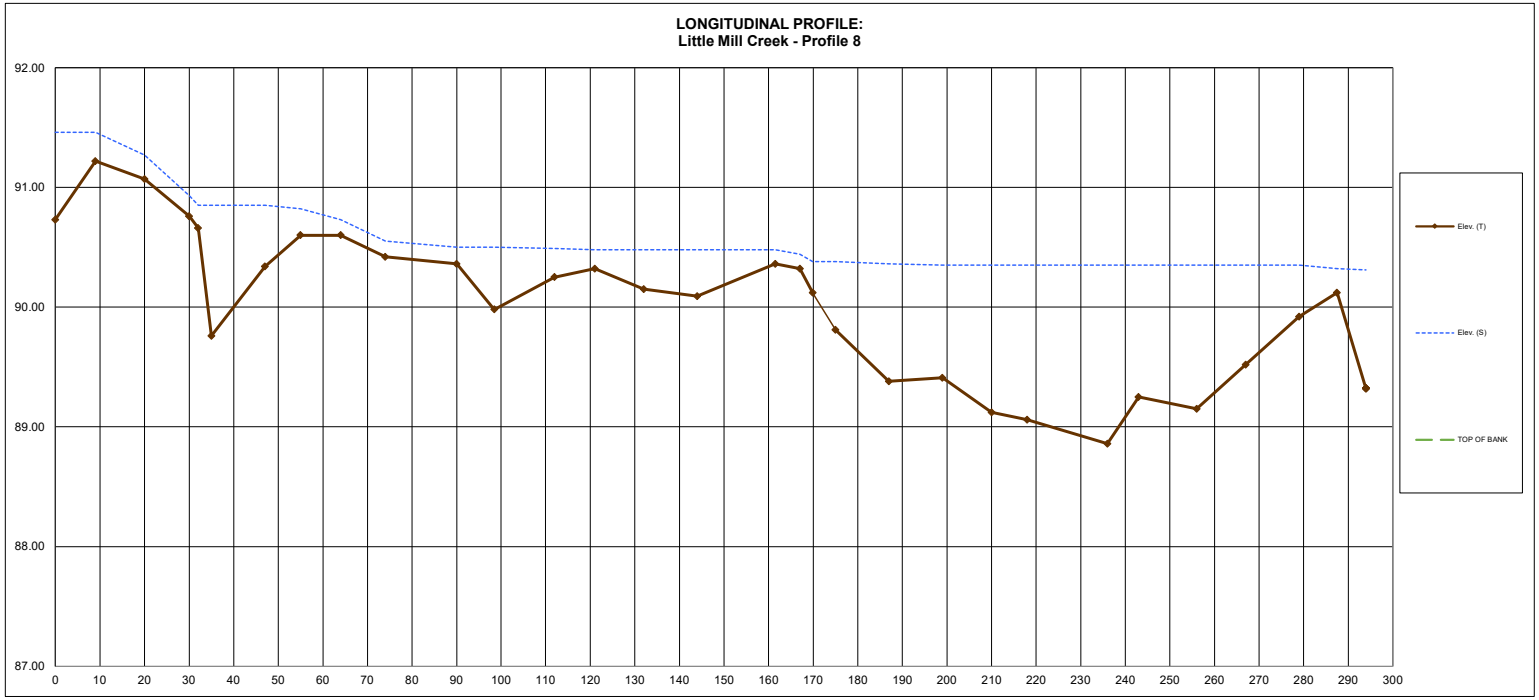
GEOMETRY	
Bank Full Elevation	91.98
Bank Full Width	20.99
Bank Full Depth	1.69
Maximum Depth	2.13
Bank Full Area	35.4
Hydraulic Radius	1.55
Wetted Perimeter	22.8
Width/Depth Ratio	12.5
Flood Prone Width	36.8
Entrenchment	
Stream Type	F4/C4
Rc	

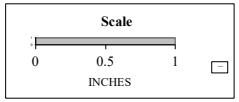
English Units

HYDRAULICS	
Slope (ft/ft)	0.0066
Manning's n	0.0299
Velocity (ft./s)	5.42
Froud #	0.77
Discharge (cu ft/s)	191.6
Shear Stress (lb/sq ft)	0.64
CX Power (ft lb/s)	78.9
Critical Size (mm)	53.4
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 8) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/21/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	9.27	8.54					0	0	90.73	91.46	100.00	100.00
9.0	9.00	8.78	8.54					0		91.22	91.46	100.00	100.00
20.0	20.00	8.93	8.73					0		91.07	91.27	100.00	100.00
30.0	30.00	9.24	9.07					0		90.76	90.93	100.00	100.00
32.0	32.00	9.34	9.15					0		90.66	90.85	100.00	100.00
35.0	35.00	10.24	9.15					0		89.76	90.85	100.00	100.00
47.0	47.00	9.66	9.15					0		90.34	90.85	100.00	100.00
55.0	55.00	9.4	9.18					0		90.60	90.82	100.00	100.00
64.0	64.00	9.4	9.27					0		90.60	90.73	100.00	100.00
74.0	74.00	9.58	9.45					0		90.42	90.55	100.00	100.00
90.0	90.00	9.64	9.5					0		90.36	90.50	100.00	100.00
98.5	98.50	10.02	9.5					0		89.98	90.50	100.00	100.00
112.0	112.00	9.75	9.51					0		90.25	90.49	100.00	100.00
121.0	121.00	9.68	9.52			Outfall Channel		0		90.32	90.48	100.00	100.00
132.0	132.00	9.85	9.52					0		90.15	90.48	100.00	100.00
144.0	144.00	9.91	9.52					0		90.09	90.48	100.00	100.00
161.5	161.50	9.64	9.52					0		90.36	90.48	100.00	100.00
167.0	167.00	9.68	9.56					0		90.32	90.44	100.00	100.00
169.9	169.90	9.88	9.62			XS		0		90.12	90.38	100.00	100.00
175.0	175.00	10.19	9.62					0		89.81	90.38	100.00	100.00
187.0	187.00	10.62	9.64					0		89.38	90.36	100.00	100.00
199.0	199.00	10.59	9.65					0		89.41	90.35	100.00	100.00
210.0	210.00	10.88	9.65					0		89.12	90.35	100.00	100.00
218.0	218.00	10.94	9.65					0		89.06	90.35	100.00	100.00
236.0	236.00	11.14	9.65			US of Bridge		0		88.86	90.35	100.00	100.00
243.0	243.00	10.75	9.65			DS of Bridge		0		89.25	90.35	100.00	100.00
256.0	256.00	10.85	9.65					0		89.15	90.35	100.00	100.00
267.0	267.00	10.48	9.65					0		89.52	90.35	100.00	100.00
279.0	279.00	10.08	9.65					0		89.92	90.35	100.00	100.00
287.5	287.50	9.88	9.68					0		90.12	90.32	100.00	100.00
294.0	294.00	10.68	9.69					0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00
	294.00							0		89.32	90.31	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.004093 ft/ft**

Little Mill Creek - Cross Section 8-1 @ STA. 170

REACH ID:	**LMC 8-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:	(yes = 1, no =		0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.5
Water Surface Elev. (from Column M)			90.6

check

Adj. Readng .
(Rci) .
R+TPc .
& Camline .

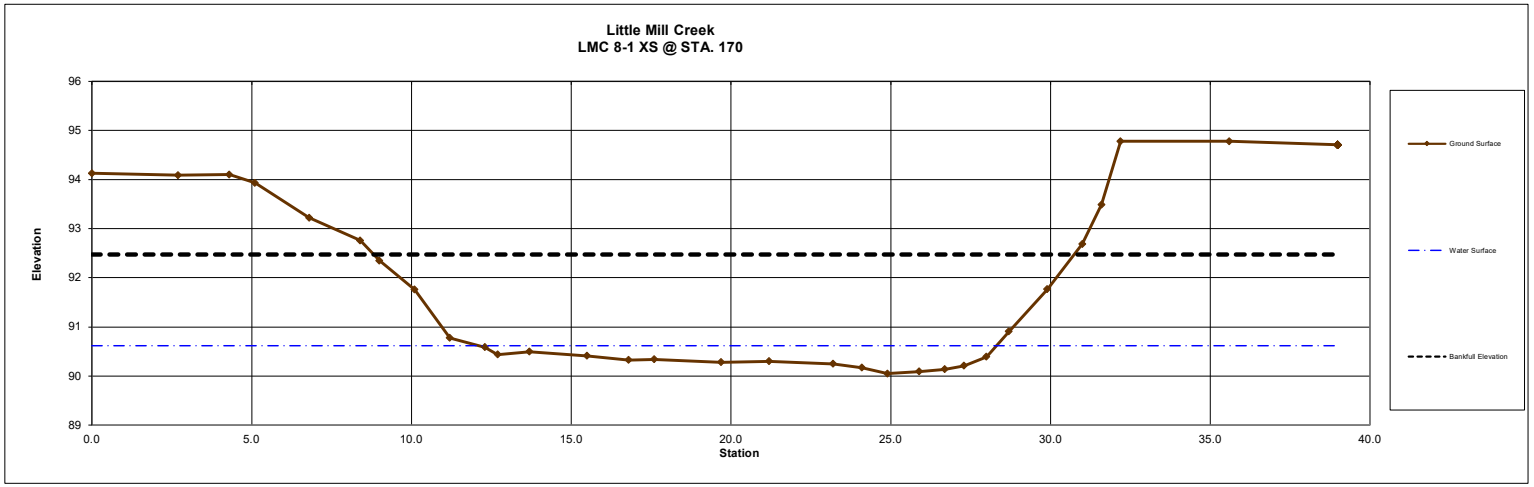
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	92.48	Slope (ft/ft)	0.00409	L.Pin Sta.	0.0
B. Width =	21.9	Mannings "n"	0.029	R.Pin Sta.	39.0
W/d =	11.73	D84 (mm) measured	51.3	L.Pin Rod	94.13
F.P.Width	39.0	Velocity (ft/s) Manning's)	4.73	R.Pin Rod	94.7
Entrenchment	1.78	Velocity (ft/s) via. (U/U*)	4.28	Tape Angle (deg.	0.9
B. Area =	41.0	Froud #	0.63		
B. Depth=	1.87	Discharge (cu ft/s)	193.90	Rc Meas.	
Max Depth	2.43	Shear Stress (lb/sq ft)	0.44	Chord	
W. Per=	23.7	CX Power (ft lb/s)	49.5	m	
H.Radius=	1.73	CX Power (watts)	67.2	Rc Calc.	
SS L Bank* =	0.82	Critical size (mm)	35.8	Rc/B. Width**	
SS R Bank* =	0.93	D84 predicted (mm)	14.1		
Shape Factor:	0.27	Flow Type	Subcritical Flow		

*Based on $HRad_{bb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas* .

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	i	Max Rod perimeter	BF Width	Entr.	Test 1	Entr Tst 2	FP Pa Sta	X R	FP Width Bnk	Area (old)		Partial LNB Se	Invert Segment is:
0.0	0.0	5.87	Next to Pin	5.87	94.13		5.87	0.00	0	0	0.00	0.00		2.70			0	
2.7	2.7	5.91		5.91	94.1		5.91	0.00	0	0	0.00	0.00		1.60	0.0		0	Above B F
4.3	4.3	5.90		5.90	94.1		5.91	0.00	0	0	0.00	0.00		0.80	0.0		0	Above B F
5.1	5.1	6.07	L-TOB	6.07	93.9		6.07	0.00	0	0	0.00	0.00		1.70	0.0		0	Above B F
6.8	6.8	6.78		6.78	93.2		6.78	0.00	0	0	0.00	0.00		1.60	0.0		0	Above B F
8.4	8.4	7.24		7.24	92.8		7.24	0.19	0	0	0.00	0.00		0.60	0.0		0	Within B F
9.0	9.0	7.65		7.65	92.4		7.65	1.10	0	0	0.00	0.00		1.10	0.0		0	Within B F
10.1	10.1	8.24		8.24	91.8		8.24	1.10	0	0	0.00	0.00		1.10	0.5		0	Within B F
11.2	11.2	9.22		9.22	90.8		9.22	1.10	0	0	0.00	0.00		1.10	1.3		0	Within B F
12.3	12.3	9.41		9.41	90.6		9.41	0.40	0	0	0.00	0.00		0.40	2.0		0	Within B F
12.7	12.7	9.56		9.56	90.4		9.56	1.00	0	0	0.00	0.00		1.00	0.8		0	Within B F
13.7	13.7	9.50		9.50	90.5		9.56	1.80	0	0	0.00	0.00		1.80	2.0		0	Within B F
15.5	15.5	9.59	L-EOW	9.59	90.4		9.59	1.30	0	0	0.00	0.00		1.30	3.6		0.48	Within B F
16.8	16.8	9.67		9.67	90.3		9.67	0.80	0	0	0.00	0.00		0.80	2.7		0.00	Within B F
17.6	17.6	9.66		9.66	90.3		9.67	2.10	0	0	0.00	0.00		2.10	1.7		0.00	Within B F
19.7	19.7	9.72		9.72	90.3		9.72	1.50	0	0	0.00	0.00		1.50	4.6		0.00	Within B F
21.2	21.2	9.70		9.70	90.3		9.72	2.00	0	0	0.00	0.00		2.00	3.3		0.00	Within B F
23.2	23.2	9.75		9.75	90.3		9.75	0.90	0	0	0.00	0.00		0.90	4.4		0.00	Within B F
24.1	24.1	9.83		9.83	90.2		9.83	0.80	0	0	0.00	0.00		0.80	2.0		0.00	Within B F
24.9	24.9	9.95		9.95	90.1		9.95	1.00	0	0	0.00	0.00		1.00	1.9		0.00	Within B F
25.9	25.9	9.91		9.91	90.1		9.95	0.80	0	0	0.00	0.00		0.80	2.4		0.00	Within B F
26.7	26.7	9.86		9.86	90.1		9.95	0.60	0	0	0.00	0.00		0.60	1.9		0.00	Within B F
27.3	27.3	9.79		9.79	90.2		9.95	0.70	0	0	0.00	0.00		0.70	1.4		0.00	Within B F
28.0	28.0	9.61	R-EOW	9.61	90.4		9.95	0.70	0	0	0.00	0.00		0.70	1.5		0.00	Within B F
28.7	28.7	9.09		9.09	90.9		9.95	1.20	0	0	0.00	0.00		1.20	1.3		0.00	Within B F
29.9	29.9	8.23		8.23	91.8		9.95	0.85	0	0	0.00	0.00		1.10	1.4		0.00	Within B F
31.0	31.0	7.31		7.31	92.7		9.95	0.00	0	0	0.00	0.00		0.60	0.3		0.00	Above B F
31.6	31.6	6.51		6.51	93.5		9.95	0.00	0	0	0.00	0.00		0.60	0.0		0.00	Above B F
32.2	32.2	5.22	R-TOB	5.22	94.8		9.95	0.00	0	0	0.00	0.00		3.40	0.0		0.00	Above B F
35.6	35.6	5.22		5.22	94.8		9.95	0.00	0	0	0.00	0.00		3.40	0.0		0.00	Above B F
39.0	39.0	5.29	Next to Pin	5.29	94.7		9.95	0.00	0	0	0.00	0.00		0.00	0.0		0.00	Above B F
39.0	39.0	5.29		5.29	94.7		9.95	0.00	0	0	0.00	0.00		0.00	0.0		0.00	Above B F
39.0				0.00	94.7													
39.0				0.00	94.7													



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

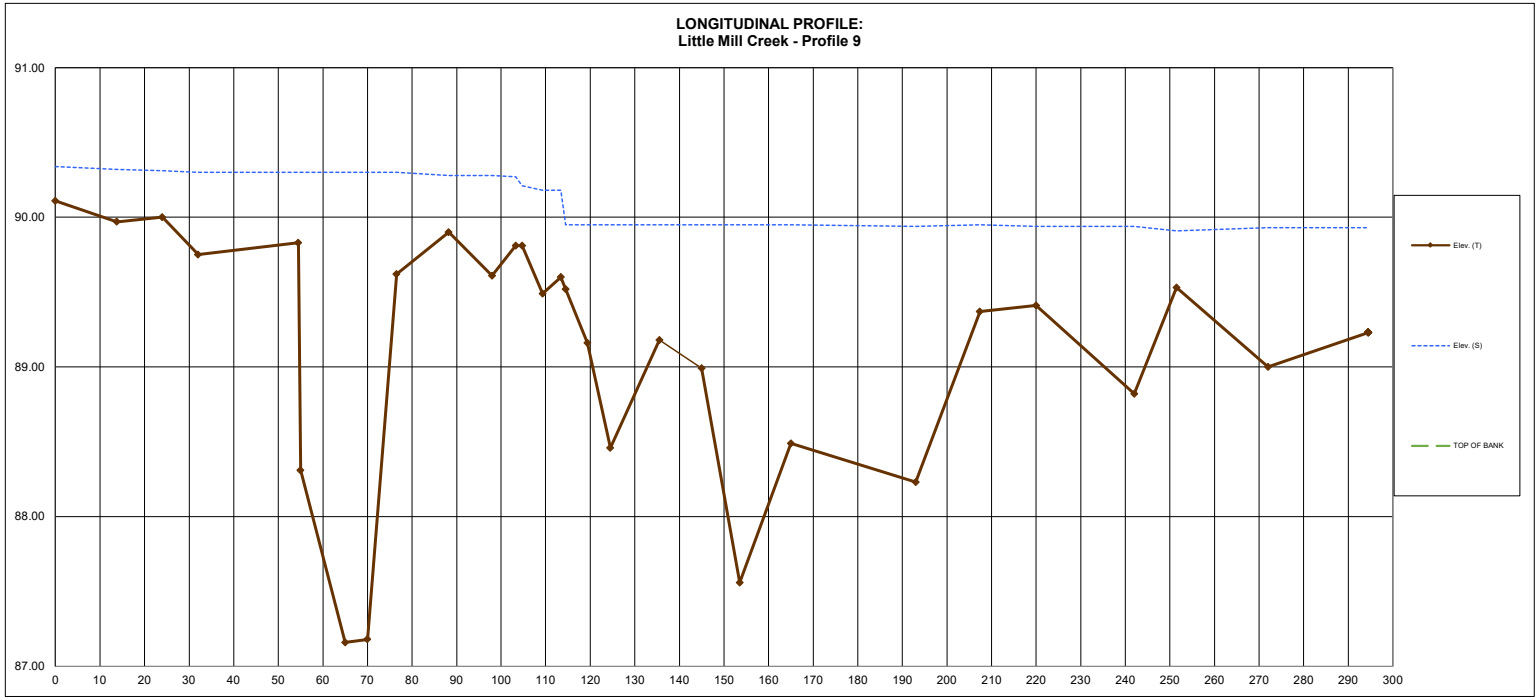
GEOMETRY	
Bank Full Elevation	92.48
Bank Full Width	21.93
Bank Full Depth	1.87
Maximum Depth	2.43
Bank Full Area	41.0
Hydraulic Radius	1.73
Wetted Perimeter	23.7
Width/Depth Ratio	11.7
Flood Prone Width	39.0
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0041
Manning's n	0.029
Velocity (ft./s)	4.73
Froud #	0.63
Discharge (cu ft/s)	193.9
Shear Stress (lb/sq ft)	0.44
CX Power (ft lb/s)	49.5
Critical Size (mm)	35.8
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 9) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/21/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	9.89	9.66					0	0	90.11	90.34	100.00	100.00
13.8	13.80	10.03	9.68					0		89.97	90.32	100.00	100.00
24.0	24.00	10	9.69					0		90.00	90.31	100.00	100.00
32.0	32.00	10.25	9.7					0		89.75	90.30	100.00	100.00
54.5	54.50	10.17	9.7					0		89.83	90.30	100.00	100.00
55.0	55.00	11.69	9.7					0		88.31	90.30	100.00	100.00
65.0	65.00	12.84	9.7					0		87.16	90.30	100.00	100.00
70.0	70.00	12.82	9.7					0		87.18	90.30	100.00	100.00
76.5	76.50	10.38	9.7					0		89.62	90.30	100.00	100.00
88.2	88.20	10.1	9.72					0		89.90	90.28	100.00	100.00
98.0	98.00	10.39	9.72					0		89.61	90.28	100.00	100.00
103.3	103.30	10.19	9.73					0		89.81	90.27	100.00	100.00
104.7	104.70	10.19	9.79			XS		0		89.81	90.21	100.00	100.00
109.3	109.30	10.51	9.82					0		89.49	90.18	100.00	100.00
113.4	113.40	10.4	9.82					0		89.60	90.18	100.00	100.00
114.5	114.50	10.48	10.05					0		89.52	89.95	100.00	100.00
119.4	119.40	10.84	10.05					0		89.16	89.95	100.00	100.00
124.5	124.50	11.54	10.05					0		88.46	89.95	100.00	100.00
135.5	135.50	10.82	10.05					0		89.18	89.95	100.00	100.00
145.0	145.00	11.01	10.05					0		88.99	89.95	100.00	100.00
153.5	153.50	12.44	10.05					0		87.56	89.95	100.00	100.00
165.0	165.00	11.51	10.05					0		88.49	89.95	100.00	100.00
193.0	193.00	11.77	10.06					0		88.23	89.94	100.00	100.00
207.4	207.40	10.63	10.05					0		89.37	89.95	100.00	100.00
220.0	220.00	10.59	10.06					0		89.41	89.94	100.00	100.00
242.0	242.00	11.18	10.06					0		88.82	89.94	100.00	100.00
251.5	251.50	10.47	10.09					0		89.53	89.91	100.00	100.00
272.0	272.00	11	10.07					0		89.00	89.93	100.00	100.00
294.5	294.50	10.77	10.07					0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00
	294.50							0		89.23	89.93	100.00	100.00



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = 0.00171 ft/ft

Little Mill Creek - Cross Section 9-1 @ STA. 105

REACH ID:	**LMC 9-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			93.0
Water Surface Elev. (from Column M)			90.2

Adj. Readng
(Rci)
R+TPc
& Camline

check

Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	93.03	Slope (ft/ft)	0.00171	L.Pin Sta.	0.0
B. Width =	26.0	Mannings "n"	0.0284	R.Pin Sta.	55.3
W/d =	11.39	D84 (mm) measured	51.3	L.Pin Rod	93.52
F.P.Width	55.3	Velocity (ft/s) Manning's)	3.32	R.Pin Rod	94.1
Entrenchment	2.13	Velocity (ft/s) via. (U/U*)	3.02	Tape Angle (deg	0.6
B. Area =	59.2	Froud #	0.42		
B. Depth=	2.28	Discharge (cu ft/s)	196.2	Rc Meas.	
Max Depth	3.25	Shear Stress (lb/sq ft)	0.20	Chord	
W. Per=	31.2	CX Power (ft lb/s)	20.9	m	
H.Radius=	1.90	CX Power (watts)	28.4	Rc Calc.	
SS L Bank* =	0.78	Critical size (mm)	15.4	Rc/B. Width**	
SS R Bank* =	0.80	D84 predicted (mm)	15.3		
Shape Factor:	0.25	Flow Type	Subcritical Flow		

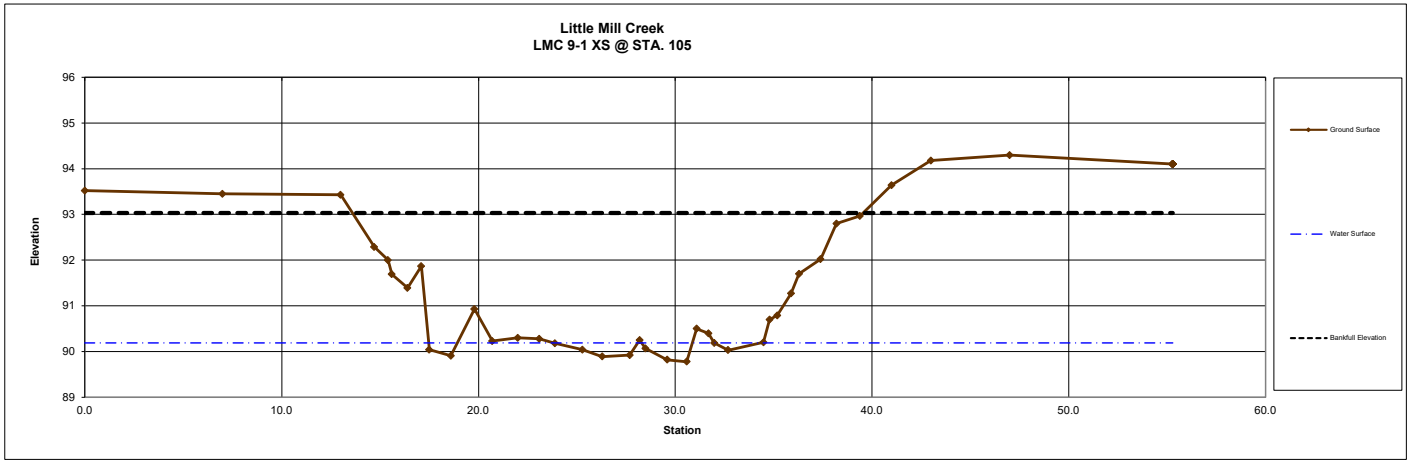
*Based on $HRad_{b(\text{within the nearest 1/3 of Wtd})}$ / $HRad_{bf}$

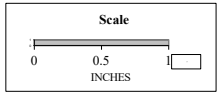
**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I
0.0	0.0	6.48	Next to Pin	6.48	93.52
7.0	7.0	6.55		6.55	93.5
13.0	13.0	6.57	L-TOB	6.57	93.4
14.7	14.7	7.71		7.71	92.3
15.4	15.4	8.00		8.00	92.0
15.6	15.6	8.31		8.31	91.7
16.4	16.4	8.61		8.61	91.4
17.1	17.1	8.13		8.13	91.9
17.5	17.5	9.96	L-EOW	9.96	90.0
18.6	18.6	10.09		10.09	89.9
19.8	19.8	9.07	EOW	9.07	90.9
20.7	20.7	9.77		9.77	90.2
22.0	22.0	9.70		9.70	90.3
23.1	23.1	9.72		9.72	90.3
23.9	23.9	9.82	EOW	9.82	90.2
25.3	25.3	9.96		9.96	90.0
26.3	26.3	10.11		10.11	89.9
27.7	27.7	10.08		10.08	89.9
28.2	28.2	9.75	Rock	9.75	90.3
28.5	28.5	9.93		9.93	90.1
29.6	29.6	10.18		10.18	89.8
30.6	30.6	10.22		10.22	89.8
31.1	31.1	9.50	Rock	9.50	90.5
31.7	31.7	9.60		9.60	90.4
32.0	32.0	9.81		9.81	90.2
32.7	32.7	9.97		9.97	90.0
34.5	34.5	9.80	R-EOW	9.80	90.2
34.8	34.8	9.30		9.30	90.7
35.2	35.2	9.21		9.21	90.8
35.9	35.9	8.73		8.73	91.3
36.3	36.3	8.30		8.30	91.7
37.4	37.4	7.98		7.98	92.0
38.2	38.2	7.20		7.20	92.8
39.4	39.4	7.03		7.03	93.0
41.0	41.0	6.36		6.36	93.6
43.0	43.0	5.82		5.82	94.2
47.0	47.0	5.70		5.70	94.3
55.3	55.3	5.90	Next to Pin	5.90	94.1

Max Rod perimeter	BF Width	Entr.	Test 1	Entr Tst 2	FP P: Sta	FP Width X R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
6.48	0.00	0	0	0.00	7.00			0	
6.55	0.00	0	0	0.00	6.00	0.0	0	Above B F	
6.57	1.11	0	0	0.00	1.70	0.0	0	Within B F	
7.71	0.70	0	0	0.00	0.70	0.0	0	Within B F	
8.00	0.20	0	0	0.00	0.20	0.6	0	Within B F	
8.31	0.80	0	0	0.00	0.80	0.2	0	Within B F	
8.61	0.70	0	0	0.00	0.70	1.2	0	Within B F	
8.61	0.40	0	0	0.00	0.40	1.0	0	Within B F	
9.96	1.10	0	0	0.00	1.10	0.8	0	Within B F	
10.09	1.20	0	0	0.00	1.20	3.4	0	Within B F	
10.09	0.90	0	0	0.00	0.90	3.1	0	Within B F	
10.09	1.30	0	0	0.00	1.30	2.2	0	Within B F	
10.09	1.10	0	0	0.00	1.10	3.6	0.22	Within B F	
10.09	0.80	0	0	0.00	0.80	3.0	0.00	Within B F	
10.09	1.40	0	0	0.00	1.40	2.2	0.00	Within B F	
10.09	1.00	0	0	0.00	1.00	4.1	0.00	Within B F	
10.11	1.40	0	0	0.00	1.40	3.1	0.00	Within B F	
10.11	0.50	0	0	0.00	0.50	4.4	0.00	Within B F	
10.11	0.30	0	0	0.00	0.30	1.5	0.00	Within B F	
10.11	1.10	0	0	0.00	1.10	0.9	0.00	Within B F	
10.18	1.00	0	0	0.00	1.00	3.4	0.00	Within B F	
10.22	0.50	0	0	0.00	0.50	3.2	0.00	Within B F	
10.22	0.60	0	0	0.00	0.60	1.4	0.00	Within B F	
10.22	0.30	0	0	0.00	0.30	1.6	0.00	Within B F	
10.22	0.70	0	0	0.00	0.70	0.8	0.00	Within B F	
10.22	1.80	0	0	0.00	1.80	2.0	0.00	Within B F	
10.22	0.30	0	0	0.00	0.30	5.3	0.00	Within B F	
10.22	0.40	0	0	0.00	0.40	0.8	0.00	Within B F	
10.22	0.70	0	0	0.00	0.70	0.9	0.00	Within B F	
10.22	0.40	0	0	0.00	0.40	1.4	0.00	Within B F	
10.22	1.10	0	0	0.00	1.10	0.6	0.00	Within B F	
10.22	0.80	0	0	0.00	0.80	1.3	0.00	Within B F	
10.22	1.20	0	0	0.00	1.20	0.5	0.00	Within B F	
10.22	0.15	0	0	0.00	1.60	0.2	0.00	Within B F	
10.22	0.00	0	0	0.00	2.00	0.0	0.00	Above B F	
10.22	0.00	0	0	0.00	4.00	0.0	0.00	Above B F	
10.22	0.00	0	0	0.00	8.30	0.0	0.00	Above B F	
10.22	0.00	0	0	0.00	0.00	0.0	0.00	Above B F	





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

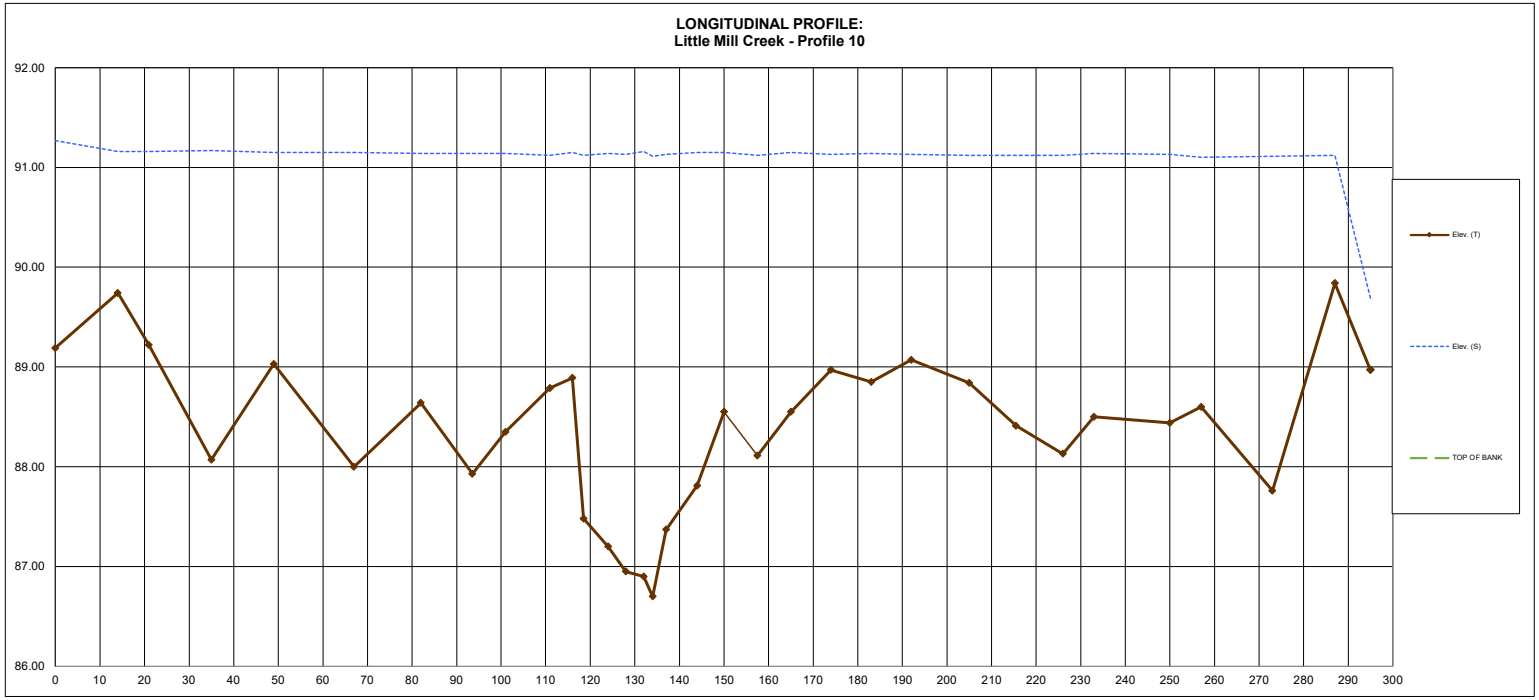
GEOMETRY	
Bank Full Elevation	93.03
Bank Full Width	25.96
Bank Full Depth	2.28
Maximum Depth	3.25
Bank Full Area	59.2
Hydraulic Radius	1.90
Wetted Perimeter	31.2
Width/Depth Ratio	11.4
Flood Prone Width	55.3
Entrenchment	
Stream Type	F4/C4
Rc	

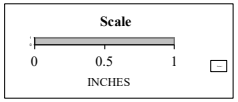
English Units

HYDRAULICS	
Slope (ft/ft)	0.0017
Manning's n	0.0284
Velocity (ft./s)	3.32
Froud #	0.42
Discharge (cu ft/s)	196.2
Shear Stress (lb/sq ft)	0.20
CX Power (ft lb/s)	20.9
Critical Size (mm)	15.4
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 10) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/22/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	10.81	8.73			WS - 8.88		0	0	89.19	91.27	100.00	100.00
14.0	14.00	10.26	8.84					0		89.74	91.16	100.00	100.00
21.0	21.00	10.78	8.84					0		89.22	91.16	100.00	100.00
35.0	35.00	11.93	8.83					0		88.07	91.17	100.00	100.00
49.0	49.00	10.97	8.85			Outfall		0		89.03	91.15	100.00	100.00
67.0	67.00	12.00	8.85					0		88.00	91.15	100.00	100.00
82.0	82.00	11.36	8.86					0		88.64	91.14	100.00	100.00
93.5	93.50	12.07	8.86					0		87.93	91.14	100.00	100.00
101.0	101.00	11.65	8.86					0		88.35	91.14	100.00	100.00
111.0	111.00	11.21	8.88					0		88.79	91.12	100.00	100.00
116.0	116.00	11.11	8.85			XS		0		88.89	91.15	100.00	100.00
118.5	118.50	12.52	8.88					0		87.48	91.12	100.00	100.00
124.0	124.00	12.80	8.86					0		87.20	91.14	100.00	100.00
128.0	128.00	13.05	8.87					0		86.95	91.13	100.00	100.00
132.0	132.00	13.10	8.84					0		86.90	91.16	100.00	100.00
134.0	134.00	13.30	8.89					0		86.70	91.11	100.00	100.00
137.0	137.00	12.63	8.87					0		87.37	91.13	100.00	100.00
144.0	144.00	12.19	8.85					0		87.81	91.15	100.00	100.00
150.0	150.00	11.45	8.85					0		88.55	91.15	100.00	100.00
157.5	157.50	11.89	8.88					0		88.11	91.12	100.00	100.00
165.0	165.00	11.45	8.85					0		88.55	91.15	100.00	100.00
174.0	174.00	11.03	8.87					0		88.97	91.13	100.00	100.00
183.0	183.00	11.15	8.86					0		88.85	91.14	100.00	100.00
192.0	192.00	10.93	8.87					0		89.07	91.13	100.00	100.00
205.0	205.00	11.16	8.88					0		88.84	91.12	100.00	100.00
215.5	215.50	11.59	8.88					0		88.41	91.12	100.00	100.00
226.0	226.00	11.87	8.88					0		88.13	91.12	100.00	100.00
233.0	233.00	11.50	8.86					0		88.50	91.14	100.00	100.00
250.0	250.00	11.56	8.87					0		88.44	91.13	100.00	100.00
257.0	257.00	11.40	8.90					0		88.60	91.10	100.00	100.00
273.0	273.00	12.24	8.89			WS - 8.88		0		87.76	91.11	100.00	100.00
287.0	287.00	10.16	8.88			Beaver Dam		0		89.84	91.12	100.00	100.00
295.0	295.00	11.03	10.31					0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00
	295.00							0		88.97	89.69	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.000523 ft/ft**

Little Mill Creek - Cross Section 10-1 @ STA. 116

REACH ID:	**LMC 10-1**		**Date: 12/22/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			91.8
Water Surface Elev. (from Column M)			91.1

check

Adj. Readng
(Rci)
R+TPc
& Camline

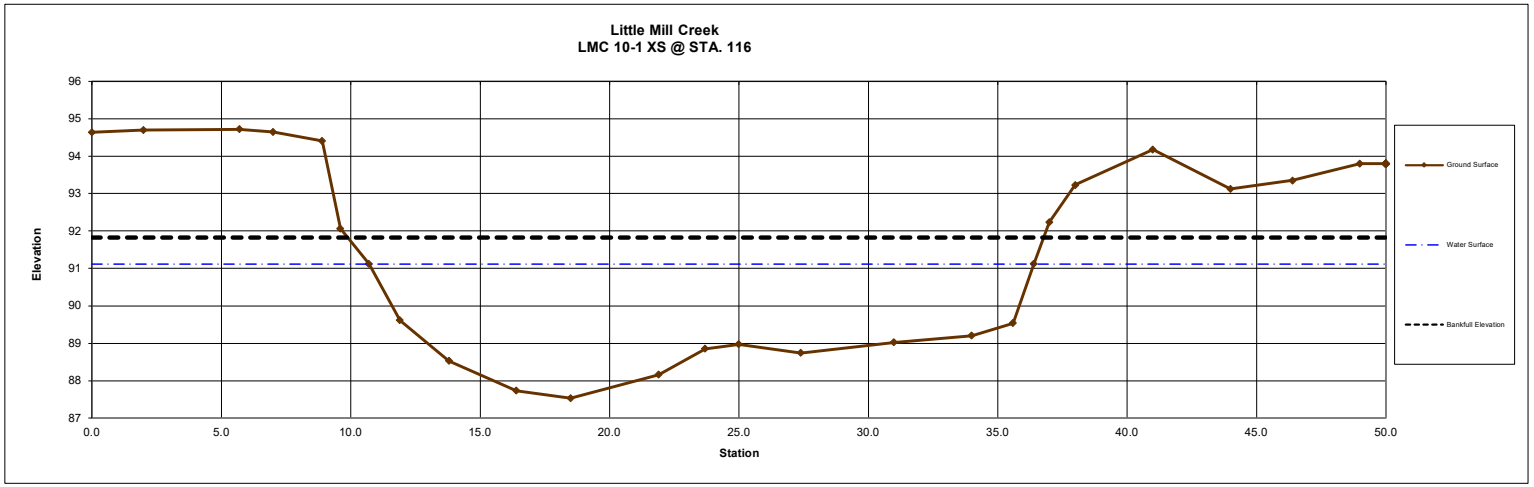
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	91.83	Slope (ft/ft)	0.00052	L.Pin Sta.	0.0
B. Width =	26.9	Mannings "n"	0.0262	R.Pin Sta.	50.0
W/d =	9.02	D84 (mm) measured	51.3	L.Pin Rod	94.64
F.P.Width	50.0	Velocity (ft/s) Manning's)	2.47	R.Pin Rod	93.8
Entrenchment	1.86	Velocity (ft/s) via. (U/U*)	2.13	Tape Angle (deg.	1.0
B. Area =	80.2	Froud #	0.27		
B. Depth=	2.98	Discharge (cu ft/s)	198.5	Rc Meas.	
Max Depth	4.30	Shear Stress (lb/sq ft)	0.09	Chord	
W. Per=	30.5	CX Power (ft lb/s)	6.5	m	
H.Radius=	2.63	CX Power (watts)	8.8	Rc Calc.	
SS L Bank* =	0.98	Critical size (mm)	6.1	Rc/B. Width**	
SS R Bank* =	0.80	D84 predicted (mm)	12.5		
Shape Factor:	0.29	Flow Type	Subcritical Flow		

*Based on $HRad_{nb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pa Sta X	FP Width R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	5.36	Next to Pin	5.36	94.64	5.36	0.00	0	0	0.00	2.00		0	
2.0	2.0	5.30		5.30	94.7	5.36	0.00	0	0	0.00	3.70	0.0	0	Above B F
5.7	5.7	5.28		5.28	94.7	5.36	0.00	0	0	0.00	1.30	0.0	0	Above B F
7.0	7.0	5.35		5.35	94.7	5.36	0.00	0	0	0.00	1.90	0.0	0	Above B F
8.9	8.9	5.59	TOB	5.59	94.4	5.59	0.00	0	0	0.00	0.70	0.0	0	Above B F
9.6	9.6	7.94		7.94	92.1	7.94	0.83	0	0	0.00	1.10	0.0	0	Within B F
10.7	10.7	8.88	L-EOW	8.88	91.1	8.88	1.20	0	0	0.00	1.20	0.0	0	Within B F
11.9	11.9	10.39		10.39	89.6	10.39	1.90	0	0	0.00	1.90	1.8	0	Within B F
13.8	13.8	11.47		11.47	88.5	11.47	2.60	0	0	0.00	2.60	5.2	0	Within B F
16.4	16.4	12.27		12.27	87.7	12.27	2.10	0	0	0.00	2.10	9.6	0	Within B F
18.5	18.5	12.47		12.47	87.5	12.47	3.40	0	0	0.00	3.40	8.8	0.10	Within B F
21.9	21.9	11.84		11.84	88.2	12.47	1.80	0	0	0.00	1.80	13.5	0.00	Within B F
23.7	23.7	11.15		11.15	88.9	12.47	1.30	0	0	0.00	1.30	6.0	0.00	Within B F
25.0	25.0	11.03		11.03	89.0	12.47	2.40	0	0	0.00	2.40	3.8	0.00	Within B F
27.4	27.4	11.26		11.26	88.7	12.47	3.60	0	0	0.00	3.60	7.1	0.00	Within B F
31.0	31.0	10.98		10.98	89.0	12.47	3.00	0	0	0.00	3.00	10.6	0.00	Within B F
34.0	34.0	10.80		10.80	89.2	12.47	1.60	0	0	0.00	1.60	8.2	0.00	Within B F
35.6	35.6	10.46		10.46	89.5	12.47	0.80	0	0	0.00	0.80	3.9	0.00	Within B F
36.4	36.4	8.88	R-EOW	8.88	91.1	12.47	0.38	0	0	0.00	0.60	1.2	0.00	Within B F
37.0	37.0	7.77		7.77	92.2	12.47	0.00	0	0	0.00	1.00	0.1	0.00	Above B F
38.0	38.0	6.77	TOB	6.77	93.2	12.47	0.00	0	0	0.00	3.00	0.0	0.00	Above B F
41.0	41.0	5.82		5.82	94.2	12.47	0.00	0	0	0.00	3.00	0.0	0.00	Above B F
44.0	44.0	6.88		6.88	93.1	12.47	0.00	0	0	0.00	2.40	0.0	0.00	Above B F
46.4	46.4	6.65		6.65	93.4	12.47	0.00	0	0	0.00	2.60	0.0	0.00	Above B F
49.0	49.0	6.20		6.20	93.8	12.47	0.00	0	0	0.00	1.00	0.0	0.00	Above B F
50.0	50.0	6.20	Next to Pin	6.20	93.8	12.47	0.00	0	0	0.00	0.00	0.0	0.00	Above B F
50.0				0.00	93.8									
50.0				0.00	93.8									
50.0				0.00	93.8									
50.0				0.00	93.8									
50.0				0.00	93.8									
50.0				0.00	93.8									
50.0				0.00	93.8									



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

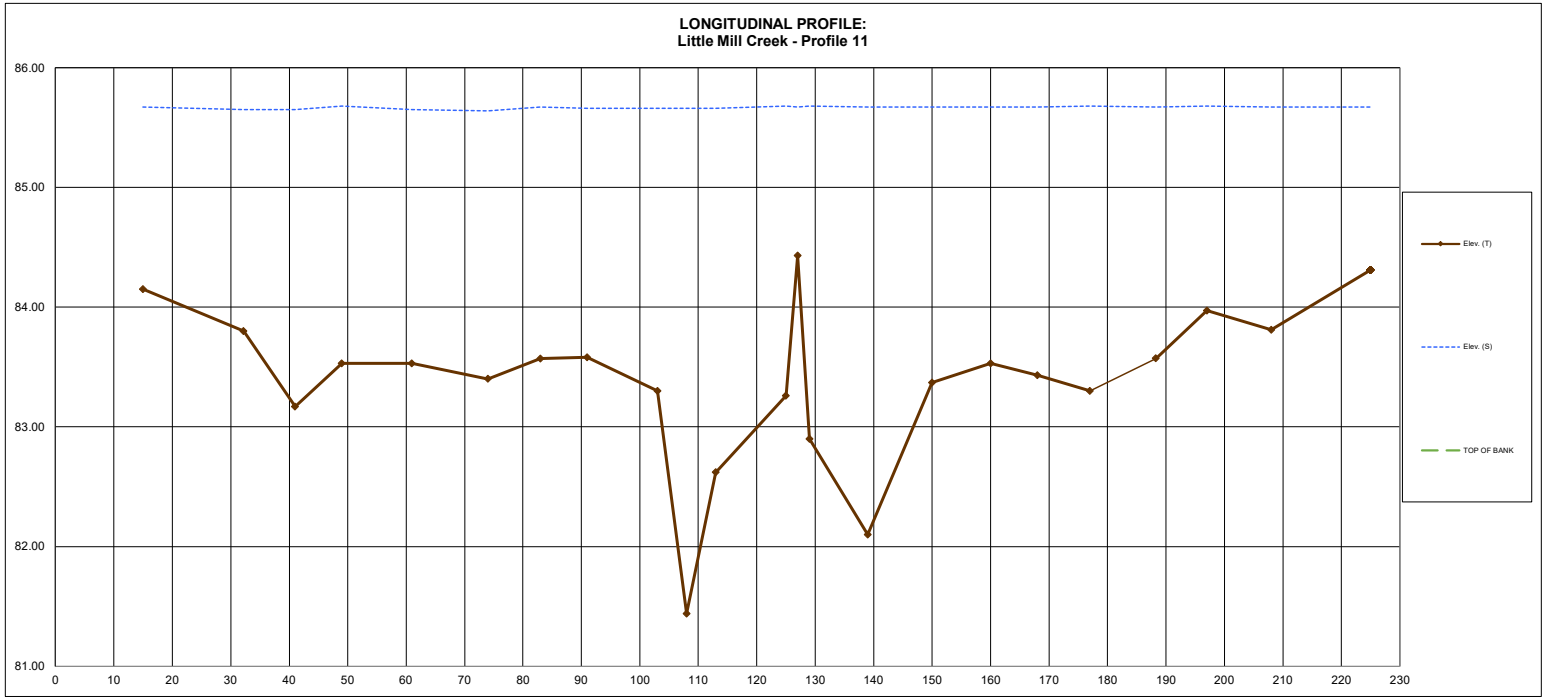
GEOMETRY	
Bank Full Elevation	91.83
Bank Full Width	26.91
Bank Full Depth	2.98
Maximum Depth	4.30
Bank Full Area	80.2
Hydraulic Radius	2.63
Wetted Perimeter	30.5
Width/Depth Ratio	9.0
Flood Prone Width	50.0
Entrenchment	
Stream Type	F4/C4
Rc	

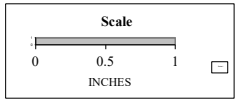
English Units

HYDRAULICS	
Slope (ft/ft)	0.0005
Manning's n	0.0262
Velocity (ft./s)	2.47
Froud #	0.27
Discharge (cu ft/s)	198.5
Shear Stress (lb/sq ft)	0.09
CX Power (ft lb/s)	6.5
Critical Size (mm)	6.1
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek (Profile 11) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			12/22/2021							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
15.0	15	15.85	14.33			WS=14.42		0	0	84.15	85.67	100.00	100.00
32.2	32.20	16.20	14.35					0		83.80	85.65	100.00	100.00
41.0	41.00	16.83	14.35					0		83.17	85.65	100.00	100.00
49.0	49.00	16.47	14.32					0		83.53	85.68	100.00	100.00
61.0	61.00	16.47	14.35					0		83.53	85.65	100.00	100.00
74.0	74.00	16.60	14.36					0		83.40	85.64	100.00	100.00
83.0	83.00	16.43	14.33					0		83.57	85.67	100.00	100.00
91.0	91.00	16.42	14.34					0		83.58	85.66	100.00	100.00
103.0	103.00	16.70	14.34					0		83.30	85.66	100.00	100.00
108.0	108.00	18.56	14.34					0		81.44	85.66	100.00	100.00
113.0	113.00	17.38	14.34					0		82.62	85.66	100.00	100.00
125.0	125.00	16.74	14.32			US of Encasement		0		83.26	85.68	100.00	100.00
127.0	127.00	15.57	14.33			Top of Encasement		0		84.43	85.67	100.00	100.00
129.0	129.00	17.10	14.32			DS of Encasement		0		82.90	85.68	100.00	100.00
139.0	139.00	17.90	14.33					0		82.10	85.67	100.00	100.00
150.0	150.00	16.63	14.33					0		83.37	85.67	100.00	100.00
160.0	160.00	16.47	14.33					0		83.53	85.67	100.00	100.00
168.0	168.00	16.57	14.33					0		83.43	85.67	100.00	100.00
177.0	177.00	16.70	14.32					0		83.30	85.68	100.00	100.00
188.3	188.30	16.43	14.33			XS		0		83.57	85.67	100.00	100.00
197.0	197.00	16.03	14.32					0		83.97	85.68	100.00	100.00
208.0	208.00	16.19	14.33					0		83.81	85.67	100.00	100.00
225.0	225.00	15.69	14.33			US of Bridge - WS=14.40		0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00
	225.00							0		84.31	85.67	100.00	100.00





Note: Scale set for print and view magnification at 65%

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.00000 ft/ft**

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

Little Mill Creek - Cross Section 11-1 @ STA. 188

REACH ID:	**LMC 11-1**		**Date: 12/22/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:	(yes = 1, no =		0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			87.9
Water Surface Elev. (from Column M)			85.6

check

Adj. Readng (Rci) R+TPc & Camline

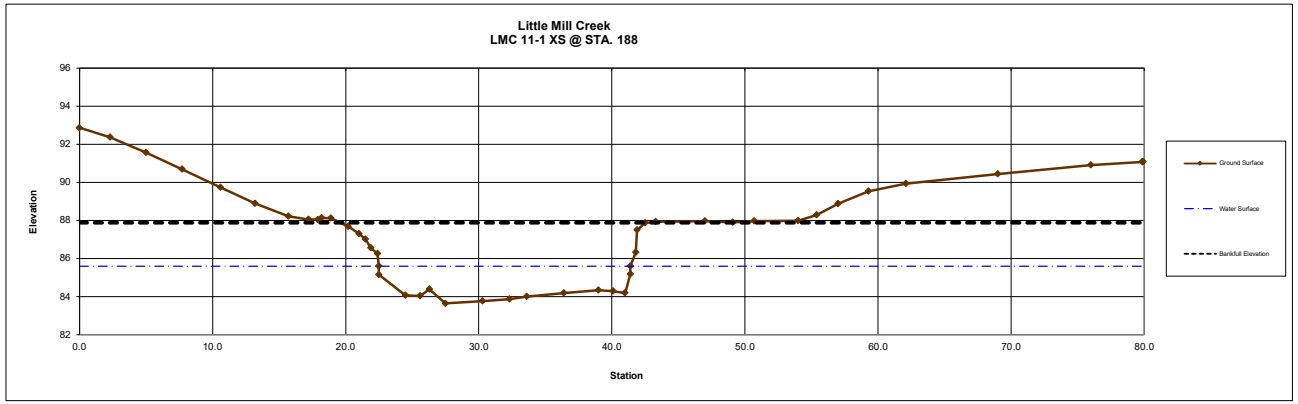
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	87.88	Slope (ft/ft)	0.00052	L.Pin Sta.	0.0
B. Width =	22.9	Mannings "n"	0.02424	R.Pin Sta.	79.9
W/d =	7.04	D84 (mm) measured	51.3	L.Pin Rod	92.87
F.P.Width	76.7	Velocity (ft/s) Manning's)	2.70	R.Pin Rod	91.1
Entrenchment	3.36	Velocity (ft/s) via. (U/U*)	2.15	Tape Angle (deg.	1.3
B. Area =	74.3	Froud #	0.29		
B. Depth=	3.25	Discharge (cu ft/s)	200.8	Rc Meas.	
Max Depth	4.24	Shear Stress (lb/sq ft)	0.09	Chord	
W. Per=	27.8	CX Power (ft lb/s)	6.6	m	
H.Radius=	2.67	CX Power (watts)	8.9	Rc Calc.	
SS L Bank* =	0.73	Critical size (mm)	6.2	Rc/B. Width**	
SS R Bank* =	0.89	D84 predicted (mm)	8.3		
Shape Factor:	0.31	Flow Type	Subcritical Flow		

*Based on $HRad_{lb}$(within the nearest 1/3 of Wbf) / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (l)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pe Sta X	FP Width R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	7.13	Next to Pin	7.13	92.87	7.13	0.00	1	0	0.00	0.00		0	
2.3	2.3	7.63		7.63	92.4	7.63	0.00	1	0	0.00	1.86	0.0	0	Above B F
5.0	5.0	8.43		8.43	91.6	8.43	0.00	0	0	0.00	2.70	0.0	0	Above B F
7.7	7.7	9.30		9.30	90.7	9.30	0.00	0	0	0.00	2.90	0.0	0	Above B F
10.6	10.6	10.26		10.26	89.7	10.26	0.00	0	0	0.00	2.60	0.0	0	Above B F
13.2	13.2	11.10		11.10	88.9	11.10	0.00	0	0	0.00	2.50	0.0	0	Above B F
15.7	15.7	11.77		11.77	88.2	11.77	0.00	0	0	0.00	1.50	0.0	0	Above B F
17.2	17.2	11.94		11.94	88.1	11.94	0.00	0	0	0.00	0.70	0.0	0	Above B F
17.9	17.9	11.95		11.95	88.1	11.95	0.00	0	0	0.00	0.30	0.0	0	Above B F
18.2	18.2	11.86		11.86	88.1	11.95	0.00	0	0	0.00	0.70	0.0	0	Above B F
18.9	18.9	11.88		11.88	88.1	11.95	0.57	0	0	0.00	1.30	0.0	0	Within B F
20.2	20.2	12.31		12.31	87.7	12.31	0.80	0	0	0.00	0.80	0.0	0	Within B F
21.0	21.0	12.69		12.69	87.3	12.69	0.50	0	0	0.00	0.50	0.3	0	Within B F
21.5	21.5	12.98		12.98	87.0	12.98	0.40	0	0	0.00	0.40	0.4	0	Within B F
21.9	21.9	13.44		13.44	86.6	13.44	0.50	0	0	0.00	0.50	0.4	0	Within B F
22.4	22.4	13.74		13.74	86.3	13.74	0.10	0	0	0.00	0.10	0.7	0	Within B F
22.5	22.5	14.40	L-EOW	14.40	85.6	14.40	0.00	0	0	0.00	0.00	0.2	0	Within B F
22.5	22.5	14.84		14.84	85.2	14.84	2.00	0	0	0.00	2.00	0.0	0	Within B F
24.5	24.5	15.92		15.92	84.1	15.92	1.10	0	0	0.00	1.10	6.5	0	Within B F
25.6	25.6	15.96		15.96	84.0	15.96	0.70	0	0	0.00	0.70	4.2	0	Within B F
26.3	26.3	15.61		15.61	84.4	15.96	1.20	0	0	0.00	1.20	2.6	0.79	Within B F
27.5	27.5	16.36		16.36	83.6	16.36	2.80	0	0	0.00	2.80	4.6	0.00	Within B F
30.3	30.3	16.23		16.23	83.8	16.36	2.00	0	0	0.00	2.00	11.7	0.00	Within B F
32.3	32.3	16.13		16.13	83.9	16.36	1.30	0	0	0.00	1.30	8.1	0.00	Within B F
33.6	33.6	15.99		15.99	84.0	16.36	2.80	0	0	0.00	2.80	5.1	0.00	Within B F
36.4	36.4	15.80		15.80	84.2	16.36	2.60	0	0	0.00	2.60	10.6	0.00	Within B F
39.0	39.0	15.65		15.65	84.4	16.36	1.10	0	0	0.00	1.10	9.4	0.00	Within B F
40.1	40.1	15.71		15.71	84.3	16.36	0.90	0	0	0.00	0.90	3.9	0.00	Within B F
41.0	41.0	15.80		15.80	84.2	16.36	0.40	0	0	0.00	0.40	3.3	0.00	Within B F
41.4	41.4	14.82		14.82	85.2	16.36	0.00	0	0	0.00	0.00	1.3	0.00	Within B F
41.4	41.4	14.40	R-EOW	14.40	85.6	16.36	0.40	0	0	0.00	0.40	0.0	0.00	Within B F
41.8	41.8	13.67		13.67	86.3	16.36	0.10	0	0	0.00	0.10	0.8	0.00	Within B F
41.9	41.9	12.49		12.49	87.5	16.36	0.60	0	0	0.00	0.60	0.1	0.00	Within B F
42.5	42.5	12.12		12.12	87.9	16.36	0.00	0	0	0.00	0.80	0.1	0.00	Above B F
43.3	43.3	12.06		12.06	87.9	16.36	0.00	0	0	0.00	3.70	0.0	0.00	Above B F
47.0	47.0	12.02		12.02	88.0	16.36	0.00	0	0	0.00	2.10	0.0	0.00	Above B F
49.1	49.1	12.09		12.09	87.9	16.36	0.00	0	0	0.00	1.60	0.0	0.00	Above B F
50.7	50.7	12.03		12.03	88.0	16.36	0.00	0	0	0.00	3.30	0.0	0.00	Above B F
54.0	54.0	12.01		12.01	88.0	16.36	0.00	0	0	0.00	1.40	0.0	0.00	Above B F
55.4	55.4	11.71		11.71	88.3	16.36	0.00	0	0	0.00	1.60	0.0	0.00	Above B F
57.0	57.0	11.12		11.12	88.9	16.36	0.00	0	0	0.00	2.30	0.0	0.00	Above B F
59.3	59.3	10.47		10.47	89.5	16.36	0.00	0	0	0.00	2.80	0.0	0.00	Above B F
62.1	62.1	10.06		10.06	89.9	16.36	0.00	0	0	0.00	6.90	0.0	0.00	Above B F
69.0	69.0	9.55		9.55	90.5	16.36	0.00	0	0	0.00	7.00	0.0	0.00	Above B F
76.0	76.0	9.09		9.09	90.9	16.36	0.00	0	0	0.00	3.90	0.0	0.00	Above B F
79.9	79.9	8.91	Next to Pin	8.91	91.1	16.36	0.00	0	0	0.00	0.00	0.0	0.00	Above B F



Scale
0 0.5 1
INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

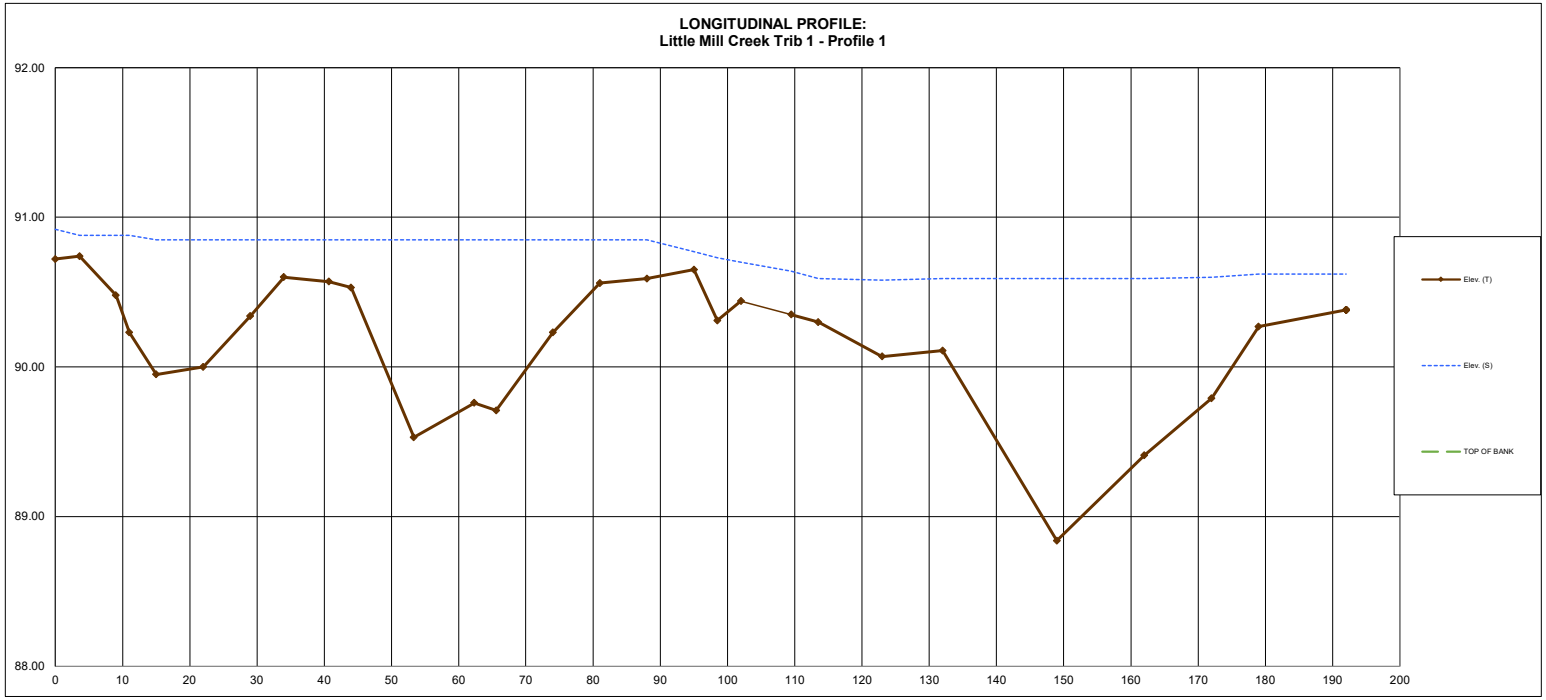
GEOMETRY	
Bank Full Elevation	87.88
Bank Full Width	22.87
Bank Full Depth	3.25
Maximum Depth	4.24
Bank Full Area	74.3
Hydraulic Radius	2.67
Wetted Perimeter	27.8
Width/Depth Ratio	7.0
Flood Prone Width	76.7
Entrenchment	
Stream Type	F4/C4
Rc	

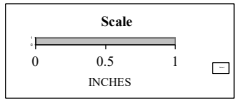
English Units

HYDRAULICS	
Slope (ft/ft)	0.0005
Manning's n	0.02424
Velocity (ft./s)	2.70
Froud #	0.29
Discharge (cu ft/s)	200.8
Shear Stress (lb/sq ft)	0.09
CX Power (ft lb/s)	6.6
Critical Size (mm)	6.2
Flow Type	Subcritical Flow
Rec. Interval	

LMC Trib 1 (Profile 1) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			1/18/2022						
Rc* at BM												
Convert English(0) to Metric (1):			0									
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .		
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
0.0	0	9.28	9.08					0	0	90.72	90.92	100.00	100.00
3.6	3.60	9.26	9.12					0		90.74	90.88	100.00	100.00
9.0	9.00	9.52	9.12					0		90.48	90.88	100.00	100.00
11.0	11.00	9.77	9.12					0		90.23	90.88	100.00	100.00
15.0	15.00	10.05	9.15					0		89.95	90.85	100.00	100.00
22.0	22.00	10	9.15					0		90.00	90.85	100.00	100.00
29.0	29.00	9.66	9.15					0		90.34	90.85	100.00	100.00
34.0	34.00	9.4	9.15					0		90.60	90.85	100.00	100.00
40.7	40.70	9.43	9.15					0		90.57	90.85	100.00	100.00
44.0	44.00	9.47	9.15					0		90.53	90.85	100.00	100.00
53.3	53.30	10.47	9.15					0		89.53	90.85	100.00	100.00
62.3	62.30	10.24	9.15					0		89.76	90.85	100.00	100.00
65.6	65.60	10.29	9.15					0		89.71	90.85	100.00	100.00
74.0	74.00	9.77	9.15					0		90.23	90.85	100.00	100.00
81.0	81.00	9.44	9.15					0		90.56	90.85	100.00	100.00
88.0	88.00	9.41	9.15					0		90.59	90.85	100.00	100.00
95.0	95.00	9.35	9.23					0		90.65	90.77	100.00	100.00
98.5	98.50	9.69	9.27					0		90.31	90.73	100.00	100.00
102.0	102.00	9.56	9.3					0		90.44	90.70	100.00	100.00
109.5	109.50	9.65	9.36			XS Sta 18		0		90.35	90.64	100.00	100.00
113.5	113.50	9.7	9.41					0		90.30	90.59	100.00	100.00
123.0	123.00	9.93	9.42					0		90.07	90.58	100.00	100.00
132.0	132.00	9.89	9.41					0		90.11	90.59	100.00	100.00
149.0	149.00	11.16	9.41					0		88.84	90.59	100.00	100.00
162.0	162.00	10.59	9.41					0		89.41	90.59	100.00	100.00
172.0	172.00	10.21	9.4					0		89.79	90.60	100.00	100.00
179.0	179.00	9.73	9.38					0		90.27	90.62	100.00	100.00
192.0	192.00	9.62	9.38					0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00
	192.00							0		90.38	90.62	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.00138 ft/ft**

Little Mill Creek Trib 1- Cross Section 1-1 @ STA. 109.5

REACH ID:	**UT1 1-1**		**Date: 01/18/2022**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.5
Water Surface Elev. (from Column M)			90.6

Adj. Readng
(Rci)
R+TPc
& Camline

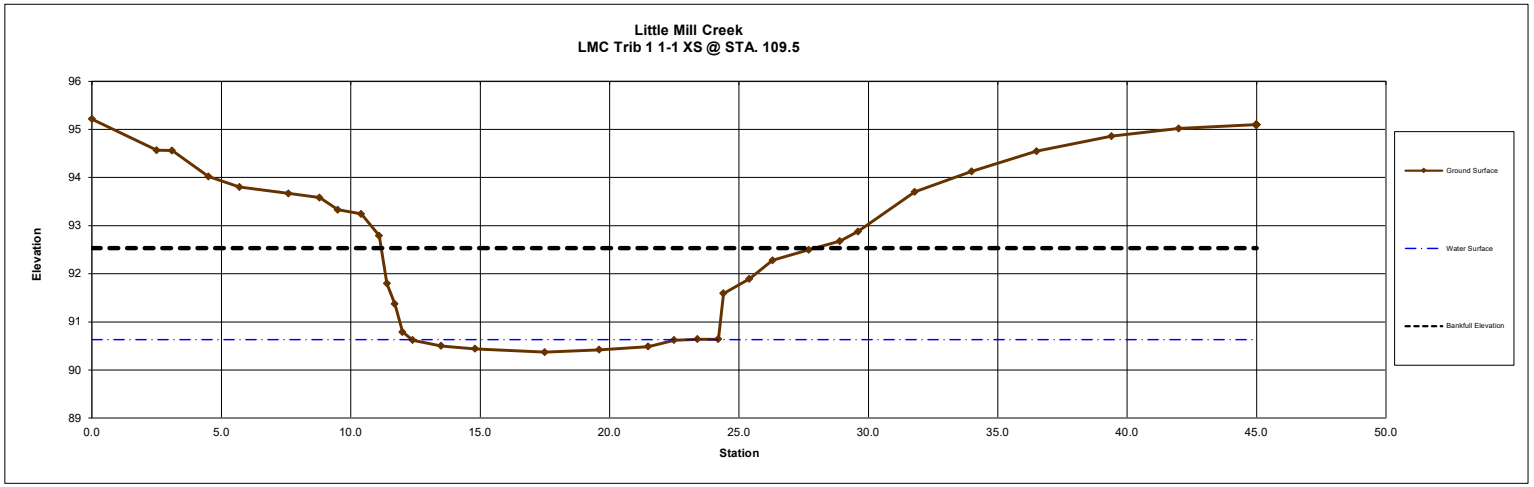
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	92.54	Slope (ft/ft)	0.00138	L.Pin Sta.	0.0
B. Width =	16.8	Mannings "n"	0.02825	R.Pin Sta.	45.0
W/d =	10.22	D84 (mm) measured	38.1	L.Pin Rod	95.22
F.P.Width	35.9	Velocity (ft/s) Manning's)	2.49	R.Pin Rod	95.1
Entrenchment	2.14	Velocity (ft/s) via. (U/U*)	2.35	Tape Angle (deg.	0.2
B. Area =	27.5	Froud #	0.37		
B. Depth=	1.64	Discharge (cu ft/s)	68.42	Rc Meas.	
Max Depth	2.17	Shear Stress (lb/sq ft)	0.12	Chord	
W. Per=	19.2	CX Power (ft lb/s)	5.9	m	
H.Radius=	1.44	CX Power (watts)	8.0	Rc Calc.	
SS L Bank* =	1.05	Critical size (mm)	9.1	Rc/B. Width**	
SS R Bank* =	0.55	D84 predicted (mm)	10.7		
Shape Factor:	0.27	Flow Type	Subcritical Flow		

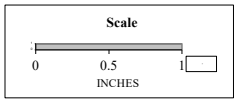
*Based on $HRad_{bb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pa Sta X	FP Width R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	4.78	Next to Pin	4.78	95.22	4.78	0.00	1	0	0.00	0.51		0	
2.5	2.5	5.43		5.43	94.6	5.43	0.00	0	0	0.00	0.60	0.0	0	Above B F
3.1	3.1	5.44		5.44	94.6	5.44	0.00	0	0	0.00	1.40	0.0	0	Above B F
4.5	4.5	5.98		5.98	94.0	5.98	0.00	0	0	0.00	1.20	0.0	0	Above B F
5.7	5.7	6.20		6.20	93.8	6.20	0.00	0	0	0.00	1.90	0.0	0	Above B F
7.6	7.6	6.33		6.33	93.7	6.33	0.00	0	0	0.00	1.20	0.0	0	Above B F
8.8	8.8	6.42		6.42	93.6	6.42	0.00	0	0	0.00	0.70	0.0	0	Above B F
9.5	9.5	6.67		6.67	93.3	6.67	0.00	0	0	0.00	0.90	0.0	0	Above B F
10.4	10.4	6.76		6.76	93.2	6.76	0.00	0	0	0.00	0.70	0.0	0	Above B F
11.1	11.1	7.21		7.21	92.8	7.21	0.22	0	0	0.00	0.30	0.0	0	Within B F
11.4	11.4	8.20		8.20	91.8	8.20	0.30	0	0	0.00	0.30	0.0	0	Within B F
11.7	11.7	8.63		8.63	91.4	8.63	0.30	0	0	0.00	0.30	0.3	0	Within B F
12.0	12.0	9.21		9.21	90.8	9.21	0.40	0	0	0.00	0.40	0.4	0	Within B F
12.4	12.4	9.38	EOW	9.38	90.6	9.38	1.10	0	0	0.00	1.10	0.7	0	Within B F
13.5	13.5	9.50		9.50	90.5	9.50	1.30	0	0	0.00	1.30	2.2	0	Within B F
14.8	14.8	9.56		9.56	90.4	9.56	2.70	0	0	0.00	2.70	2.7	0.73	Within B F
17.5	17.5	9.63		9.63	90.4	9.63	2.10	0	0	0.00	2.10	5.8	0.00	Within B F
19.6	19.6	9.58		9.58	90.4	9.63	1.90	0	0	0.00	1.90	4.5	0.00	Within B F
21.5	21.5	9.51		9.51	90.5	9.63	1.00	0	0	0.00	1.00	4.0	0.00	Within B F
22.5	22.5	9.38		9.38	90.6	9.63	0.90	0	0	0.00	0.90	2.0	0.00	Within B F
23.4	23.4	9.36	EOW	9.36	90.6	9.63	0.80	0	0	0.00	0.80	1.7	0.00	Within B F
24.2	24.2	9.36		9.36	90.6	9.63	0.20	0	0	0.00	0.20	1.5	0.00	Within B F
24.4	24.4	8.41		8.41	91.6	9.63	1.00	0	0	0.00	1.00	0.3	0.00	Within B F
25.4	25.4	8.11		8.11	91.9	9.63	0.90	0	0	0.00	0.90	0.8	0.00	Within B F
26.3	26.3	7.72		7.72	92.3	9.63	1.40	0	0	0.00	1.40	0.4	0.00	Within B F
27.7	27.7	7.50		7.50	92.5	9.63	0.24	0	0	0.00	1.20	0.2	0.00	Within B F
28.9	28.9	7.32		7.32	92.7	9.63	0.00	0	0	0.00	0.70	0.0	0.00	Above B F
29.6	29.6	7.12		7.12	92.9	9.63	0.00	0	0	0.00	2.20	0.0	0.00	Above B F
31.8	31.8	6.30		6.30	93.7	9.63	0.00	0	0	0.00	2.20	0.0	0.00	Above B F
34.0	34.0	5.87		5.87	94.1	9.63	0.00	0	0	0.00	2.50	0.0	0.00	Above B F
36.5	36.5	5.45		5.45	94.6	9.63	0.00	0	1	####	1.42	0.0	0.00	Above B F
39.4	39.4	5.14		5.14	94.9	9.63	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
42.0	42.0	4.98		4.98	95.0	9.63	0.00	0	1	0.00	0.00	0.0	0.00	Above B F
45.0	45.0	4.90	Next to Pin	4.90	95.1	9.63	0.00	0	1	0.00	0.00	0.0	0.00	Above B F





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

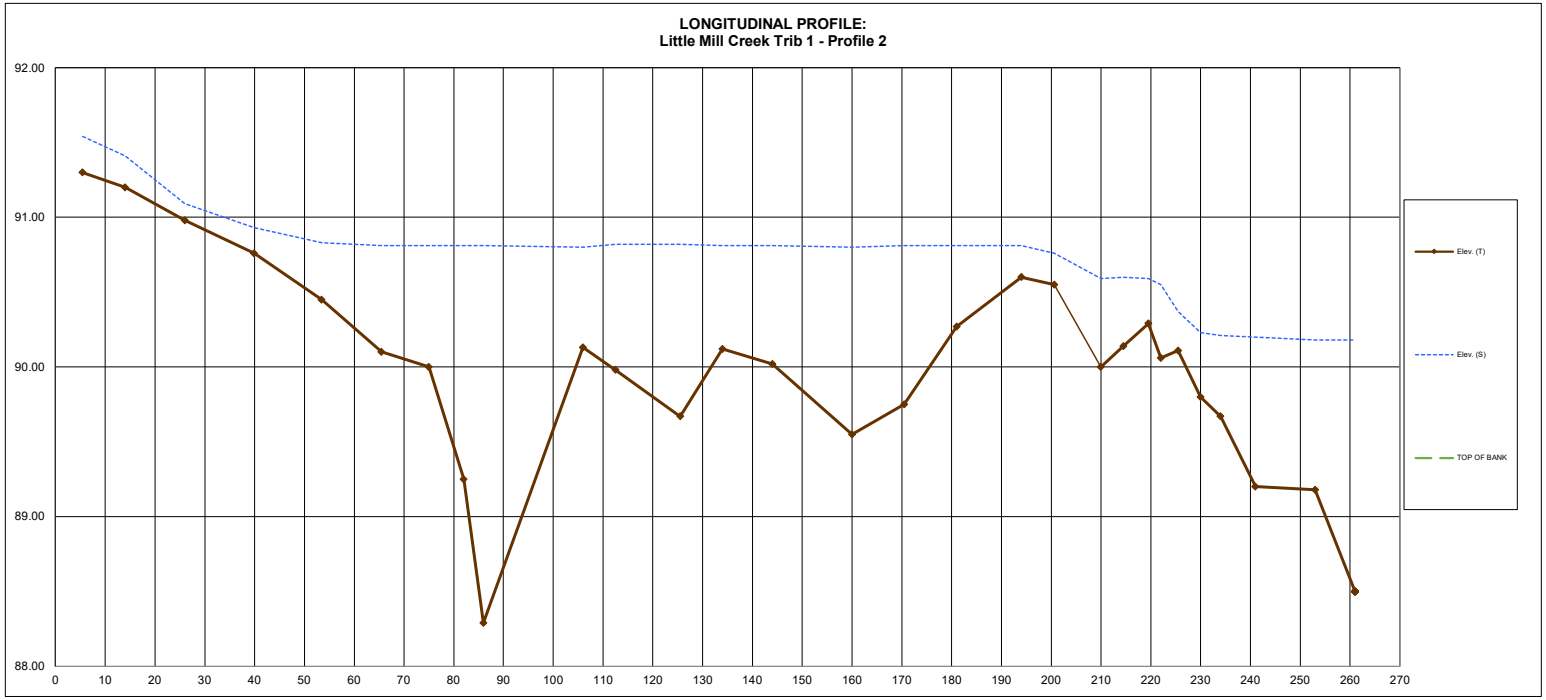
GEOMETRY	
Bank Full Elevation	92.54
Bank Full Width	16.76
Bank Full Depth	1.64
Maximum Depth	2.17
Bank Full Area	27.5
Hydraulic Radius	1.44
Wetted Perimeter	19.2
Width/Depth Ratio	10.2
Flood Prone Width	35.9
Entrenchment	2.14
Stream Type	F4/C4
Rc	

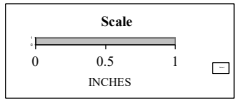
English Units

HYDRAULICS	
Slope (ft/ft)	0.0014
Manning's n	0.02825
Velocity (ft./s)	2.49
Froud #	0.37
Discharge (cu ft/s)	68.4
Shear Stress (lb/sq ft)	0.12
CX Power (ft lb/s)	5.9
Critical Size (mm)	9.1
Flow Type	Subcritical Flow
Rec. Interval	

LMC Trib 1 (Profile 2) - LONGITUDINAL PROFILE SURVEY

Enter BM Elevation in Cell D3:			100			1/18/2022							
Rc* at BM													
Convert English(0) to Metric (1):			0										
Station (ft)	Cumulative & Adjusted Station (ft) (Cum. Sta.+ Sta.A)	Rod Readg Thalwag (T)	Rod Readg Surface (S)	Rod Readg Bnkfull (B)	Rod Readg TopoBnk (TB)		TP Diff TPst-TPed @ Transit Changes	TP C (TPc) (TPc'	Rod Readin @ BM if any	. . .			
Station		**Rod. (T)**	**Rod (S)**	**Rod (BF)**	**Rod (TB)**	**NOTES**			0	**Elev. (T)**	**Elev. (S)**	**Elev. (BF**	**Elev. (TB)**
5.5	5.5	8.7	8.46					0	0	91.30	91.54	100.00	100.00
14.0	14.00	8.8	8.59					0		91.20	91.41	100.00	100.00
26.0	26.00	9.02	8.91					0		90.98	91.09	100.00	100.00
39.9	39.90	9.24	9.07					0		90.76	90.93	100.00	100.00
53.5	53.50	9.55	9.17					0		90.45	90.83	100.00	100.00
65.5	65.50	9.9	9.19					0		90.10	90.81	100.00	100.00
75.0	75.00	10	9.19					0		90.00	90.81	100.00	100.00
82.0	82.00	10.75	9.19					0		89.25	90.81	100.00	100.00
86.0	86.00	11.71	9.19					0		88.29	90.81	100.00	100.00
106.0	106.00	9.87	9.2					0		90.13	90.80	100.00	100.00
112.5	112.50	10.02	9.18					0		89.98	90.82	100.00	100.00
125.5	125.50	10.33	9.18					0		89.67	90.82	100.00	100.00
134.0	134.00	9.88	9.19					0		90.12	90.81	100.00	100.00
144.0	144.00	9.98	9.19					0		90.02	90.81	100.00	100.00
160.0	160.00	10.45	9.2					0		89.55	90.80	100.00	100.00
170.5	170.50	10.25	9.19					0		89.75	90.81	100.00	100.00
181.0	181.00	9.73	9.19					0		90.27	90.81	100.00	100.00
194.0	194.00	9.4	9.19					0		90.60	90.81	100.00	100.00
200.6	200.60	9.45	9.24					0		90.55	90.76	100.00	100.00
210.0	210.00	10	9.41					0		90.00	90.59	100.00	100.00
214.5	214.50	9.86	9.4					0		90.14	90.60	100.00	100.00
219.5	219.50	9.71	9.41					0		90.29	90.59	100.00	100.00
222.0	222.00	9.94	9.45					0		90.06	90.55	100.00	100.00
225.5	225.50	9.89	9.63					0		90.11	90.37	100.00	100.00
230.0	230.00	10.2	9.77					0		89.80	90.23	100.00	100.00
234.0	234.00	10.33	9.79					0		89.67	90.21	100.00	100.00
241.0	241.00	10.8	9.8					0		89.20	90.20	100.00	100.00
253.0	253.00	10.82	9.82					0		89.18	90.18	100.00	100.00
261.0	261.00	11.5	9.82					0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00
	261.00							0		88.50	90.18	100.00	100.00





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

ENGLISH UNITS (FT)

Reach Averaged Water Surface Slope = **0.00387 ft/ft**

Little Mill Creek Trib 1- Cross Section 2-1 @ STA. 181

REACH ID:	**UT1 2-1**		**Date: 01/18/2022**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			91.8
Water Surface Elev. (from Column M)			90.8

Adj. Readng
(Rci)
R+TPc
& Camline

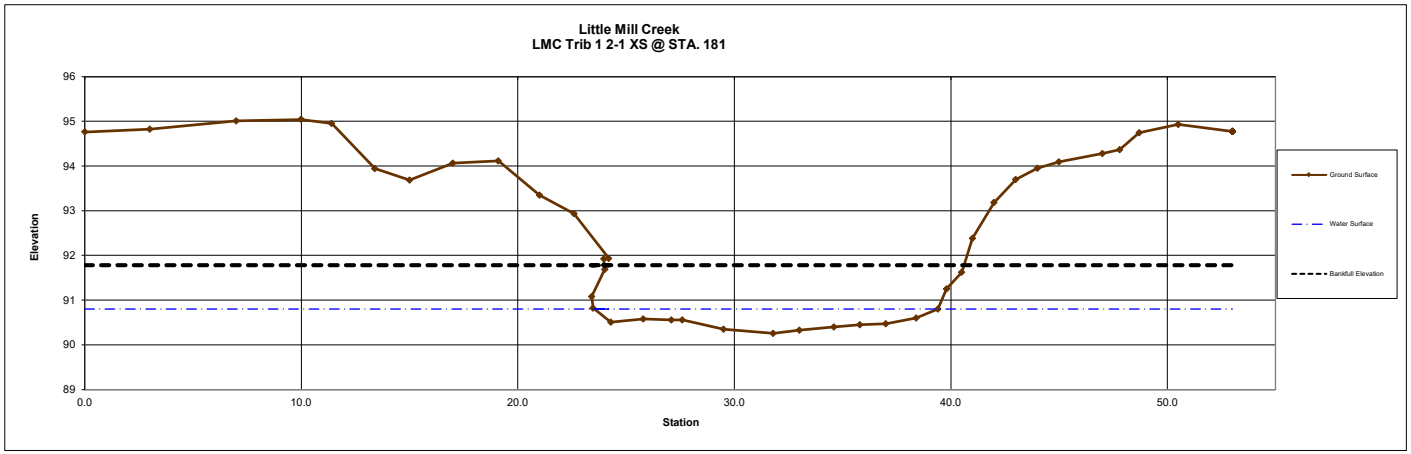
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	91.78	Slope (ft/ft)	0.00387	L.Pin Sta.	0.0
B. Width =	16.6	Mannings "n"	0.0304	R.Pin Sta.	53.0
W/d =	12.92	D84 (mm) measured	38.1	L.Pin Rod	94.76
F.P.Width	21.1	Velocity (ft/s) Manning's)	3.23	R.Pin Rod	94.8
Entrenchment	1.27	Velocity (ft/s) via. (U/U*)	3.16	Tape Angle (deg.	0.0
B. Area =	21.4	Froud #	0.54		
B. Depth=	1.29	Discharge (cu ft/s)	68.87	Rc Meas.	
Max Depth	1.52	Shear Stress (lb/sq ft)	0.26	Chord	
W. Per=	19.5	CX Power (ft lb/s)	16.6	m	
H.Radius=	1.09	CX Power (watts)	22.6	Rc Calc.	
SS L Bank* =	0.90	Critical size (mm)	20.5	Rc/B. Width**	
SS R Bank* =	0.84	D84 predicted (mm)	12.5		
Shape Factor:	0.24	Flow Type	Subcritical Flow		

*Based on $HRad_{bf(\text{within the nearest } 1/3 \text{ of } W/d)}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Sta	FP X R	FP Width Bnk	Area (old)	Partial LNB	Invert Segment is:
0.0	0.0	5.24		5.24	94.76	5.24	0.00	1	0	0.00		0.00		0	
3.0	3.0	5.18		5.18	94.8	5.24	0.00	1	0	0.00		0.00	0.0	0	Above B F
7.0	7.0	4.99		4.99	95.0	5.24	0.00	1	0	0.00		0.00	0.0	0	Above B F
10.0	10.0	4.96		4.96	95.0	5.24	0.00	1	0	0.00		0.00	0.0	0	Above B F
11.4	11.4	5.05		5.05	95.0	5.24	0.00	1	0	0.00		0.00	0.0	0	Above B F
13.4	13.4	6.06		6.06	93.9	6.06	0.00	1	0	0.00		0.00	0.0	0	Above B F
15.0	15.0	6.32		6.32	93.7	6.32	0.00	1	0	0.00		0.00	0.0	0	Above B F
17.0	17.0	5.94		5.94	94.1	6.32	0.00	1	0	0.00		0.00	0.0	0	Above B F
19.1	19.1	5.89		5.89	94.1	6.32	0.00	1	0	0.00		0.00	0.0	0	Above B F
21.0	21.0	6.65		6.65	93.4	6.65	0.00	1	0	0.00		1.43	0.0	0	Above B F
22.6	22.6	7.07	TOB	7.07	92.9	7.07	0.00	0	0	0.00		1.60	0.0	0	Above B F
24.2	24.2	8.07		8.07	91.9	8.07	0.00	0	0	0.00		-0.23	0.0	0	Above B F
24.0	24.0	8.08	toe pin	8.08	91.9	8.08	0.02	0	0	0.00		0.05	0.0	0	Within B F
24.0	24.0	8.31		8.31	91.7	8.31	-0.61	0	0	0.00		-0.61	0.0	0	Within B F
23.4	23.4	8.92		8.92	91.1	8.92	0.07	0	0	0.00		0.07	0.2	0	Within B F
23.5	23.5	9.18		9.18	90.8	9.18	0.82	0	0	0.00		0.82	0.1	0	Within B F
24.3	24.3	9.49		9.49	90.5	9.49	1.50	0	0	0.00		1.50	0.9	0	Within B F
25.8	25.8	9.42		9.42	90.6	9.49	1.30	0	0	0.00		1.30	1.9	0	Within B F
27.1	27.1	9.44		9.44	90.6	9.49	0.50	0	0	0.00		0.50	1.6	0	Within B F
27.6	27.6	9.44		9.44	90.6	9.49	1.90	0	0	0.00		1.90	0.6	0	Within B F
29.5	29.5	9.65		9.65	90.4	9.65	2.30	0	0	0.00		2.30	2.5	0.02	Within B F
31.8	31.8	9.74		9.74	90.3	9.74	1.20	0	0	0.00		1.20	3.4	0.00	Within B F
33.0	33.0	9.67		9.67	90.3	9.74	1.60	0	0	0.00		1.60	1.8	0.00	Within B F
34.6	34.6	9.60		9.60	90.4	9.74	1.20	0	0	0.00		1.20	2.3	0.00	Within B F
35.8	35.8	9.55		9.55	90.5	9.74	1.20	0	0	0.00		1.20	1.6	0.00	Within B F
37.0	37.0	9.53		9.53	90.5	9.74	1.40	0	0	0.00		1.40	1.6	0.00	Within B F
38.4	38.4	9.40		9.40	90.6	9.74	1.00	0	0	0.00		1.00	1.7	0.00	Within B F
39.4	39.4	9.20		9.20	90.8	9.74	0.40	0	0	0.00		0.40	1.1	0.00	Within B F
39.8	39.8	8.75	EOW	8.75	91.3	9.74	0.70	0	0	0.00		0.70	0.3	0.00	Within B F
40.5	40.5	8.38		8.38	91.6	9.74	0.11	0	0	0.00		0.50	0.2	0.00	Within B F
41.0	41.0	7.62		7.62	92.4	9.74	0.00	0	0	0.00		1.00	0.0	0.00	Above B F
42.0	42.0	6.82		6.82	93.2	9.74	0.00	0	1	####		0.24	0.0	0.00	Above B F
43.0	43.0	6.30		6.30	93.7	9.74	0.00	0	1	0.00		0.00	0.0	0.00	Above B F
44.0	44.0	6.05		6.05	94.0	9.74	0.00	0	1	0.00		0.00	0.0	0.00	Above B F
45.0	45.0	5.91		5.91	94.1	9.74	0.00	0	1	0.00		0.00	0.0	0.00	Above B F
47.0	47.0	5.72		5.72	94.3	9.74	0.00	0	1	0.00		0.00	0.0	0.00	Above B F
47.8	47.8	5.64		5.64	94.4	9.74	0.00	0	1	0.00		0.00	0.0	0.00	Above B F
48.7	48.7	5.26		5.26	94.7	9.74	0.00	0	1	0.00		0.00	0.0	0.00	Above B F
50.5	50.5	5.07		5.07	94.9	9.74	0.00	0	1	0.00		0.00	0.0	0.00	Above B F
53.0	53.0	5.23		5.23	94.8	9.74	0.00	0	1	0.00		0.00	0.0	0.00	Above B F



Scale
0 0.5 1
INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	91.78
Bank Full Width	16.61
Bank Full Depth	1.29
Maximum Depth	1.52
Bank Full Area	21.4
Hydraulic Radius	1.09
Wetted Perimeter	19.5
Width/Depth Ratio	12.9
Flood Prone Width	21.1
Entrenchment	1.27
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0039
Manning's n	0.0304
Velocity (ft./s)	3.23
Froud #	0.54
Discharge (cu ft/s)	68.9
Shear Stress (lb/sq ft)	0.26
CX Power (ft lb/s)	16.6
Critical Size (mm)	20.5
Flow Type	Subcritical Flow
Rec. Interval	

APPENDIX G
TOP OF BANK ANALYSIS DATA

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Little Mill Creek - Cross Section 1-1 @ STA. 99

REACH ID:	**LMC 1-1**		**Date: 12/16/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:	(yes = 1, no		0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			92.7
Water Surface Elev. (from Column M)			90.1

check

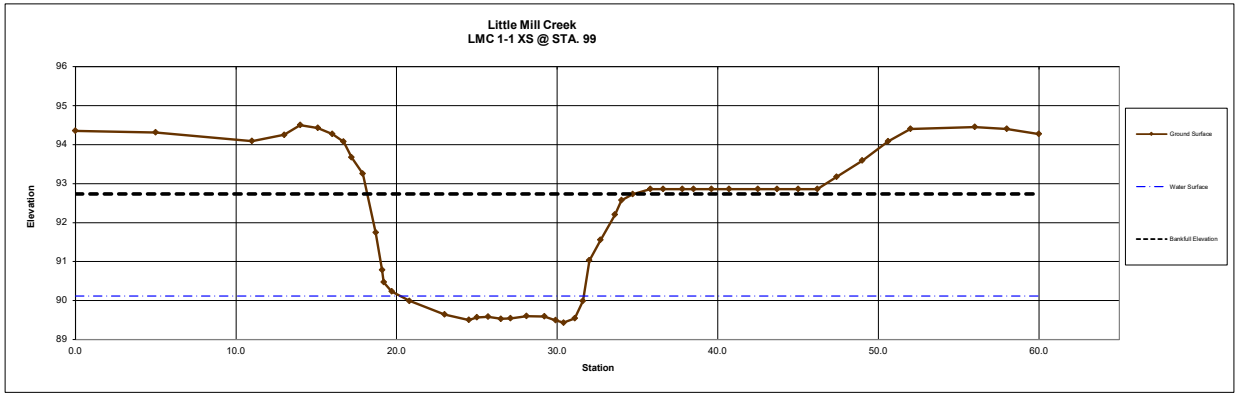
Adj. Reading
(Rci)
R+TPc
& Camline

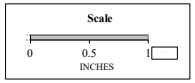
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	92.73	Slope (ft/ft)	0.006	L.Pin Sta.	0.0
B. Width =	16.5	Mannings "n"	0.026	R.Pin Sta.	60.0
W/d =	6.56	D84 (mm) measured	23.1	L.Pin Rod	94.35
F.P.Width	60.0	Velocity (ft/s) Manning's)	7.21	R.Pin Rod	94.3
Entrenchment	3.63	Velocity (ft/s) via. (U/U*)	7.29	Tape Angle (deg.	0.1
B. Area =	41.6	Froud #	0.88		
B. Depth=	2.52	Discharge (cu ft/s)	300.2	Rc Meas.	
Max Depth	3.30	Shear Stress (lb/sq ft)	0.78	Chord	
W. Per=	20.0	CX Power (ft lb/s)	112.4	m	
H.Radius=	2.08	CX Power (watts)	152.4	Rc Calc.	
SS L Bank* =	0.87	Critical size (mm)	65.9	Rc/B. Width**	
SS R Bank* =	0.73	D84 predicted (mm)	10.1		
Shape Factor:	0.32	Flow Type	Subcritical Flow		

*Based on $HRad_{bf}$(within the nearest 1/3 of Wbf)/ $HRad_{bf}$ **Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP P: Sta	FP Width X R	Bnk	Area (old)	L Partial LNB Se	Invert Segment is:
0.0	0.0	5.65	Next to Pin	5.65	94.35	5.65	0.00	0	0	0.00	0.00	5.00		0	
5.0	5.0	5.69		5.69	94.3	5.69	0.00	0	0	0.00	0.00	6.00	0.0	0	Above B F
11.0	11.0	5.91		5.91	94.1	5.91	0.00	0	0	0.00	0.00	2.00	0.0	0	Above B F
13.0	13.0	5.75		5.75	94.3	5.91	0.00	0	0	0.00	0.00	1.00	0.0	0	Above B F
14.0	14.0	5.5		5.50	94.5	5.91	0.00	0	0	0.00	0.00	1.10	0.0	0	Above B F
15.1	15.1	5.57	TOB	5.57	94.4	5.91	0.00	0	0	0.00	0.00	0.90	0.0	0	Above B F
16.0	16.0	5.73		5.73	94.3	5.91	0.00	0	0	0.00	0.00	0.70	0.0	0	Above B F
16.7	16.7	5.93		5.93	94.1	5.93	0.00	0	0	0.00	0.00	0.50	0.0	0	Above B F
17.2	17.2	6.33		6.33	93.7	6.33	0.00	0	0	0.00	0.00	0.70	0.0	0	Above B F
17.9	17.9	6.75		6.75	93.3	6.75	0.52	0	0	0.00	0.00	0.80	0.0	0	Within B F
18.7	18.7	8.26		8.26	91.7	8.26	0.40	0	0	0.00	0.00	0.40	0.0	0	Within B F
19.1	19.1	9.22		9.22	90.8	9.22	0.10	0	0	0.00	0.00	0.10	0.6	0	Within B F
19.2	19.2	9.53		9.53	90.5	9.53	0.50	0	0	0.00	0.00	0.50	0.2	0	Within B F
19.7	19.7	9.77	EOW	9.77	90.2	9.77	1.10	0	0	0.00	0.00	1.10	1.2	0	Within B F
20.8	20.8	10.01		10.01	90.0	10.01	2.20	0	0	0.00	0.00	2.20	2.9	0	Within B F
23.0	23.0	10.36		10.36	89.6	10.36	1.50	0	0	0.00	0.00	1.50	6.4	0.46	Within B F
24.5	24.5	10.5		10.50	89.5	10.50	0.50	0	0	0.00	0.00	0.50	4.7	0.00	Within B F
25.0	25.0	10.43		10.43	89.6	10.50	0.70	0	0	0.00	0.00	0.70	1.6	0.00	Within B F
25.7	25.7	10.42		10.42	89.6	10.50	0.80	0	0	0.00	0.00	0.80	2.2	0.00	Within B F
26.5	26.5	10.47		10.47	89.5	10.50	0.60	0	0	0.00	0.00	0.60	2.5	0.00	Within B F
27.1	27.1	10.46		10.46	89.5	10.50	1.00	0	0	0.00	0.00	1.00	1.9	0.00	Within B F
28.1	28.1	10.4		10.40	89.6	10.50	1.10	0	0	0.00	0.00	1.10	3.2	0.00	Within B F
29.2	29.2	10.41		10.41	89.6	10.50	0.70	0	0	0.00	0.00	0.70	3.4	0.00	Within B F
29.9	29.9	10.51		10.51	89.5	10.51	0.50	0	0	0.00	0.00	0.50	2.2	0.00	Within B F
30.4	30.4	10.57		10.57	89.4	10.57	0.70	0	0	0.00	0.00	0.70	1.6	0.00	Within B F
31.1	31.1	10.46		10.46	89.5	10.57	0.50	0	0	0.00	0.00	0.50	2.3	0.00	Within B F
31.6	31.6	10.01	EOW	10.01	90.0	10.57	0.40	0	0	0.00	0.00	0.40	1.5	0.00	Within B F
32.0	32.0	8.97		8.97	91.0	10.57	0.70	0	0	0.00	0.00	0.70	0.9	0.00	Within B F
32.7	32.7	8.45		8.45	91.6	10.57	0.90	0	0	0.00	0.00	0.90	1.0	0.00	Within B F
33.6	33.6	7.8		7.80	92.2	10.57	0.40	0	0	0.00	0.00	0.40	0.8	0.00	Within B F
34.0	34.0	7.43		7.43	92.6	10.57	0.70	0	0	0.00	0.00	0.70	0.1	0.00	Within B F
34.7	34.7	7.27	TOB	7.27	92.7	10.57	0.00	0	0	0.00	0.00	1.10	0.1	0.00	Above B F
35.8	35.8	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	0.80	0.0	0.00	Above B F
36.6	36.6	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	1.20	0.0	0.00	Above B F
37.8	37.8	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	0.70	0.0	0.00	Above B F
38.5	38.5	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	1.10	0.0	0.00	Above B F
39.6	39.6	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	1.10	0.0	0.00	Above B F
40.7	40.7	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	1.80	0.0	0.00	Above B F
42.5	42.5	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	1.20	0.0	0.00	Above B F
43.7	43.7	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	1.30	0.0	0.00	Above B F
45.0	45.0	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	1.20	0.0	0.00	Above B F
46.2	46.2	7.14		7.14	92.9	10.57	0.00	0	0	0.00	0.00	1.20	0.0	0.00	Above B F
47.4	47.4	6.83		6.83	93.2	10.57	0.00	0	0	0.00	0.00	1.60	0.0	0.00	Above B F
49.0	49.0	6.41		6.41	93.6	10.57	0.00	0	0	0.00	0.00	1.60	0.0	0.00	Above B F
50.6	50.6	5.92		5.92	94.1	10.57	0.00	0	0	0.00	0.00	1.40	0.0	0.00	Above B F
52.0	52.0	5.6		5.60	94.4	10.57	0.00	0	0	0.00	0.00	4.00	0.0	0.00	Above B F
56.0	56.0	5.55		5.55	94.5	10.57	0.00	0	0	0.00	0.00	2.00	0.0	0.00	Above B F
58.0	58.0	5.6		5.60	94.4	10.57	0.00	0	0	0.00	0.00	2.00	0.0	0.00	Above B F
60.0	60.0	5.73	Next to Pin	5.73	94.3	10.57	0.00	0	0	0.00	0.00	0.00	0.0	0.00	Above B F





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	92.73
Bank Full Width	16.52
Bank Full Depth	2.52
Maximum Depth	3.30
Bank Full Area	41.6
Hydraulic Radius	2.08
Wetted Perimeter	20.0
Width/Depth Ratio	6.6
Flood Prone Width	60.0
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0060
Manning's n	0.026
Velocity (ft./s)	7.21
Froud #	0.88
Discharge (cu ft/s)	300.2
Shear Stress (lb/sq ft)	0.78
CX Power (ft lb/s)	112.4
Critical Size (mm)	65.9
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek - Cross Section 3-1 @ STA. 56

REACH ID:	**LMC 3-1**		**Date: 12/17/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			94.2
Water Surface Elev. (from Column M)			90.3

check

Adj. Readng
(Rci)
R+TPc
& Camline

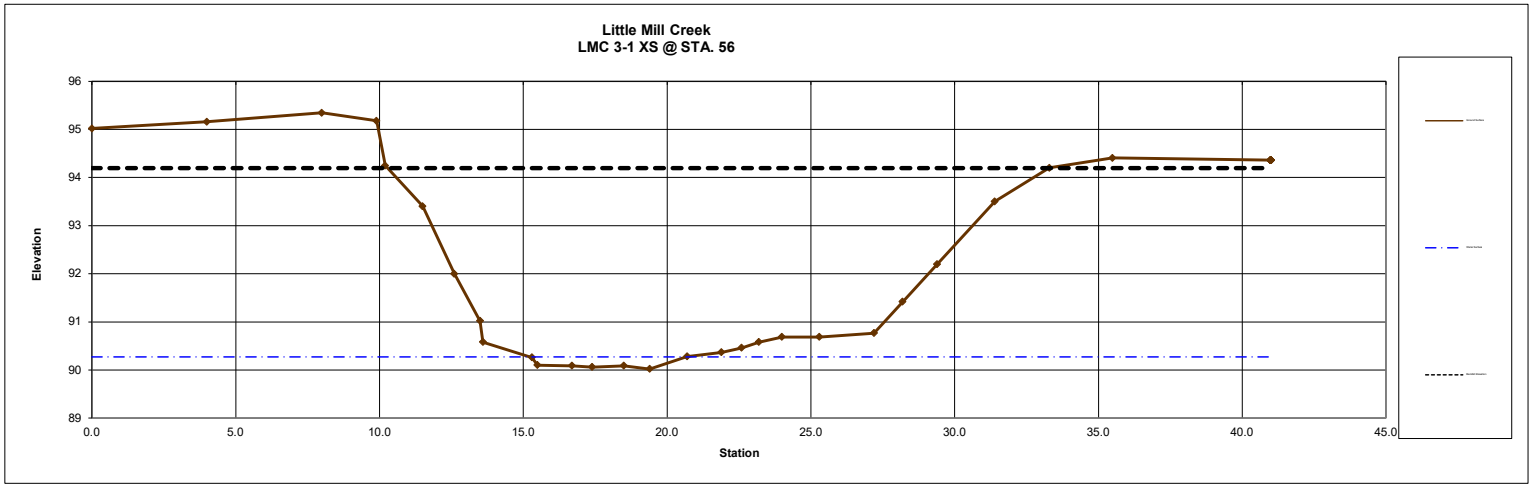
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	94.20	Slope (ft/ft)	0.00615	L.Pin Sta.	0.0
B. Width =	23.0	Mannings "n"	0.025	R.Pin Sta.	41.0
W/d =	7.99	D84 (mm) measured	23.1	L.Pin Rod	95.02
F.P.Width	41.0	Velocity (ft/s) Manning's)	8.74	R.Pin Rod	94.4
Entrenchment	1.78	Velocity (ft/s) via. (U/U*)	8.60	Tape Angle (deg.	0.9
B. Area =	66.3	Froud #	0.96		
B. Depth=	2.88	Discharge (cu ft/s)	579.9	Rc Meas.	
Max Depth	4.18	Shear Stress (lb/sq ft)	0.99	Chord	
W. Per=	25.8	CX Power (ft lb/s)	222.5	m	
H.Radius=	2.57	CX Power (watts)	301.8	Rc Calc.	
SS L Bank* =	0.91	Critical size (mm)	85.0	Rc/B. Width**	
SS R Bank* =	0.67	D84 predicted (mm)	9.0		
Shape Factor:	0.32	Flow Type	Subcritical Flow		

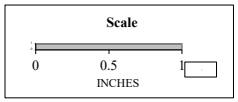
*Based on $HRad_{bb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pa Sta X R	FP Width Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	4.98	Next to Pin	4.98	95.02	4.98	0.00	0	0	0.00	4.00		0	
4.0	4.0	4.84		4.84	95.2	4.98	0.00	0	0	0.00	4.00	0.0	0	Above B F
8.0	8.0	4.65		4.65	95.4	4.98	0.00	0	0	0.00	1.90	0.0	0	Above B F
9.9	9.9	4.82	L-TOB	4.82	95.2	4.98	0.00	0	0	0.00	0.30	0.0	0	Above B F
10.2	10.2	5.75		5.75	94.3	5.75	1.22	0	0	0.00	1.30	0.0	0	Within B F
11.5	11.5	6.60		6.60	93.4	6.60	1.10	0	0	0.00	1.10	0.0	0	Within B F
12.6	12.6	8.00		8.00	92.0	8.00	0.90	0	0	0.00	0.90	1.6	0	Within B F
13.5	13.5	8.98		8.98	91.0	8.98	0.10	0	0	0.00	0.10	2.4	0	Within B F
13.6	13.6	9.42		9.42	90.6	9.42	1.70	0	0	0.00	1.70	0.3	0	Within B F
15.3	14.3	9.74	L-EOW	9.74	90.3	9.74	0.20	0	0	0.00	0.20	6.4	0	Within B F
15.5	15.5	9.90		9.90	90.1	9.90	1.20	0	0	0.00	1.20	0.8	0	Within B F
16.7	16.7	9.91		9.91	90.1	9.91	0.70	0	0	0.00	0.70	4.9	0	Within B F
17.4	17.4	9.94	Thalweg	9.94	90.1	9.94	1.10	0	0	0.00	1.10	2.9	0.50	Within B F
18.5	18.5	9.91		9.91	90.1	9.94	0.90	0	0	0.00	0.90	4.5	0.00	Within B F
19.4	19.4	9.98		9.98	90.0	9.98	1.30	0	0	0.00	1.30	3.7	0.00	Within B F
20.7	20.7	9.72	R-EOW	9.72	90.3	9.98	1.20	0	0	0.00	1.20	5.3	0.00	Within B F
21.9	21.9	9.63		9.63	90.4	9.98	0.70	0	0	0.00	0.70	4.6	0.00	Within B F
22.6	22.6	9.54		9.54	90.5	9.98	0.60	0	0	0.00	0.60	2.6	0.00	Within B F
23.2	23.2	9.42	BFF	9.42	90.6	9.98	0.80	0	0	0.00	0.80	2.2	0.00	Within B F
24.0	24.0	9.31		9.31	90.7	9.98	1.30	0	0	0.00	1.30	2.9	0.00	Within B F
25.3	25.3	9.31		9.31	90.7	9.98	1.90	0	0	0.00	1.90	4.6	0.00	Within B F
27.2	27.2	9.23		9.23	90.8	9.98	1.00	0	0	0.00	1.00	6.6	0.00	Within B F
28.2	28.2	8.58		8.58	91.4	9.98	1.20	0	0	0.00	1.20	3.1	0.00	Within B F
29.4	29.4	7.80		7.80	92.2	9.98	2.00	0	0	0.00	2.00	2.9	0.00	Within B F
31.4	31.4	6.50		6.50	93.5	9.98	1.90	0	0	0.00	1.90	2.7	0.00	Within B F
33.3	33.3	5.80	R-TOB	5.80	94.2	9.98	0.00	0	0	0.00	2.20	0.7	0.00	Above B F
35.5	35.5	5.59		5.59	94.4	9.98	0.00	0	0	0.00	5.50	0.0	0.00	Above B F
41.0	41.0	5.64	Next to Pin	5.64	94.4	9.98	0.00	0	0	0.00	0.00	0.0	0.00	Above B F
41.0				0.00	94.4									
41.0				0.00	94.4									
41.0				0.00	94.4									
41.0				0.00	94.4									
41.0				0.00	94.4									
41.0				0.00	94.4									





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	94.20
Bank Full Width	23.02
Bank Full Depth	2.88
Maximum Depth	4.18
Bank Full Area	66.3
Hydraulic Radius	2.57
Wetted Perimeter	25.8
Width/Depth Ratio	8.0
Flood Prone Width	41.0
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0062
Manning's n	0.025
Velocity (ft./s)	8.74
Froud #	0.96
Discharge (cu ft/s)	579.87
Shear Stress (lb/sq ft)	0.99
CX Power (ft lb/s)	222.5
Critical Size (mm)	85.0
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek - Cross Section 5-1 @ STA. 31

REACH ID:	**LMC 5-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			93.1
Water Surface Elev. (from Column M)			89.2

check

Adj. Readng (Rci) R+TPc & Camline

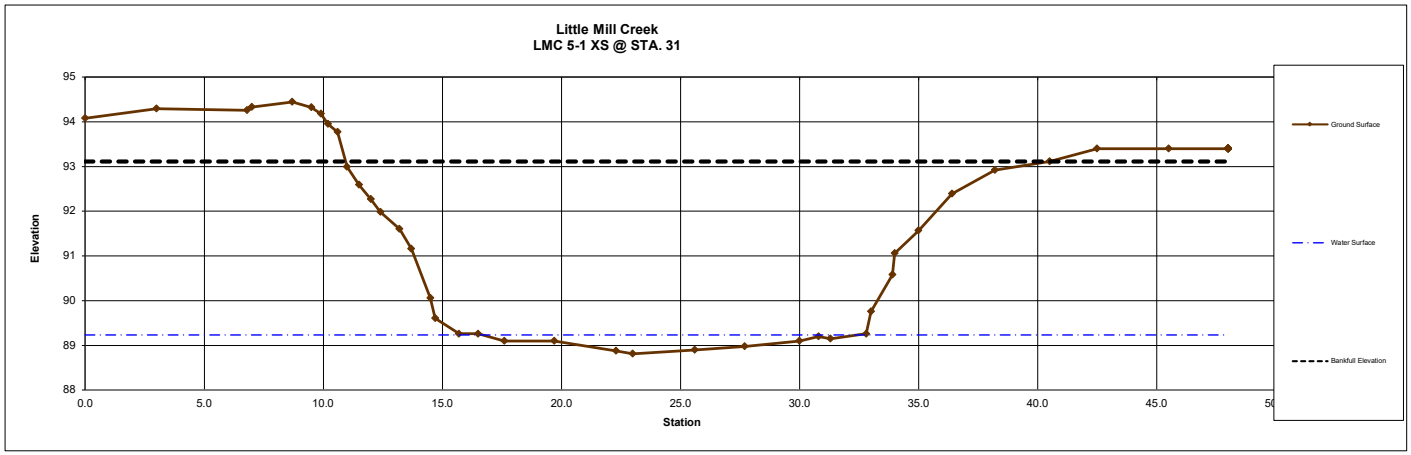
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	93.11	Slope (ft/ft)	0.00546	L.Pin Sta.	0.0
B. Width =	29.6	Mannings "n"	0.028	R.Pin Sta.	48.0
W/d =	10.06	D84 (mm) measured	51.3	L.Pin Rod	94.08
F.P.Width	48.0	Velocity (ft/s) Manning's)	7.43	R.Pin Rod	93.4
Entrenchment	1.62	Velocity (ft/s) via. (U/U*)	6.85	Tape Angle (deg	0.8
B. Area =	86.8	Froud #	0.81		
B. Depth=	2.94	Discharge (cu ft/s)	645.6	Rc Meas.	
Max Depth	4.30	Shear Stress (lb/sq ft)	0.89	Chord	
W. Per=	33.3	CX Power (ft lb/s)	220.0	m	
H.Radius=	2.61	CX Power (watts)	298.3	Rc Calc.	
SS L Bank* =	0.94	Critical size (mm)	76.1	Rc/B. Width**	
SS R Bank* =	0.56	D84 predicted (mm)	18.2		
Shape Factor:	0.28	Flow Type	Subcritical Flow		

*Based on $HRad_{bf}$(within the nearest 1/3 of Wbf) / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pa Sta X R	FP Width Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	5.92	Next to Pin	5.92	94.08	5.92	0.00	0	0	0.00	3.00		0	
3.0	3.0	5.71		5.71	94.3	5.92	0.00	0	0	0.00	3.80	0.0	0	Above B F
6.8	6.8	5.74		5.74	94.3	5.92	0.00	0	0	0.00	0.20	0.0	0	Above B F
7.0	7.0	5.67		5.67	94.3	5.92	0.00	0	0	0.00	1.70	0.0	0	Above B F
8.7	8.7	5.56		5.56	94.4	5.92	0.00	0	0	0.00	0.80	0.0	0	Above B F
9.5	9.5	5.68	L-TOB	5.68	94.3	5.92	0.00	0	0	0.00	0.40	0.0	0	Above B F
9.9	9.9	5.82		5.82	94.2	5.92	0.00	0	0	0.00	0.30	0.0	0	Above B F
10.2	10.2	6.05		6.05	94.0	6.05	0.00	0	0	0.00	0.40	0.0	0	Above B F
10.6	10.6	6.23		6.23	93.8	6.23	0.06	0	0	0.00	0.40	0.0	0	Within B F
11.0	11.0	7.01		7.01	93.0	7.01	0.50	0	0	0.00	0.50	0.0	0	Within B F
11.5	11.5	7.41		7.41	92.6	7.41	0.50	0	0	0.00	0.50	0.2	0	Within B F
12.0	12.0	7.73		7.73	92.3	7.73	0.40	0	0	0.00	0.40	0.3	0	Within B F
12.4	12.4	8.02		8.02	92.0	8.02	0.80	0	0	0.00	0.80	0.4	0	Within B F
13.2	13.2	8.40		8.40	91.6	8.40	0.50	0	0	0.00	0.50	1.1	0	Within B F
13.7	13.7	8.84		8.84	91.2	8.84	0.80	0	0	0.00	0.80	0.9	0	Within B F
14.5	14.5	9.94		9.94	90.1	9.94	0.20	0	0	0.00	0.20	2.0	0	Within B F
14.7	14.7	10.39		10.39	89.6	10.39	1.00	0	0	0.00	1.00	0.7	0	Within B F
15.7	15.7	10.74		10.74	89.3	10.74	0.80	0	0	0.00	0.80	3.7	0	Within B F
16.5	16.5	10.74	L-EOW	10.74	89.3	10.74	1.10	0	0	0.00	1.10	3.1	0	Within B F
17.6	17.6	10.90		10.90	89.1	10.90	2.10	0	0	0.00	2.10	4.3	0	Within B F
19.7	19.7	10.90		10.90	89.1	10.90	2.60	0	0	0.00	2.60	8.4	0.42	Within B F
22.3	22.3	11.12		11.12	88.9	11.12	0.70	0	0	0.00	0.70	10.7	0.00	Within B F
23.0	23.0	11.19	TW	11.19	88.8	11.19	2.60	0	0	0.00	2.60	3.0	0.00	Within B F
25.6	25.6	11.10		11.10	88.9	11.19	2.10	0	0	0.00	2.10	11.1	0.00	Within B F
27.7	27.7	11.02		11.02	89.0	11.19	2.30	0	0	0.00	2.30	8.8	0.00	Within B F
30.0	30.0	10.90		10.90	89.1	11.19	0.80	0	0	0.00	0.80	9.4	0.00	Within B F
30.8	30.8	10.80	R-EOW	10.80	89.2	11.19	0.50	0	0	0.00	0.50	3.2	0.00	Within B F
31.3	31.3	10.85		10.85	89.2	11.19	1.50	0	0	0.00	1.50	2.0	0.00	Within B F
32.8	32.8	10.74		10.74	89.3	11.19	0.20	0	0	0.00	0.20	5.9	0.00	Within B F
33.0	33.0	10.24		10.24	89.8	11.19	0.90	0	0	0.00	0.90	0.7	0.00	Within B F
33.9	33.9	9.42		9.42	90.6	11.19	0.10	0	0	0.00	0.10	2.6	0.00	Within B F
34.0	34.0	8.94		8.94	91.1	11.19	1.00	0	0	0.00	1.00	0.2	0.00	Within B F
35.0	35.0	8.43		8.43	91.6	11.19	1.40	0	0	0.00	1.40	1.8	0.00	Within B F
36.4	36.4	7.61		7.61	92.4	11.19	1.80	0	0	0.00	1.80	1.6	0.00	Within B F
38.2	38.2	7.08		7.08	92.9	11.19	2.30	0	0	0.00	2.30	0.8	0.00	Within B F
40.5	40.5	6.89	R-TOB	6.89	93.1	11.19	0.00	0	0	0.00	2.00	0.2	0.00	Above B F
42.5	42.5	6.60		6.60	93.4	11.19	0.00	0	0	0.00	3.00	0.0	0.00	Above B F
45.5	45.5	6.60		6.60	93.4	11.19	0.00	0	0	0.00	2.50	0.0	0.00	Above B F
48.0	48.0	6.60	Next to Pin	6.60	93.4	11.19	0.00	0	0	0.00	0.00	0.0	0.00	Above B F



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	93.11
Bank Full Width	29.56
Bank Full Depth	2.94
Maximum Depth	4.30
Bank Full Area	86.8
Hydraulic Radius	2.61
Wetted Perimeter	33.3
Width/Depth Ratio	10.1
Flood Prone Width	48.0
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0055
Manning's n	0.028
Velocity (ft./s)	7.43
Froud #	0.81
Discharge (cu ft/s)	645.59
Shear Stress (lb/sq ft)	0.89
CX Power (ft lb/s)	220.0
Critical Size (mm)	76.1
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek - Cross Section 6-1 @ STA. 109

REACH ID:	**LMC 6-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			94.3
Water Surface Elev. (from Column M)			90.0

check

Adj. Readng .
(Rci) .
R+TPc .
& Camline .

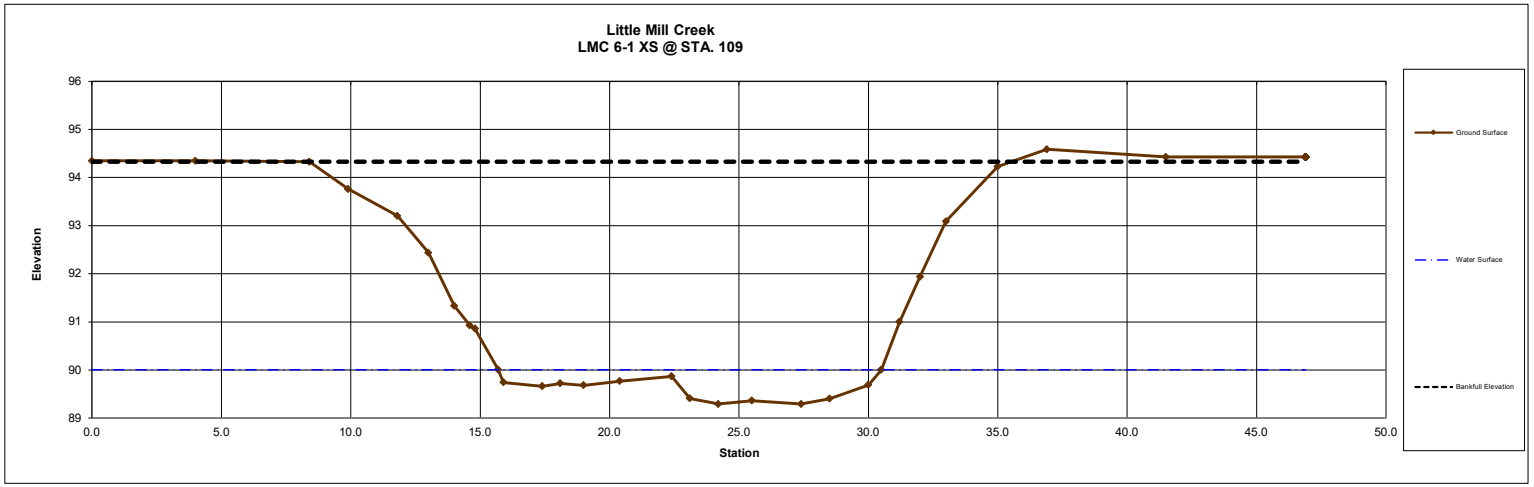
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	94.33	Slope (ft/ft)	0.0038	L.Pin Sta.	0.0
B. Width =	27.1	Mannings "n"	0.028	R.Pin Sta.	46.9
W/d =	8.09	D84 (mm) measured	51.3	L.Pin Rod	94.35
F.P.Width	46.9	Velocity (ft/s) Manning's)	6.74	R.Pin Rod	94.4
Entrenchment	1.73	Velocity (ft/s) via. (U/U*)	6.28	Tape Angle (deg.	0.1
B. Area =	91.0	Froud #	0.69		
B. Depth=	3.35	Discharge (cu ft/s)	612.7	Rc Meas.	
Max Depth	5.04	Shear Stress (lb/sq ft)	0.70	Chord	
W. Per=	30.8	CX Power (ft lb/s)	145.3	m	
H.Radius=	2.95	CX Power (watts)	197.0	Rc Calc.	
SS L Bank* =	0.66	Critical size (mm)	58.8	Rc/B. Width**	
SS R Bank* =	0.85	D84 predicted (mm)	20.8		
Shape Factor:	0.31	Flow Type	Subcritical Flow		

*Based on $HRad_{bb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas* .

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr.	Test 1	Entr Tst 2	FP Pa Sta	X R	FP Width Bnk	Area (old)	L. Partial LNB Se	Invert Segment is:
0.0	0.0	5.65	Next to Pin	5.65	94.35	5.65	0.00	0	0	0.00			4.00		0	
4.0	4.0	5.65		5.65	94.4	5.65	0.00	0	0	0.00			4.40	0.0	0	Above B F
8.4	8.4	5.67	L-TOB	5.67	94.3	5.67	1.50	0	0	0.00			1.50	0.0	0	Within B F
9.9	9.9	6.24		6.24	93.8	6.24	1.90	0	0	0.00			1.90	0.4	0	Within B F
11.8	11.8	6.80		6.80	93.2	6.80	1.20	0	0	0.00			1.20	1.6	0	Within B F
13.0	13.0	7.56		7.56	92.4	7.56	1.00	0	0	0.00			1.00	1.8	0	Within B F
14.0	14.0	8.67		8.67	91.3	8.67	0.60	0	0	0.00			0.60	2.4	0	Within B F
14.6	14.6	9.07		9.07	90.9	9.07	0.20	0	0	0.00			0.20	1.9	0	Within B F
14.8	14.8	9.14		9.14	90.9	9.14	0.90	0	0	0.00			0.90	0.7	0	Within B F
15.7	15.7	9.99	L-EOW	9.99	90.0	9.99	0.20	0	0	0.00			0.20	3.5	0	Within B F
15.9	15.9	10.26		10.26	89.7	10.26	1.50	0	0	0.00			1.50	0.9	0	Within B F
17.4	17.4	10.34		10.34	89.7	10.34	0.70	0	0	0.00			0.70	6.9	0.06	Within B F
18.1	18.1	10.28		10.28	89.7	10.34	0.90	0	0	0.00			0.90	3.2	0.00	Within B F
19.0	19.0	10.32		10.32	89.7	10.34	1.40	0	0	0.00			1.40	4.2	0.00	Within B F
20.4	20.4	10.23		10.23	89.8	10.34	2.00	0	0	0.00			2.00	6.4	0.00	Within B F
22.4	22.4	10.13		10.13	89.9	10.34	0.70	0	0	0.00			0.70	9.0	0.00	Within B F
23.1	23.1	10.59		10.59	89.4	10.59	1.10	0	0	0.00			1.10	3.3	0.00	Within B F
24.2	24.2	10.71		10.71	89.3	10.71	1.30	0	0	0.00			1.30	5.5	0.00	Within B F
25.5	25.5	10.64		10.64	89.4	10.71	1.90	0	0	0.00			1.90	6.5	0.00	Within B F
27.4	27.4	10.71		10.71	89.3	10.71	1.10	0	0	0.00			1.10	9.5	0.00	Within B F
28.5	28.5	10.60		10.60	89.4	10.71	1.50	0	0	0.00			1.50	5.5	0.00	Within B F
30.0	30.0	10.31		10.31	89.7	10.71	0.50	0	0	0.00			0.50	7.2	0.00	Within B F
30.5	30.5	10.00	R-EOW	10.00	90.0	10.71	0.70	0	0	0.00			0.70	2.2	0.00	Within B F
31.2	31.2	9.00		9.00	91.0	10.71	0.80	0	0	0.00			0.80	2.7	0.00	Within B F
32.0	32.0	8.06		8.06	91.9	10.71	1.00	0	0	0.00			1.00	2.3	0.00	Within B F
33.0	33.0	6.91		6.91	93.1	10.71	2.00	0	0	0.00			2.00	1.8	0.00	Within B F
35.0	35.0	5.77		5.77	94.2	10.71	0.53	0	0	0.00			1.90	1.3	0.00	Within B F
36.9	36.9	5.41		5.41	94.6	10.71	0.00	0	0	0.00			4.60	0.0	0.00	Above B F
41.5	41.5	5.57		5.57	94.4	10.71	0.00	0	0	0.00			5.40	0.0	0.00	Above B F
46.9	46.9	5.57	Next to Pin	5.57	94.4	10.71	0.00	0	0	0.00			0.00	0.0	0.00	Above B F
46.9				0.00	94.4											
46.9				0.00	94.4											
46.9				0.00	94.4											
46.9				0.00	94.4											



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	94.33
Bank Full Width	27.13
Bank Full Depth	3.35
Maximum Depth	5.04
Bank Full Area	91.0
Hydraulic Radius	2.95
Wetted Perimeter	30.8
Width/Depth Ratio	8.1
Flood Prone Width	46.9
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0038
Manning's n	0.028
Velocity (ft./s)	6.74
Froud #	0.69
Discharge (cu ft/s)	612.68
Shear Stress (lb/sq ft)	0.70
CX Power (ft lb/s)	145.3
Critical Size (mm)	58.8
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek - Cross Section 8-1 @ STA. 170

REACH ID:	**LMC 8-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:	(yes = 1, no =		0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			93.9
Water Surface Elev. (from Column M)			90.6

check

Adj. Readng
(Rci)
R+TPc
& Camline

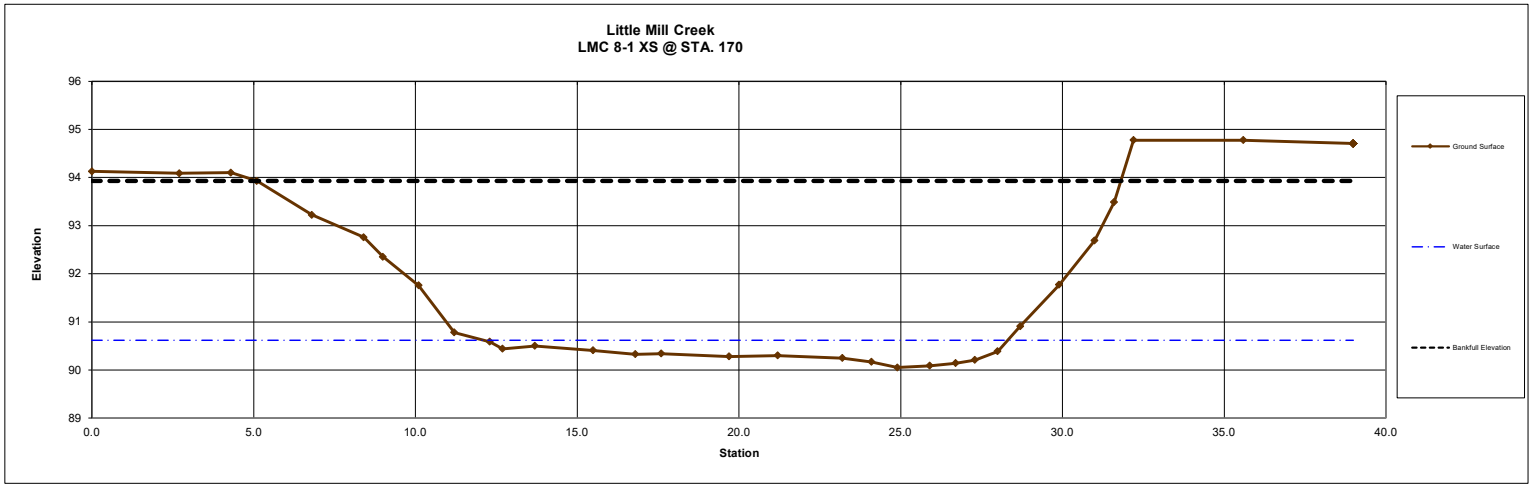
Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	93.93	Slope (ft/ft)	0.00867	L.Pin Sta.	0.0
B. Width =	26.7	Mannings "n"	0.028	R.Pin Sta.	39.0
W/d =	9.34	D84 (mm) measured	51.3	L.Pin Rod	94.13
F.P.Width	39.0	Velocity (ft/s) Manning's)	9.23	R.Pin Rod	94.7
Entrenchment	1.46	Velocity (ft/s) via. (U/U*)	8.44	Tape Angle (deg.	0.9
B. Area =	76.4	Froud #	1.02		
B. Depth=	2.86	Discharge (cu ft/s)	704.88	Rc Meas.	
Max Depth	3.88	Shear Stress (lb/sq ft)	1.38	Chord	
W. Per=	29.9	CX Power (ft lb/s)	381.3	m	
H.Radius=	2.55	CX Power (watts)	517.1	Rc Calc.	
SS L Bank* =	0.69	Critical size (mm)	122.3	Rc/B. Width**	
SS R Bank* =	0.94	D84 predicted (mm)	17.8		
Shape Factor:	0.29	Flow Type	Supercritical Flow		

*Based on $HRad_{bb(\text{within the nearest 1/3 of Wbf})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr.	Test 1	Entr Tst 2	FP Pa Sta	FP Width X R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	5.87	Next to Pin	5.87	94.13	5.87	0.00	0	0	0.00	2.70		0		
2.7	2.7	5.91		5.91	94.1	5.91	0.00	0	0	0.00	1.60	0.0	0		Above B F
4.3	4.3	5.90		5.90	94.1	5.91	0.00	0	0	0.00	0.80	0.0	0		Above B F
5.1	5.1	6.07	L-TOB	6.07	93.9	6.07	1.70	0	0	0.00	1.70	0.0	0		Within B F
6.8	6.8	6.78		6.78	93.2	6.78	1.60	0	0	0.00	1.60	0.6	0		Within B F
8.4	8.4	7.24		7.24	92.8	7.24	0.60	0	0	0.00	0.60	1.5	0		Within B F
9.0	9.0	7.65		7.65	92.4	7.65	1.10	0	0	0.00	1.10	0.8	0		Within B F
10.1	10.1	8.24		8.24	91.8	8.24	1.10	0	0	0.00	1.10	2.1	0		Within B F
11.2	11.2	9.22		9.22	90.8	9.22	1.10	0	0	0.00	1.10	2.9	0		Within B F
12.3	12.3	9.41		9.41	90.6	9.41	0.40	0	0	0.00	0.40	3.6	0		Within B F
12.7	12.7	9.56		9.56	90.4	9.56	1.00	0	0	0.00	1.00	1.4	0		Within B F
13.7	13.7	9.50		9.50	90.5	9.56	1.80	0	0	0.00	1.80	3.5	0.17		Within B F
15.5	15.5	9.59	L-EOW	9.59	90.4	9.59	1.30	0	0	0.00	1.30	6.3	0.00		Within B F
16.8	16.8	9.67		9.67	90.3	9.67	0.80	0	0	0.00	0.80	4.6	0.00		Within B F
17.6	17.6	9.66		9.66	90.3	9.67	2.10	0	0	0.00	2.10	2.9	0.00		Within B F
19.7	19.7	9.72		9.72	90.3	9.72	1.50	0	0	0.00	1.50	7.6	0.00		Within B F
21.2	21.2	9.70		9.70	90.3	9.72	2.00	0	0	0.00	2.00	5.5	0.00		Within B F
23.2	23.2	9.75		9.75	90.3	9.75	0.90	0	0	0.00	0.90	7.3	0.00		Within B F
24.1	24.1	9.83		9.83	90.2	9.83	0.80	0	0	0.00	0.80	3.3	0.00		Within B F
24.9	24.9	9.95		9.95	90.1	9.95	1.00	0	0	0.00	1.00	3.1	0.00		Within B F
25.9	25.9	9.91		9.91	90.1	9.95	0.80	0	0	0.00	0.80	3.9	0.00		Within B F
26.7	26.7	9.86		9.86	90.1	9.95	0.60	0	0	0.00	0.60	3.1	0.00		Within B F
27.3	27.3	9.79		9.79	90.2	9.95	0.70	0	0	0.00	0.70	2.3	0.00		Within B F
28.0	28.0	9.61	R-EOW	9.61	90.4	9.95	0.70	0	0	0.00	0.70	2.5	0.00		Within B F
28.7	28.7	9.09		9.09	90.9	9.95	1.20	0	0	0.00	1.20	2.3	0.00		Within B F
29.9	29.9	8.23		8.23	91.8	9.95	1.10	0	0	0.00	1.10	3.1	0.00		Within B F
31.0	31.0	7.31		7.31	92.7	9.95	0.60	0	0	0.00	0.60	1.9	0.00		Within B F
31.6	31.6	6.51		6.51	93.5	9.95	0.20	0	0	0.00	0.60	0.5	0.00		Within B F
32.2	32.2	5.22	R-TOB	5.22	94.8	9.95	0.00	0	0	0.00	3.40	0.0	0.00		Above B F
35.6	35.6	5.22		5.22	94.8	9.95	0.00	0	0	0.00	3.40	0.0	0.00		Above B F
39.0	39.0	5.29	Next to Pin	5.29	94.7	9.95	0.00	0	0	0.00	0.00	0.0	0.00		Above B F
39.0	39.0	5.29		5.29	94.7	9.95	0.00	0	0	0.00	0.00	0.0	0.00		Above B F
39.0				0.00	94.7										
39.0				0.00	94.7										



Scale

0 0.5 1

INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	93.93
Bank Full Width	26.70
Bank Full Depth	2.86
Maximum Depth	3.88
Bank Full Area	76.4
Hydraulic Radius	2.55
Wetted Perimeter	29.9
Width/Depth Ratio	9.3
Flood Prone Width	39.0
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0087
Manning's n	0.028
Velocity (ft./s)	9.23
Froud #	1.02
Discharge (cu ft/s)	704.9
Shear Stress (lb/sq ft)	1.38
CX Power (ft lb/s)	381.3
Critical Size (mm)	122.3
Flow Type	Supercritical Flow
Rec. Interval	

Little Mill Creek - Cross Section 9-1 @ STA. 105

REACH ID:	**LMC 9-1**		**Date: 12/21/21**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			93.4
Water Surface Elev. (from Column M)			90.2

Adj. Readng
(Rci)
R+TPc
& Camline

Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	93.43	Slope (ft/ft)	0.003	L.Pin Sta.	0.0
B. Width =	27.5	Mannings "n"	0.029	R.Pin Sta.	55.3
W/d =	10.84	D84 (mm) measured	51.3	L.Pin Rod	93.52
F.P.Width	55.3	Velocity (ft/s) Manning's)	4.70	R.Pin Rod	94.1
check Entrenchment	2.01	Velocity (ft/s) via. (U/U*)	4.42	Tape Angle (deg	0.6
B. Area =	69.8	Froud #	0.56		
B. Depth=	2.54	Discharge (cu ft/s)	327.6	Rc Meas.	
Max Depth	3.65	Shear Stress (lb/sq ft)	0.40	Chord	
W. Per=	32.2	CX Power (ft lb/s)	61.3	m	
H.Radius=	2.16	CX Power (watts)	83.1	Rc Calc.	
SS L Bank* =	0.79	Critical size (mm)	32.6	Rc/B. Width**	
SS R Bank* =	0.79	D84 predicted (mm)	19.1		
Shape Factor:	0.26	Flow Type	Subcritical Flow		

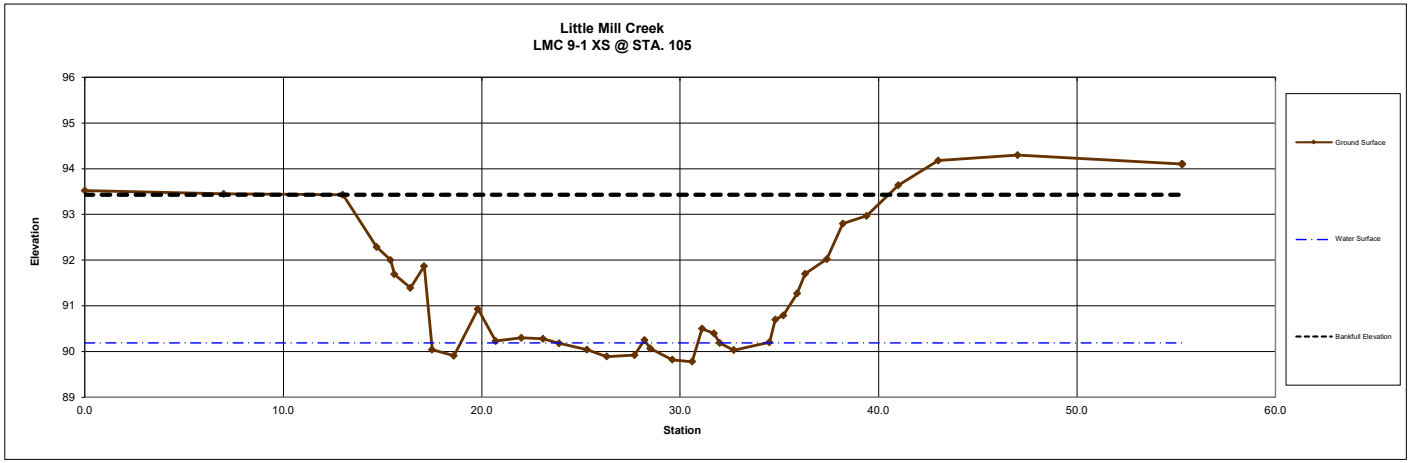
*Based on $HRad_{lb(\text{within the nearest 1/3 of Wtd})}$ / $HRad_{bf}$

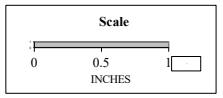
**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I
0.0	0.0	6.48	Next to Pin	6.48	93.52
7.0	7.0	6.55		6.55	93.5
13.0	13.0	6.57	L-TOB	6.57	93.4
14.7	14.7	7.71		7.71	92.3
15.4	15.4	8.00		8.00	92.0
15.6	15.6	8.31		8.31	91.7
16.4	16.4	8.61		8.61	91.4
17.1	17.1	8.13		8.13	91.9
17.5	17.5	9.96	L-EOW	9.96	90.0
18.6	18.6	10.09		10.09	89.9
19.8	19.8	9.07	EOW	9.07	90.9
20.7	20.7	9.77		9.77	90.2
22.0	22.0	9.70		9.70	90.3
23.1	23.1	9.72		9.72	90.3
23.9	23.9	9.82	EOW	9.82	90.2
25.3	25.3	9.96		9.96	90.0
26.3	26.3	10.11		10.11	89.9
27.7	27.7	10.08		10.08	89.9
28.2	28.2	9.75	Rock	9.75	90.3
28.5	28.5	9.93		9.93	90.1
29.6	29.6	10.18		10.18	89.8
30.6	30.6	10.22		10.22	89.8
31.1	31.1	9.50	Rock	9.50	90.5
31.7	31.7	9.60		9.60	90.4
32.0	32.0	9.81		9.81	90.2
32.7	32.7	9.97		9.97	90.0
34.5	34.5	9.80	R-EOW	9.80	90.2
34.8	34.8	9.30		9.30	90.7
35.2	35.2	9.21		9.21	90.8
35.9	35.9	8.73		8.73	91.3
36.3	36.3	8.30		8.30	91.7
37.4	37.4	7.98		7.98	92.0
38.2	38.2	7.20		7.20	92.8
39.4	39.4	7.03		7.03	93.0
41.0	41.0	6.36		6.36	93.6
43.0	43.0	5.82		5.82	94.2
47.0	47.0	5.70		5.70	94.3
55.3	55.3	5.90	Next to Pin	5.90	94.1

Max Rod perimeter		Entr. Test 1	Entr Tst 2	FP Sta	FP P: X R	FP Width Bnk	Area (old)	Partial LNB	Se	Invert Segment is:
6.48	0.00	0	0	0.00	7.00			0		
6.55	0.00	0	0	0.00	6.00	0.0	0	0		Above B F
6.57	1.70	0	0	0.00	1.70	0.0	0	0		Within B F
7.71	0.70	0	0	0.00	0.70	1.0	0	0		Within B F
8.00	0.20	0	0	0.00	0.20	0.9	0	0		Within B F
8.31	0.80	0	0	0.00	0.80	0.3	0	0		Within B F
8.61	0.70	0	0	0.00	0.70	1.5	0	0		Within B F
8.61	0.40	0	0	0.00	0.40	1.3	0	0		Within B F
9.96	1.10	0	0	0.00	1.10	1.0	0	0		Within B F
10.09	1.20	0	0	0.00	1.20	3.8	0	0		Within B F
10.09	0.90	0	0	0.00	0.90	3.6	0	0		Within B F
10.09	1.30	0	0	0.00	1.30	2.6	0	0		Within B F
10.09	1.10	0	0	0.00	1.10	4.1	0.15	0		Within B F
10.09	0.80	0	0	0.00	0.80	3.5	0.00	0		Within B F
10.09	1.40	0	0	0.00	1.40	2.6	0.00	0		Within B F
10.09	1.00	0	0	0.00	1.00	4.6	0.00	0		Within B F
10.11	1.40	0	0	0.00	1.40	3.5	0.00	0		Within B F
10.11	0.50	0	0	0.00	0.50	4.9	0.00	0		Within B F
10.11	0.30	0	0	0.00	0.30	1.7	0.00	0		Within B F
10.11	1.10	0	0	0.00	1.10	1.0	0.00	0		Within B F
10.18	1.00	0	0	0.00	1.00	3.8	0.00	0		Within B F
10.22	0.50	0	0	0.00	0.50	3.6	0.00	0		Within B F
10.22	0.60	0	0	0.00	0.60	1.6	0.00	0		Within B F
10.22	0.30	0	0	0.00	0.30	1.8	0.00	0		Within B F
10.22	0.70	0	0	0.00	0.70	0.9	0.00	0		Within B F
10.22	1.80	0	0	0.00	1.80	2.3	0.00	0		Within B F
10.22	0.30	0	0	0.00	0.30	6.0	0.00	0		Within B F
10.22	0.40	0	0	0.00	0.40	0.9	0.00	0		Within B F
10.22	0.70	0	0	0.00	0.70	1.1	0.00	0		Within B F
10.22	0.40	0	0	0.00	0.40	1.7	0.00	0		Within B F
10.22	1.10	0	0	0.00	1.10	0.8	0.00	0		Within B F
10.22	0.80	0	0	0.00	0.80	1.7	0.00	0		Within B F
10.22	1.20	0	0	0.00	1.20	0.8	0.00	0		Within B F
10.22	1.10	0	0	0.00	1.60	0.7	0.00	0		Within B F
10.22	0.00	0	0	0.00	2.00	0.2	0.00	0		Above B F
10.22	0.00	0	0	0.00	4.00	0.0	0.00	0		Above B F
10.22	0.00	0	0	0.00	8.30	0.0	0.00	0		Above B F
10.22	0.00	0	0	0.00	0.00	0.0	0.00	0		Above B F





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	93.43
Bank Full Width	27.50
Bank Full Depth	2.54
Maximum Depth	3.65
Bank Full Area	69.8
Hydraulic Radius	2.16
Wetted Perimeter	32.2
Width/Depth Ratio	10.8
Flood Prone Width	55.3
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0030
Manning's n	0.029
Velocity (ft./s)	4.70
Froud #	0.56
Discharge (cu ft/s)	327.6
Shear Stress (lb/sq ft)	0.40
CX Power (ft lb/s)	61.3
Critical Size (mm)	32.6
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek Trib 1- Cross Section 1-1 @ STA. 109.5

REACH ID:	**UT1 1-1**		**Date: 01/18/2022**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			93.2
Water Surface Elev. (from Column M)			90.6

Adj. Readng
(Rci)
R+TPc
& Camline

Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	93.24	Slope (ft/ft)	0.00493	L.Pin Sta.	0.0
B. Width =	20.2	Mannings "n"	0.028	R.Pin Sta.	45.0
W/d =	10.01	D84 (mm) measured	38.1	L.Pin Rod	95.22
F.P.Width	45.0	Velocity (ft/s) Manning's)	5.46	R.Pin Rod	95.1
Entrenchment	2.23	Velocity (ft/s) via. (U/U*)	5.24	Tape Angle (deg.	0.2
B. Area =	40.6	Froud #	0.72		
B. Depth=	2.01	Discharge (cu ft/s)	221.66	Rc Meas.	
Max Depth	2.87	Shear Stress (lb/sq ft)	0.55	Chord	
W. Per=	22.9	CX Power (ft lb/s)	68.2	m	
H.Radius=	1.77	CX Power (watts)	92.5	Rc Calc.	
SS L Bank* =	1.08	Critical size (mm)	44.9	Rc/B. Width**	
SS R Bank* =	0.44	D84 predicted (mm)	12.5		
Shape Factor:	0.28	Flow Type	Subcritical Flow		

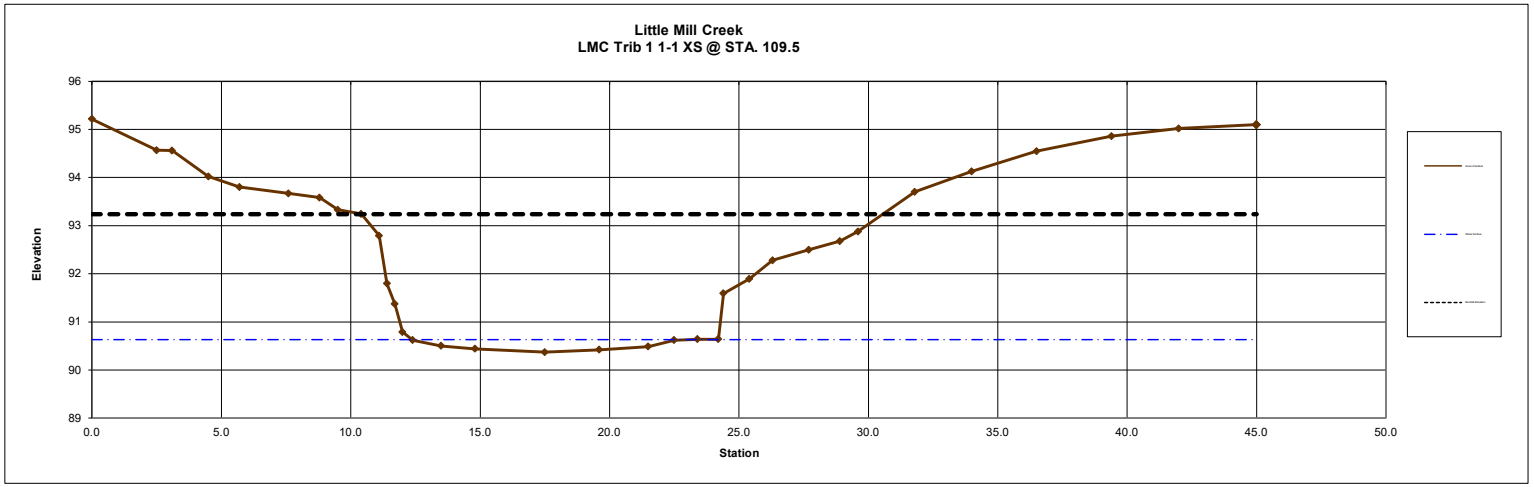
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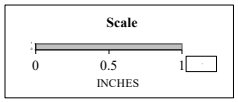
*Based on $HRad_{bb(within\ the\ nearest\ 1/3\ of\ Wbf)}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I	Max Rod perimeter	BF Width	Entr. Test 1	Entr Tst 2	FP Pa Sta X	FP Width R Bnk	Area (old)	Partial LNB Se	Invert Segment is:
0.0	0.0	4.78	Next to Pin	4.78	95.22	4.78	0.00	0	0	0.00	2.50		0	
2.5	2.5	5.43		5.43	94.6	5.43	0.00	0	0	0.00	0.60	0.0	0	Above B F
3.1	3.1	5.44		5.44	94.6	5.44	0.00	0	0	0.00	1.40	0.0	0	Above B F
4.5	4.5	5.98		5.98	94.0	5.98	0.00	0	0	0.00	1.20	0.0	0	Above B F
5.7	5.7	6.20		6.20	93.8	6.20	0.00	0	0	0.00	1.90	0.0	0	Above B F
7.6	7.6	6.33		6.33	93.7	6.33	0.00	0	0	0.00	1.20	0.0	0	Above B F
8.8	8.8	6.42		6.42	93.6	6.42	0.00	0	0	0.00	0.70	0.0	0	Above B F
9.5	9.5	6.67		6.67	93.3	6.67	0.00	0	0	0.00	0.90	0.0	0	Above B F
10.4	10.4	6.76		6.76	93.2	6.76	0.70	0	0	0.00	0.70	0.0	0	Within B F
11.1	11.1	7.21		7.21	92.8	7.21	0.30	0	0	0.00	0.30	0.2	0	Within B F
11.4	11.4	8.20		8.20	91.8	8.20	0.30	0	0	0.00	0.30	0.3	0	Within B F
11.7	11.7	8.63		8.63	91.4	8.63	0.30	0	0	0.00	0.30	0.5	0	Within B F
12.0	12.0	9.21		9.21	90.8	9.21	0.40	0	0	0.00	0.40	0.6	0	Within B F
12.4	12.4	9.38	EOW	9.38	90.6	9.38	1.10	0	0	0.00	1.10	1.0	0	Within B F
13.5	13.5	9.50		9.50	90.5	9.50	1.30	0	0	0.00	1.30	2.9	0	Within B F
14.8	14.8	9.56		9.56	90.4	9.56	2.70	0	0	0.00	2.70	3.6	0.86	Within B F
17.5	17.5	9.63		9.63	90.4	9.63	2.10	0	0	0.00	2.10	7.7	0.00	Within B F
19.6	19.6	9.58		9.58	90.4	9.63	1.90	0	0	0.00	1.90	6.0	0.00	Within B F
21.5	21.5	9.51		9.51	90.5	9.63	1.00	0	0	0.00	1.00	5.3	0.00	Within B F
22.5	22.5	9.38		9.38	90.6	9.63	0.90	0	0	0.00	0.90	2.7	0.00	Within B F
23.4	23.4	9.36	EOW	9.36	90.6	9.63	0.80	0	0	0.00	0.80	2.3	0.00	Within B F
24.2	24.2	9.36		9.36	90.6	9.63	0.20	0	0	0.00	0.20	2.1	0.00	Within B F
24.4	24.4	8.41		8.41	91.6	9.63	1.00	0	0	0.00	1.00	0.4	0.00	Within B F
25.4	25.4	8.11		8.11	91.9	9.63	0.90	0	0	0.00	0.90	1.5	0.00	Within B F
26.3	26.3	7.72		7.72	92.3	9.63	1.40	0	0	0.00	1.40	1.0	0.00	Within B F
27.7	27.7	7.50		7.50	92.5	9.63	1.20	0	0	0.00	1.20	1.2	0.00	Within B F
28.9	28.9	7.32		7.32	92.7	9.63	0.70	0	0	0.00	0.70	0.8	0.00	Within B F
29.6	29.6	7.12		7.12	92.9	9.63	0.97	0	0	0.00	2.20	0.3	0.00	Within B F
31.8	31.8	6.30		6.30	93.7	9.63	0.00	0	0	0.00	2.20	0.0	0.00	Above B F
34.0	34.0	5.87		5.87	94.1	9.63	0.00	0	0	0.00	2.50	0.0	0.00	Above B F
36.5	36.5	5.45		5.45	94.6	9.63	0.00	0	0	0.00	2.90	0.0	0.00	Above B F
39.4	39.4	5.14		5.14	94.9	9.63	0.00	0	0	0.00	2.60	0.0	0.00	Above B F
42.0	42.0	4.98		4.98	95.0	9.63	0.00	0	0	0.00	3.00	0.0	0.00	Above B F
45.0	45.0	4.90	Next to Pin	4.90	95.1	9.63	0.00	0	0	0.00	0.00	0.0	0.00	Above B F





Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	93.24
Bank Full Width	20.17
Bank Full Depth	2.01
Maximum Depth	2.87
Bank Full Area	40.6
Hydraulic Radius	1.77
Wetted Perimeter	22.9
Width/Depth Ratio	10.0
Flood Prone Width	45.0
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0049
Manning's n	0.028
Velocity (ft./s)	5.46
Froud #	0.72
Discharge (cu ft/s)	221.7
Shear Stress (lb/sq ft)	0.55
CX Power (ft lb/s)	68.2
Critical Size (mm)	44.9
Flow Type	Subcritical Flow
Rec. Interval	

Little Mill Creek Trib 1- Cross Section 2-1 @ STA. 181

REACH ID:	**UT1 2-1**		**Date: 01/18/2022**
Reference Base Elevation:			100
Enter Rod Reading at Base Elevation:			0
Diagonal Camline Used:		(yes = 1, no =	0
Convert English(0) to Metric (1):			0
Bankfull Elev. (from Column M)			93.7
Water Surface Elev. (from Column M)			90.8

check

Adj. Readng
(Rci)
R+TPc
& Camline

Geometry (English Units)		**Hydraulics** (English Units)		**Other**	
B elev =	93.70	Slope (ft/ft)	0.00493	L.Pin Sta.	0.0
B. Width =	22.9	Mannings "n"	0.028	R.Pin Sta.	53.0
W/d =	9.06	D84 (mm) measured	38.1	L.Pin Rod	94.76
F.P.Width	53.0	Velocity (ft/s) Manning's)	6.18	R.Pin Rod	94.8
Entrenchment	2.32	Velocity (ft/s) via. (U/U*)	6.02	Tape Angle (deg.	0.0
B. Area =	57.7	Froud #	0.75		
B. Depth=	2.52	Discharge (cu ft/s)	356.94	Rc Meas.	
Max Depth	3.44	Shear Stress (lb/sq ft)	0.66	Chord	
W. Per=	27.0	CX Power (ft lb/s)	109.8	m	
H.Radius=	2.14	CX Power (watts)	148.9	Rc Calc.	
SS L Bank* =	0.66	Critical size (mm)	54.9	Rc/B. Width**	
SS R Bank* =	0.93	D84 predicted (mm)	15.7		
Shape Factor:	0.28	Flow Type	Subcritical Flow		

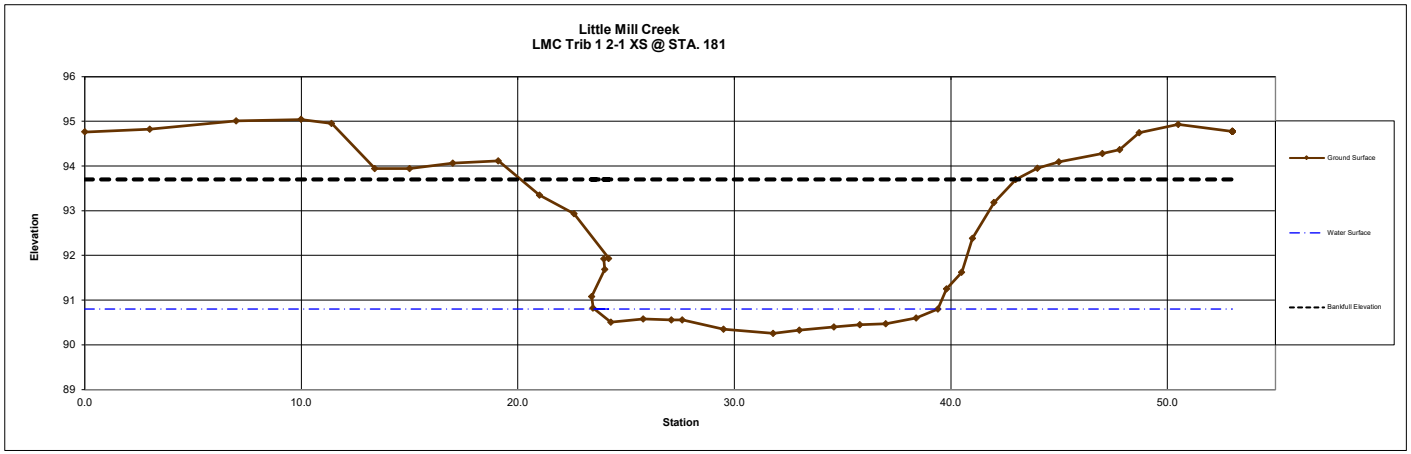
*Based on $HRad_{bf(\text{within the nearest 1/3 of W/d})}$ / $HRad_{bf}$

**Based on entry in *Rc Meas*.

Rod Readings

Station (ft) Horiz. Adj.	Station (ft) Raw	Invert (I)	Notes	Adj. Rod Invert	Elev I
0.0	0.0	5.24		5.24	94.76
3.0	3.0	5.18		5.18	94.8
7.0	7.0	4.99		4.99	95.0
10.0	10.0	4.96		4.96	95.0
11.4	11.4	5.05		5.05	95.0
13.4	13.4	6.06		6.06	93.9
15.0	15.0	6.06		6.06	93.9
17.0	17.0	5.94		5.94	94.1
19.1	19.1	5.89		5.89	94.1
21.0	21.0	6.65		6.65	93.4
22.6	22.6	7.07	TOB	7.07	92.9
24.2	24.2	8.07		8.07	91.9
24.0	24.0	8.08	toe pin	8.08	91.9
24.0	24.0	8.31		8.31	91.7
23.4	23.4	8.92		8.92	91.1
23.5	23.5	9.18		9.18	90.8
24.3	24.3	9.49		9.49	90.5
25.8	25.8	9.42		9.42	90.6
27.1	27.1	9.44		9.44	90.6
27.6	27.6	9.44		9.44	90.6
29.5	29.5	9.65		9.65	90.4
31.8	31.8	9.74		9.74	90.3
33.0	33.0	9.67		9.67	90.3
34.6	34.6	9.60		9.60	90.4
35.8	35.8	9.55		9.55	90.5
37.0	37.0	9.53		9.53	90.5
38.4	38.4	9.40		9.40	90.6
39.4	39.4	9.20		9.20	90.8
39.8	39.8	8.75	EOW	8.75	91.3
40.5	40.5	8.38		8.38	91.6
41.0	41.0	7.62		7.62	92.4
42.0	42.0	6.82		6.82	93.2
43.0	43.0	6.30		6.30	93.7
44.0	44.0	6.05		6.05	94.0
45.0	45.0	5.91		5.91	94.1
47.0	47.0	5.72		5.72	94.3
47.8	47.8	5.64		5.64	94.4
48.7	48.7	5.26		5.26	94.7
50.5	50.5	5.07		5.07	94.9
53.0	53.0	5.23		5.23	94.8

i	Max Rod perimeter	BF Width	Entr.	Test 1	Entr Tst 2	FP P& Sta	FP X R	FP Width Bnk	Area (old)	Partial LNB Se	Invert Segment is:
	5.24	0.00	0	0		0.00		3.00		0	
	5.24	0.00	0	0		0.00		4.00	0.0	0	Above B F
	5.24	0.00	0	0		0.00		3.00	0.0	0	Above B F
	5.24	0.00	0	0		0.00		1.40	0.0	0	Above B F
	5.24	0.00	0	0		0.00		2.00	0.0	0	Above B F
	6.06	0.00	0	0		0.00		1.60	0.0	0	Above B F
	6.06	0.00	0	0		0.00		2.00	0.0	0	Above B F
	6.06	0.00	0	0		0.00		2.10	0.0	0	Above B F
	6.06	0.87	0	0		0.00		1.90	0.0	0	Within B F
	6.65	1.60	0	0		0.00		1.60	0.0	0	Within B F
	7.07	1.60	0	0		0.00		1.60	0.9	0	Within B F
	8.07	-0.23	0	0		0.00		-0.23	2.0	0	Within B F
	8.08	0.05	0	0		0.00		0.05	0.4	0	Within B F
	8.31	-0.61	0	0		0.00		-0.61	0.1	0	Within B F
	8.92	0.07	0	0		0.00		0.07	1.4	0	Within B F
	9.18	0.82	0	0		0.00		0.82	0.2	0	Within B F
	9.49	1.50	0	0		0.00		1.50	2.5	0	Within B F
	9.49	1.30	0	0		0.00		1.30	4.7	0	Within B F
	9.49	0.50	0	0		0.00		0.50	4.1	0	Within B F
	9.49	1.90	0	0		0.00		1.90	1.6	0.08	Within B F
	9.65	2.30	0	0		0.00		2.30	6.2	0.00	Within B F
	9.74	1.20	0	0		0.00		1.20	7.8	0.00	Within B F
	9.74	1.60	0	0		0.00		1.60	4.1	0.00	Within B F
	9.74	1.20	0	0		0.00		1.20	5.3	0.00	Within B F
	9.74	1.20	0	0		0.00		1.20	3.9	0.00	Within B F
	9.74	1.40	0	0		0.00		1.40	3.9	0.00	Within B F
	9.74	1.00	0	0		0.00		1.00	4.4	0.00	Within B F
	9.74	0.40	0	0		0.00		0.40	3.0	0.00	Within B F
	9.74	0.70	0	0		0.00		0.70	1.1	0.00	Within B F
	9.74	0.50	0	0		0.00		0.50	1.6	0.00	Within B F
	9.74	1.00	0	0		0.00		1.00	0.8	0.00	Within B F
	9.74	1.00	0	0		0.00		1.00	0.9	0.00	Within B F
	9.74	0.00	0	0		0.00		1.00	0.3	0.00	Above B F
	9.74	0.00	0	0		0.00		1.00	0.0	0.00	Above B F
	9.74	0.00	0	0		0.00		2.00	0.0	0.00	Above B F
	9.74	0.00	0	0		0.00		0.80	0.0	0.00	Above B F
	9.74	0.00	0	0		0.00		0.90	0.0	0.00	Above B F
	9.74	0.00	0	0		0.00		1.80	0.0	0.00	Above B F
	9.74	0.00	0	0		0.00		2.50	0.0	0.00	Above B F
	9.74	0.00	0	0		0.00		0.00	0.0	0.00	Above B F



Scale
0 0.5 1
INCHES

Note: Scale set for print and view magnification at 65%

Plot Scale		
1inch =		feet horiz.
1inch =		feet vert.

English Units

GEOMETRY	
Bank Full Elevation	93.70
Bank Full Width	22.87
Bank Full Depth	2.52
Maximum Depth	3.44
Bank Full Area	57.7
Hydraulic Radius	2.14
Wetted Perimeter	27.0
Width/Depth Ratio	9.1
Flood Prone Width	53.0
Entrenchment	
Stream Type	F4/C4
Rc	

English Units

HYDRAULICS	
Slope (ft/ft)	0.0049
Manning's n	0.028
Velocity (ft./s)	6.18
Froud #	0.75
Discharge (cu ft/s)	356.9
Shear Stress (lb/sq ft)	0.66
CX Power (ft lb/s)	109.8
Critical Size (mm)	54.9
Flow Type	Subcritical Flow
Rec. Interval	

BEHI Bank Height values

			A		B	A/B
Bank	Top Bank elev.	Bottom Elev.	**Bank Height**	Bankfull Elev.	**Bankfull Height**	**Bank/ Bankfull**
1-1 L	94.07	90.23	**3.84**	92.171	**1.94**	**1.98**
1-1 R	92.57	89.54	**3.03**	92.171	**2.63**	**1.15**
2-1 L	95.31	91.32	**3.99**	92.372	**1.05**	**3.79**
2-1 R	94.77	90.76	**4.01**	92.372	**1.61**	**2.49**
3-1 L	95.18	90.1	**5.08**	92.453	**2.35**	**2.16**
3-1 R	94.2	90.77	**3.43**	92.453	**1.68**	**2.04**
4-1 L	94.31	90.71	**3.6**	92.692	**1.98**	**1.82**
4-1 R	94.97	90.5	**4.47**	92.692	**2.19**	**2.04**
5-1 L	94.32	89.26	**5.06**	91.3384	**2.08**	**2.43**
5-1 R	93.11	89.26	**3.85**	91.3384	**2.08**	**1.85**
6-1 L	94.33	89.74	**4.59**	92.4	**2.66**	**1.73**
6-1 R	94.59	89.69	**4.90**	92.4	**2.71**	**1.81**
7-1 L	92.09	90.13	**1.96**	91.979	**1.85**	**1.06**
7-1 R	94.31	89.9	**4.41**	91.979	**2.08**	**2.12**
8-1 L	94.1	90.44	**3.66**	92.4783	**2.04**	**1.80**
8-1 R	94.78	90.39	**4.39**	92.4783	**2.09**	**2.10**
9-1 L	93.43	90.04	**3.39**	93.034	**2.99**	**1.13**
9-1 R	94.18	90.2	**3.98**	93.034	**2.83**	**1.40**
10-1 L	94.41	88.53	**5.88**	91.83	**3.30**	**1.78**
10-1 R	94.18	89.54	**4.64**	91.83	**2.29**	**2.03**
11-1 L	88.12	84.08	**4.04**	87.88	**3.80**	**1.06**
11-1 R	87.9	84.2	**3.7**	87.88	**3.68**	**1.01**
UT 1-1 L	93.24	90.62	**2.62**	92.536	**1.92**	**1.37**
UT 1-1 R	93.7	90.64	**3.06**	92.536	**1.90**	**1.61**
UT 2-1 L	94.11	90.51	**3.6**	91.7826	**1.27**	**2.83**
UT 2-1 R	93.7	90.8	**2.9**	91.7826	**0.98**	**2.95**

NBSS Worksheets Method 5

NB Low Elev	NB Max D	Mean depth	Ratio	Adj Rating	Mean Bkfl Depth (RE)	Ratio with RE	Adj Rating
89.64	2.53	1.66	1.52	moderate	1.462	1.73	moderate
89.43	2.74	1.66	1.65	moderate	1.462	1.87	high
90.98	1.39	1.43	0.97	very low	1.466	0.95	very low
90.41	1.96	1.43	1.37	low	1.466	1.34	low
90.06	2.39	1.8	1.33	low	1.47	1.63	moderate
90.58	1.87	1.47	1.27	low	1.47	1.27	low
90.50	2.19	2.09	1.05	low	1.473	1.49	low
90.13	2.56	2.09	1.23	low	1.473	1.74	moderate
89.10	2.24	2.08	1.08	low	1.683	1.33	low
88.98	2.36	2.08	1.13	low	1.683	1.40	low
89.66	2.74	2.45	1.12	low	1.692	1.62	moderate
89.29	3.11	2.45	1.27	low	1.692	1.84	high
89.85	2.13	1.69	1.26	low	1.701	1.25	low
89.9	2.08	1.69	1.23	low	1.701	1.22	low
90.41	2.07	1.87	1.11	low	1.71	1.21	low
90.05	2.43	1.87	1.30	low	1.71	1.42	low
89.91	3.12	2.28	1.37	low	1.72	1.82	high
89.78	3.25	2.28	1.43	low	1.72	1.89	high
87.53	4.30	2.98	1.44	low	1.728	2.49	high
88.74	3.09	2.98	1.04	low	1.728	1.79	moderate
83.64	4.24	3.25	1.30	low	1.737	2.44	high
84.2	3.68	3.25	1.13	low	1.737	2.12	high
90.44	2.10	1.64	1.28	low	1.073	1.95	high
90.49	2.05	1.64	1.25	low	1.073	1.91	high
90.51	1.27	1.29	0.99	very low	1.076	1.18	low
90.45	1.33	1.29	1.03	low	1.076	1.24	low

NBSS Worksheets Method 6

NB Max D	Near-Bank Slope	Near-Bank Shear Stress	Mean Depth	Average Slope	Shear Stress	Ratio		Mean Bkfl Depth (RE)	Shear Stress	Ratio	
2.53	0.0016077	0.253914	1.66	0.00277	0.28692768	0.8849402	low	1.462	0.2527038	1.00	low
2.74	0.0016077	0.274981	1.66	0.00277	0.28692768	0.9583647	low	1.462	0.2527038	1.09	moderate
1.39	0.003314	0.287857	1.43	0.0064	0.5710848	0.5040527	very low	1.466	0.5854618	0.49	very low
1.96	0.003314	0.405729	1.43	0.0064	0.5710848	0.7104536	very low	1.466	0.5854618	0.69	very low
2.39			1.8					1.47			
1.87			1.47					1.47			
2.19	0.00216	0.295447	2.09	0.00305	0.3977688	0.7427594	very low	1.473	0.2803414	1.05	low
2.56			2.09					1.473			
2.24	0.0223077	3.115853	2.08	0.002937	0.38116132	8.1746302	extreme	1.683	0.3084108	10.10	extreme
2.36	0.0223077	3.282893	2.08	0.002937	0.38116132	8.6128698	extreme	1.683	0.3084108	10.64	extreme
2.74	0.0045263	0.773891	2.45	0.002048	0.31303597	2.4722123	extreme	1.692	0.2161865	3.58	extreme
3.11	0.0045263	0.878395	2.45	0.002048	0.31303597	2.8060512	extreme	1.692	0.2161865	4.06	extreme
Backwatered											
Backwatered											
2.07	0.0074074	0.956014	1.87	0.004093	0.47764567	2.0015134	extreme	1.71	0.4367776	2.19	extreme
2.43	0.0074074	1.122414	1.87	0.004093	0.47764567	2.3498888	extreme	1.71	0.4367776	2.57	extreme
3.12	0.0125475	2.445985	2.28	0.00171	0.24324835	10.055505	extreme	1.72	0.1835031	13.33	extreme
3.25	0.0125475	2.547771	2.28	0.00171	0.24324835	10.473948	extreme	1.72	0.1835031	13.88	extreme
Backwatered											
Backwatered											
Backwatered											
Backwatered											
2.10	0.0095652	1.251039	1.64	0.00138	0.14122803	8.8582886	extreme	1.073	0.092401	13.54	extreme
2.05	0.0095652	1.221195	1.64	0.00138	0.14122803	8.6469745	extreme	1.073	0.092401	13.22	extreme
Pool											
Pool											

NBSS Worksheets Method 2

Radius of Curvature	Bankfull Width	Ratio	
36.1055	17.54	2.058466363	moderate
39.206133	18.11	2.164602578	moderate
63.133	21.93221075	2.878551584	low
53.78335	26.91083639	1.998575935	high

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 1-1 L | Date: 12/16/21 | Crew: JM

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 70 I: **4.9**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: 2.05 I: **7.9**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: 0.13 I: **8.1**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: 1.95 I: **10.0**	V: I: **0**	V: 5 I: **10.0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **40.9**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **40.9**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek Reach: 1-1 R Date: 12/16/21 Crew: JM

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: 1.15 I: **3.0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 80 I: **5.9**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: 0.17 I: **7.6**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: 2.48 I: **10.0**	V: I: **0**	V: 5 I: **10.0**
	V = Value, I = Index			**SUB-TOTAL** (Sum one index from each column):		**36.5**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **36.5**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 2-1 L | Date: 12/17/21 | Crew: JM, MD, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: 1 I: **1.0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: 60 I: **3.5**	V: I: **0**	V: 70 I: **2.7**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 65 I: **4.4**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: 3.79 I: **10.0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **21.6**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **21.6**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 2-1 R | Date: 12/17/21 | Crew: JM, MD, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.62 I: **3.3**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 75 I: **5.4**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: 28.05 I: **6.1**	V: I: **0**	V: 20 I: **7.2**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: 2.49 I: **8.6**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **30.6**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **30.6**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 3-1 L | Date: 12/17/21 | Crew: JM, MD, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: 0.39 I: **5.0**	V: I: **0**	V: 70 I: **4.9**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: 20 I: **7.2**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: 2.16 I: **8.1**	V: I: **0**	V: 7.87 I: **8.7**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **33.9**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **33.9**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 3-1 R | Date: 12/17/21 | Crew: JM, MD, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 45 I: **3.2**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: 50 I: **4.3**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: 2.04 I: **7.9**	V: 0.29 I: **6.0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: 8.75 I: **8.6**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **30.0**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **30.0**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 4-1 L | Date: 12/17/21 | Crew: JM, MD, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: 1.37 I: **5.0**	V: I: **0**	V: I: **0**	V: 80 I: **5.9**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: 0.28 I: **6.1**	V: I: **0**	V: I: **0**	V: 15 I: **7.9**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: 5.56 I: **8.9**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **33.8**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **33.8**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 4-1 R | Date: 12/17/21 | Crew: JM, MD, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: 0.45 I: **4.4**	V: I: **0**	V: I: **0**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: 2.04 I: **7.9**	V: I: **0**	V: I: **0**	V: 85 I: **6.8**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: 6.71 I: **8.8**	V: I: **0**	V: 10 I: **9.0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **37.0**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **37.0**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 5-1 L | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.89 I: **2.0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 75 I: **5.4**	V: 50 I: **4.3**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: 17.79 I: **7.5**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: 2.43 I: **8.5**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **27.7**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **27.7**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 5-1 R | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential		Bank Height (ft): / Bankfull Height (ft):	Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
	VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
		Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
		Choice	V: I: **0**	V: 1 I: **1.0**	V: I: **0**	V: I: **0**	V: I: **0**
	LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
		Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
		Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
	MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
		Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
		Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: 40 I: **5.1**
	HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
		Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
		Choice	V: 1.85 I: **7.2**	V: I: **0**	V: 25 I: **6.5**	V: 85 I: **6.8**	V: I: **0**
	VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
		Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
		Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
	EXTREME	Value	>2.8	<0.05	<5	>119	<10
		Index	10	10	10	10	10
		Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **26.7**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **26.7**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 6-1 L | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.87 I: **2.1**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: 43.57 I: **4.8**	V: 75 I: **5.4**	V: 50 I: **4.3**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: 1.73 I: **6.7**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
V = Value, I = Index				**SUB-TOTAL** (Sum one index from each column):		**23.3**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **23.3**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 6-1 R | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: 0.41 I: **4.8**	V: I: **0**	V: 80 I: **5.9**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: 1.81 I: **7.0**	V: I: **0**	V: I: **0**	V: I: **0**	V: 15 I: **7.9**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: 6.12 I: **8.9**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **34.5**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **34.5**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 7-1 L | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: 1.06 I: **1.5**	V: 1 I: **1.0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: 60 I: **3.5**	V: 30 I: **2.4**	V: 70 I: **2.7**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
V = Value, I = Index				**SUB-TOTAL** (Sum one index from each column):		**11.2**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **11.2**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek Reach: 7-1 R Date: 12/21/21 Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.57 I: **3.6**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 80 I: **5.9**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: 17 I: **7.6**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: 2.12 I: **8.1**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: 5 I: **10.0**

V = Value, I = Index **SUB-TOTAL** (Sum one index from each column): **35.2**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **35.2**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 8-1 L | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 50 I: **3.4**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: 0.32 I: **5.7**	V: I: **0**	V: I: **0**	V: 50 I: **4.3**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: 2.17 I: **8.2**	V: I: **0**	V: 8 I: **8.7**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **30.2**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **30.2**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 8-1 R | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: 1 I: **1.0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.57 I: **3.6**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: 17.08 I: **7.6**	V: 85 I: **6.8**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: 2.1 I: **8.1**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: 5 I: **10.0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **37.1**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **37.1**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 9-1 L | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: 1 I: **1.0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: 1.13 I: **2.5**	V: I: **0**	V: I: **0**	V: 50 I: **3.4**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: 50 I: **4.3**	V: I: **0**	V: 50 I: **4.3**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
V = Value, I = Index				**SUB-TOTAL** (Sum one index from each column):		**15.5**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **15.5**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 9-1 R | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential		Bank Height (ft): / Bankfull Height (ft):	Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
	VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
		Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
		Choice	V: I: **0**	V: 1 I: **1.0**	V: I: **0**	V: I: **0**	V: I: **0**
	LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
		Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
		Choice	V: I: **0**	V: I: **0**	V: 60 I: **3.5**	V: 35 I: **2.7**	V: I: **0**
	MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
		Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
		Choice	V: 1.4 I: **5.1**	V: I: **0**	V: I: **0**	V: I: **0**	V: 50 I: **4.3**
	HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
		Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
		Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
	VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
		Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
		Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
	EXTREME	Value	>2.8	<0.05	<5	>119	<10
		Index	10	10	10	10	10
		Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
	V = Value, I = Index				**SUB-TOTAL** (Sum one index from each column):		**16.6**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **16.6**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 10-1 L | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: 1.78 I: **6.9**	V: I: **0**	V: I: **0**	V: 85 I: **6.8**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: 0.09 I: **8.6**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: 1.7 I: **10.0**	V: I: **0**	V: 5 I: **10.0**
	V = Value, I = Index			**SUB-TOTAL** (Sum one index from each column):		**42.3**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **42.3**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 10-1 R | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: 1 I: **1.0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.75 I: **2.7**	V: I: **0**	V: I: **0**	V: 60 I: **3.5**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: 52.8 I: **4.1**	V: 75 I: **5.4**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: 2.03 I: **7.9**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
V = Value, I = Index				**SUB-TOTAL** (Sum one index from each column):		**24.5**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **24.5**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 11-1 L | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: 1.06 I: **1.5**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: 0.37 I: **5.2**	V: I: **0**	V: I: **0**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 85 I: **6.8**	V: 20 I: **7.2**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: 5.55 I: **8.9**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **29.7**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **29.7**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek | Reach: 6-1 R | Date: 12/21/21 | Crew: MD, ES

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: 1.01 I: **1.1**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 75 I: **5.4**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: 0.14 I: **8.0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: 2.03 I: **10.0**	V: I: **0**	V: 5 I: **10.0**

V = Value, I = Index

SUB-TOTAL (Sum one index from each column): **34.5**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **34.5**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek, Trib 1 Reach: UT 1-1 L Date: 1/18/22 Crew: MD, JM, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.57 I: **3.6**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: 1.37 I: **5.0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 85 I: **6.8**	V: 20 I: **7.2**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: 11.45 I: **8.3**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index **SUB-TOTAL** (Sum one index from each column): **30.9**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **30.9**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek, Trib 1 Reach: UT 1-1 R Date: 1/18/22 Crew: MD, JM, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: 0.33 I: **5.6**	V: I: **0**	V: I: **0**	V: 40 I: **5.1**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: 1.61 I: **6.2**	V: I: **0**	V: I: **0**	V: 90 I: **7.9**	V: I: **0**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: 11.44 I: **8.3**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index **SUB-TOTAL** (Sum one index from each column): **33.1**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **33.1**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek, Trib 1 Reach: UT 2-1 L Date: 1/18/22 Crew: MD, JM, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.56 I: **3.6**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 65 I: **4.4**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: 16.67 I: **7.7**	V: I: **0**	V: 15 I: **7.9**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: 2.83 I: **10.0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
V = Value, I = Index				**SUB-TOTAL** (Sum one index from each column):		**33.6**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **33.6**

Worksheet 21. Summary of Bank Erosion Hazard Index (BEHI)

BANK EROSION HAZARD GUIDE

Stream: Little Mill Creek, Trib 1 Reach: UT 2-1 R Date: 1/18/22 Crew: MD, JM, CU

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Height	Root Depth/ Bankfull Height	Root Density %	Bank Angle (Degrees)	Surface Protection %
VERY LOW	Value	1.0 - 1.1	1.0 - 0.9	100 - 80	0 - 20	100 - 80
	Index	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9	1.0 - 1.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
LOW	Value	1.11 - 1.19	0.89 - 0.50	79 - 55	21 - 60	79 - 55
	Index	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9	2.0 - 3.9
	Choice	V: I: **0**	V: 0.69 I: **3.0**	V: I: **0**	V: I: **0**	V: I: **0**
MODERATE	Value	1.2 - 1.5	0.49 - 0.30	54 - 30	61 - 80	54 - 30
	Index	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9	4.0 - 5.9
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: 80 I: **5.9**	V: I: **0**
HIGH	Value	1.6 - 2.0	0.29 - 0.15	29 - 15	81 - 90	29 - 15
	Index	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9	6.0 - 7.9
	Choice	V: I: **0**	V: I: **0**	V: 20.69 I: **7.1**	V: I: **0**	V: 15 I: **7.9**
VERY HIGH	Value	2.1 - 2.8	0.14 - 0.05	14 - 5	91 - 119	14 - 10
	Index	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0	8.0 - 9.0
	Choice	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: 2.95 I: **10.0**	V: I: **0**	V: I: **0**	V: I: **0**	V: I: **0**

V = Value, I = Index **SUB-TOTAL** (Sum one index from each column): **33.9**

Bank Material Description:

Bank Materials:

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: **0**

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: **0**

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: **33.9**

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 1-1 L **Date:** 12/16/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **Low**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.53	1.46	1.73	Moderate

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress
2.53	0.0016	0.25	1.46	0.0028	0.25	1.00	Low

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 1-1 R **Date:** 12/16/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

Dominant Near-Bank Stress: Moderate

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.74	1.46	1.87	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress
2.74	0.0016	0.27	1.46	0.0028	0.29	1.09	Moderate

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Moderate

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 2-1 L **Date:** 12/17/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (t_{nb}/t_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1) Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **Very Low**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
1.39	1.43	0.97	Very Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress
1.39	0.0033	0.29	1.43	0.0064	0.57	0.50	Very Low

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: Very Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 2-1 R **Date:** 12/17/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **Low**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
1.96	1.47	1.34	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress
1.96	0.0033	0.41	1.43	0.0064	0.57	0.71	Very Low

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 3-1 L **Date:** 12/17/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress
36.1	17.54	2.06	Moderate

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress
Moderate

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.39	1.47	1.63	Moderate

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating
Moderate

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 3-1 R **Date:** 12/17/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: Low

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
1.87	1.47	1.27	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 4-1 L **Date:** 12/17/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **Low**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.19	1.47	1.49	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress
2.19	0.00216	0.30	1.47	0.00305	0.28	1.05	Low

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 4-1 R **Date:** 12/17/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress
39.21	18.11	2.16	Moderate

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress
Moderate

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.56	1.47	1.74	Moderate

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating
Moderate

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 5-1 L **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: Low

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.24	1.68	1.33	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 5-1 R **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

Dominant Near-Bank Stress
Low

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.36	1.68	1.40	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating
Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 6-1 L **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

Dominant Near-Bank Stress: Moderate

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.74	1.69	1.62	Moderate

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Moderate

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 6-1 R **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

Dominant Near-Bank Stress: High

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
3.11	1.69	1.84	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 7-1 L **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: Low

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.13	1.70	1.25	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 7-1 R **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.08	1.70	1.22	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating
Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 8-1 L **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (t_{nb}/t_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1) Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress
63.13	21.93	2.88	Low

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.07	1.71	1.21	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating
Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 8-1 R **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

Dominant Near-Bank Stress
Low

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.43	1.71	1.42	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating
Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 9-1 L **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High

Extensive deposition (continuous, cross channel). NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **High**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
3.12	1.72	1.82	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 9-1 R **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (t_{nb}/t_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **High**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
3.25	1.72	1.89	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 10-1 L **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress
53.78	26.91	2.00	High

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: High

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
4.30	1.73	2.49	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 10-1 R **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

Dominant Near-Bank Stress: Moderate

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
3.09	1.73	1.79	Moderate

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Moderate

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 11-1 L **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High

Extensive deposition (continuous, cross channel). NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **High**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
4.24	3.25	1.74	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek **Location:** LMC 11-1 R **Date:** 12/21/21 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **High**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
3.68	1.74	2.12	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek Trib 1 **Location:** UT 1-1 L **Date:** 1/18/22 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **High**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.10	1.07	1.95	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek Trib 1 **Location:** UT 1-1 R **Date:** 1/18/22 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: **High**

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
2.05	1.07	1.91	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: ~~Little Mill Creek~~ Trib 1 **Location:** UT 2-1 L **Date:** 1/18/22 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High

Extensive deposition (continuous, cross channel). NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: Low

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
1.27	1.08	1.18	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Low

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Little Mill Creek Trib 1 **Location:** UT 2-1 R **Date:** 1/18/22 **Crew:**

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**

(2) Channel pattern (Rc/W): **Level II - General Prediction.**

(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**

(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**

(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**

(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**

(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

Level I

(1)

Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

Dominant Near-Bank Stress
Low

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
1.33	1.08	1.24	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating
Low

APPENDIX H
SUBSURFACE SOIL INVESTIGATION

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Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, CV	Date — Started: 12/9/21	Photo Numbers:
Drill Crew:	Date — Completed: 12/9/21	Boring Method: DP
Boring Number: 1	Date — Backfilled:	Total Depth of Boring:
Groundwater Depth:	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 2.5	clay loam
2.5 - 4.5	Clay - dark gray color
4.5 - 4.6	Loamy sand
4.6 - 5.3	Loamy sand with large gravels
5.5 - 6.7	weathered bedrock, some orange hue

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, CV	Date Started: 12/8/21	Photo Numbers:
Drill Crew:	Date Completed: 12/9/21	Boring Method: DP
Boring Number: 2	Date Backfilled:	Total Depth of Boring: 10'
Groundwater Depth:	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0-3.4	clay loam
3.4-3.7	clay, orange hue
3.7-4.3	clay, gray
4.3-4.6	loamy sand w/ small gravels
4.6-5.6	loamy sand w/ a few large gravels
5.6-5.8	Rocks
5.8-7	Weathered bedrock? Loamy Sand?

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: CS, CV	Started: 12/8/21	Photo Numbers:
Drill Crew:	Completed: 12/9/21	Boring Method: DP
Boring Number: 3	Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 4.6	Existing Elevation:	Proposed Elevation:

Date

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 – 2.6	clay loam
2.6 - 3.6	Clay loam
3.6 - 4.0	clay loam
4 - 5.4	loamy sand w/large gravel
5.4 - 5.6	Weathered Bedrock, orange hue
5.6 - 6.5	Weathered Bedrock

RK&K

Boring Log: Sheet __of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, AM	Date Started: 12/8/21	Photo Numbers:
Drill Crew:	Completed: 12/8/21	Boring Method: DP
Boring Number: 4	Backfilled:	Total Depth of Boring: 10'
Groundwater Depth:	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors	
0-0.4	loamy sand	
0.4-3.2	CLAY LOAM, SOME ROCK	
3.2-3.8	LS, DARK GREY	Loamy sand
3.8-4.1	CL, HISTORIC LYR, ORG. PRESENT	clay loam
4.1-5.4	LS, GRAVELS PRES.	Loamy sand
5.4-6.7	LRG GRAVEL W/ RED CLAY	
6.7-7.0	WEATH. BR	

RK&K

Boring Log: Sheet __of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, CV	Date Started: 12/9	Photo Numbers:
Drill Crew:	Date Completed: 12/9	Boring Method: DD
Boring Number: 5	Date Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: approx. 2.7'	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 1.6	clay loam
1.6 - 2.6	loamy sand
2.6 - 3	loamy sand, small gravels
3 - 4	clay
4 - 4.4	loamy sand, large gravels
4.4 - 4.7	loamy sand, large gravels, orange ish
4.7 - 5.7	weathered bedrock

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, CL	Date — Started: 12/8/21	Photo Numbers:
Drill Crew:	Date — Completed: 12/9/21	Boring Method: DP
Boring Number: 6	Date — Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 4.2'	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 3.5	Clay loam
3.5 - 3.8	Loamy sand
3.8 - 4.1	Sandy clay loam
4.1 - 5.4	Sandy clay loam w/ large gravel
5.4 - 6.9	Loamy Sand

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, CV	Started: 12/8/21	Photo Numbers:
Drill Crew:	Completed: 12/9/21	Boring Method: DP
Boring Number: 7	Backfilled:	Total Depth of Boring: 10'
Groundwater Depth:	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors
	silty
0 - 2.8	clay loam
2.8 - 3.4	loamy sand
3.4 - 4.6	loamy sand w/ large gravels
4.6 - 5.2	loamy sand w/ large gravels, orange hue
5.2 - 5.6	Crushed white rock
5.6 - 5.9	Weathered bedrock

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, AM	Date — Started: 12/8/21	Photo Numbers:
Drill Crew:	Date — Completed: 12/8/21	Boring Method:
Boring Number: 8	Date — Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 4.6'	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 0.6	CL, TS (DARKER) — CL =clay loam, top soil
0.6 - 2.4	CL, RED & BLUE/GREY TONES
2.4 - 2.8	LS — Loamy sand
2.8 - 3.5	B/G CLAY
3.5 - 3.7	CL, HIST. LIN, DARK
3.7 - 4.2	LS W/ GRAVELS — Loamy sand
4.2 - 5.8	WEATH. BR W/ GRAVELS
5.8 - 6.7	WEATH. BR
10	
15	

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES	Date — Started: 12/9	Photo Numbers:
Drill Crew:	Date — Completed: 12/9	Boring Method: DP
Boring Number: 9	Date — Backfilled:	Total Depth of Boring: 10'
Groundwater Depth:	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0-4	clay loam
4-4.3	clay
4.3-4.9	loamy sand w/ small gravels
4.9-6.1	loamy sand w/ large gravels
6.1-7	weathered bedrock

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, AM	Date — Started: 12/8/21	Photo Numbers:
Drill Crew:	Date — Completed: 12/8/21	Boring Method: DP
Boring Number: 10	Date — Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 9.6'	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0	
0-2.6	clay loam
2.6-2.9	LS Loamy sand
2.9-4.4	~~LS f w/ Bar~~ sandy loam, w/ large gravels
4.4-4.9	" " , reddish hue
4.9-6.6	weathered bedrock
6.6-7.4	finer weathered bedrock
5	
10	
15	

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: GS, CV	Date Started: 12/9	Photo Numbers:
Drill Crew:	Date Completed: 12/9	Boring Method: DP
Boring Number: 11	Date Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 4.3	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 2.4	Clay loam
2.4 - 3.5	Clay loam
3.5 - 4.3	Sandy loam
4.3 - 5.5	Sandy loam w/ large gravel
5.5 - 6.7	Weathered bedrock

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, AM	Date — Started: 12/8/21	Photo Numbers:
Drill Crew:	Date — Completed: 12/8/21	Boring Method: DP
Boring Number: 12	Date — Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: DNM	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 3.7	Sandy loam
3.7 - 4.2	gravels w/ LS Loamy sand
~~3.7 - 4.2~~	~~gravels~~
4.2 - 4.5	gravels, orange hue
4.5 - 5.2	sand, large gravels
~~5.2 - 7.5~~	~~weathered bedrock~~
5.2 - 7.5	weathered bedrock

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES	Date Started: 12/9	Photo Numbers:
Drill Crew:	Date Completed: 12/9	Boring Method: DP
Boring Number: 13	Date Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 4.3'	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0-2	clay loam
2-3.6	clay loam, light gray, some orange hues
3.6-4.2	loam
4.2-5.3	clay loam, gray (some darker gray)
~~5.3-6~~	~~sandy loam~~
5.3-6	sandy loam w/ large gravels
6-7	weathered bedrock

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: AM, ES	Date Started: 12/8/21	Photo Numbers:
Drill Crew:	Date Completed: 12/8/21	Boring Method: DP
Boring Number: 14	Date Backfilled:	Total Depth of Boring: 6.5'
Groundwater Depth:	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 1.6	CL
1.6 - 3.1	SCL silty clay loam
3.1 - 3.8	SAND W/ LARGE GRAVELS
3.8 - 4.3	SL W/ LARGE GRAVELS sandy loam
4.3 - 4.9	COMPACT ROCKY MATERIAL - REFUSAL
5	
10	
15	

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, CV	Date Started: 12/9	Photo Numbers:
Drill Crew:	Date Completed: 12/9	Boring Method: DP
Boring Number: 15	Date Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 3.8	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 1.5	Clay loam
1.5 - 2.5	Clay
2.5 - 4.2	Sandy Clay
4.2 - 5.3	Sandy Clay w/ large gravel
5.3 - 6.7	Weathered Bedrock

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, AM	Date — Started: 12/8/21	Photo Numbers:
Drill Crew:	Date — Completed: 12/8/21	Boring Method: DP
Boring Number: 16	Date — Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 3.8'	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 1.1	CL
1.1 - 1.4	CL w/ ORGANICS
1.4 - 7.9	SCL silty clay loam
7.9 - 3.1	SAL sandy loam
3.1 - 3.8	SAND w/ GRAVELS
3.8 - 4.7	WEATH. BR
4.7 - 5.1	" w/ GRAVELS

RK&K

Boring Log: Sheet __of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, CH	Date — Started: 12/9/21	Photo Numbers:
Drill Crew:	Date — Completed: 12/9/21	Boring Method: DP
Boring Number: 17	Date — Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 3.5	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0.0 – 3.0'	clay loam
3.0 – 4.1	clay loam
4.1 – 5.1	Clay
5.1 – 5.9	Sandy loam
5.9 – 6.5	Loamy sand w/small gravel
6.5 – 7.0	Loamy sand w/ large gravel

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES, CL	Date — Started: 12/9/21	Photo Numbers:
Drill Crew:	Date — Completed: 12/9/21	Boring Method: DP
Boring Number: 18	Date — Backfilled:	Total Depth of Boring: 10'
Groundwater Depth:	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0.0 - 2.5	clay loam
2.5 - 4.0	Clay loam
4.0 - 7.5	Clay
7.5 - 7.8	loamy sand

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: ES	Date Started: 12/9	Photo Numbers:
Drill Crew:	Date Completed: 12/9	Boring Method: DP
Boring Number: 13	Date Backfilled:	Total Depth of Boring: 10'
Groundwater Depth: 4.3'	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0-2	clay loam
2-3.6	clay loam, light gray, some orange hues
3.6-4.2	loam
4.2-5.3	clay loam, gray (some darker gray)
~~5.3-6~~	~~sandy loam~~
5.3-6	sandy loam w/ large gravels
6-7	weathered bedrock

RK&K

Boring Log: Sheet __ of ___

Project: Little Mill Creek	Project Number:	Client:
Property Owner:		Drilling Contractor:
Logged By: AM, ES	Date Started: 12/8/21	Photo Numbers:
Drill Crew:	Date Completed: 12/8/21	Boring Method: DP
Boring Number: 14	Date Backfilled:	Total Depth of Boring: 6.5'
Groundwater Depth:	Existing Elevation:	Proposed Elevation:

Depth (feet)	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors
0 - 1.6	CL
1.6 - 3.1	SCL silty clay loam
3.1 - 3.8	SAND W/ LARGE GRAVELS
3.8 - 4.3	SL W/ LARGE GRAVELS sandy loam
4.3 - 4.9	COMPACT ROCKY MATERIAL - REFUSAL
5	
10	
15	

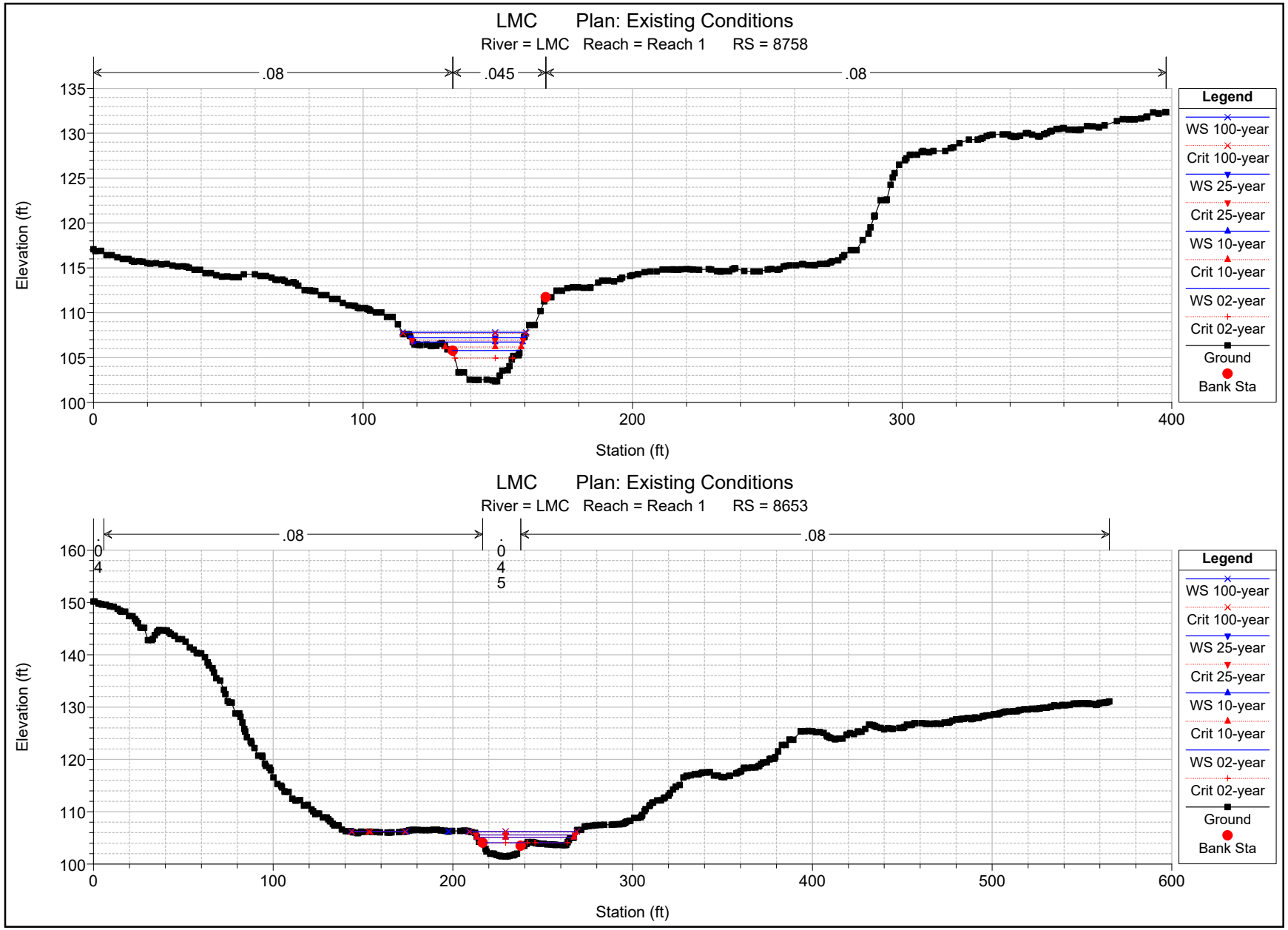
RK&K

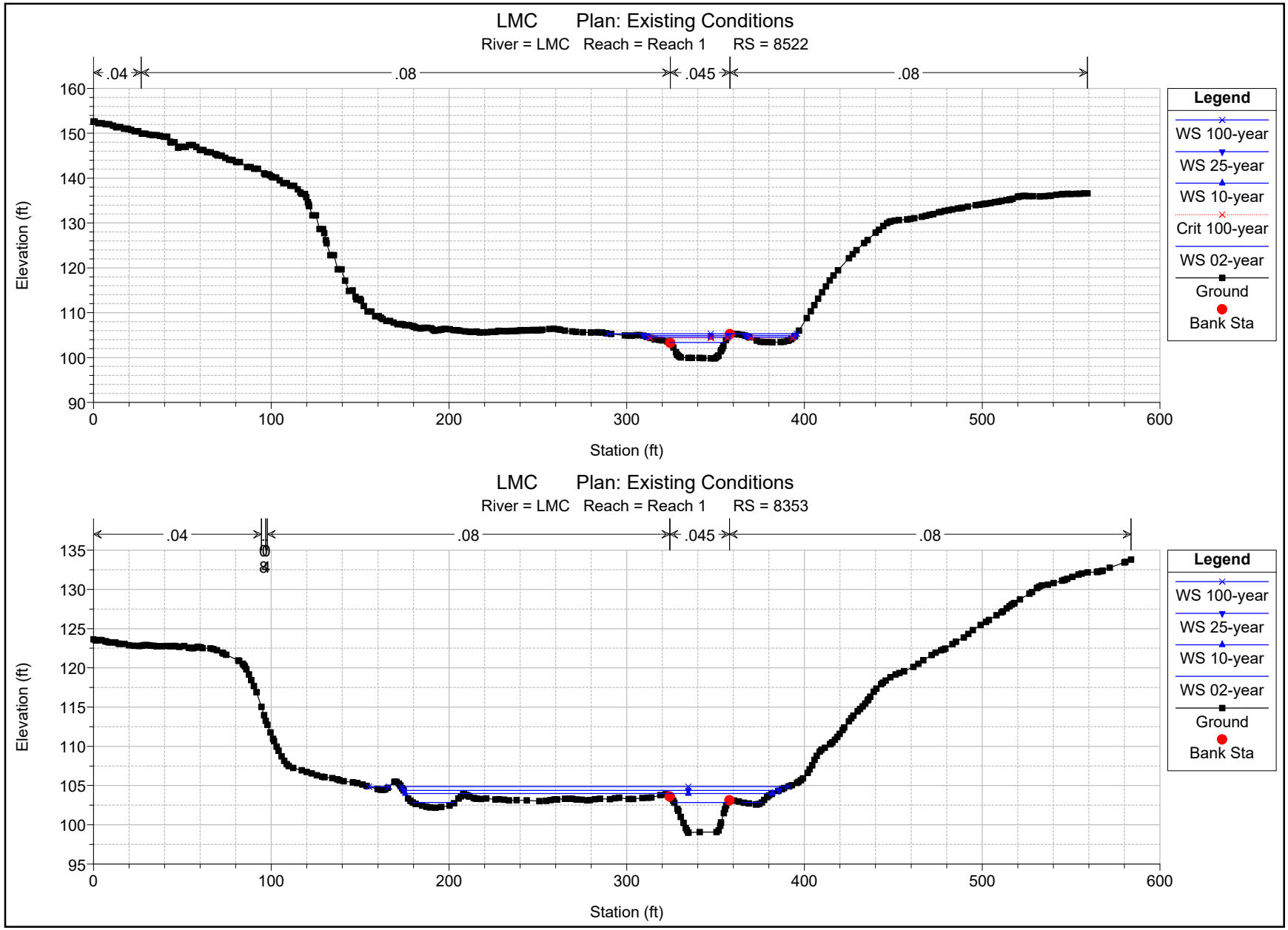
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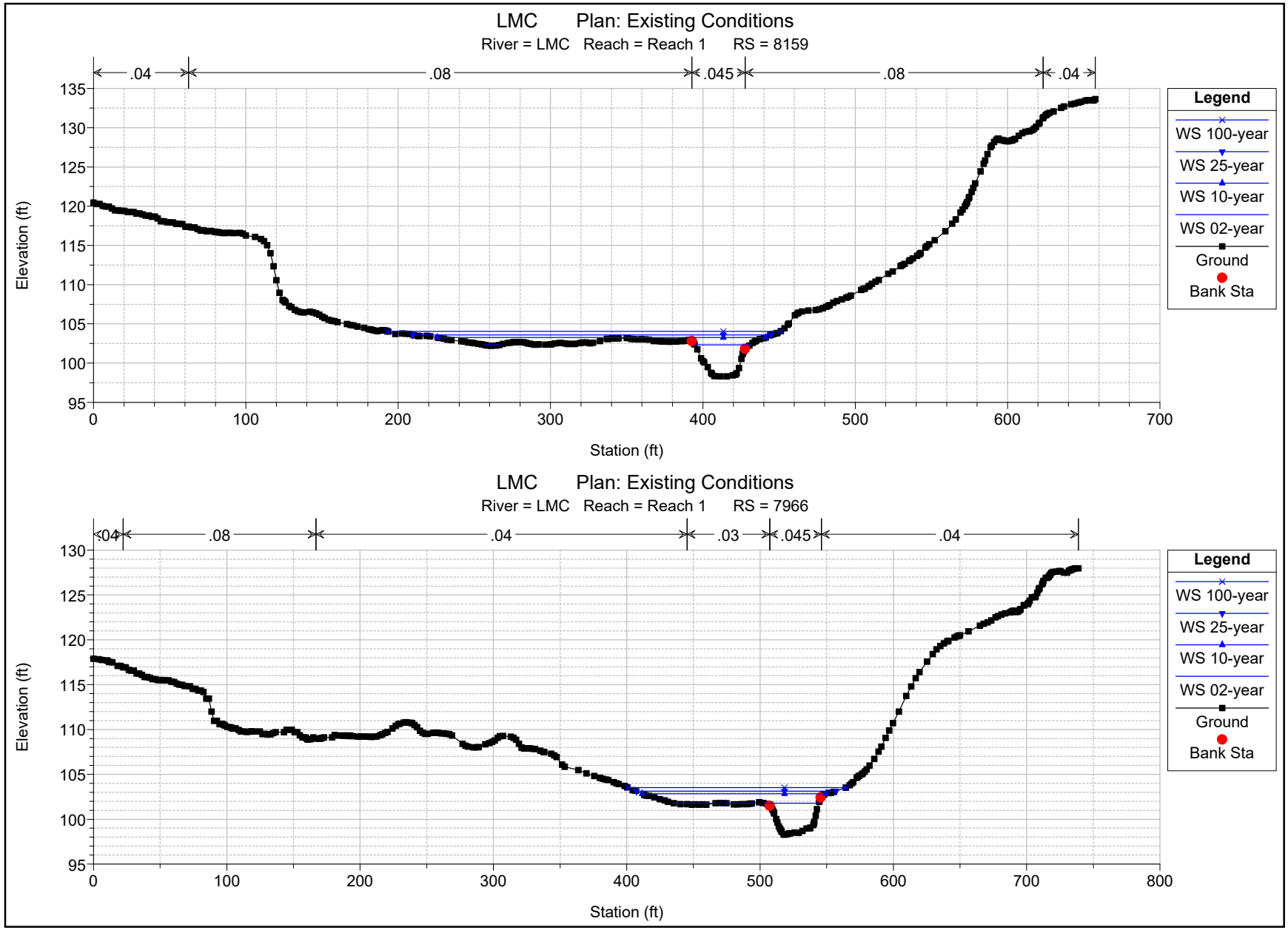
APPENDIX I

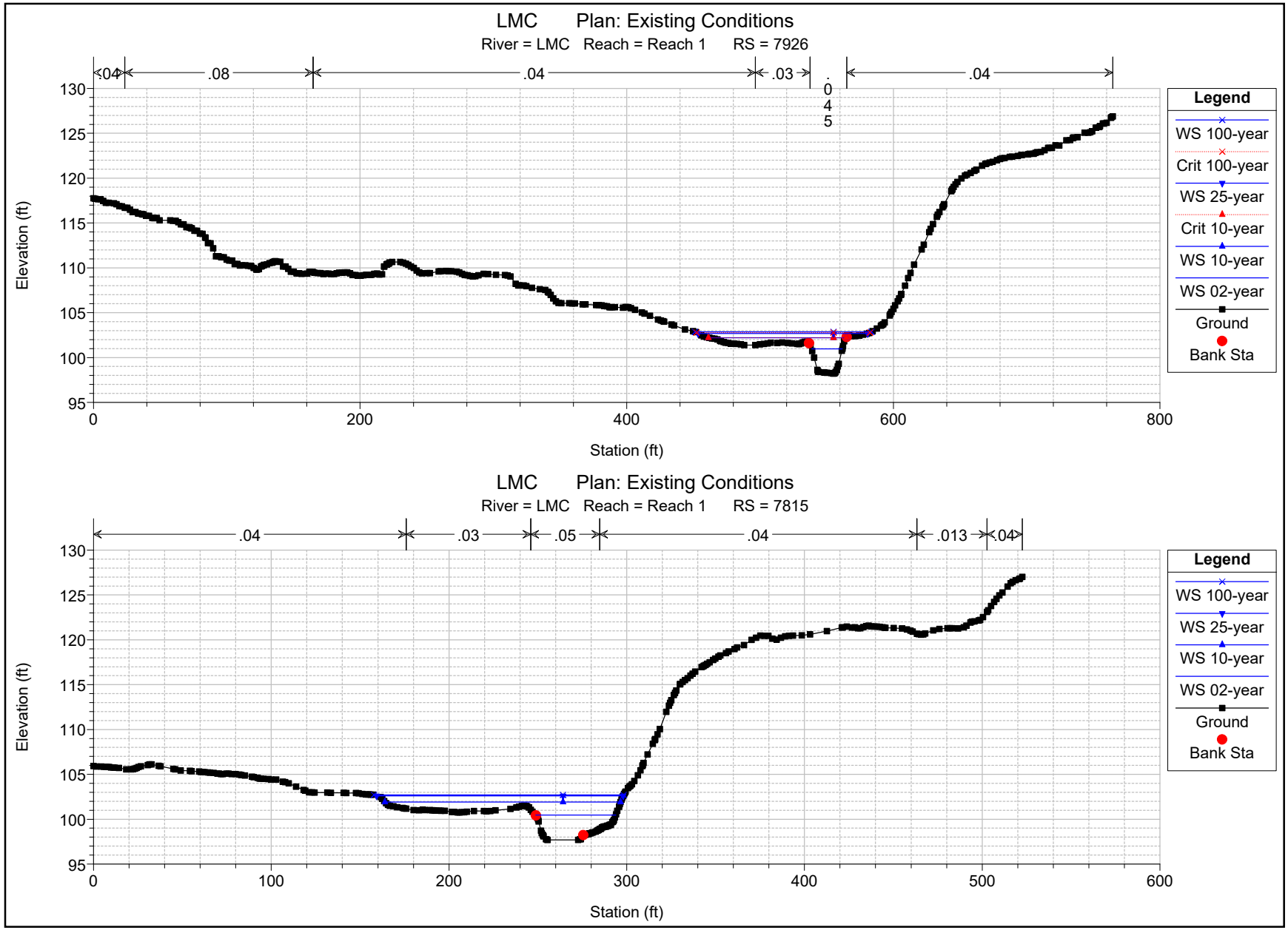
HEC-RAS HYDRAULIC ANALYSIS

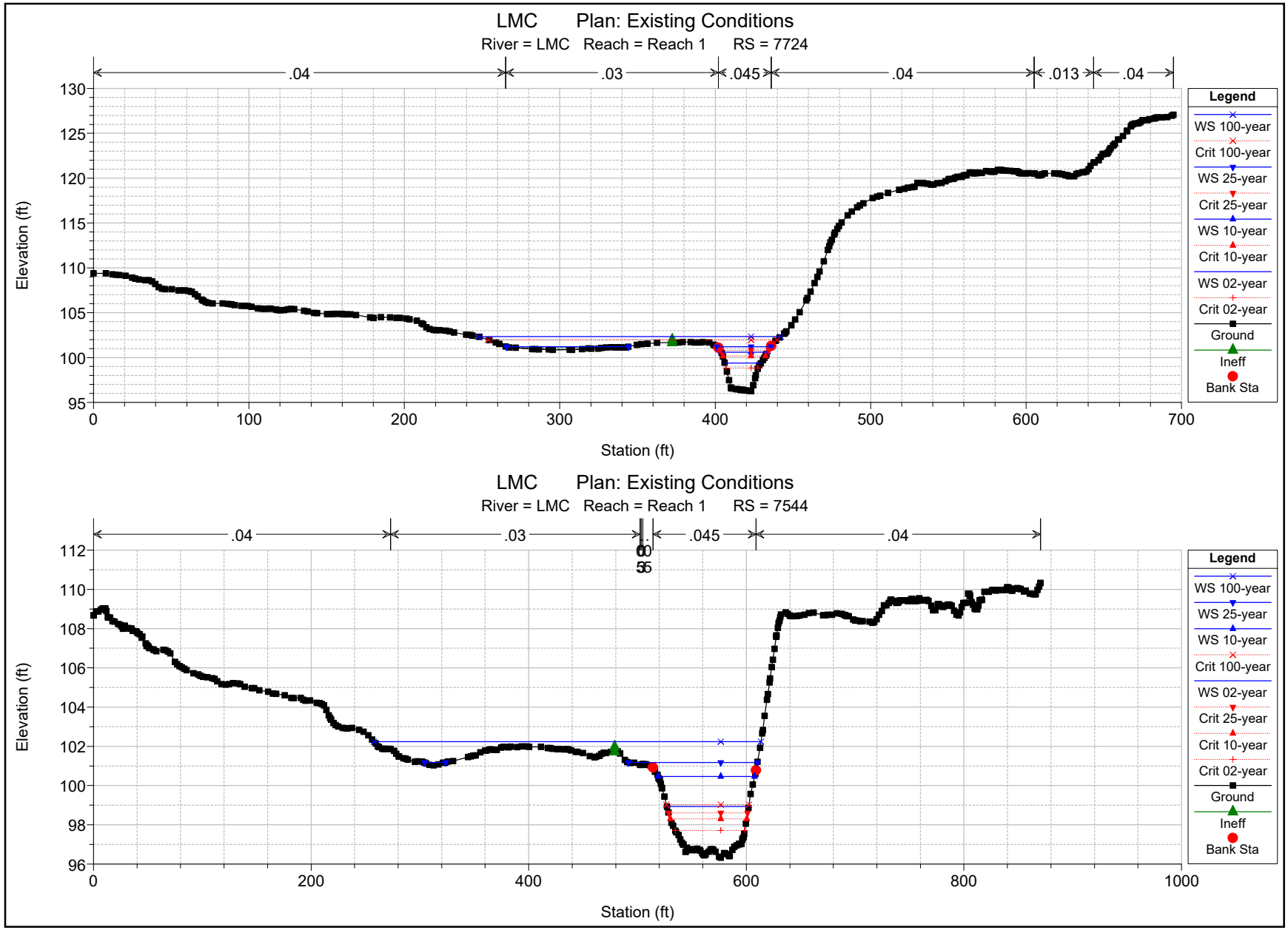
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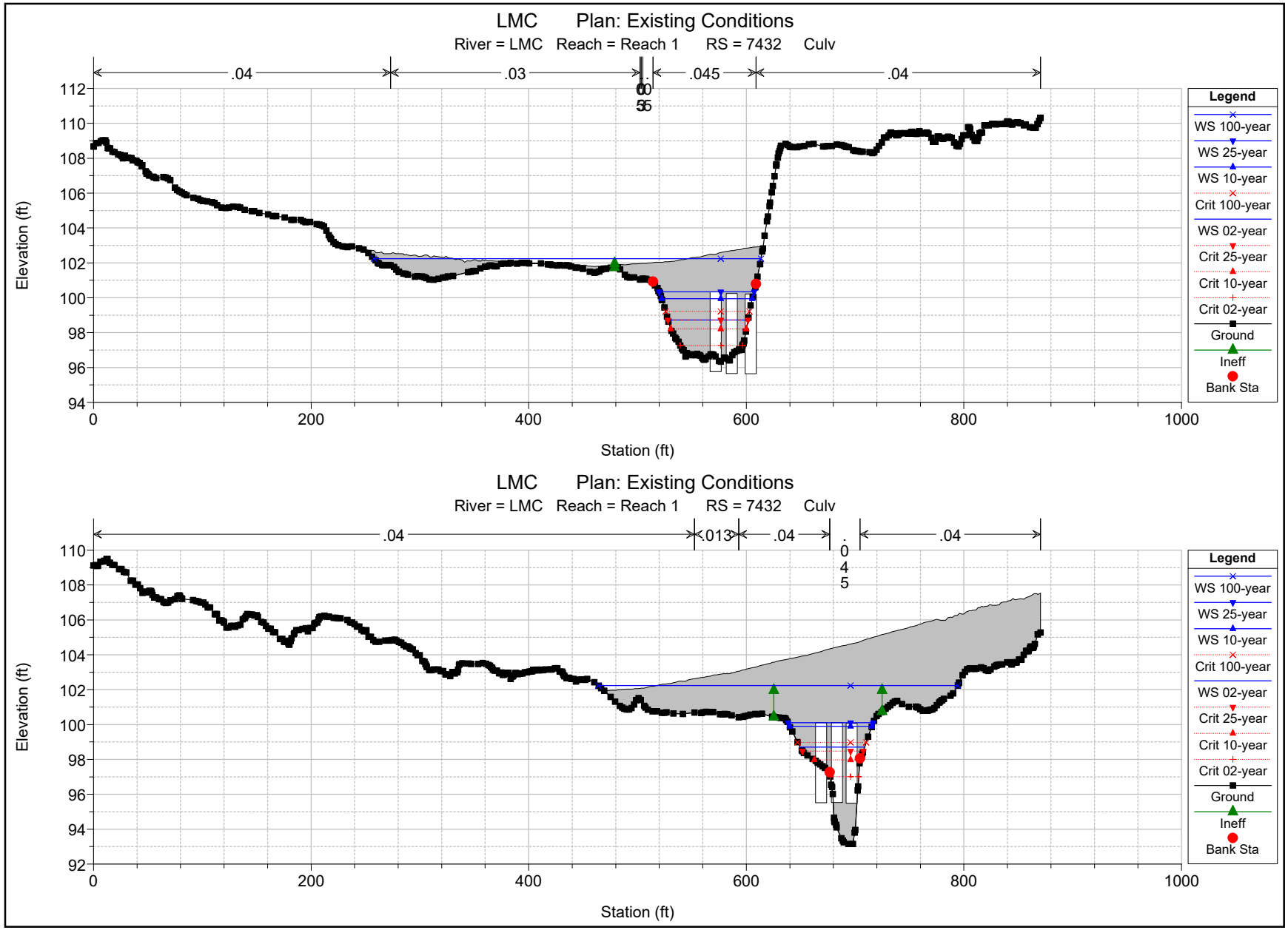

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 8758
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 8653
.08
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta

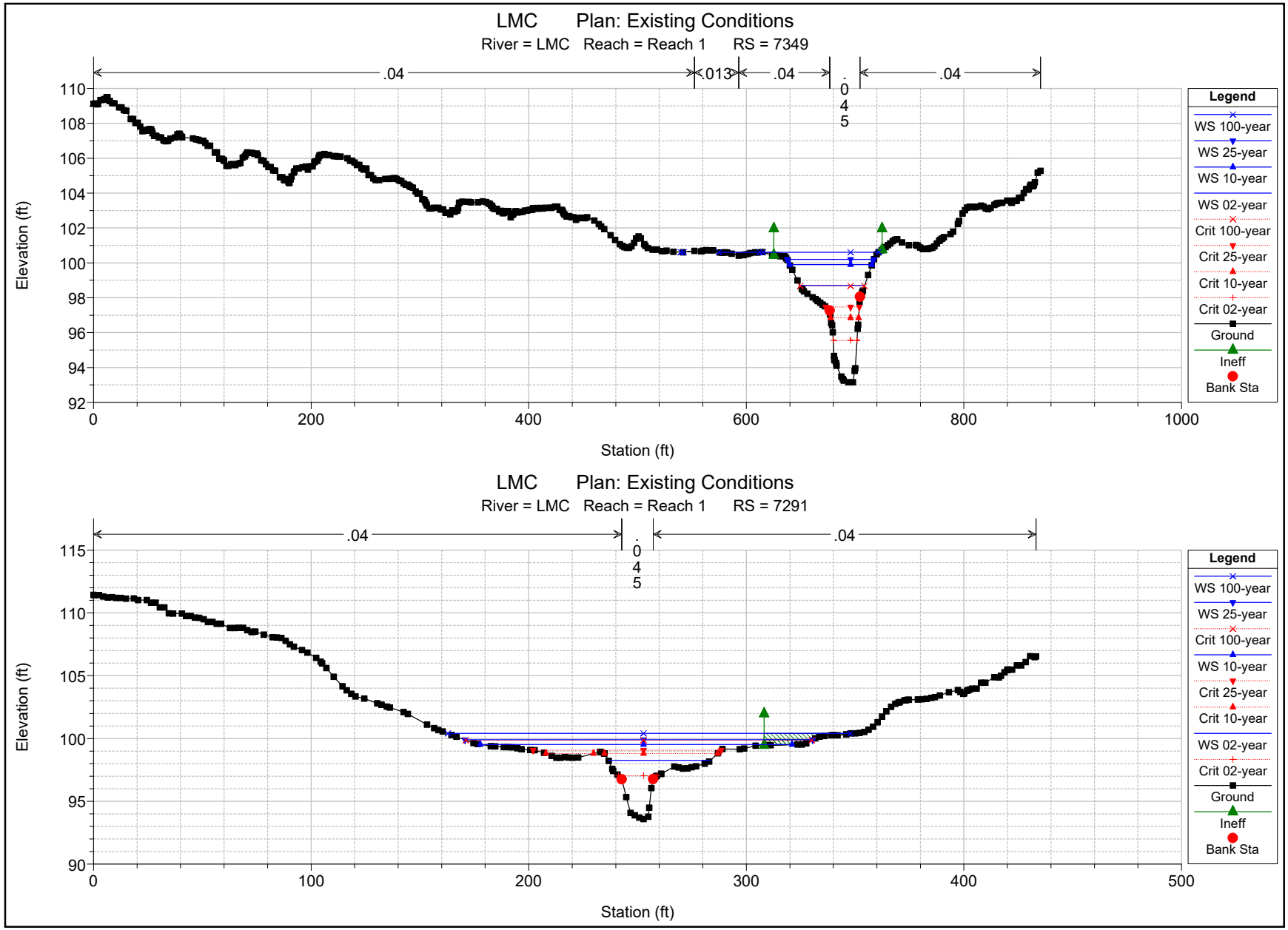

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 8522
.04
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 8353
.04
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

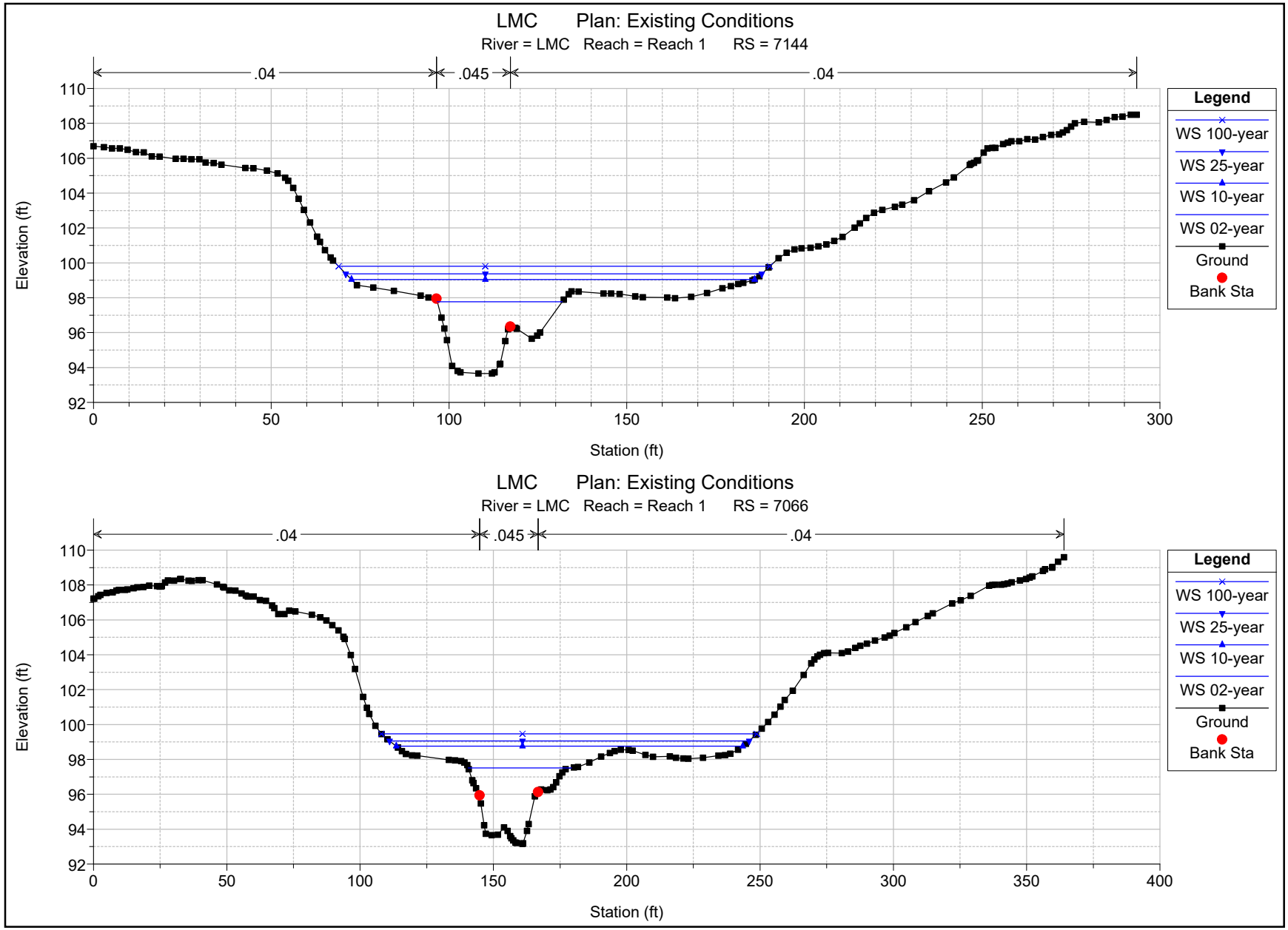

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 8159
.04
.08
.045
.08
.04
Elevation (ft)
135
130
125
120
115
110
105
100
95
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7966
.04
.08
.04
.03
.045
.04
Elevation (ft)
130
125
120
115
110
105
100
95
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

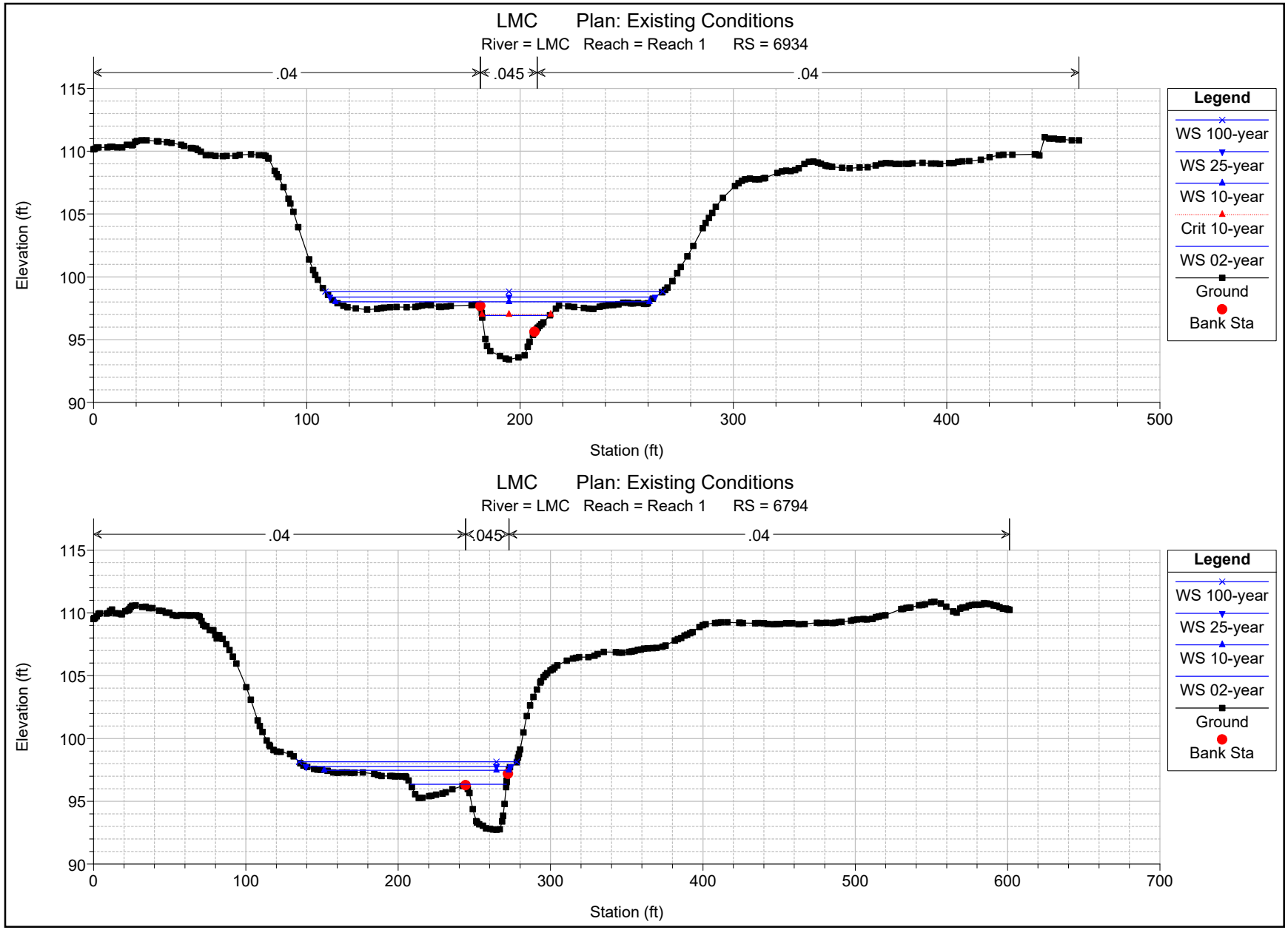

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7926
.04
.08
.04
.03
.045
.04
Elevation (ft)
130
125
120
115
110
105
100
95
0
200
400
600
800
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 10-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7815
.04
.03
.05
.04
.013
.04
Elevation (ft)
130
125
120
115
110
105
100
95
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

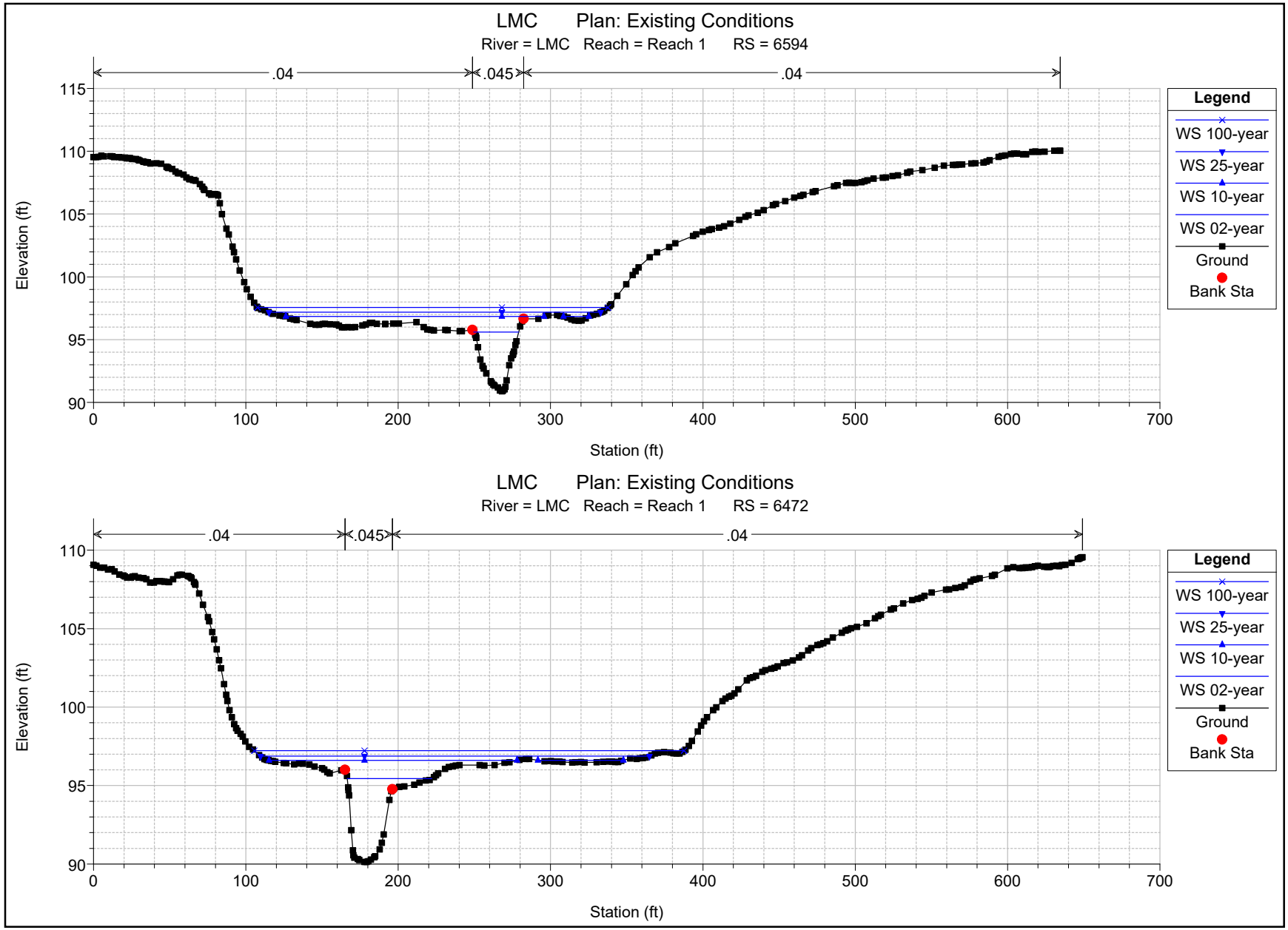

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7724
.04
.03
.045
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7544
.04
.03
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

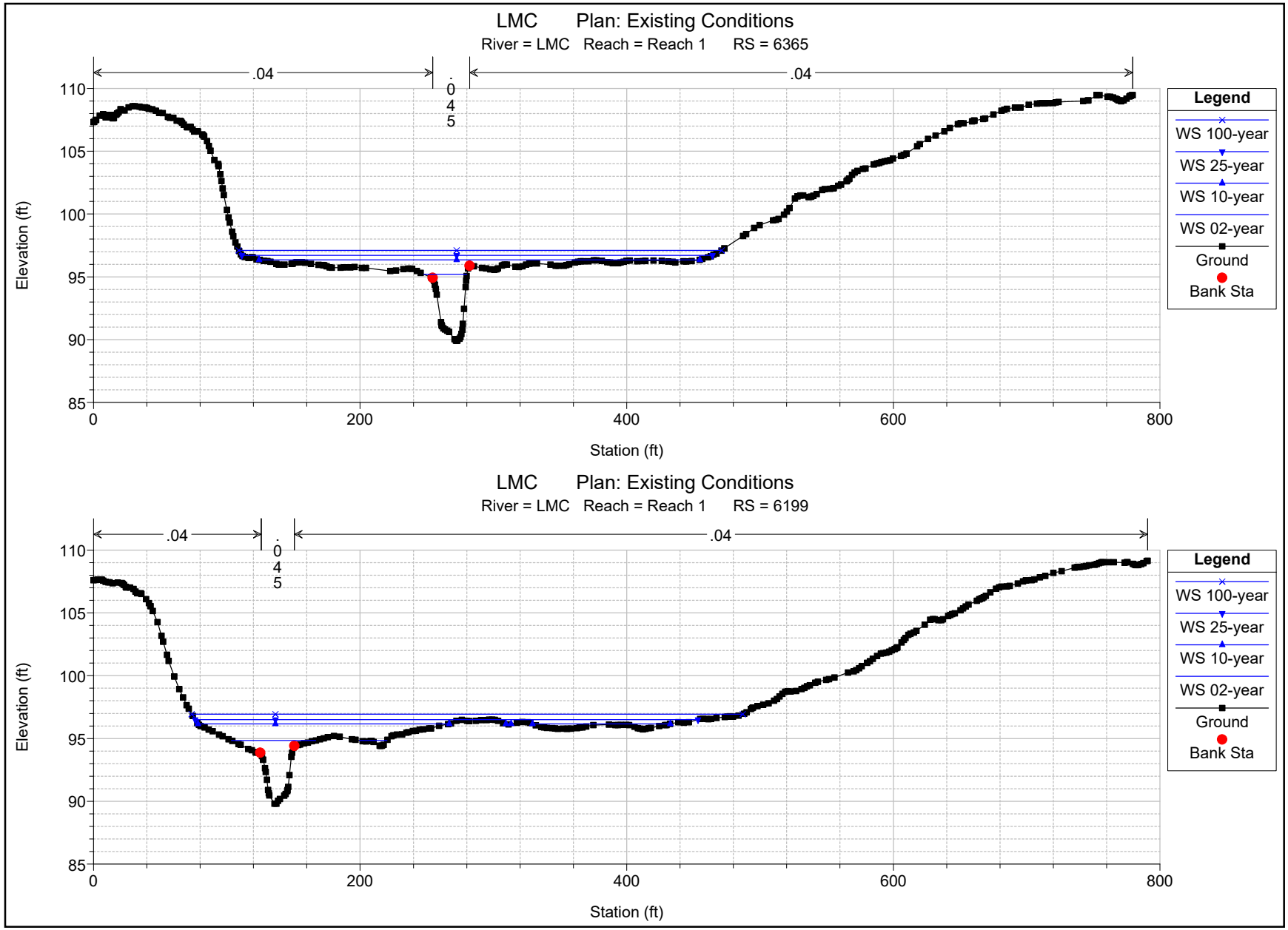

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7432 Culv
.04
.03
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7432 Culv
.04
.013
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

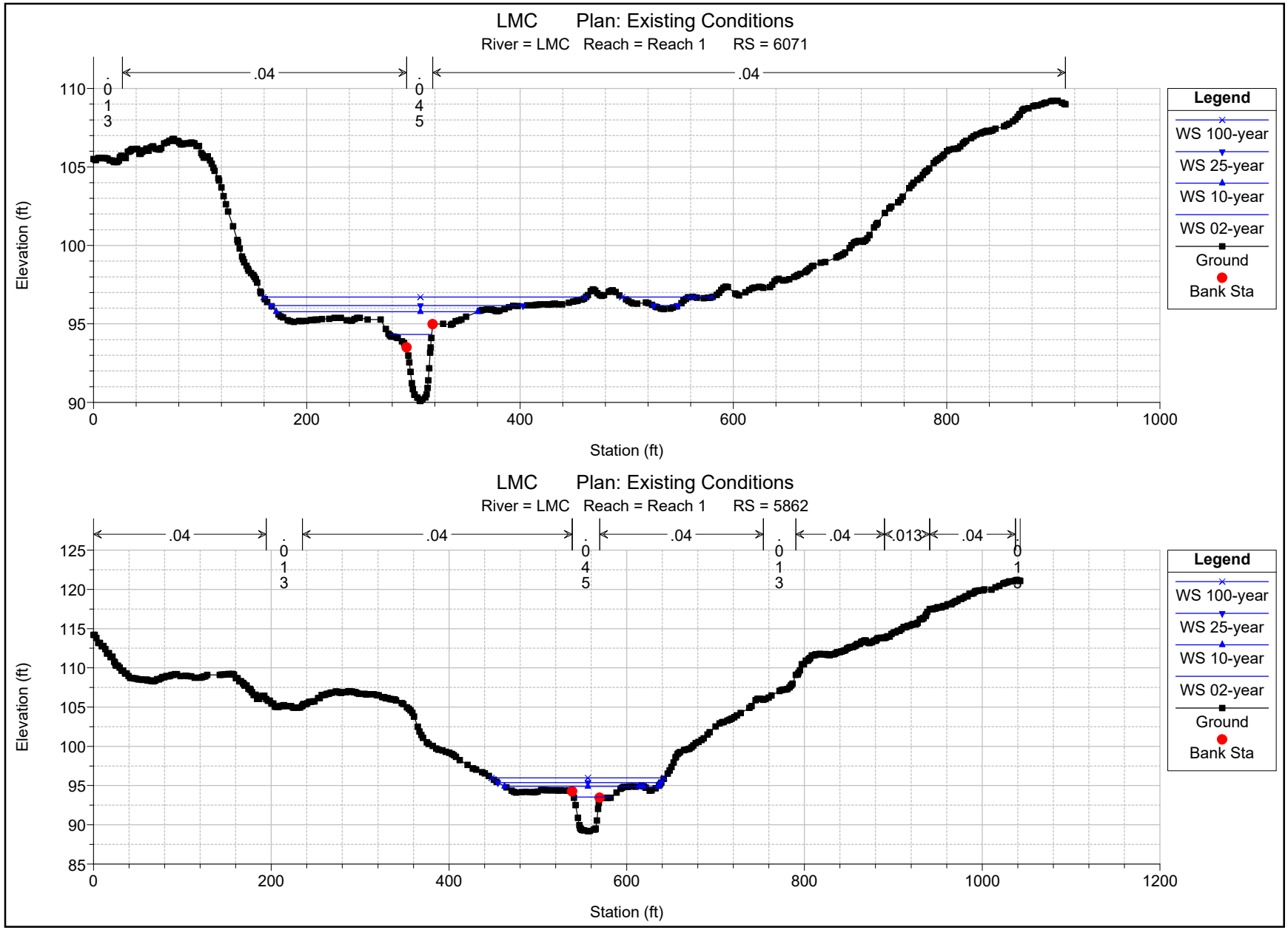

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7349
.04
.013
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7291
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

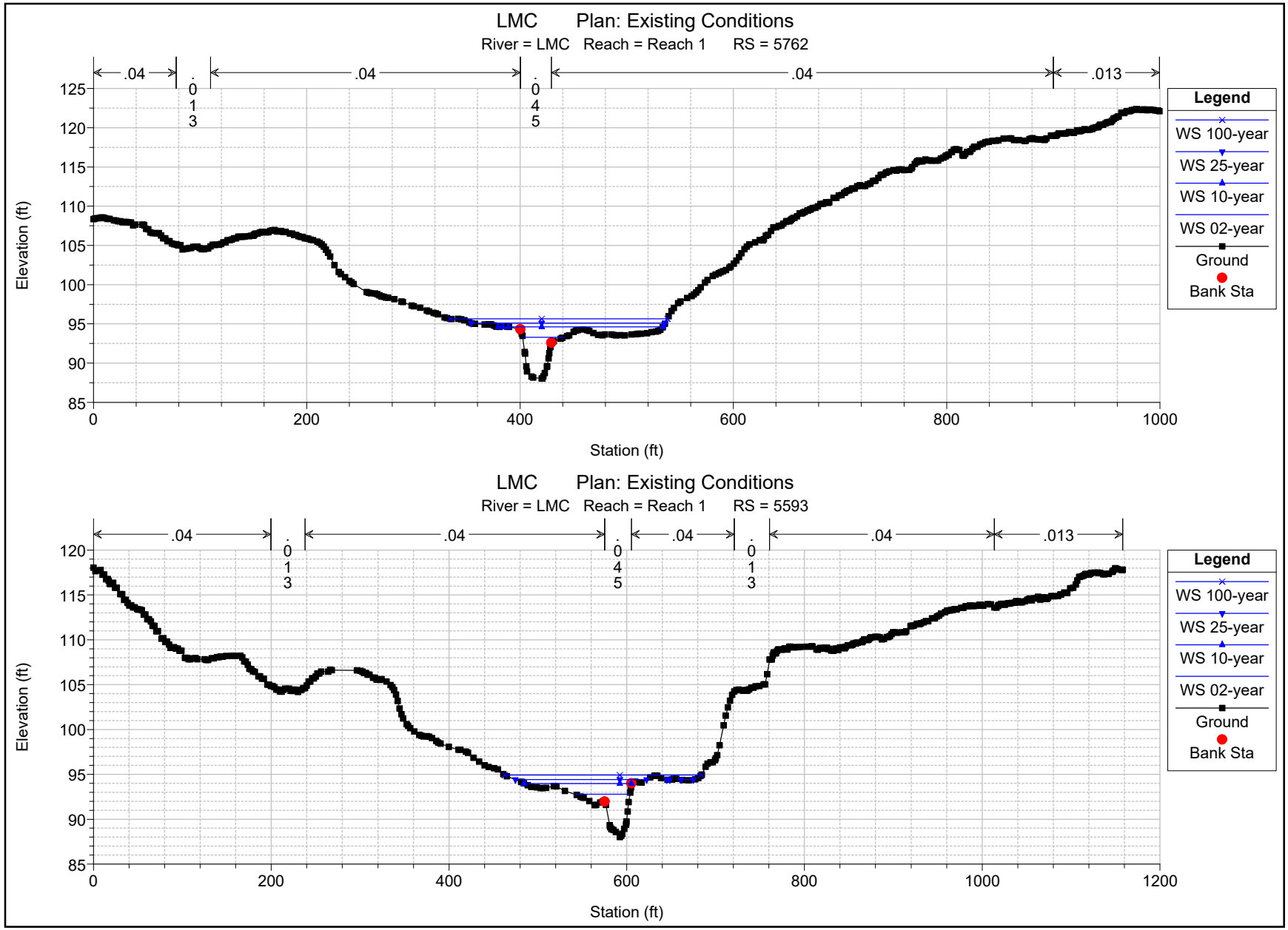

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7144
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 7066
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

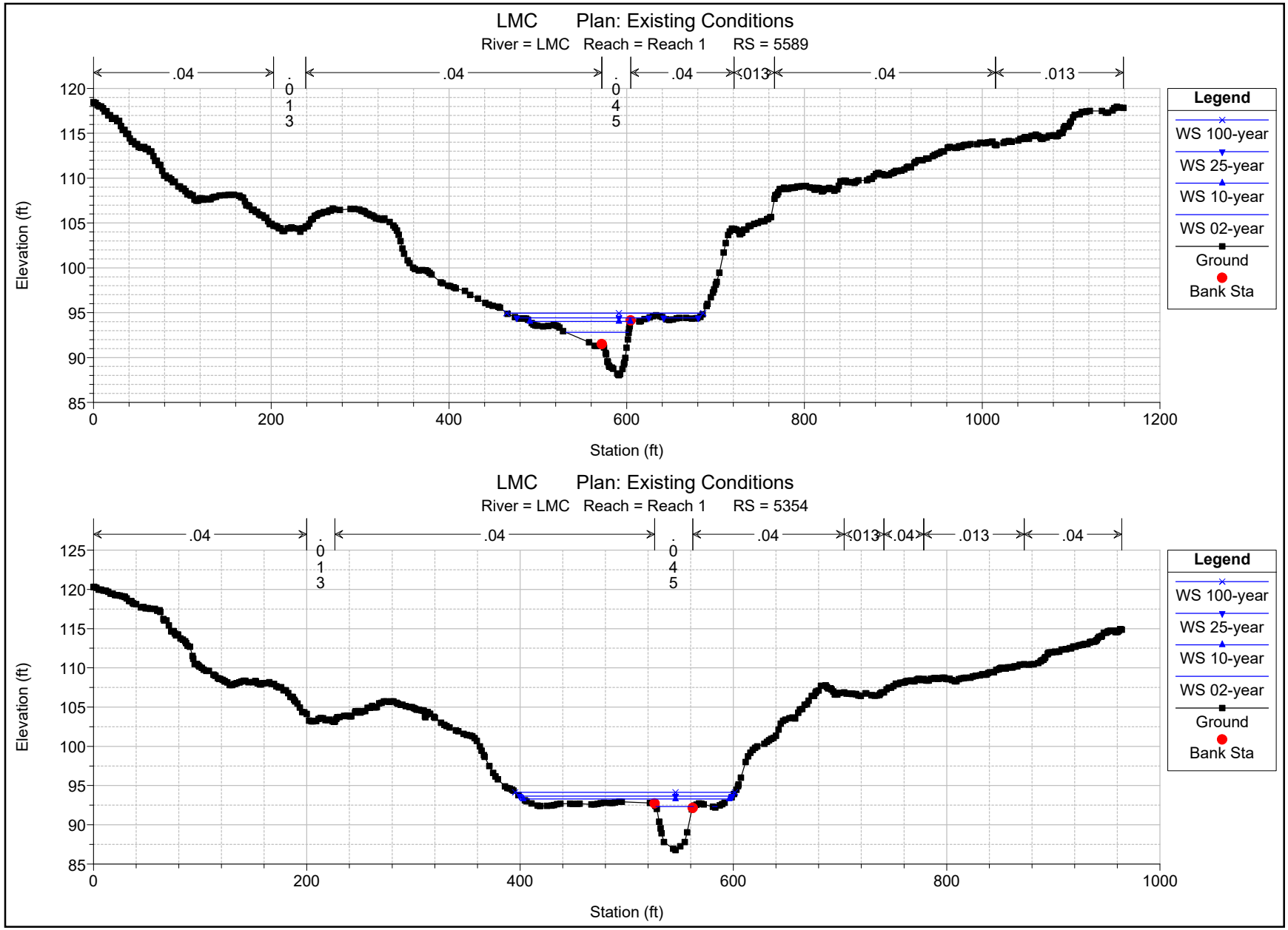

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 6934
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 6794
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

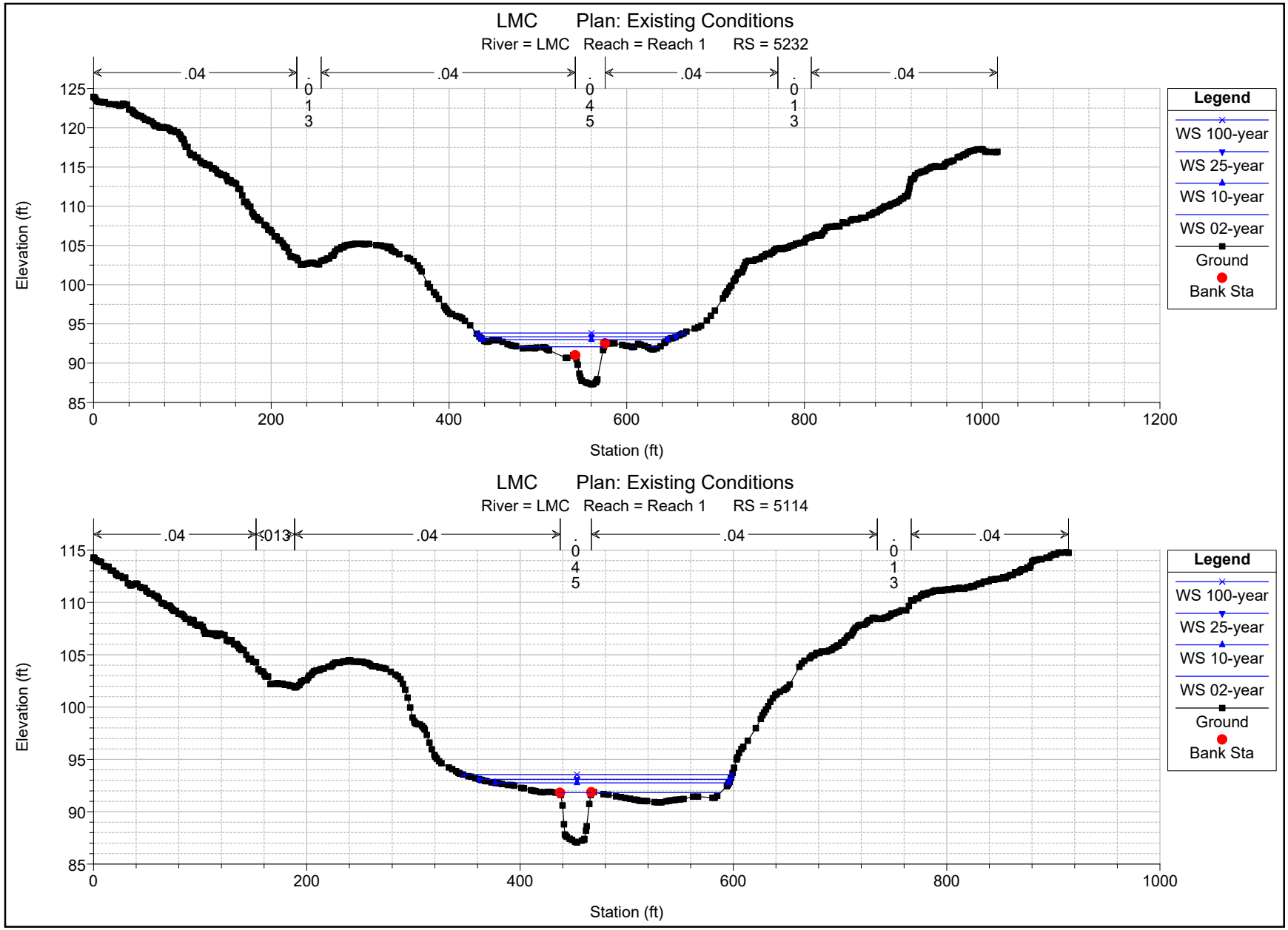

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 6594
.04
.045
.04
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 6472
.04
.045
.04
Elevation (ft)
110
105
100
95
90
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

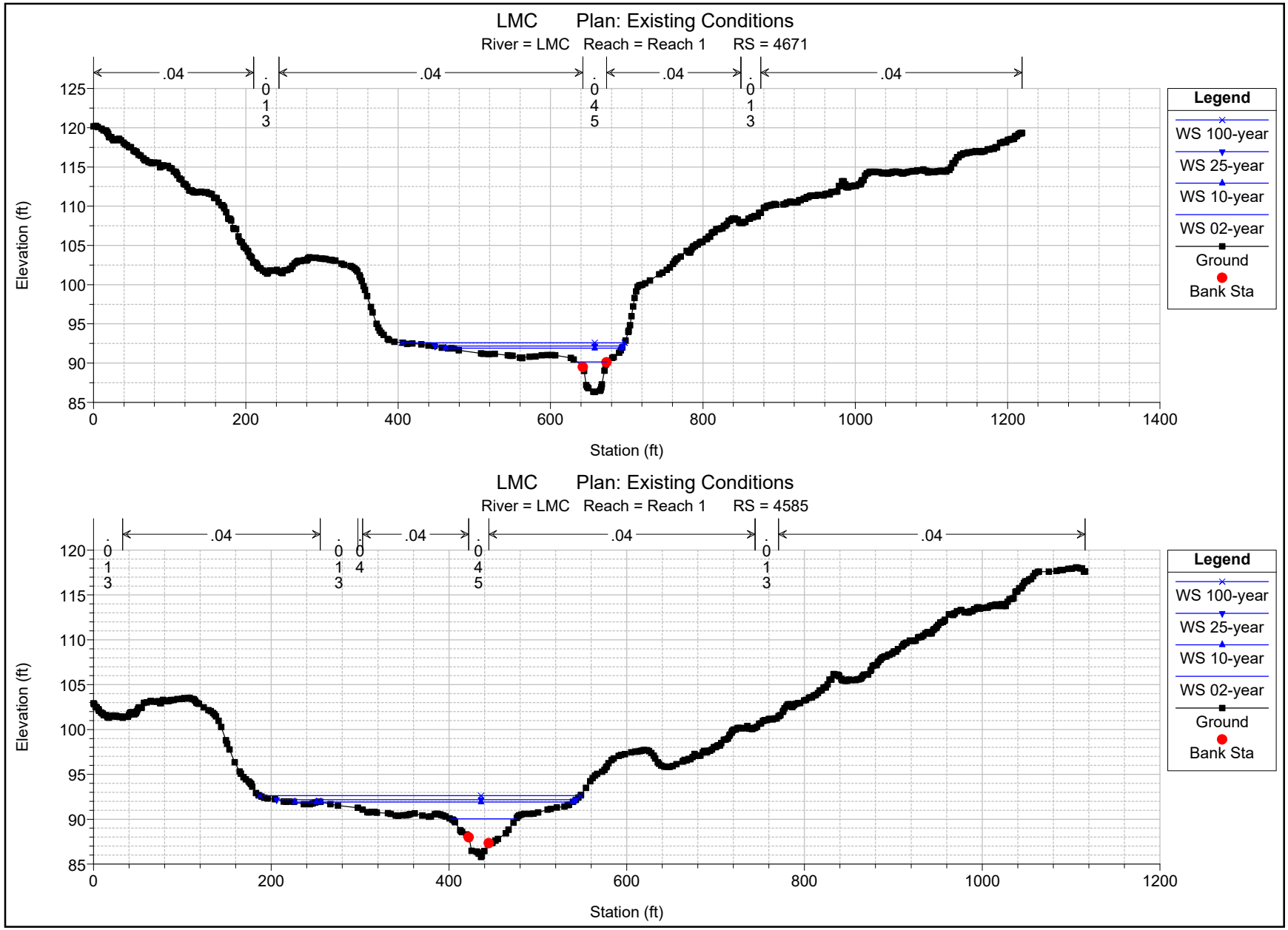

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 6365
.04
.045
.04
Elevation (ft)
110
105
100
95
90
85
0
200
400
600
800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 6199
.04
.045
.04
Elevation (ft)
110
105
100
95
90
85
0
200
400
600
800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

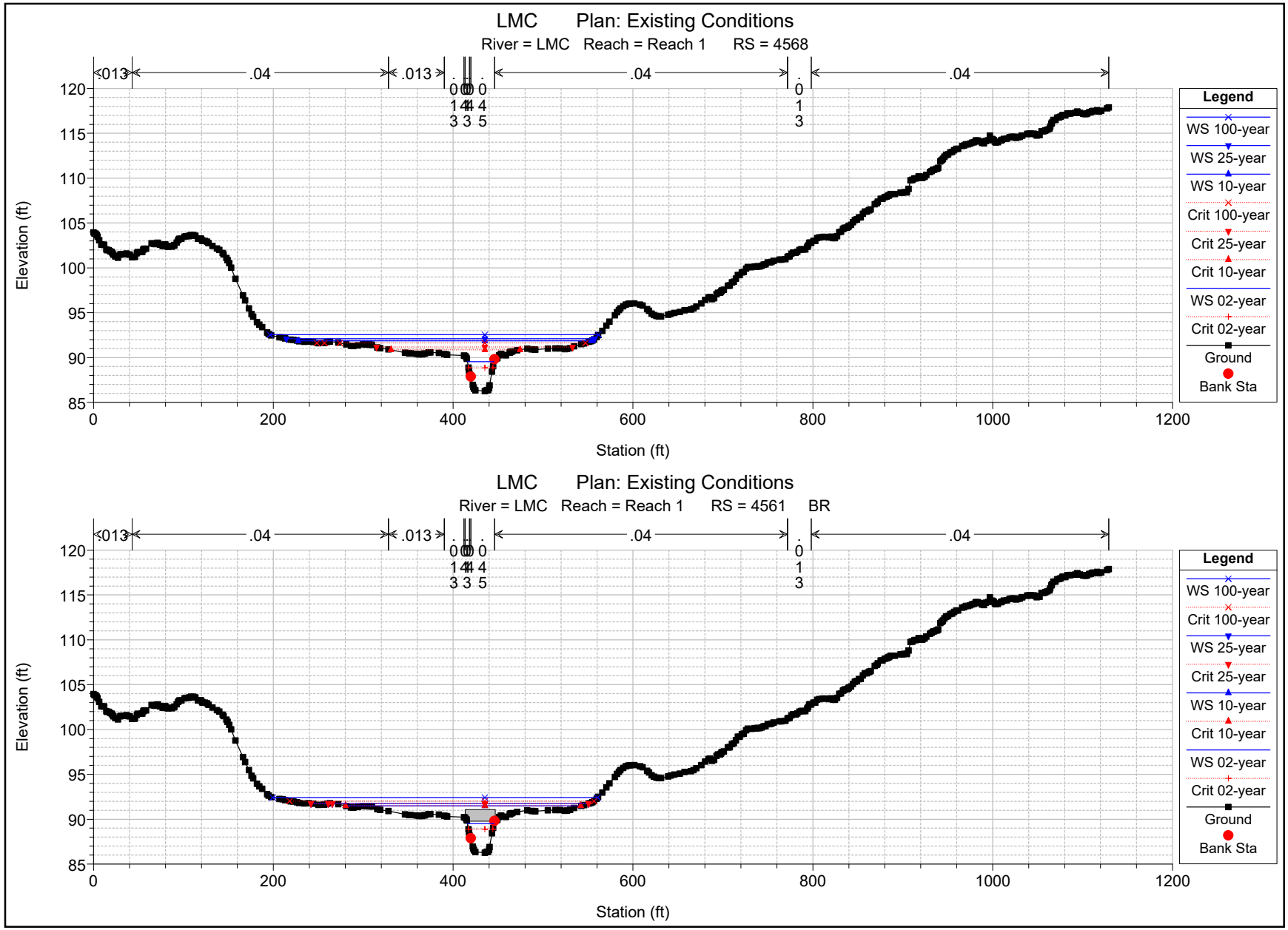

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 6071
.04
.04
.04
.013
.045
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 5862
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

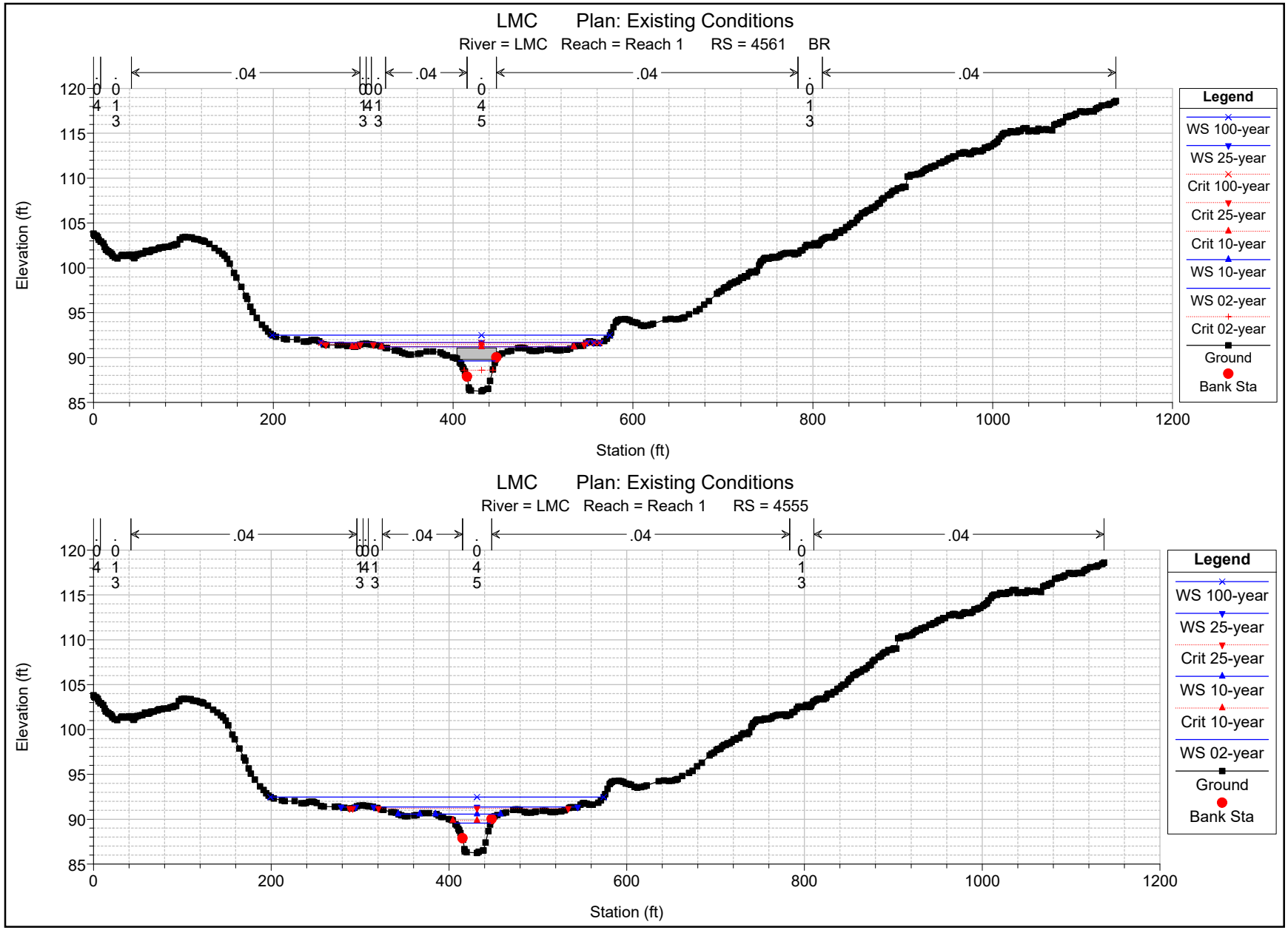

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 5762
.04
.013
.045
.04
.04
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 5593
.04
.013
.045
.04
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

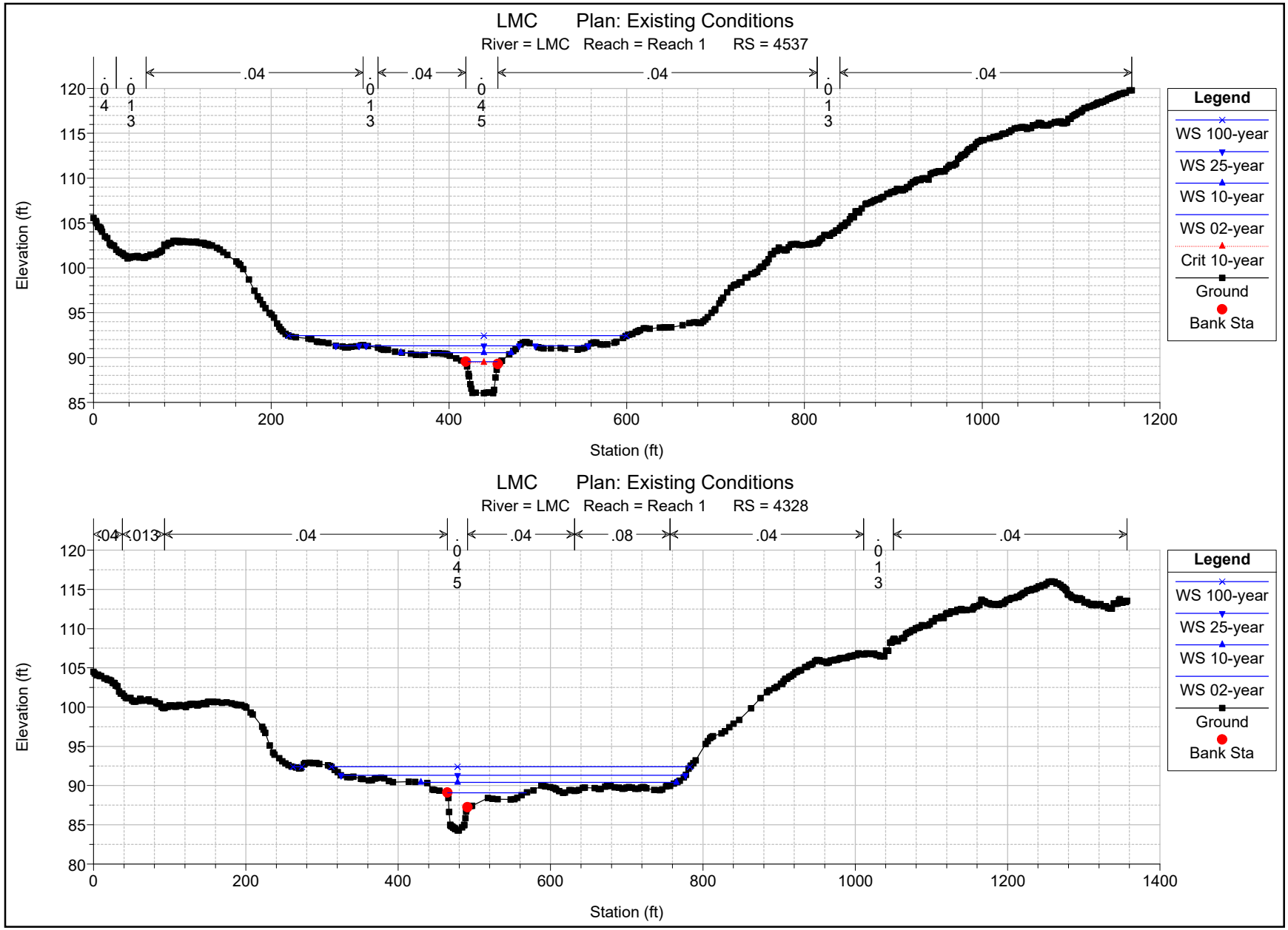

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 5589
.04
.013
.04
.045
.04
.013
.04
Elevation (ft)
120
115
110
105
100
95
90
85
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 5354
.04
.013
.04
.045
.04
.013
.04
.013
.04
Elevation (ft)
125
120
115
110
105
100
95
90
85
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

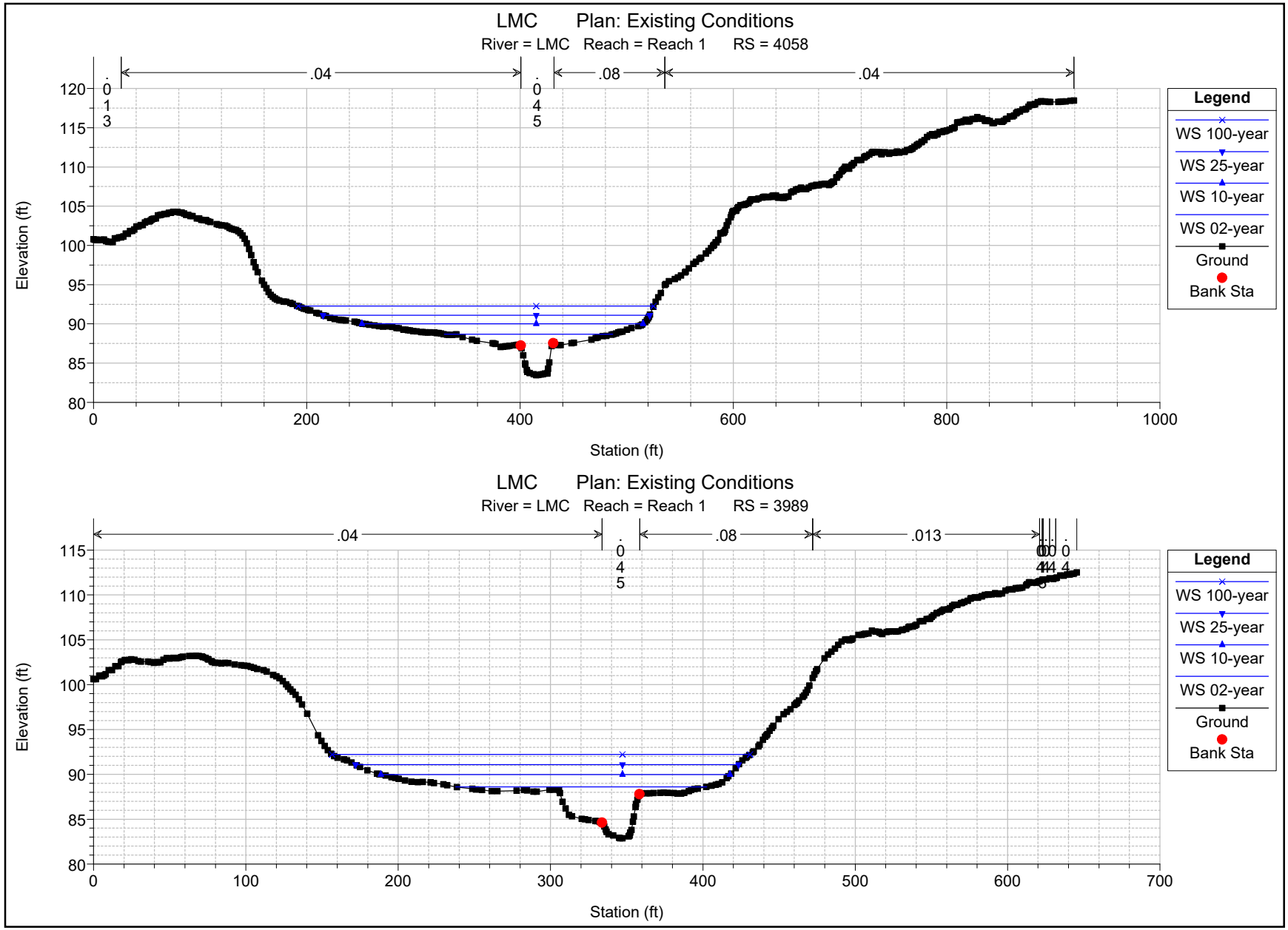

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 5232
.04
.013
.04
.045
.04
.013
.04
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 5114
.04
.013
.04
.045
.04
.013
.04
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
Elevation (ft)
Station (ft)

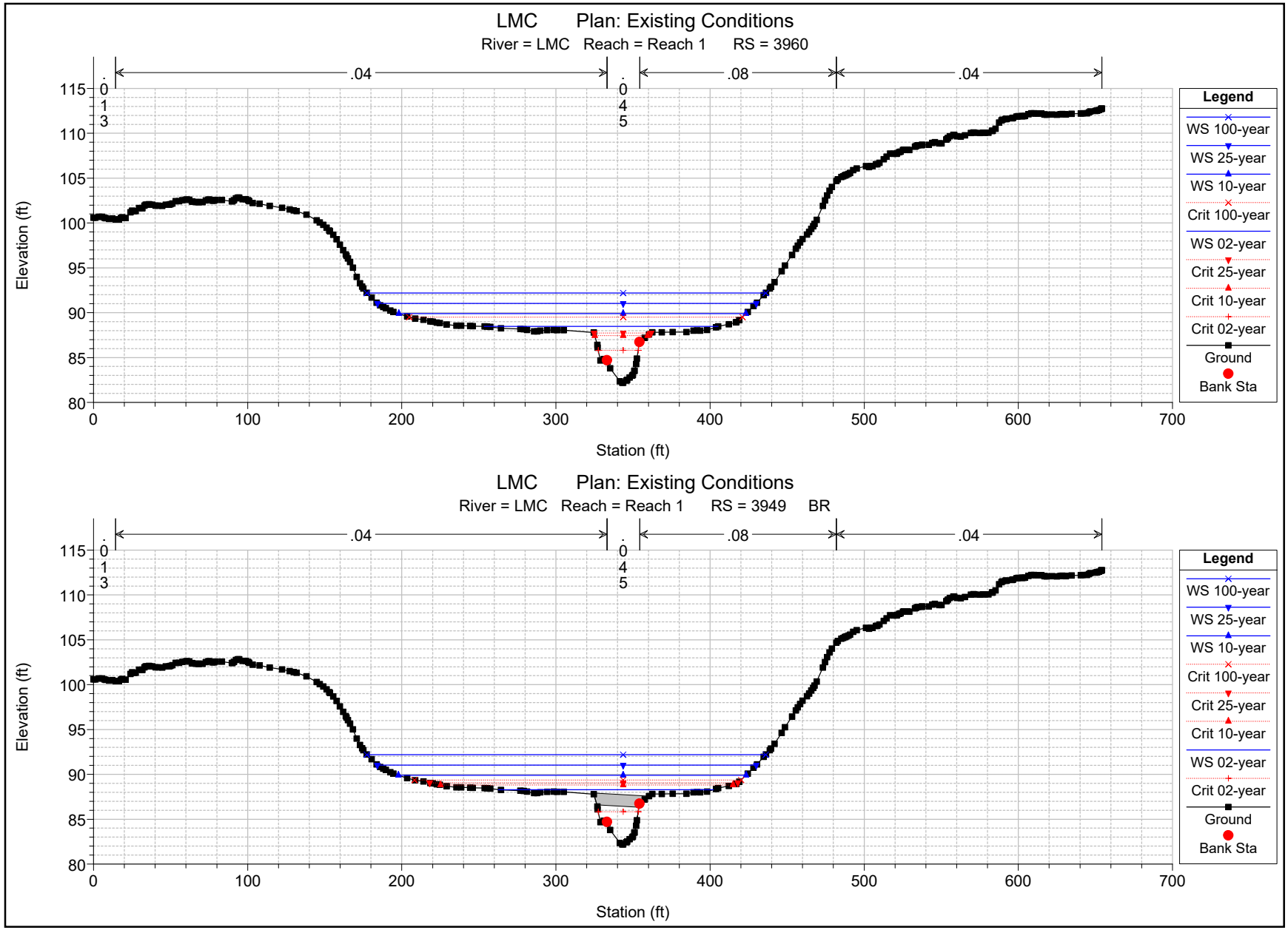

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4671
.04
.04
.04
.04
.013
.045
.013
Elevation (ft)
125
120
115
110
105
100
95
90
85
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4585
.04
.04
.04
.04
.013
.013
.04
.045
.013
Elevation (ft)
120
115
110
105
100
95
90
85
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

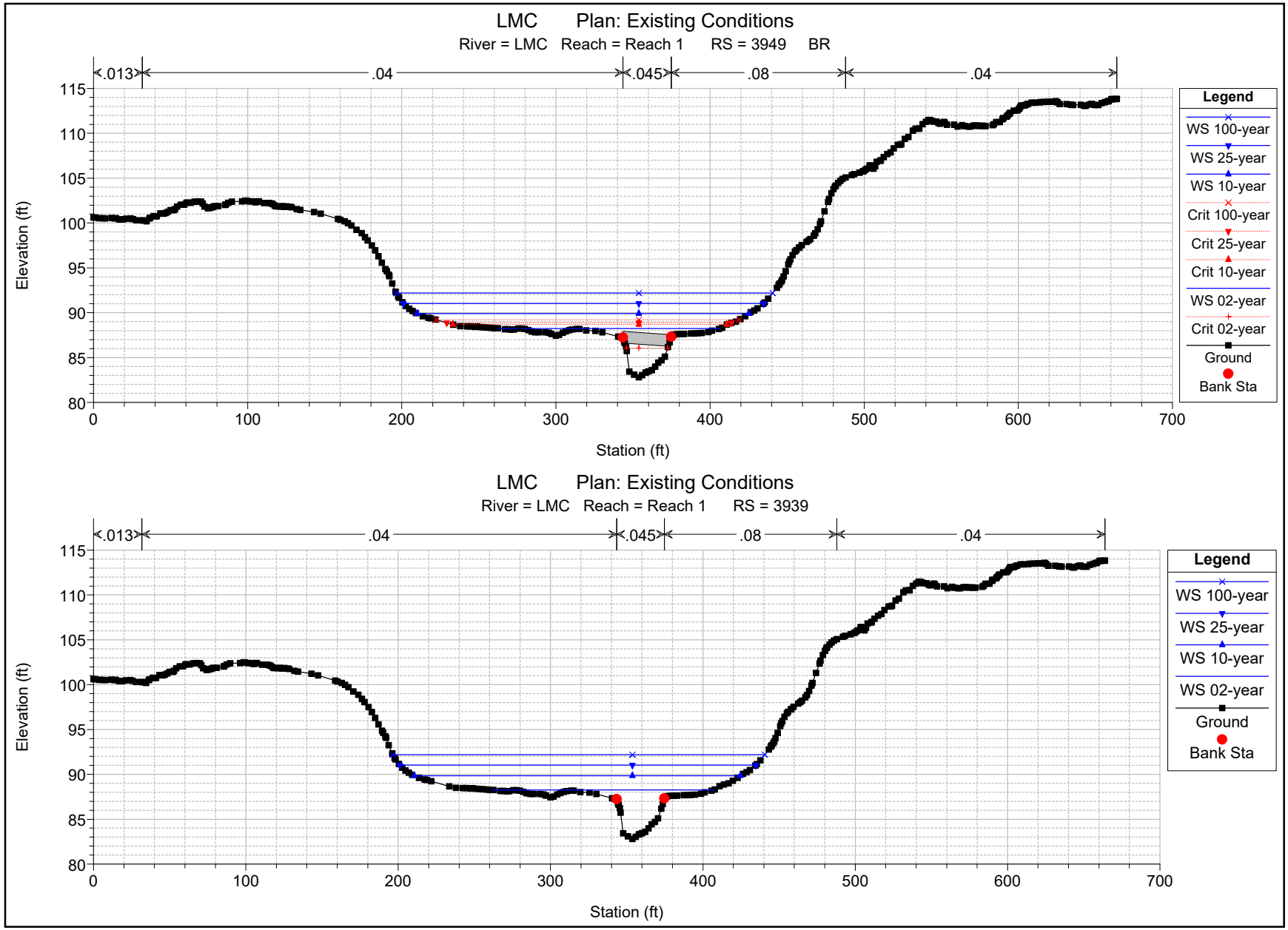

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4568
.013
.04
.013
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4561 BR
.013
.04
.013
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta

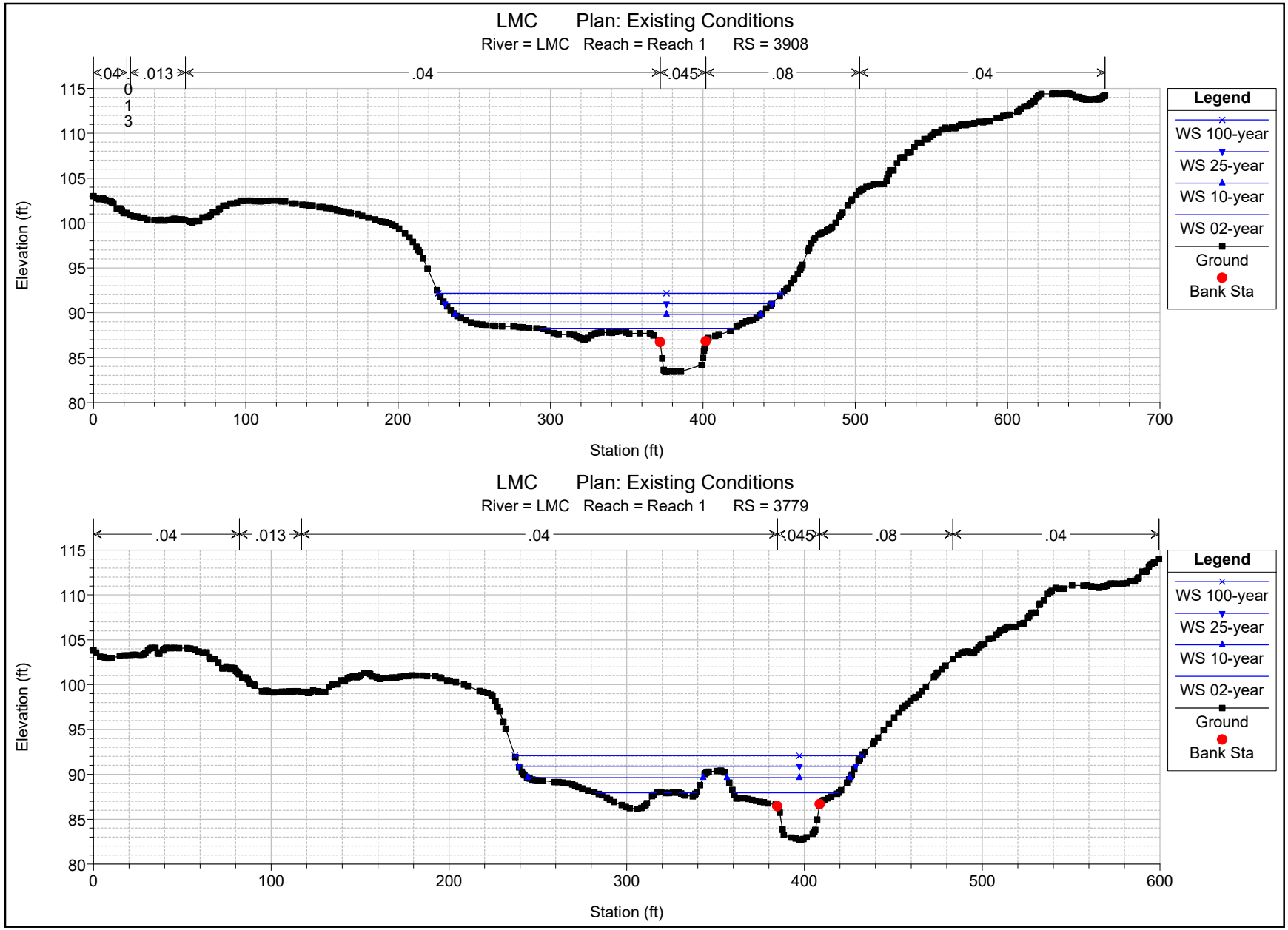

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4561 BR
.04
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4555
.04
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Ground
Bank Sta

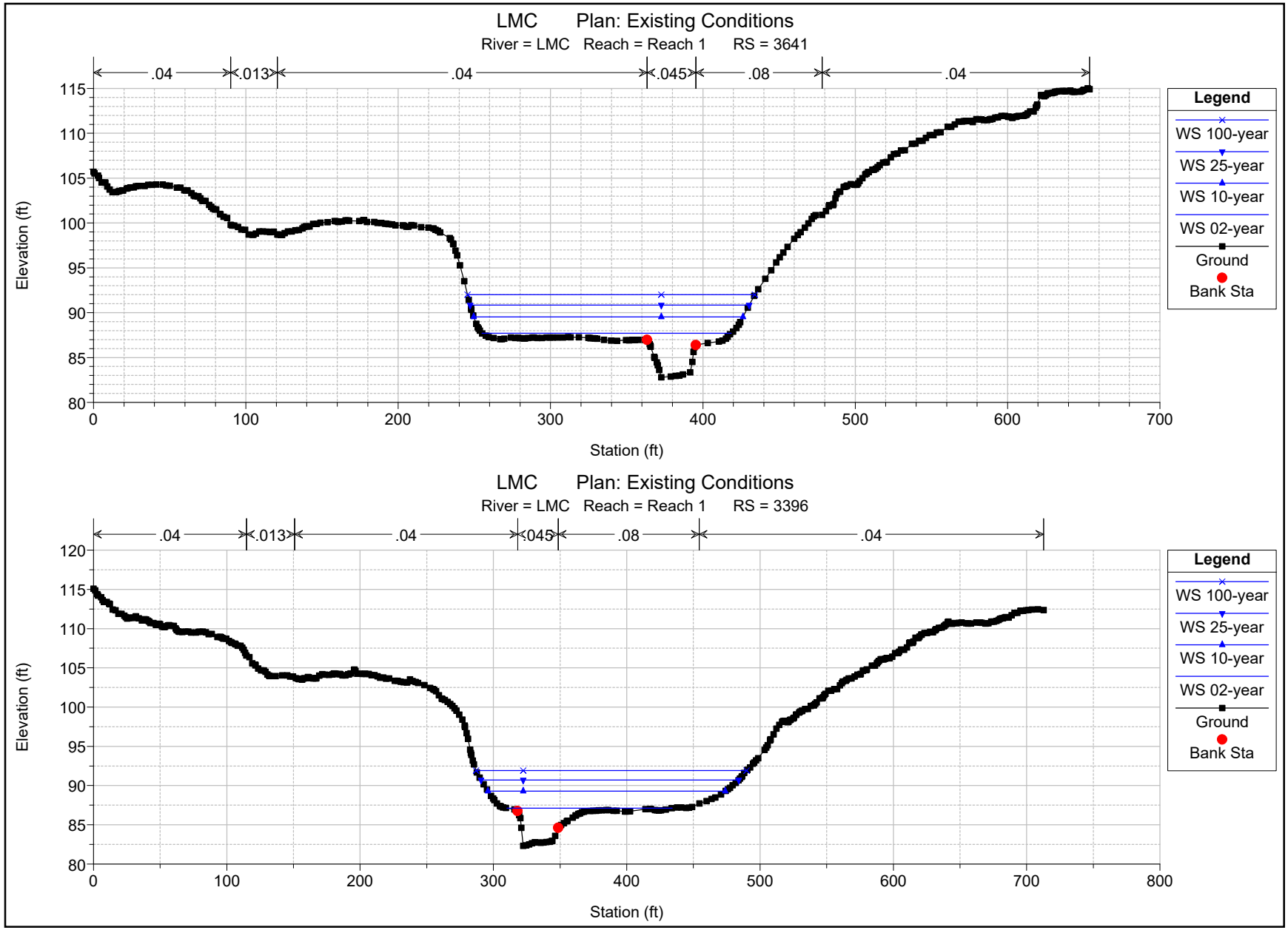

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4537
.04
.04
.04
.04
.04
.013
.045
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 10-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4328
.04
.013
.04
.045
.04
.08
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

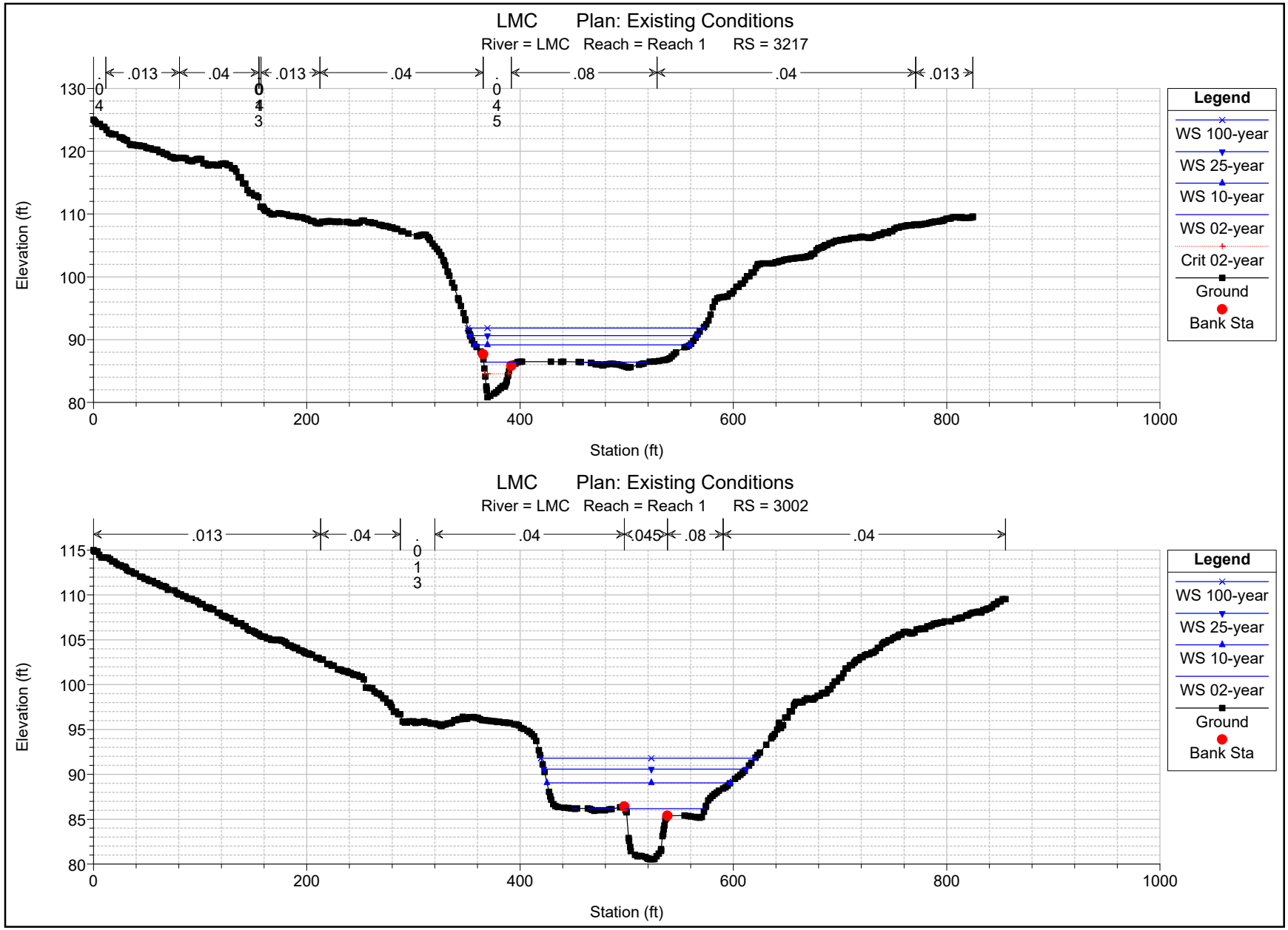

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 4058
.04
.08
.04
.013
.045
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3989
.04
.08
.013
.045
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

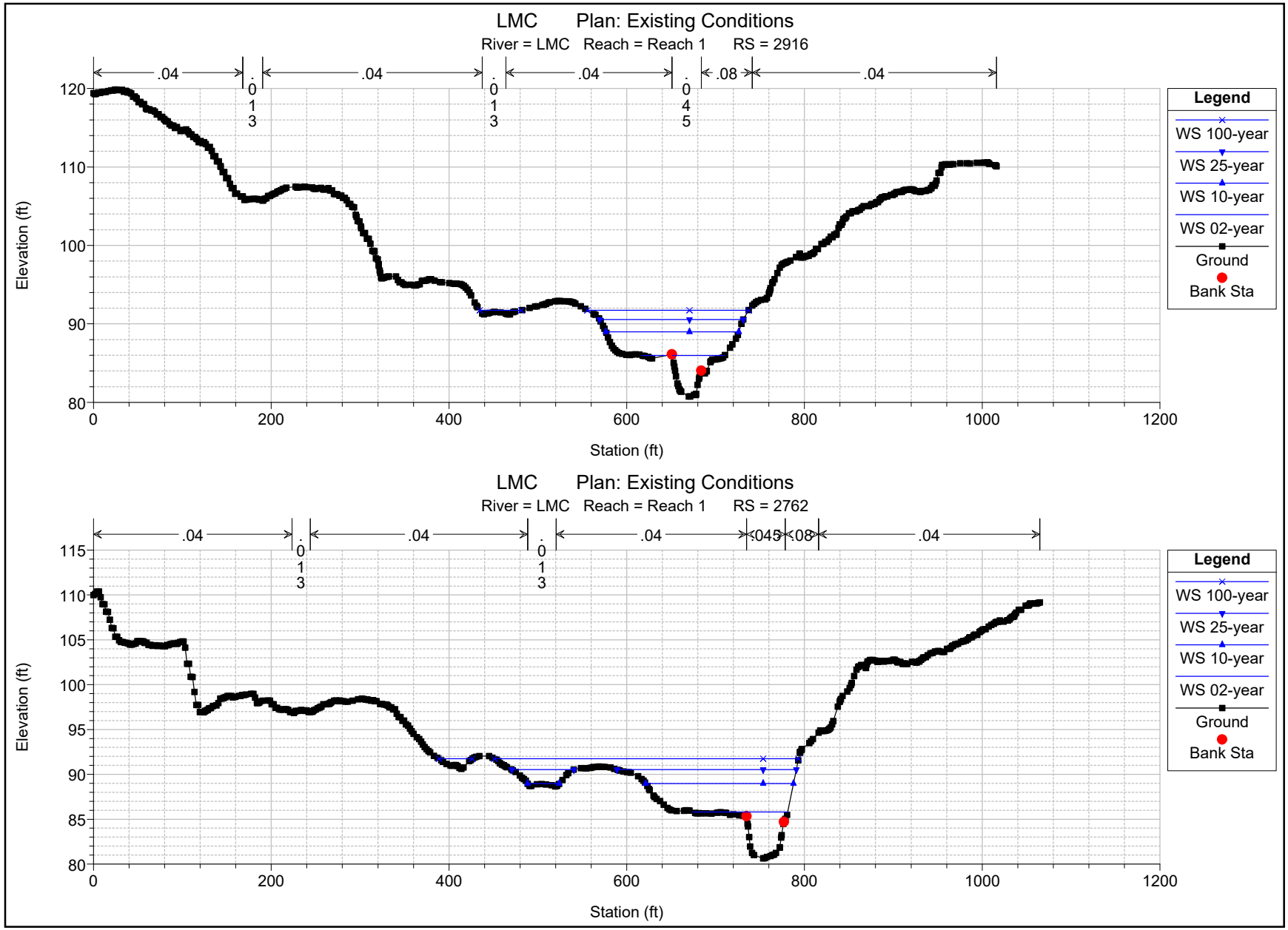

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3960
.04
.08
.04
.013
.045
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3949 BR
.04
.08
.04
.013
.045
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta

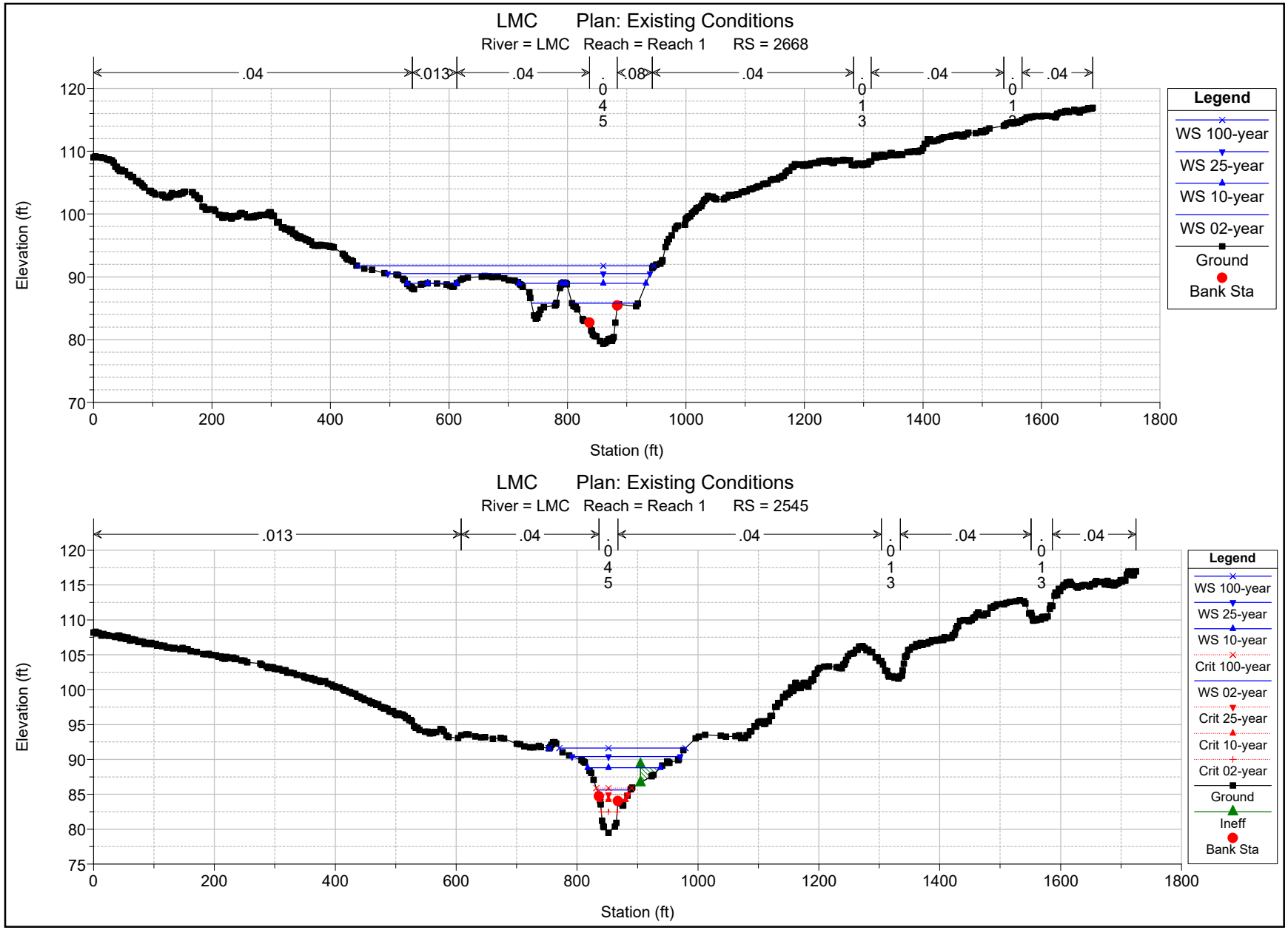

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3949 BR
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3939
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

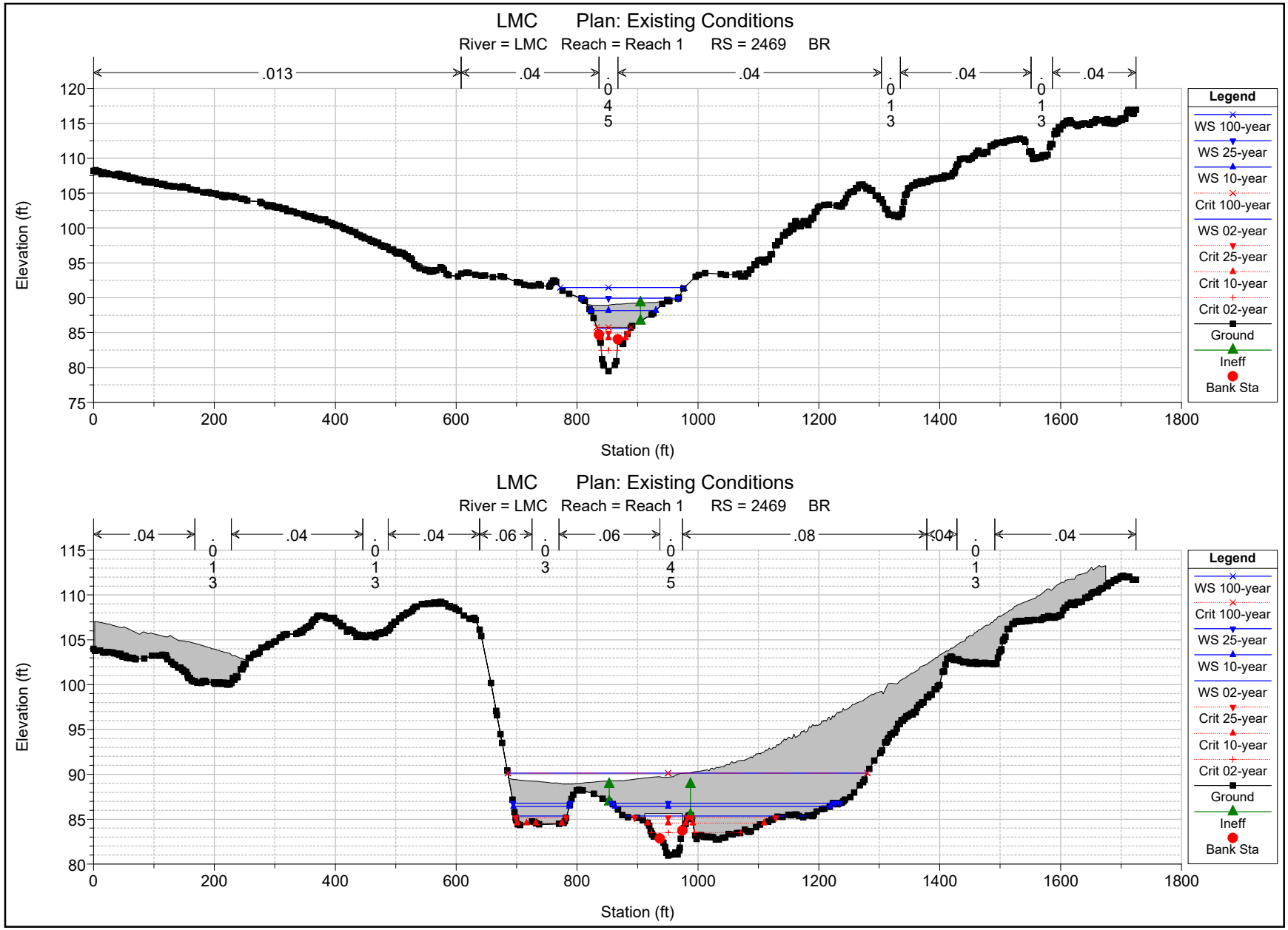

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3908
.04
.013
.04
.045
.08
.04
0
1
3
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3779
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

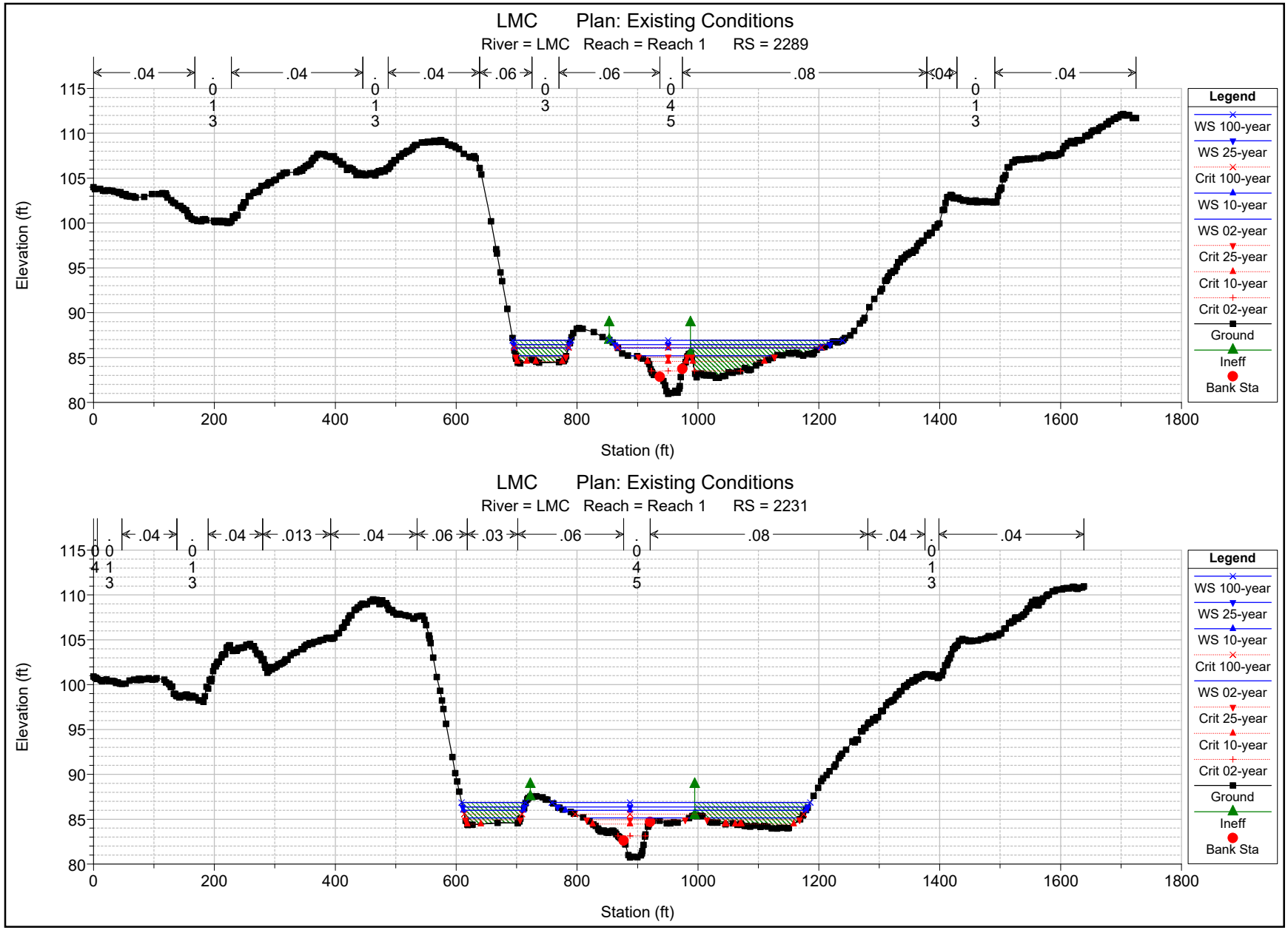

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3641
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3396
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

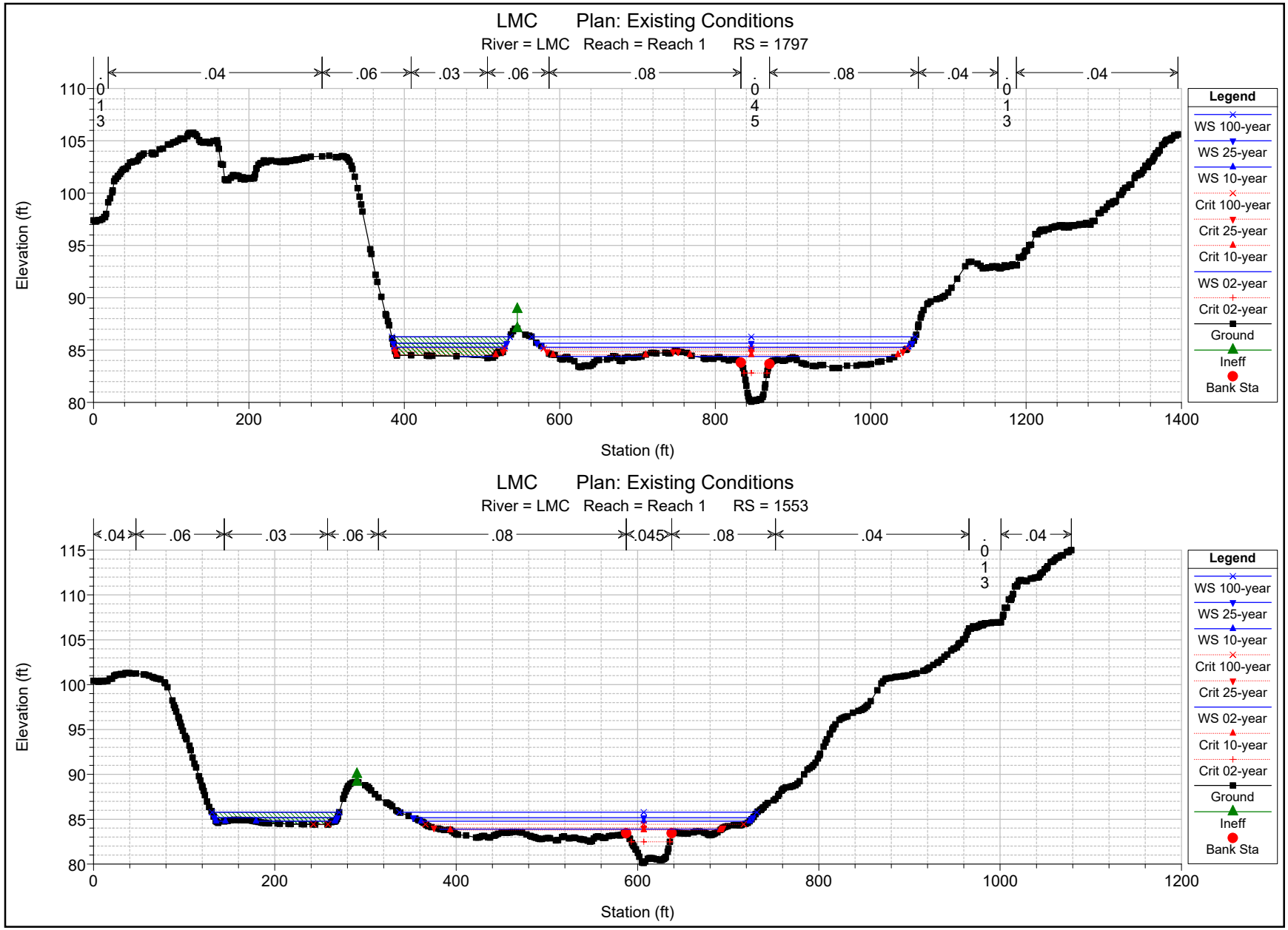

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3217
.013
.04
.013
.04
.08
.04
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 3002
.013
.04
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

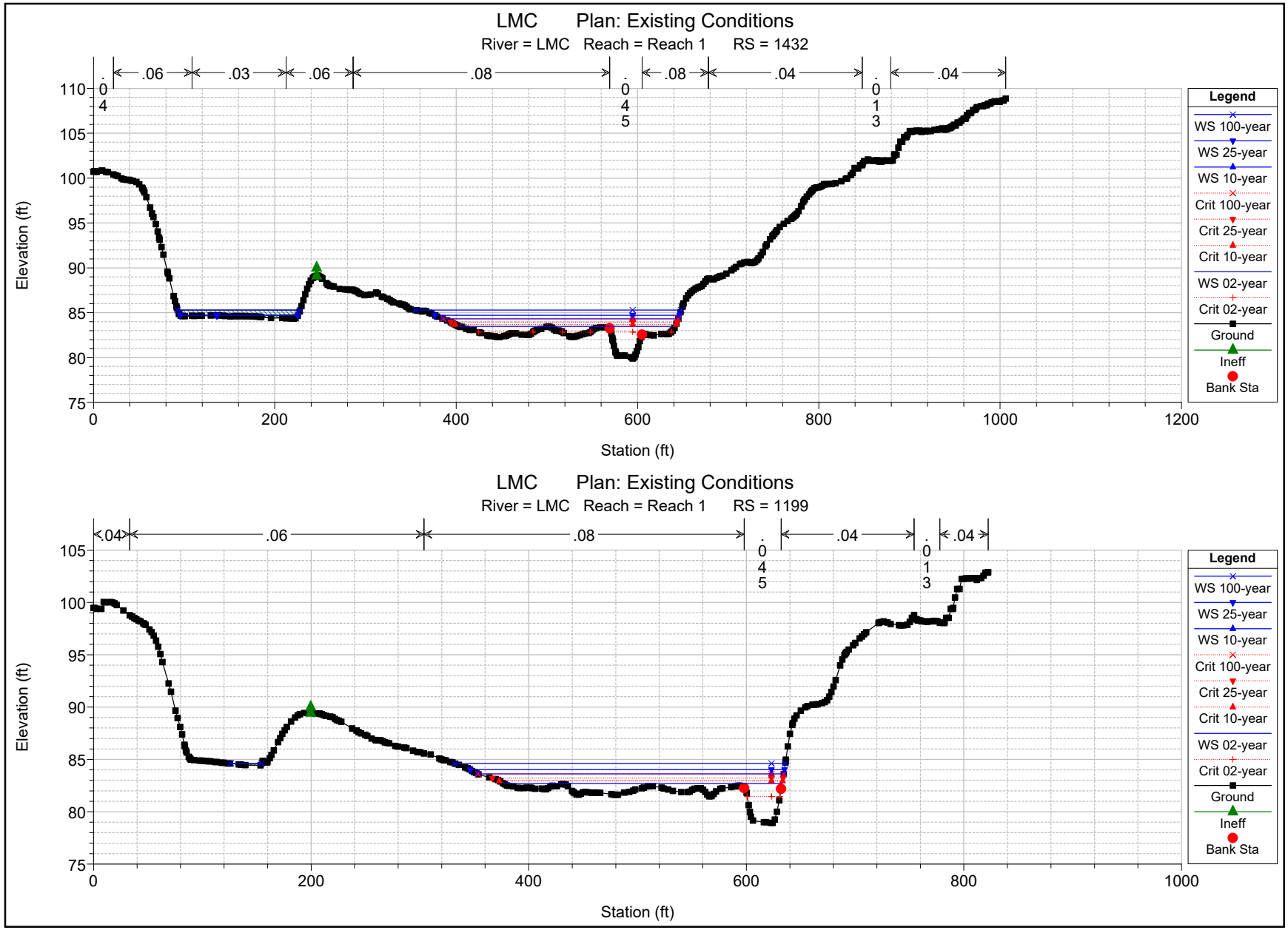

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 2916
.04
.04
.04
.08
.04
.013
.013
.045
Elevation (ft)
120
110
100
90
80
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 2762
.04
.04
.04
.045
.08
.04
.013
.013
Elevation (ft)
115
110
105
100
95
90
85
80
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

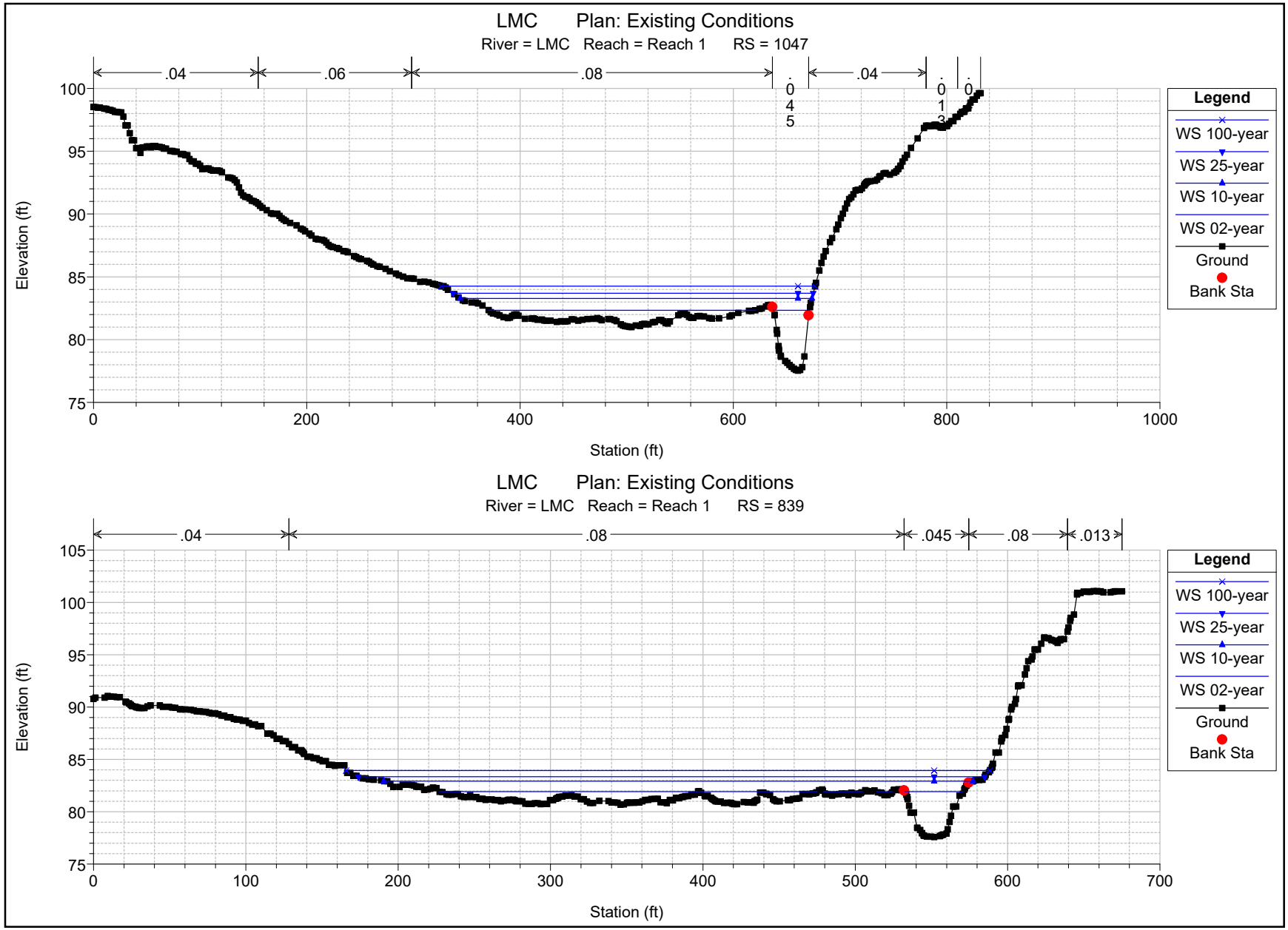

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 2668
.04
.013
.04
.045
.08
.04
.013
.04
.04
.013
.04
Elevation (ft)
120
110
100
90
80
70
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 2545
.013
.04
.045
.04
.013
.04
.04
.013
.04
Elevation (ft)
120
115
110
105
100
95
90
85
80
75
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

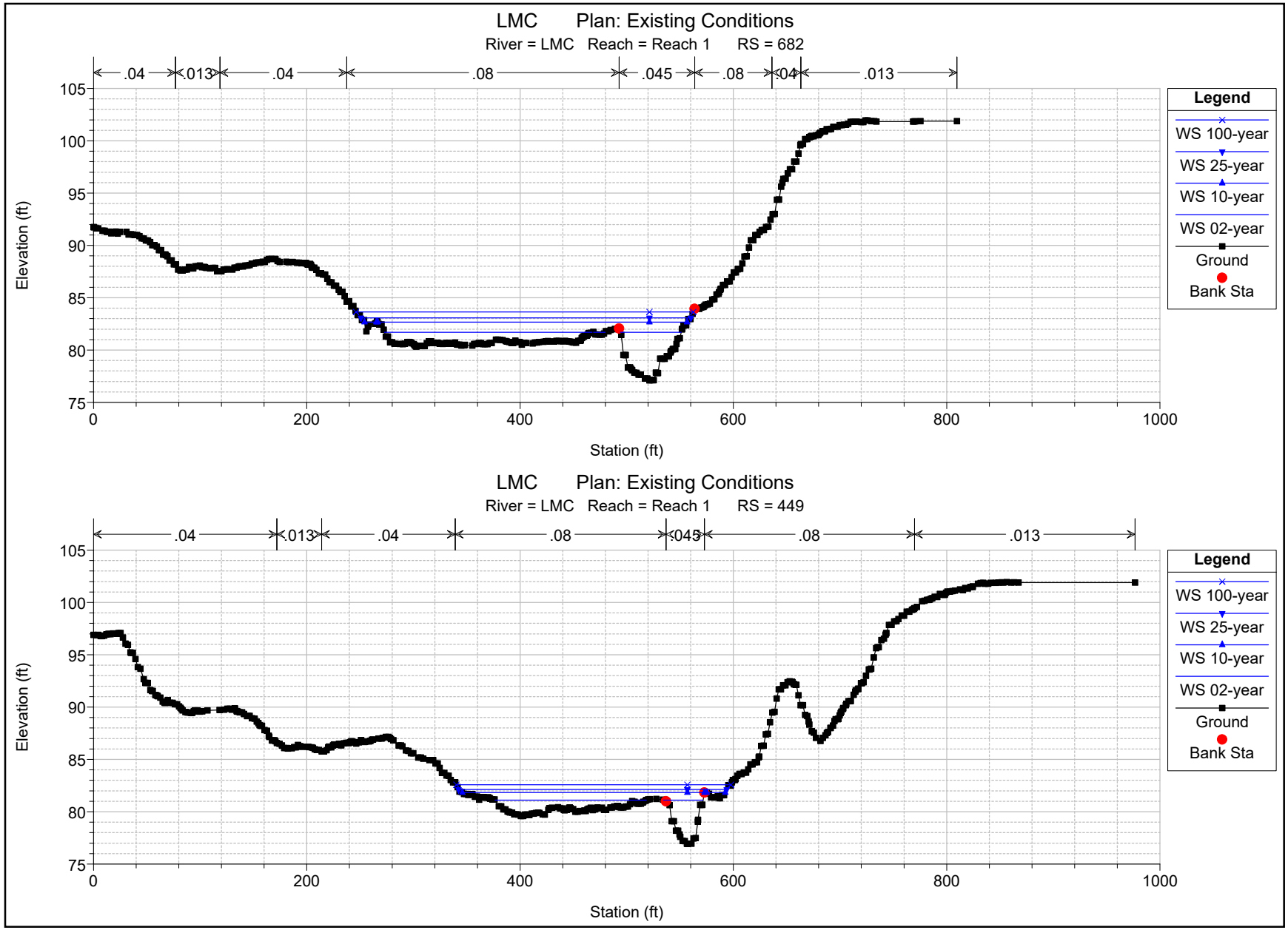

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 2469 BR
.013
.04
.045
.04
.013
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 2469 BR
.04
.013
.04
.013
.04
.06
.03
.06
.045
.08
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

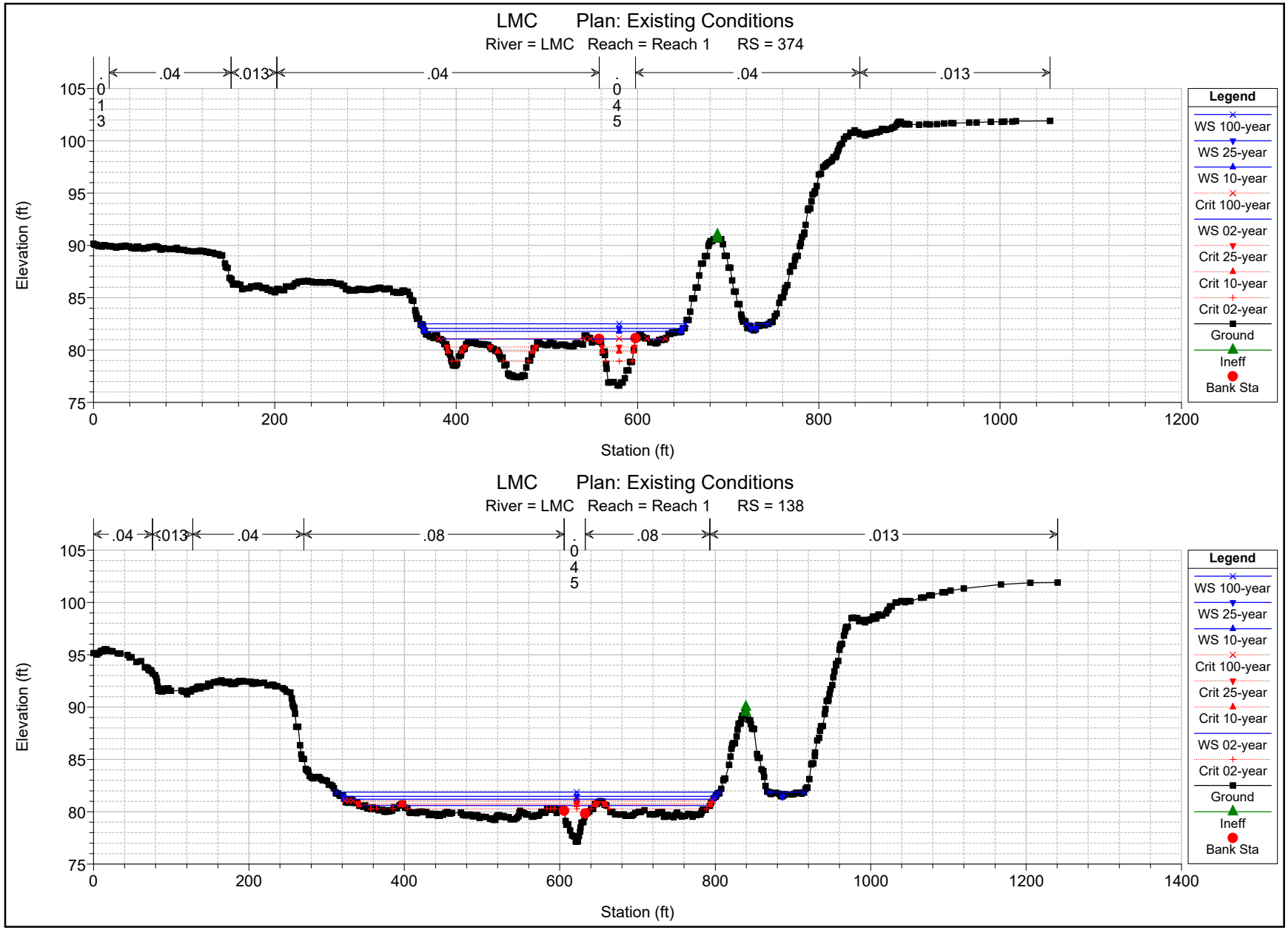

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 2289
.04
.04
.04
.06
.06
.08
.04
.04
.035
.035
.03
.045
.035
Elevation (ft)
115
110
105
100
95
90
85
80
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 2231
.04
.04
.04
.013
.04
.06
.03
.06
.08
.04
.04
.035
.035
.035
.045
.035
Elevation (ft)
115
110
105
100
95
90
85
80
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

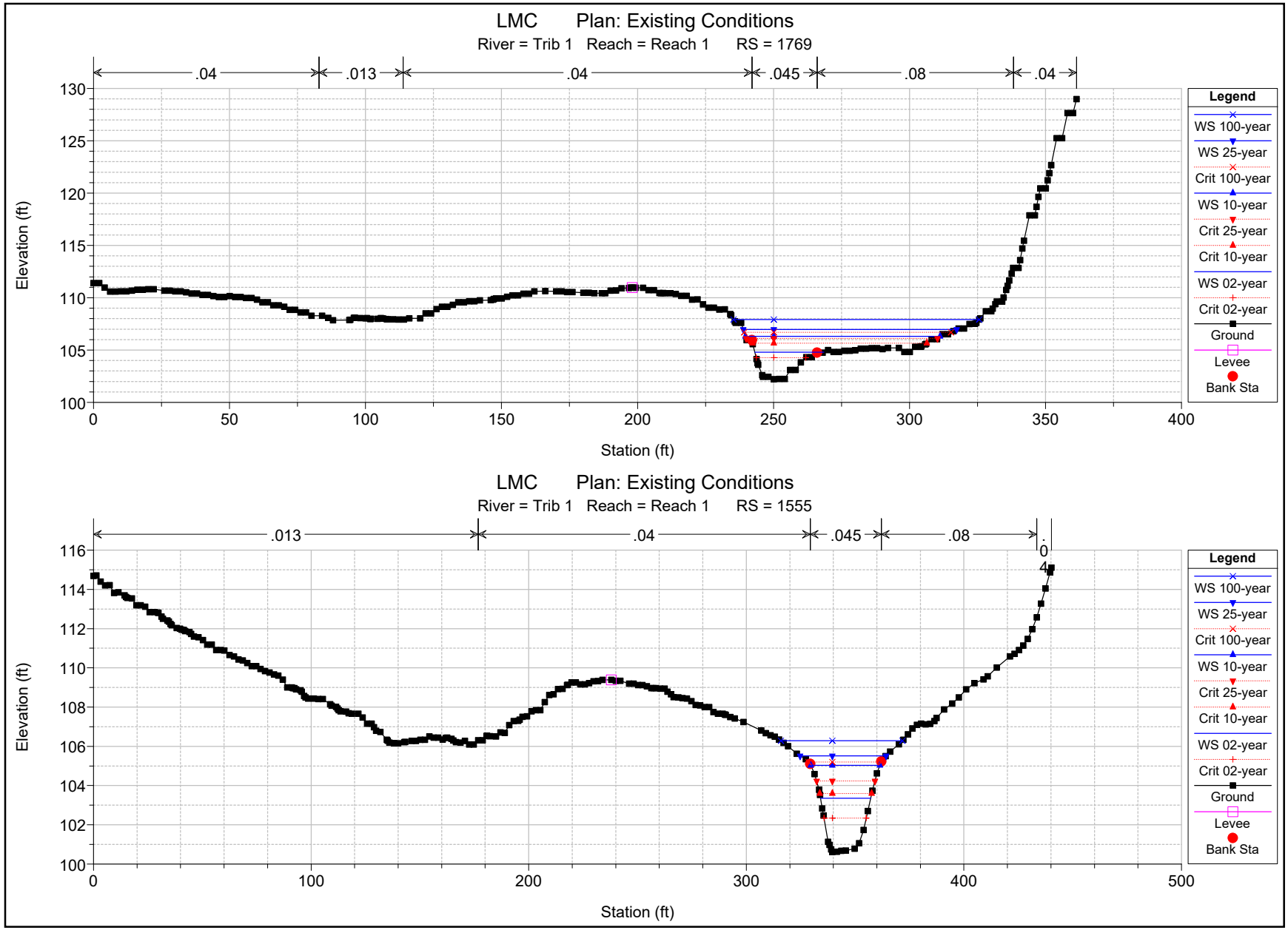

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 1797
.04
.06
.03
.06
.08
.045
.08
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 1553
.04
.06
.03
.06
.08
.045
.08
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
WS 02-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

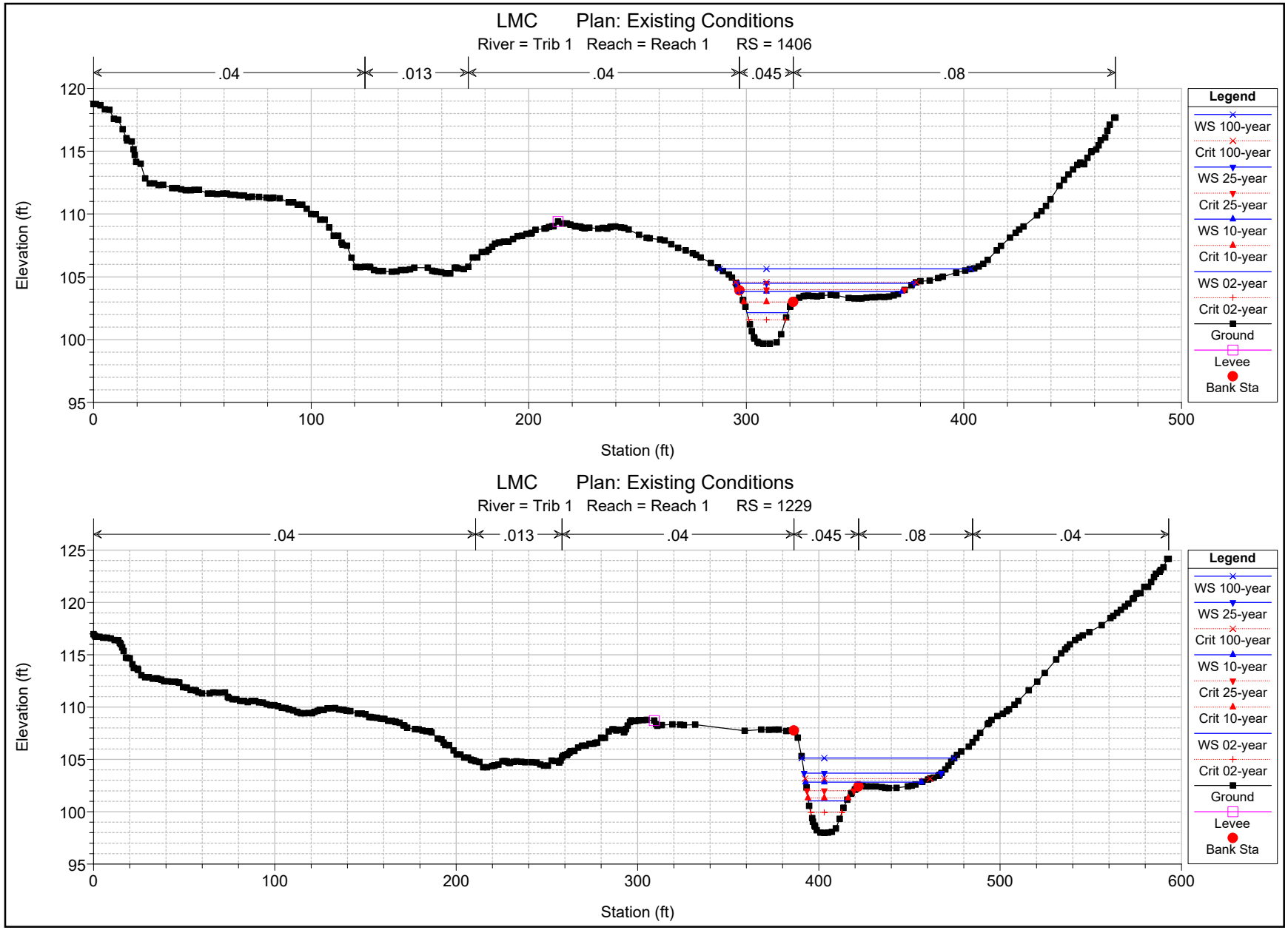

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 1432
.04
.06
.03
.06
.08
.045
.08
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 1199
.04
.06
.08
.045
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

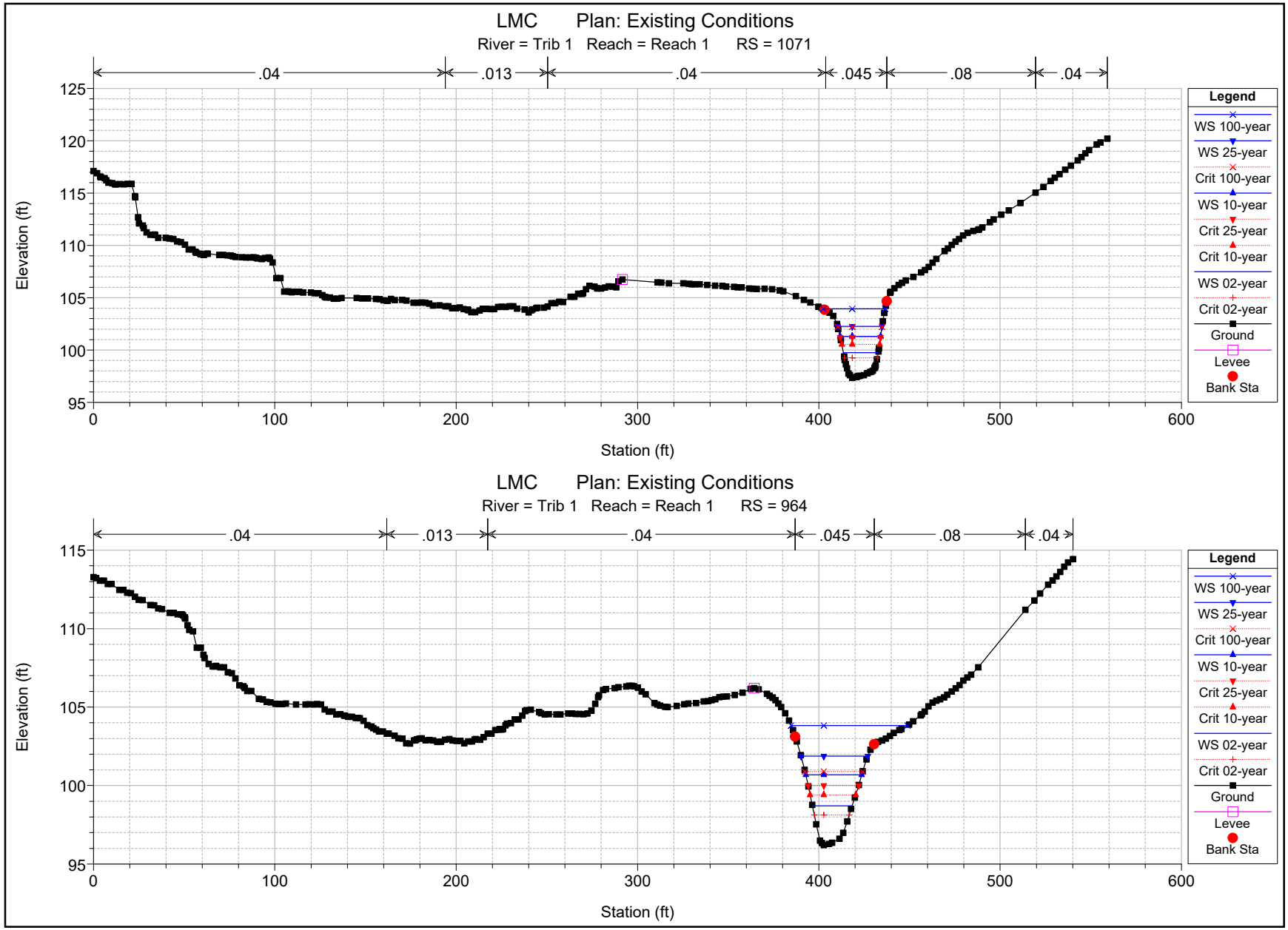

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 1047
.04
.06
.08
.045
.04
.013
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 839
.04
.08
.045
.08
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

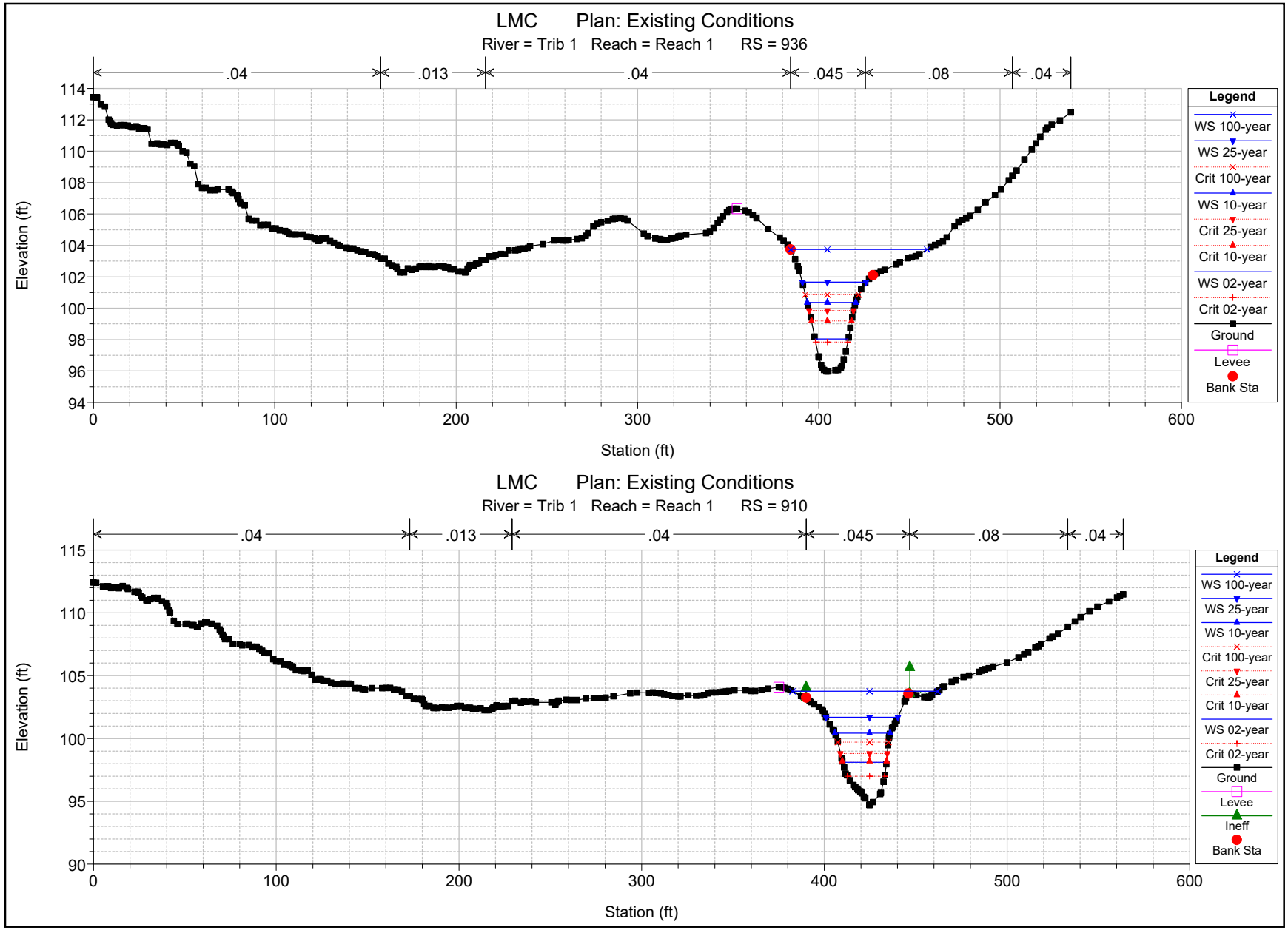

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 682
.04
.013
.04
.08
.045
.08
.04
.013
Elevation (ft)
105
100
95
90
85
80
75
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 449
.04
.013
.04
.08
.045
.08
.013
Elevation (ft)
105
100
95
90
85
80
75
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

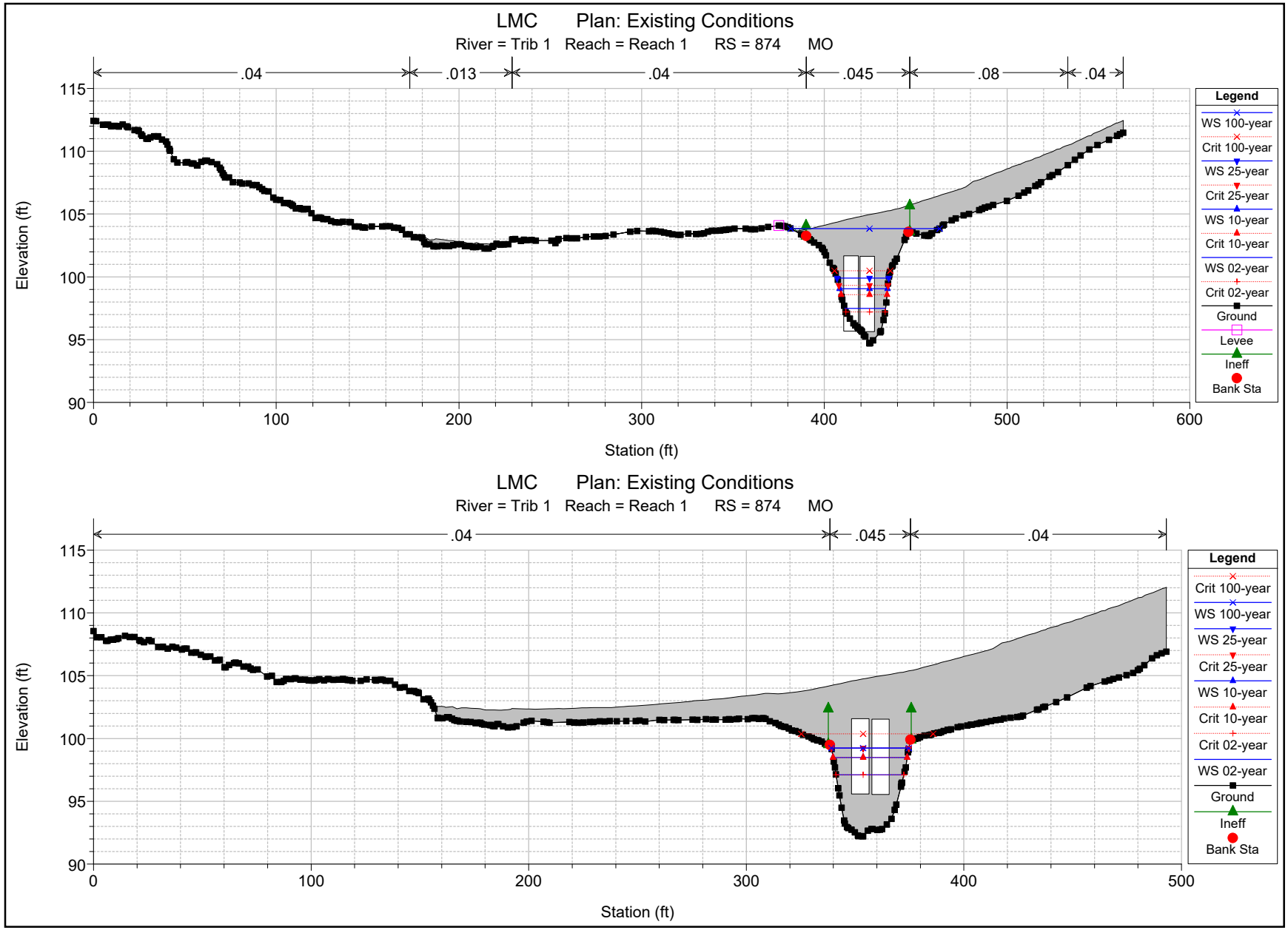

LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 374
.04
.013
.04
.04
.013
.013
.045
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = LMC Reach = Reach 1 RS = 138
.04
.013
.04
.08
.08
.013
.045
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

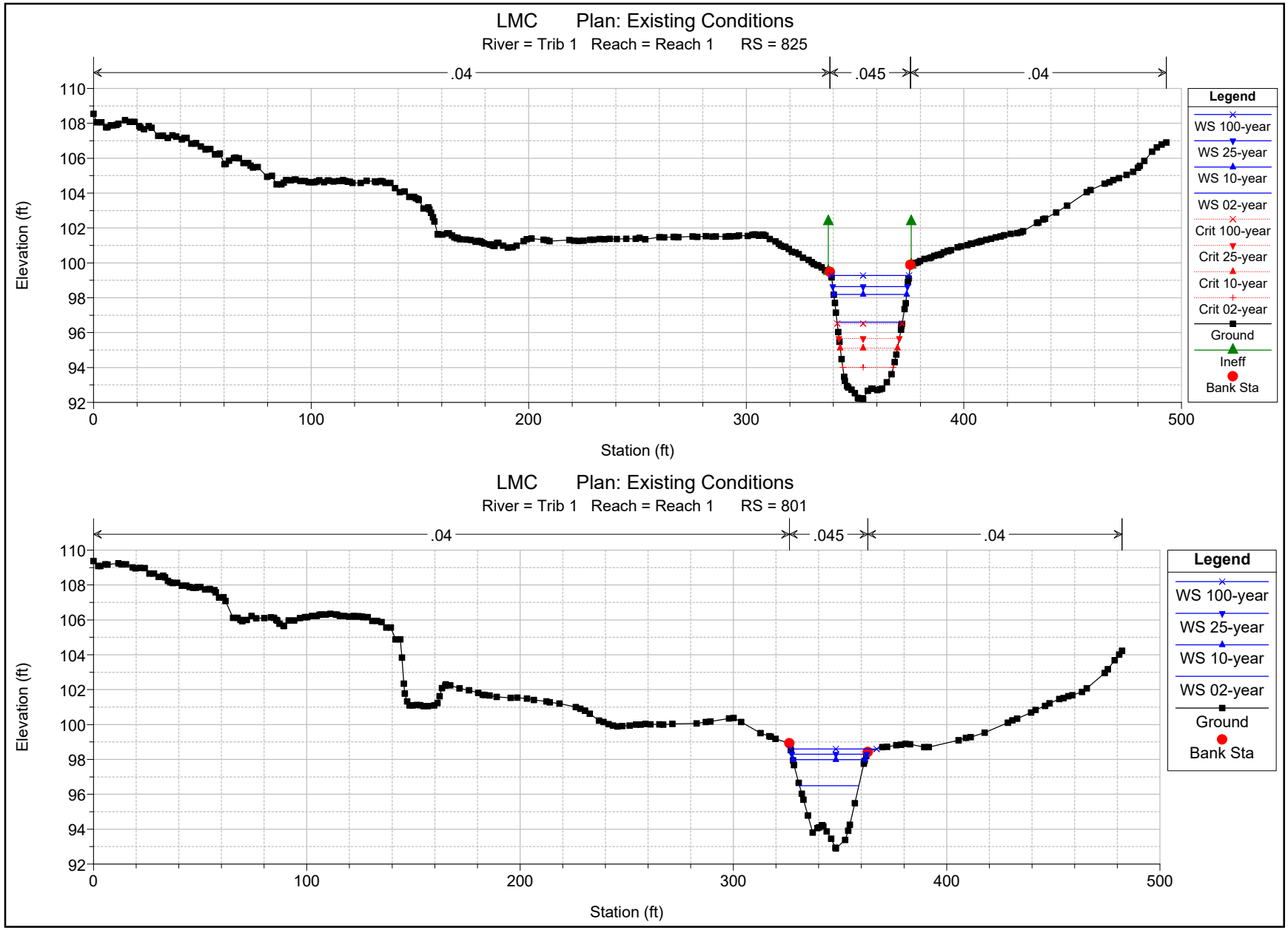

LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 1769
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta
LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 1555
.013
.04
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta

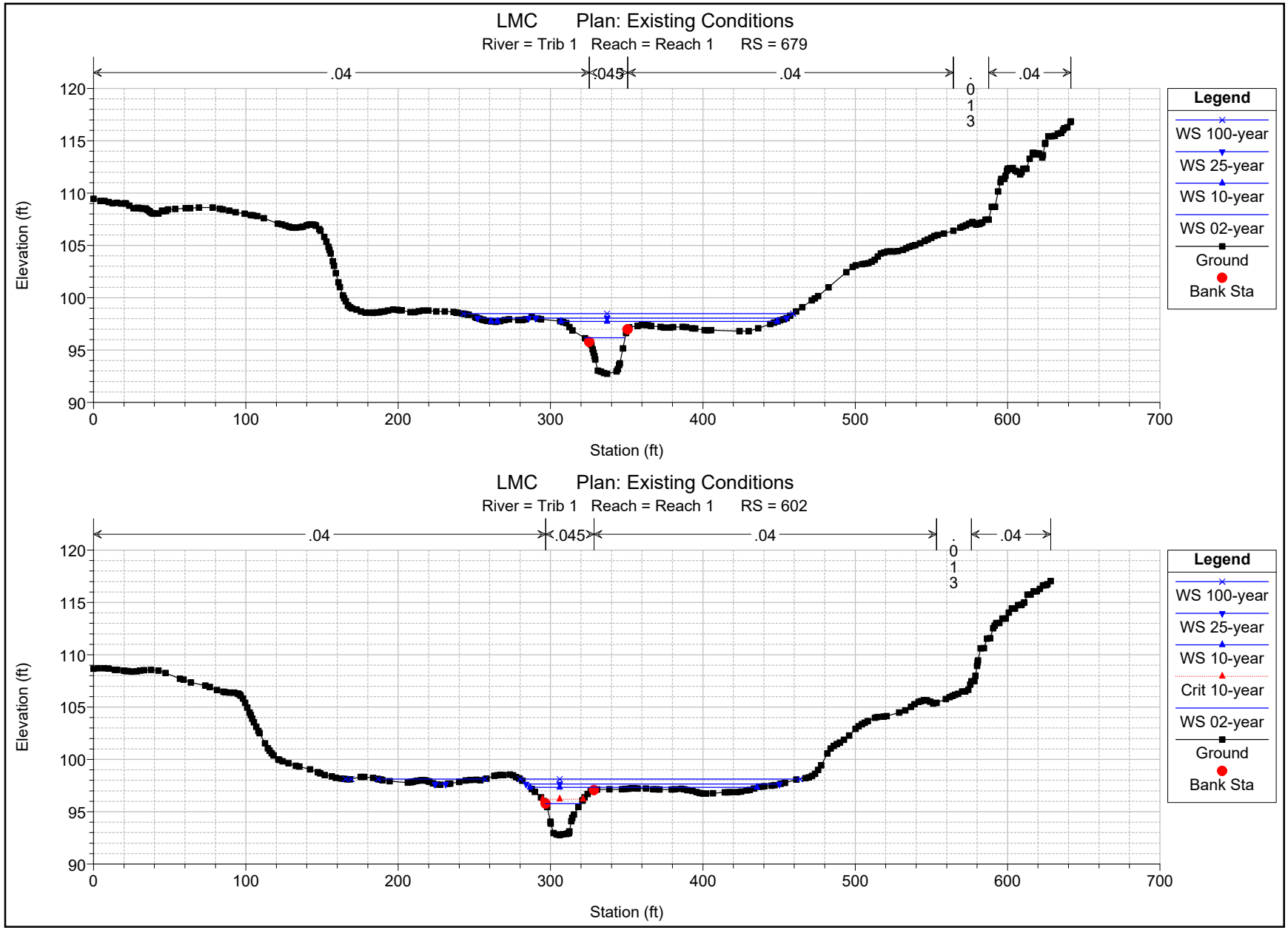

LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 1406
.04
.013
.04
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta
LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 1229
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta

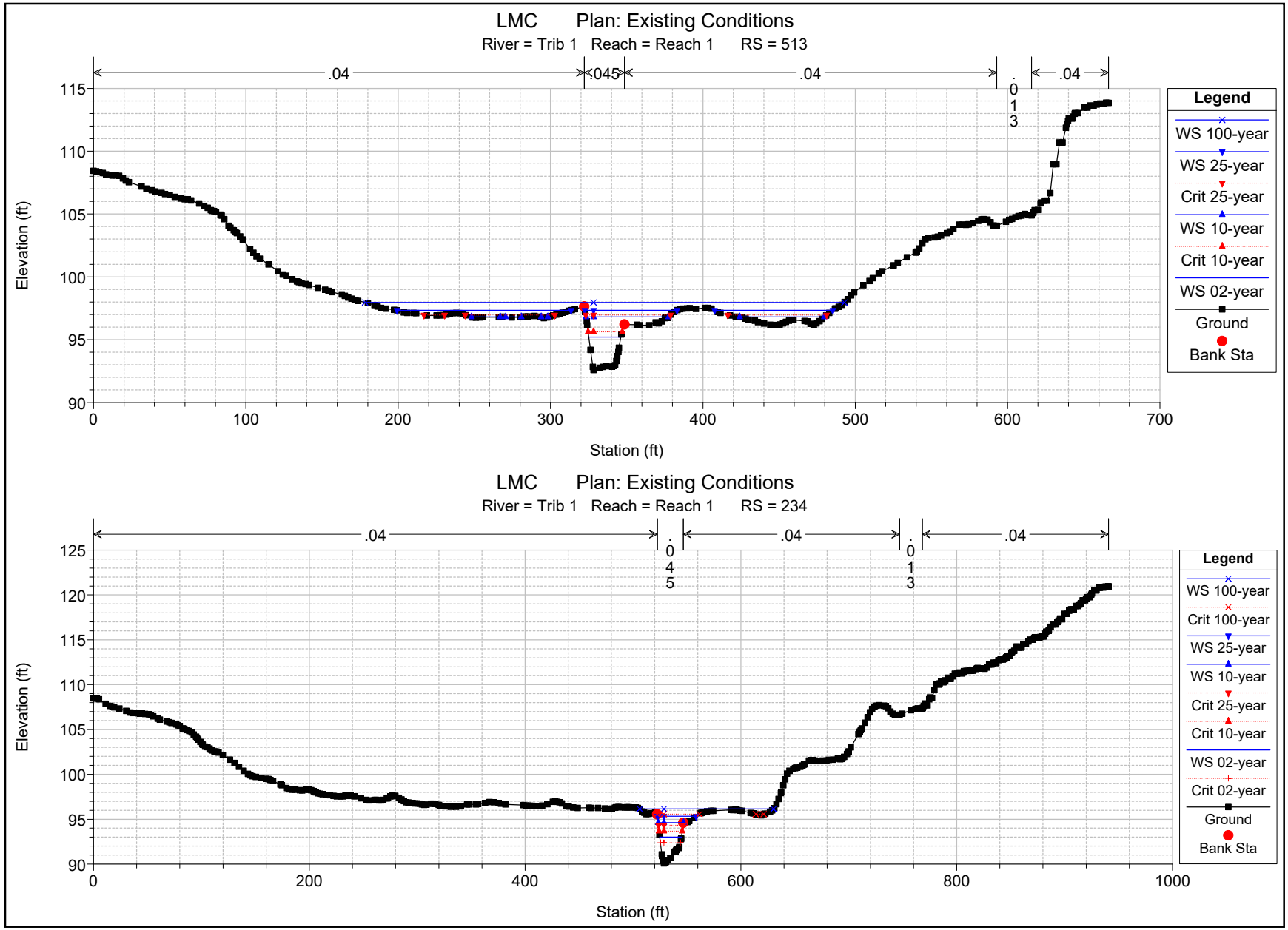

LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 1071
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta
LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 964
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta

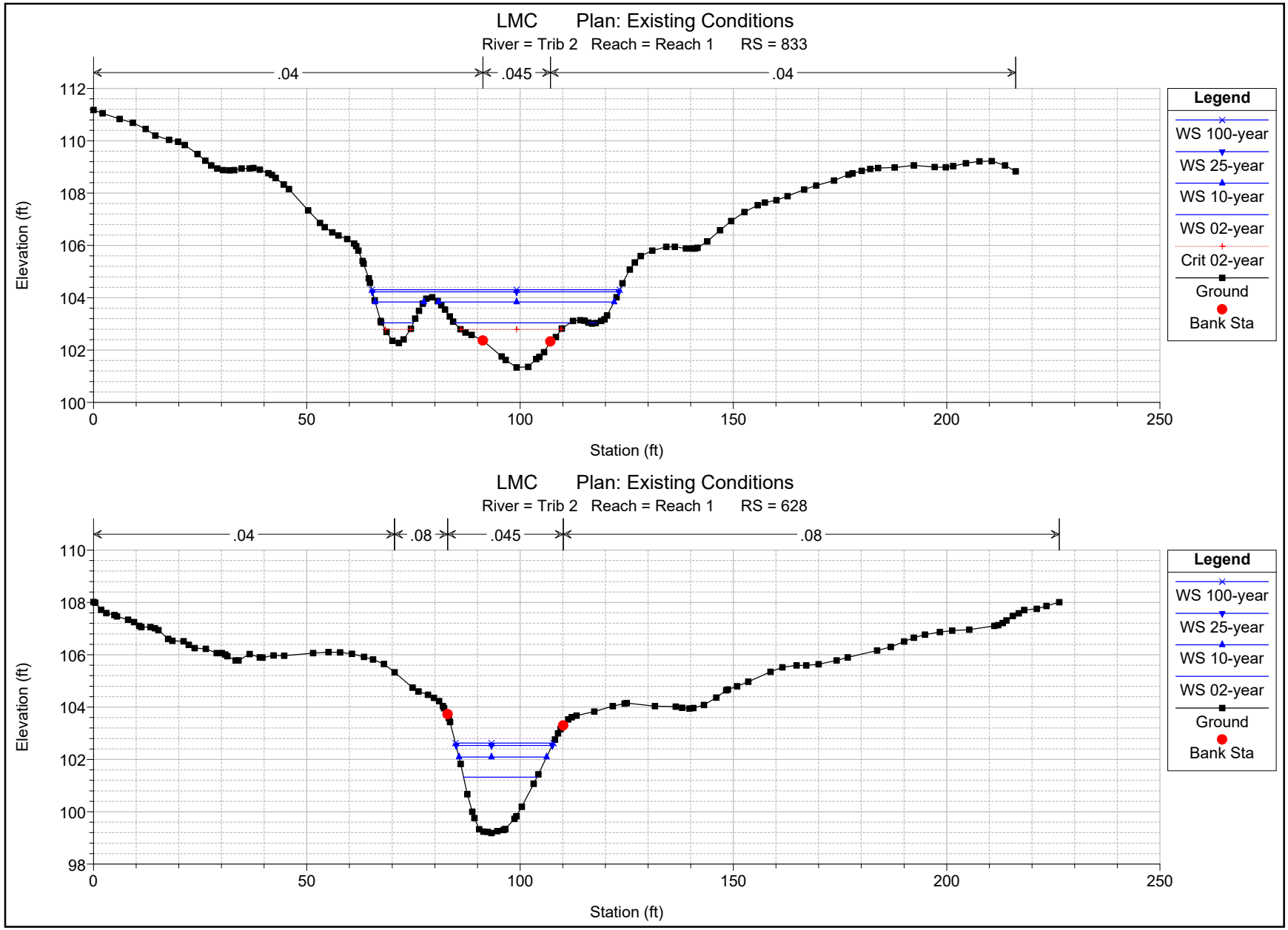

LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 936
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta
LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 910
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Ineff
Bank Sta

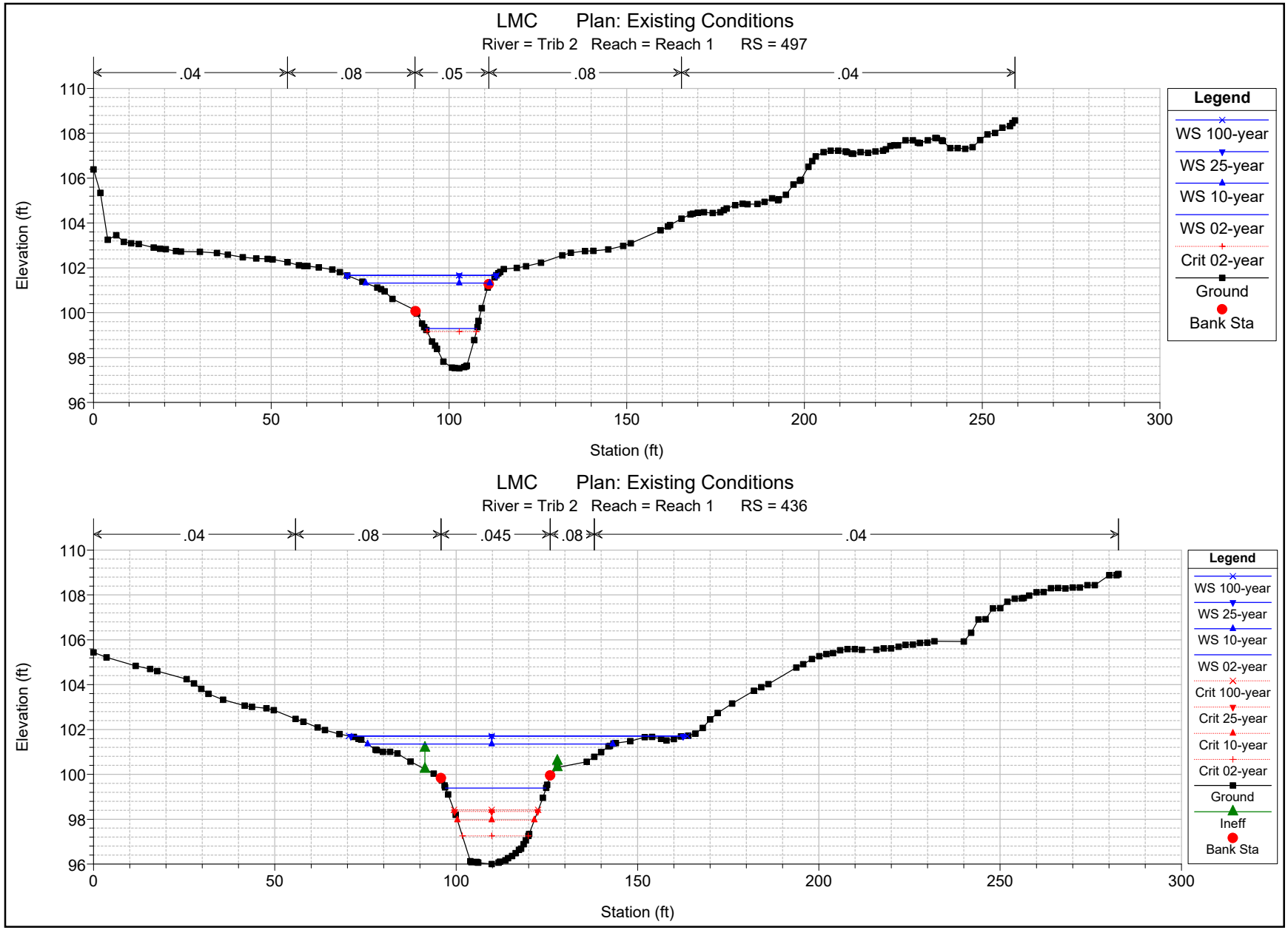

LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 874 MO
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 874 MO
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
Crit 100-year
WS 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
Crit 02-year
WS 02-year
Ground
Ineff
Bank Sta

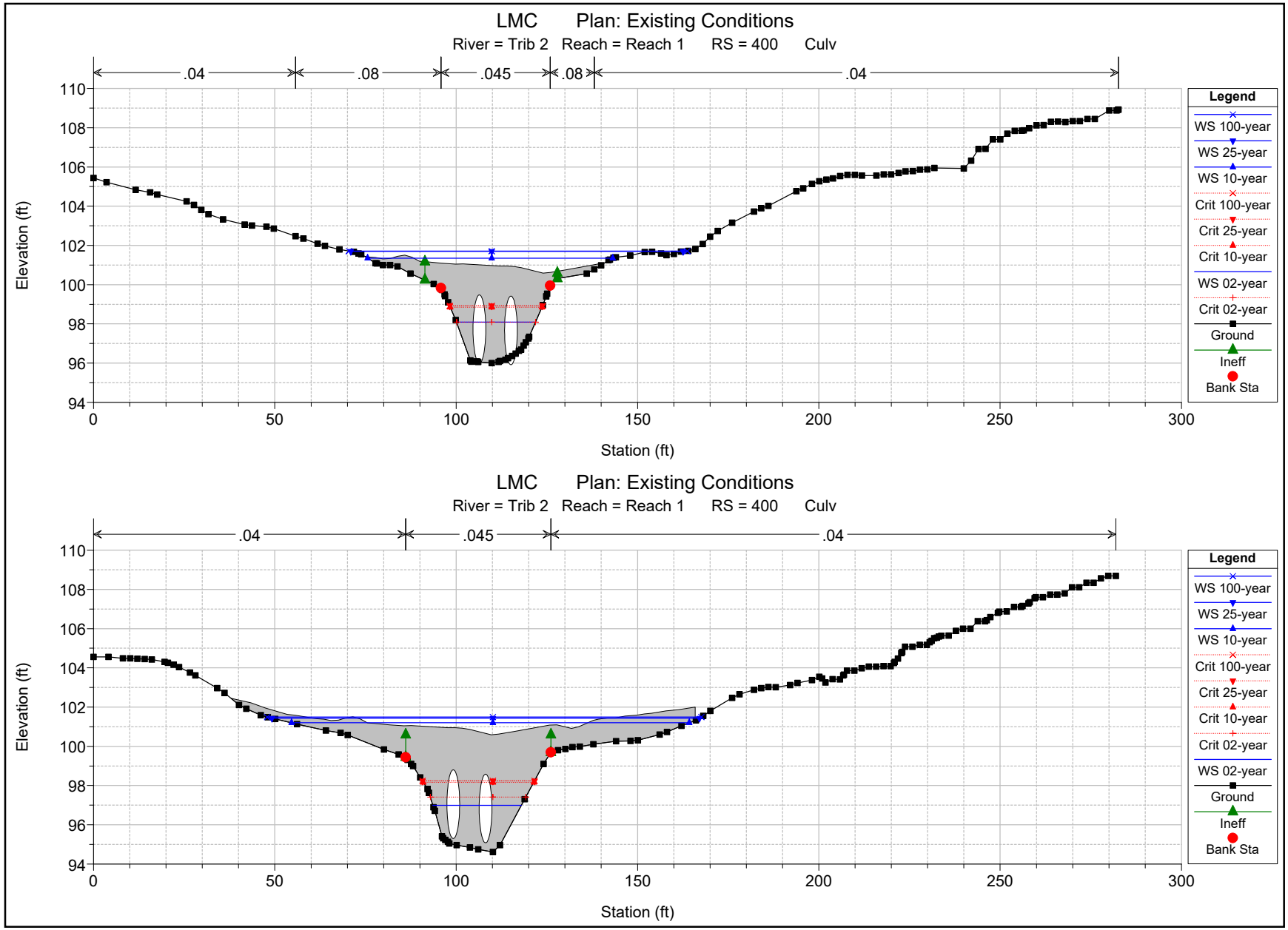

LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 825
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 801
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

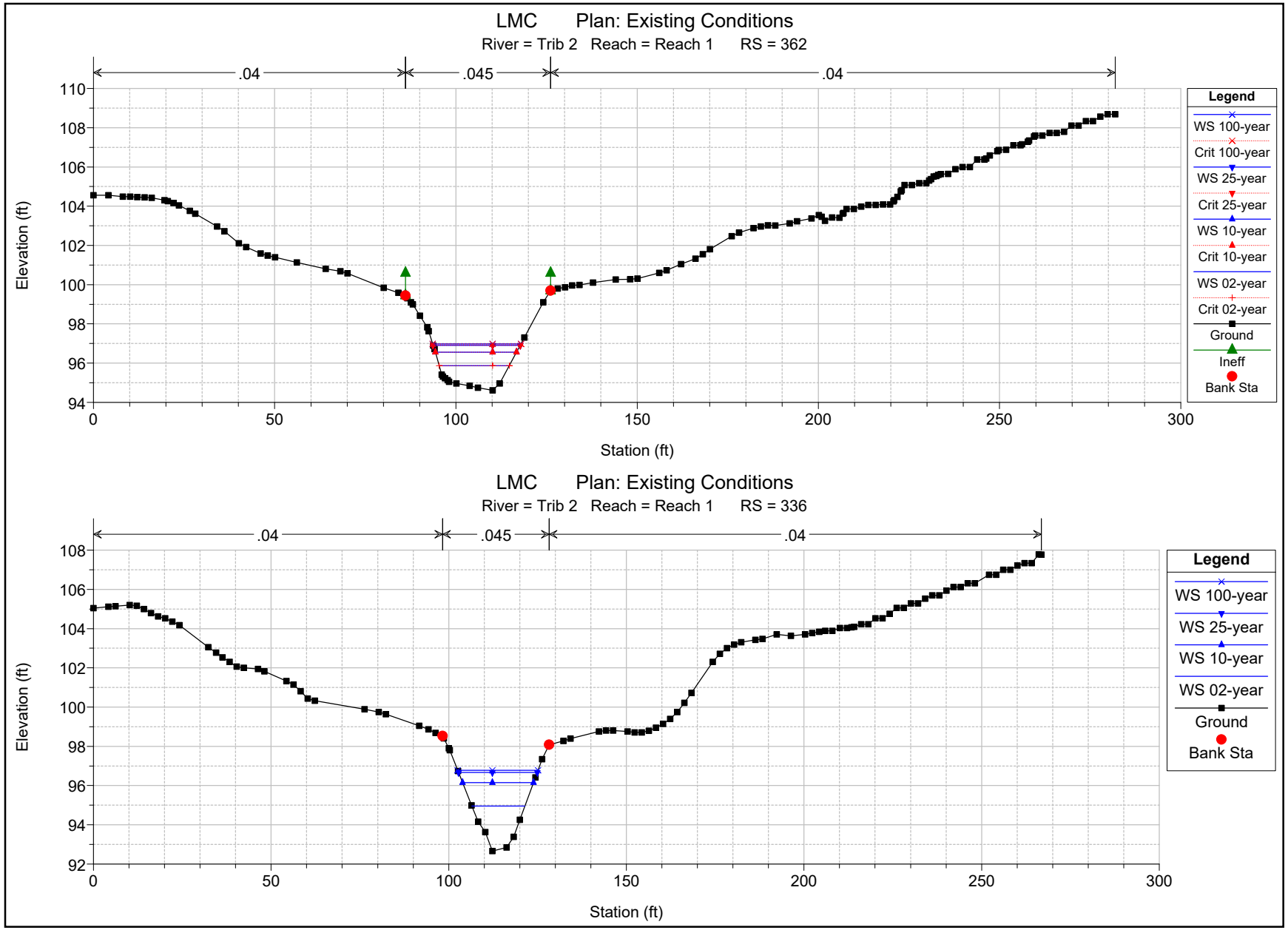

LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 679
.04
.045
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 602
.04
.045
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 10-year
WS 02-year
Ground
Bank Sta

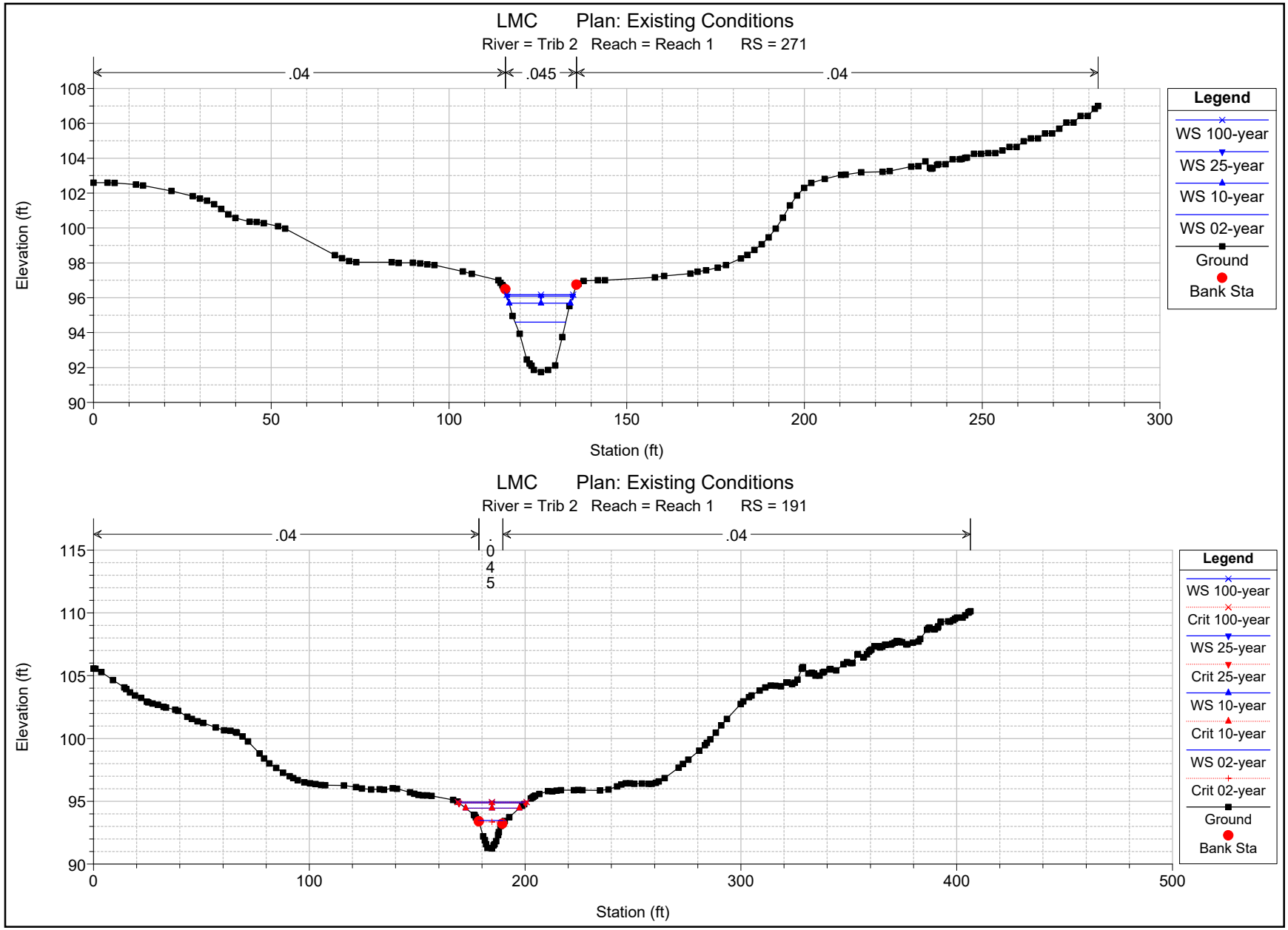

LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 513
.04
.045
.04
.013
.04
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = Trib 1 Reach = Reach 1 RS = 234
.04
.045
.04
.013
.04
Elevation (ft)
125
120
115
110
105
100
95
90
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta

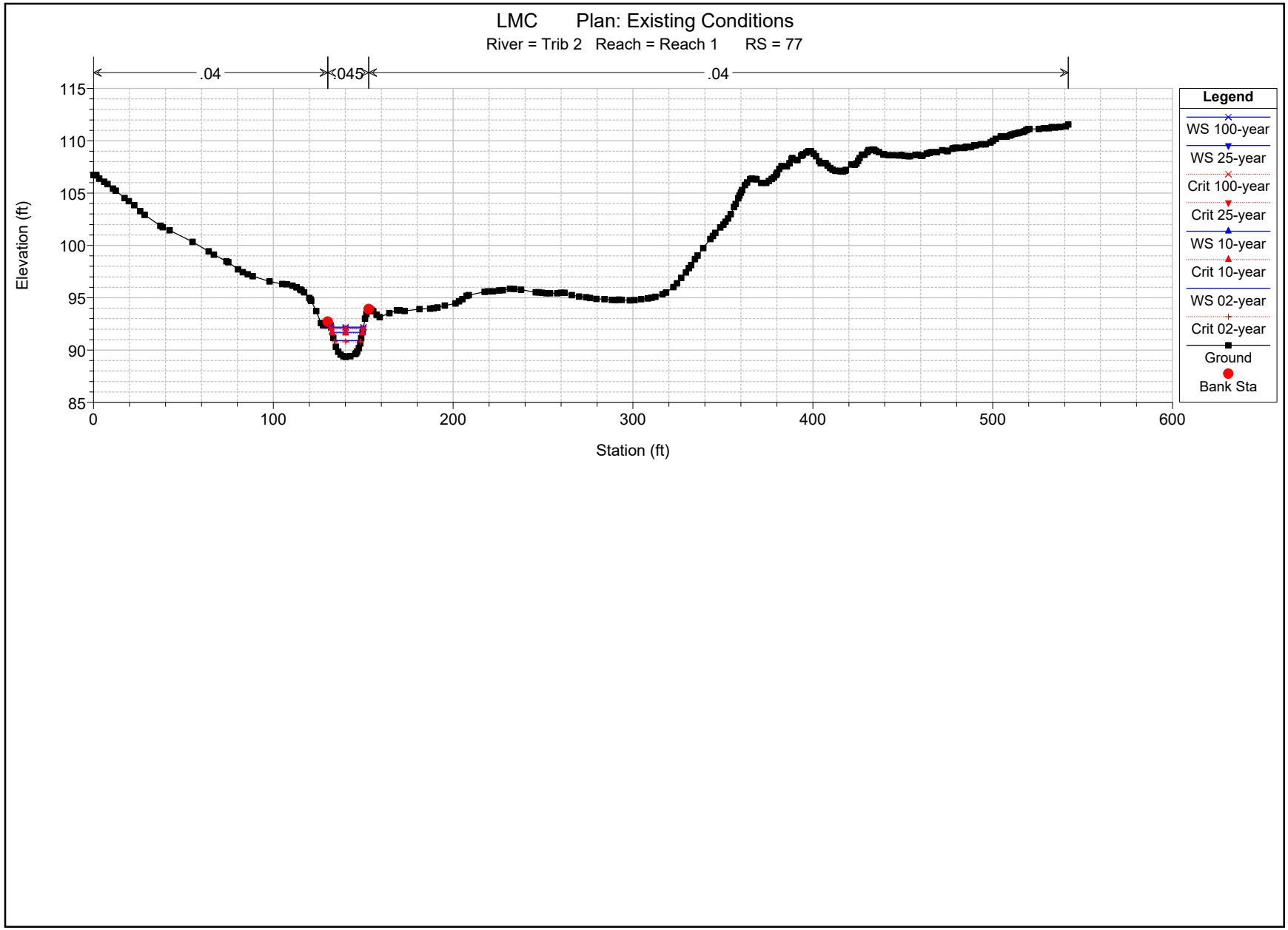

LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 833
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 628
.04
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

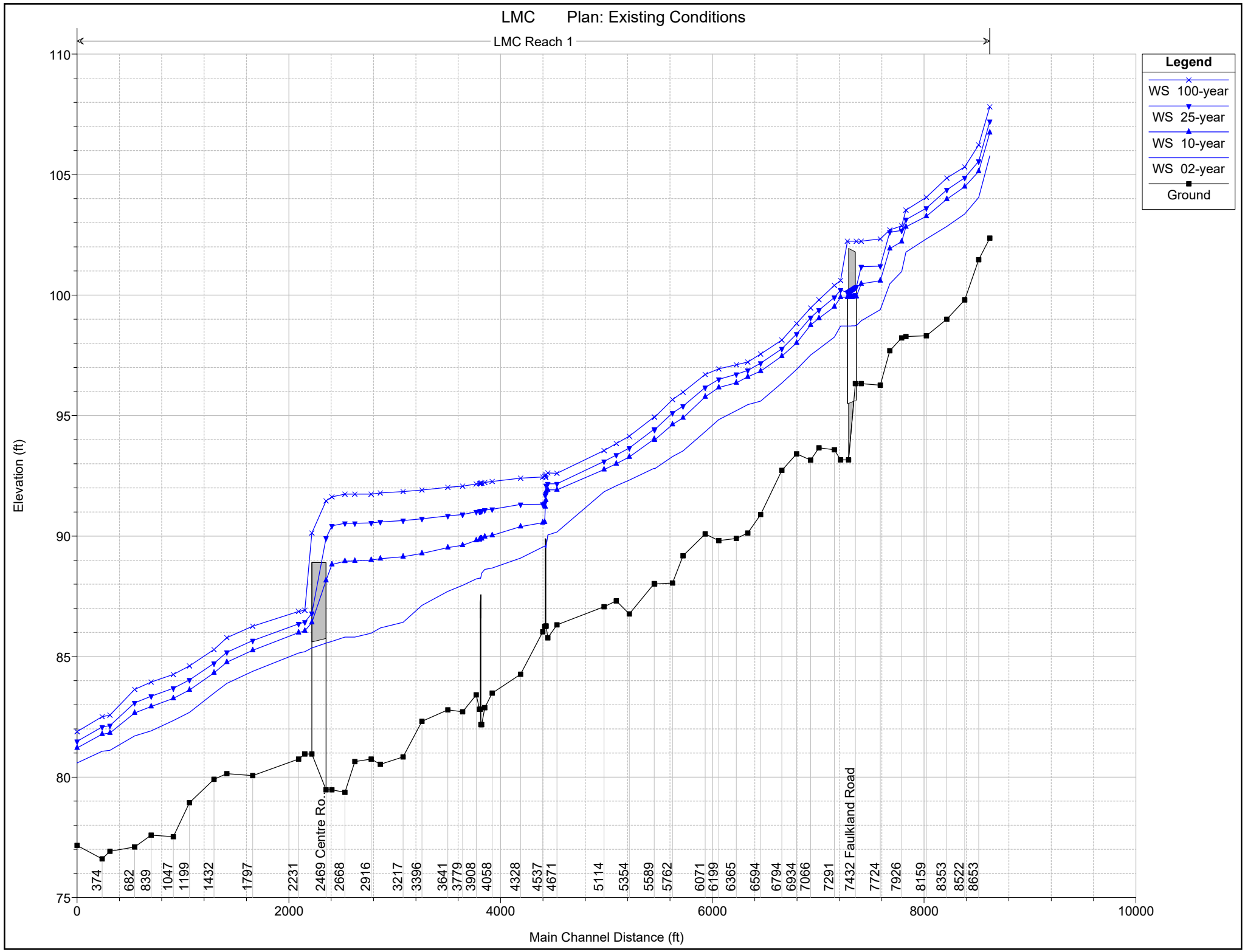

LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 497
.04
.08
.05
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 436
.04
.08
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

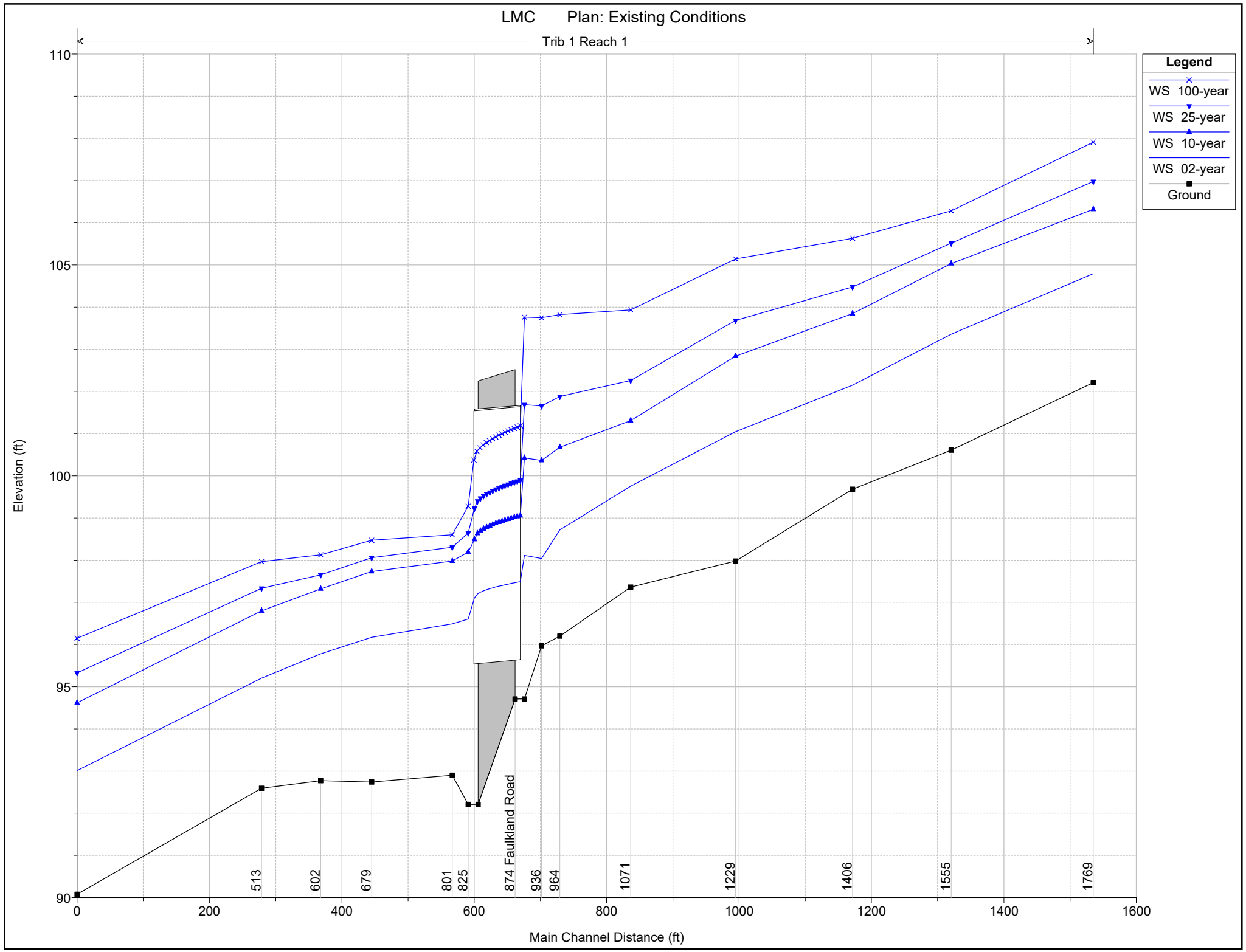

LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 400 Culv
.04
.08
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 400 Culv
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
WS 02-year
Ground
Ineff
Bank Sta

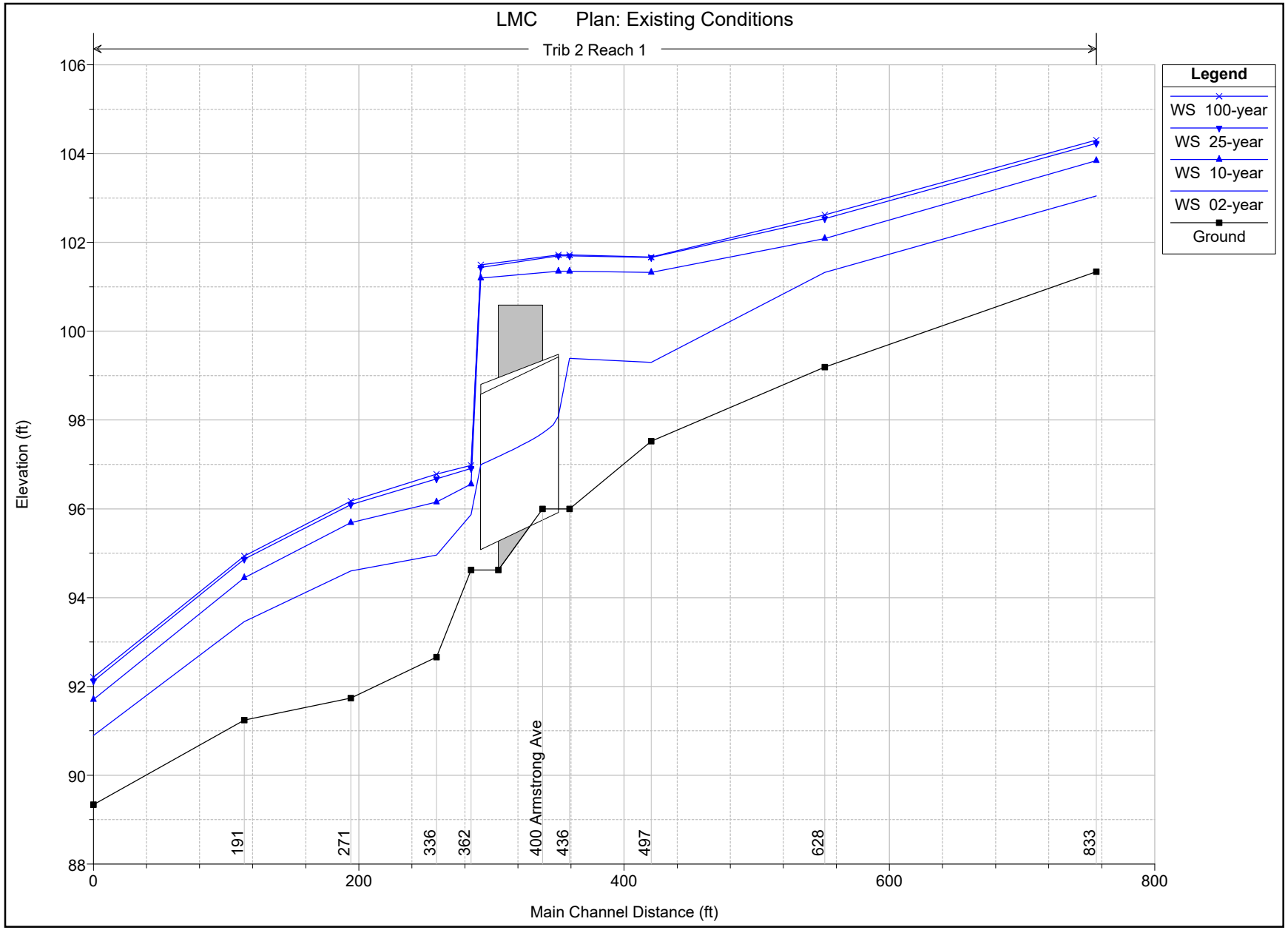

LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 362
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 336
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta


LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 271
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 191
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta


LMC Plan: Existing Conditions
River = Trib 2 Reach = Reach 1 RS = 77
.04
.045
.04
Elevation (ft)
115
110
105
100
95
90
85
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta


LMC Plan: Existing Conditions
LMC Reach 1
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Elevation (ft)
Main Channel Distance (ft)
110
105
100
95
90
85
80
75
0
2000
4000
6000
8000
10000
374
682
839
1047
1199
1432
1797
2231
2469 Centre Ro...
2668
2916
3217
3396
3641
3779
3908
4058
4328
4537
4671
5114
5354
5589
5762
6071
6199
6365
6594
6794
6934
7066
7291
7432 Faulkland Road
7724
7926
8159
8353
8522
8653


LMC Plan: Existing Conditions
Trib 1 Reach 1
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Elevation (ft)
Main Channel Distance (ft)
110
105
100
95
90
0
200
400
600
800
1000
1200
1400
1600
513
602
679
801
825
874 Faulkland Road
936
964
1071
1229
1406
1555
1769


LMC Plan: Existing Conditions
Trib 2 Reach 1
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Elevation (ft)
Main Channel Distance (ft)
106
104
102
100
98
96
94
92
90
88
0
200
400
600
800
191
271
336
362
400 Armstrong Ave
436
497
628
833

HEC-RAS Plan: Existing

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Trib 2	Reach 1	833	02-year	92.80	101.34	103.04	102.78	103.23	0.008967	3.73	28.68	36.58	0.57
Trib 2	Reach 1	833	10-year	213.00	101.34	103.84		104.03	0.005389	3.96	65.97	52.65	0.48
Trib 2	Reach 1	833	25-year	291.00	101.34	104.23		104.42	0.004535	4.07	87.77	57.79	0.45
Trib 2	Reach 1	833	100-year	308.00	101.34	104.31		104.50	0.004377	4.08	92.24	58.12	0.45
Trib 2	Reach 1	628	02-year	92.80	99.19	101.32		101.54	0.008107	3.70	25.06	17.22	0.54
Trib 2	Reach 1	628	10-year	213.00	99.19	102.09		102.54	0.012051	5.40	39.46	20.53	0.69
Trib 2	Reach 1	628	25-year	291.00	99.19	102.53		103.08	0.012367	5.93	49.09	22.54	0.71
Trib 2	Reach 1	628	100-year	308.00	99.19	102.62		103.19	0.012445	6.03	51.05	22.92	0.71
Trib 2	Reach 1	497	02-year	92.80	97.52	99.30	99.15	99.74	0.027051	5.33	17.41	14.61	0.86
Trib 2	Reach 1	497	10-year	213.00	97.52	101.32		101.53	0.004735	3.76	63.01	34.94	0.41
Trib 2	Reach 1	497	25-year	291.00	97.52	101.66		101.95	0.005681	4.46	76.00	41.85	0.45
Trib 2	Reach 1	497	100-year	308.00	97.52	101.67		102.00	0.006260	4.69	76.55	42.11	0.48
Trib 2	Reach 1	436	02-year	92.80	96.00	99.39	97.25	99.42	0.000619	1.41	65.65	27.78	0.16
Trib 2	Reach 1	436	10-year	213.00	96.00	101.35	97.97	101.39	0.000402	1.65	150.81	67.59	0.14
Trib 2	Reach 1	436	25-year	291.00	96.00	101.70	98.34	101.76	0.000544	2.02	177.84	91.64	0.17
Trib 2	Reach 1	436	100-year	308.00	96.00	101.72	98.42	101.78	0.000600	2.13	179.48	93.37	0.18
Trib 2	Reach 1	400		Culvert									
Trib 2	Reach 1	362	02-year	92.80	94.62	95.87	95.87	96.32	0.031206	5.35	17.33	19.35	1.00
Trib 2	Reach 1	362	10-year	213.00	94.62	96.56	96.56	97.26	0.027252	6.73	31.65	22.39	1.00
Trib 2	Reach 1	362	25-year	291.00	94.62	96.91	96.91	97.74	0.026091	7.30	39.87	24.07	1.00
Trib 2	Reach 1	362	100-year	308.00	94.62	96.98	96.98	97.83	0.025980	7.42	41.53	24.38	1.00
Trib 2	Reach 1	336	02-year	92.80	92.66	94.96		95.25	0.011504	4.33	21.44	14.95	0.64
Trib 2	Reach 1	336	10-year	213.00	92.66	96.15		96.55	0.009382	5.03	42.32	19.99	0.61
Trib 2	Reach 1	336	25-year	291.00	92.66	96.67		97.14	0.009386	5.46	53.25	22.17	0.62
Trib 2	Reach 1	336	100-year	308.00	92.66	96.78		97.26	0.009330	5.53	55.66	22.62	0.62
Trib 2	Reach 1	271	02-year	92.80	91.74	94.60		94.77	0.004606	3.28	28.26	14.28	0.41
Trib 2	Reach 1	271	10-year	213.00	91.74	95.69		96.03	0.006572	4.69	45.45	17.23	0.51
Trib 2	Reach 1	271	25-year	291.00	91.74	96.09		96.57	0.008235	5.52	52.69	18.42	0.58
Trib 2	Reach 1	271	100-year	308.00	91.74	96.17		96.67	0.008572	5.69	54.15	18.65	0.59
Trib 2	Reach 1	191	02-year	92.80	91.24	93.46	93.35	94.02	0.023295	6.00	15.58	12.41	0.89
Trib 2	Reach 1	191	10-year	213.00	91.24	94.44	94.44	95.19	0.016793	7.25	33.59	24.91	0.82
Trib 2	Reach 1	191	25-year	291.00	91.24	94.87	94.87	95.66	0.015214	7.69	45.41	30.88	0.81
Trib 2	Reach 1	191	100-year	308.00	91.24	94.94	94.94	95.74	0.015207	7.81	47.62	31.87	0.81
Trib 2	Reach 1	77	02-year	92.80	89.34	90.89	90.79	91.35	0.023122	5.39	17.21	14.87	0.88
Trib 2	Reach 1	77	10-year	213.00	89.34	91.71	91.61	92.48	0.023130	7.06	30.16	16.93	0.93
Trib 2	Reach 1	77	25-year	291.00	89.34	92.12	92.03	93.06	0.023104	7.79	37.37	17.87	0.95
Trib 2	Reach 1	77	100-year	308.00	89.34	92.20	92.12	93.18	0.023102	7.92	38.87	18.06	0.95
Trib 1	Reach 1	1769	02-year	173.00	102.21	104.79	104.26	105.13	0.011424	4.68	37.08	25.33	0.65
Trib 1	Reach 1	1769	10-year	453.00	102.21	106.32	105.66	106.65	0.005864	5.06	126.33	71.60	0.51
Trib 1	Reach 1	1769	25-year	636.00	102.21	106.98	106.10	107.32	0.005043	5.35	175.97	78.50	0.49
Trib 1	Reach 1	1769	100-year	961.00	102.21	107.91	106.70	108.29	0.004448	5.84	255.29	90.27	0.48
Trib 1	Reach 1	1555	02-year	173.00	100.61	103.36	102.35	103.56	0.004869	3.62	47.82	23.08	0.44
Trib 1	Reach 1	1555	10-year	453.00	100.61	105.03	103.60	105.40	0.005676	4.89	92.66	31.74	0.50
Trib 1	Reach 1	1555	25-year	636.00	100.61	105.52	104.23	106.05	0.006864	5.86	109.54	39.44	0.57
Trib 1	Reach 1	1555	100-year	961.00	100.61	106.28	105.20	107.04	0.007512	7.04	146.00	55.80	0.61
Trib 1	Reach 1	1406	02-year	173.00	99.68	102.15	101.57	102.52	0.010378	4.91	35.26	18.85	0.63
Trib 1	Reach 1	1406	10-year	453.00	99.68	103.85	102.99	104.37	0.008367	5.95	93.78	74.60	0.61
Trib 1	Reach 1	1406	25-year	636.00	99.68	104.48	103.97	105.01	0.007130	6.23	143.39	81.79	0.58
Trib 1	Reach 1	1406	100-year	961.00	99.68	105.63	104.57	106.07	0.004698	6.09	256.97	115.45	0.49
Trib 1	Reach 1	1229	02-year	173.00	97.98	101.05	99.93	101.26	0.004855	3.73	46.43	21.06	0.44
Trib 1	Reach 1	1229	10-year	453.00	97.98	102.84	101.31	103.19	0.005070	4.80	106.88	63.87	0.48
Trib 1	Reach 1	1229	25-year	636.00	97.98	103.69	102.01	104.03	0.004021	4.90	166.80	75.59	0.44
Trib 1	Reach 1	1229	100-year	961.00	97.98	105.14	103.17	105.42	0.002605	4.70	283.33	84.12	0.36
Trib 1	Reach 1	1071	02-year	173.00	97.36	99.76	99.26	100.14	0.010966	4.94	35.04	19.29	0.65
Trib 1	Reach 1	1071	10-year	453.00	97.36	101.31	100.55	102.01	0.011025	6.72	67.41	22.44	0.68
Trib 1	Reach 1	1071	25-year	636.00	97.36	102.26	101.22	103.04	0.009669	7.09	89.71	24.51	0.65
Trib 1	Reach 1	1071	100-year	961.00	97.36	103.94	102.22	104.71	0.008001	7.04	136.59	34.11	0.61
Trib 1	Reach 1	964	02-year	173.00	96.20	98.72	98.13	99.03	0.009353	4.51	38.32	21.88	0.60
Trib 1	Reach 1	964	10-year	453.00	96.20	100.68	99.40	101.07	0.005963	5.02	90.18	30.85	0.52
Trib 1	Reach 1	964	25-year	636.00	96.20	101.88	100.01	102.25	0.004332	4.86	130.82	36.87	0.45
Trib 1	Reach 1	964	100-year	961.00	96.20	103.83	100.90	104.14	0.002429	4.50	223.85	64.20	0.36
Trib 1	Reach 1	936	02-year	173.00	95.97	98.04	97.85	98.60	0.019135	6.00	28.83	18.28	0.84
Trib 1	Reach 1	936	10-year	453.00	95.97	100.37	99.19	100.86	0.007376	5.63	80.48	26.70	0.57
Trib 1	Reach 1	936	25-year	636.00	95.97	101.66	99.86	102.09	0.005451	5.31	119.70	35.10	0.51
Trib 1	Reach 1	936	100-year	961.00	95.97	103.75	100.86	104.06	0.002702	4.56	231.24	75.32	0.38
Trib 1	Reach 1	910	02-year	173.00	94.71	98.11	97.00	98.30	0.004006	3.35	51.68	24.03	0.40
Trib 1	Reach 1	910	10-year	453.00	94.71	100.42	98.20	100.67	0.002868	3.99	113.53	30.30	0.36

HEC-RAS Plan: Existing (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Trib 1	Reach 1	910	25-year	636.00	94.71	101.69	98.80	101.94	0.002646	4.04	157.53	39.43	0.36
Trib 1	Reach 1	910	100-year	961.00	94.71	103.76	99.70	103.98	0.001820	3.73	258.08	79.49	0.31
Trib 1	Reach 1	874		Mult Open									
Trib 1	Reach 1	825	02-year	173.00	92.21	96.61	94.01	96.66	0.000671	1.78	97.28	29.99	0.17
Trib 1	Reach 1	825	10-year	453.00	92.21	98.19	95.11	98.34	0.001372	3.07	147.78	33.53	0.26
Trib 1	Reach 1	825	25-year	636.00	92.21	98.64	95.67	98.88	0.002032	3.90	163.05	34.32	0.32
Trib 1	Reach 1	825	100-year	961.00	92.21	99.28	96.53	99.70	0.003236	5.18	185.38	35.81	0.40
Trib 1	Reach 1	801	02-year	173.00	92.90	96.49		96.61	0.002524	2.76	62.70	27.76	0.32
Trib 1	Reach 1	801	10-year	453.00	92.90	97.98		98.25	0.003648	4.17	108.60	33.71	0.41
Trib 1	Reach 1	801	25-year	636.00	92.90	98.31		98.74	0.005512	5.31	119.79	35.25	0.51
Trib 1	Reach 1	801	100-year	961.00	92.90	98.60		99.44	0.009818	7.37	130.69	40.27	0.68
Trib 1	Reach 1	679	02-year	173.00	92.74	96.17		96.30	0.002435	2.90	60.12	26.73	0.32
Trib 1	Reach 1	679	10-year	453.00	92.74	97.73		97.89	0.002089	3.56	176.67	146.39	0.32
Trib 1	Reach 1	679	25-year	636.00	92.74	98.06		98.24	0.002428	4.05	233.51	198.09	0.35
Trib 1	Reach 1	679	100-year	961.00	92.74	98.47		98.69	0.002744	4.59	320.44	216.39	0.38
Trib 1	Reach 1	602	02-year	173.00	92.77	95.78		96.01	0.006092	3.87	44.67	22.94	0.49
Trib 1	Reach 1	602	10-year	453.00	92.77	97.32	96.19	97.63	0.005574	4.67	122.52	149.04	0.50
Trib 1	Reach 1	602	25-year	636.00	92.77	97.65		97.96	0.005516	5.01	174.83	173.38	0.51
Trib 1	Reach 1	602	100-year	961.00	92.77	98.13		98.41	0.004820	5.16	275.18	257.94	0.48
Trib 1	Reach 1	513	02-year	173.00	92.59	95.20		95.45	0.006381	4.03	42.89	21.08	0.50
Trib 1	Reach 1	513	10-year	453.00	92.59	96.80	95.62	97.13	0.005425	4.94	116.86	143.10	0.49
Trib 1	Reach 1	513	25-year	636.00	92.59	97.34	96.96	97.54	0.003547	4.35	229.56	252.31	0.40
Trib 1	Reach 1	513	100-year	961.00	92.59	97.96		98.09	0.002144	3.72	414.99	314.71	0.32
Trib 1	Reach 1	234	02-year	173.00	90.08	93.01	92.38	93.34	0.009101	4.57	37.82	20.13	0.59
Trib 1	Reach 1	234	10-year	453.00	90.08	94.62	93.67	95.22	0.009104	6.23	72.75	23.61	0.62
Trib 1	Reach 1	234	25-year	636.00	90.08	95.33	94.32	96.07	0.009107	6.99	94.55	35.71	0.64
Trib 1	Reach 1	234	100-year	961.00	90.08	96.15	95.57	97.04	0.009103	7.93	154.44	123.91	0.66
LMC	Reach 1	8758	02-year	324.00	102.36	105.78	104.93	106.22	0.008791	5.30	61.13	25.25	0.60
LMC	Reach 1	8758	10-year	674.00	102.36	106.74	106.19	107.67	0.012934	7.79	91.90	40.70	0.76
LMC	Reach 1	8758	25-year	888.00	102.36	107.21	106.91	108.38	0.014289	8.81	111.15	41.92	0.81
LMC	Reach 1	8758	100-year	1230.00	102.36	107.81	107.72	109.36	0.016471	10.23	137.50	45.95	0.88
LMC	Reach 1	8653	02-year	324.00	101.47	104.05	104.05	104.85	0.019805	7.26	50.27	42.68	0.89
LMC	Reach 1	8653	10-year	674.00	101.47	105.13	105.13	106.15	0.016242	8.70	104.12	53.97	0.87
LMC	Reach 1	8653	25-year	888.00	101.47	105.55	105.55	106.76	0.016790	9.63	127.24	55.12	0.90
LMC	Reach 1	8653	100-year	1230.00	101.47	106.23	106.19	107.61	0.015940	10.54	169.93	91.41	0.90
LMC	Reach 1	8522	02-year	324.00	99.80	103.36		103.56	0.003087	3.60	90.09	31.07	0.37
LMC	Reach 1	8522	10-year	674.00	99.80	104.50		104.89	0.004342	5.13	153.51	69.21	0.46
LMC	Reach 1	8522	25-year	888.00	99.80	104.87		105.40	0.005424	6.02	180.35	75.96	0.52
LMC	Reach 1	8522	100-year	1230.00	99.80	105.32	104.38	106.08	0.007204	7.33	222.35	105.90	0.61
LMC	Reach 1	8353	02-year	324.00	99.00	102.85		103.04	0.003030	3.57	100.93	64.58	0.37
LMC	Reach 1	8353	10-year	674.00	99.00	103.98		104.21	0.003183	4.31	269.51	206.58	0.39
LMC	Reach 1	8353	25-year	888.00	99.00	104.37		104.61	0.003193	4.61	350.70	211.33	0.40
LMC	Reach 1	8353	100-year	1230.00	99.00	104.86		105.12	0.003326	5.06	457.81	228.72	0.42
LMC	Reach 1	8159	02-year	324.00	98.31	102.33		102.50	0.002524	3.31	99.39	46.94	0.34
LMC	Reach 1	8159	10-year	674.00	98.31	103.27		103.56	0.003571	4.60	231.27	215.68	0.42
LMC	Reach 1	8159	25-year	888.00	98.31	103.61		103.94	0.003860	5.06	307.97	235.50	0.44
LMC	Reach 1	8159	100-year	1230.00	98.31	104.06		104.42	0.004080	5.59	420.55	258.13	0.46
LMC	Reach 1	7966	02-year	324.00	98.28	101.78		101.96	0.003137	3.40	99.78	92.89	0.37
LMC	Reach 1	7966	10-year	674.00	98.28	102.83		102.99	0.002189	3.49	228.03	138.14	0.33
LMC	Reach 1	7966	25-year	888.00	98.28	103.13		103.32	0.002389	3.84	270.86	149.95	0.35
LMC	Reach 1	7966	100-year	1230.00	98.28	103.53		103.76	0.002620	4.30	332.95	163.50	0.37
LMC	Reach 1	7926	02-year	324.00	98.22	100.98		101.67	0.016224	6.66	48.62	23.08	0.81
LMC	Reach 1	7926	10-year	674.00	98.22	102.22	102.22	102.78	0.010364	6.62	125.11	103.29	0.69
LMC	Reach 1	7926	25-year	888.00	98.22	102.68		103.14	0.007436	6.14	178.88	127.24	0.59
LMC	Reach 1	7926	100-year	1230.00	98.22	102.87	102.78	103.53	0.010222	7.46	203.38	132.38	0.70
LMC	Reach 1	7815	02-year	324.00	97.69	100.47		100.65	0.004574	3.63	94.39	45.06	0.41
LMC	Reach 1	7815	10-year	674.00	97.69	101.93		102.07	0.002155	3.39	235.26	132.58	0.30
LMC	Reach 1	7815	25-year	888.00	97.69	102.61		102.73	0.001426	3.07	328.09	138.78	0.25
LMC	Reach 1	7815	100-year	1230.00	97.69	102.70		102.91	0.002446	4.07	340.73	140.45	0.33
LMC	Reach 1	7724	02-year	324.00	96.26	99.39	98.82	99.97	0.012505	6.10	53.11	23.35	0.71
LMC	Reach 1	7724	10-year	674.00	96.26	100.60	100.17	101.57	0.015625	7.93	85.00	29.77	0.83
LMC	Reach 1	7724	25-year	888.00	96.26	101.20	100.81	102.33	0.016170	8.51	104.39	113.50	0.85
LMC	Reach 1	7724	100-year	1230.00	96.26	102.33	101.98	102.63	0.003908	5.13	302.12	194.33	0.44
LMC	Reach 1	7544	02-year	324.00	96.33	98.93	97.71	99.01	0.001923	2.23	145.09	75.15	0.28
LMC	Reach 1	7544	10-year	674.00	96.33	100.47	98.31	100.56	0.001320	2.50	269.95	88.95	0.25
LMC	Reach 1	7544	25-year	888.00	96.33	101.18	98.60	101.29	0.001196	2.64	338.42	138.06	0.25
LMC	Reach 1	7544	100-year	1230.00	96.33	102.23	99.03	102.32	0.000722	2.44	606.23	355.59	0.20

HEC-RAS Plan: Existing (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LMC	Reach 1	7432		Culvert									
LMC	Reach 1	7349	02-year	324.00	93.16	98.71	95.56	98.80	0.000892	2.48	145.25	59.54	0.21
LMC	Reach 1	7349	10-year	674.00	93.16	99.91	96.84	100.07	0.001316	3.53	225.91	75.67	0.26
LMC	Reach 1	7349	25-year	888.00	93.16	100.21	97.47	100.44	0.001790	4.26	249.13	79.86	0.31
LMC	Reach 1	7349	100-year	1230.00	93.16	100.61	98.67	100.98	0.002611	5.38	284.71	146.61	0.38
LMC	Reach 1	7291	02-year	324.00	93.58	98.26	97.04	98.61	0.004999	5.11	76.78	46.78	0.46
LMC	Reach 1	7291	10-year	674.00	93.58	99.52	98.80	99.87	0.004317	5.76	180.21	143.32	0.45
LMC	Reach 1	7291	25-year	888.00	93.58	99.90	99.07	100.24	0.004079	5.87	231.39	159.81	0.44
LMC	Reach 1	7291	100-year	1230.00	93.58	100.40	99.86	100.74	0.003865	6.06	302.15	184.96	0.44
LMC	Reach 1	7144	02-year	324.00	93.66	97.77		97.99	0.003345	3.96	88.61	35.15	0.38
LMC	Reach 1	7144	10-year	674.00	93.66	99.04		99.31	0.003298	4.85	190.80	113.42	0.40
LMC	Reach 1	7144	25-year	888.00	93.66	99.37		99.69	0.003601	5.31	229.29	117.00	0.42
LMC	Reach 1	7144	100-year	1230.00	93.66	99.80		100.18	0.004033	5.94	280.32	121.27	0.45
LMC	Reach 1	7066	02-year	324.00	93.15	97.51		97.74	0.003015	3.94	89.67	38.78	0.37
LMC	Reach 1	7066	10-year	674.00	93.15	98.76		99.06	0.003150	4.94	192.29	130.01	0.40
LMC	Reach 1	7066	25-year	888.00	93.15	99.06		99.41	0.003554	5.47	232.46	134.90	0.43
LMC	Reach 1	7066	100-year	1230.00	93.15	99.46		99.87	0.004015	6.12	287.88	140.81	0.46
LMC	Reach 1	6934	02-year	324.00	93.41	96.92		97.23	0.005042	4.51	74.31	31.72	0.47
LMC	Reach 1	6934	10-year	674.00	93.41	98.02	97.00	98.49	0.005890	5.93	152.18	147.25	0.53
LMC	Reach 1	6934	25-year	888.00	93.41	98.38		98.83	0.005467	6.07	207.34	152.41	0.52
LMC	Reach 1	6934	100-year	1230.00	93.41	98.82		99.26	0.005271	6.37	275.62	158.17	0.52
LMC	Reach 1	6794	02-year	324.00	92.73	96.35		96.57	0.004118	3.91	95.66	62.93	0.42
LMC	Reach 1	6794	10-year	674.00	92.73	97.46		97.75	0.004221	4.84	183.39	121.10	0.44
LMC	Reach 1	6794	25-year	888.00	92.73	97.77		98.10	0.004632	5.35	222.95	134.58	0.47
LMC	Reach 1	6794	100-year	1230.00	92.73	98.14		98.54	0.005172	6.00	274.25	142.97	0.51
LMC	Reach 1	6594	02-year	324.00	90.89	95.60		95.82	0.003505	3.80	85.31	29.51	0.39
LMC	Reach 1	6594	10-year	674.00	90.89	96.84		97.07	0.003060	4.21	218.43	186.06	0.38
LMC	Reach 1	6594	25-year	888.00	90.89	97.17		97.40	0.003034	4.43	286.61	217.67	0.39
LMC	Reach 1	6594	100-year	1230.00	90.89	97.55		97.80	0.003139	4.78	371.50	230.13	0.40
LMC	Reach 1	6472	02-year	324.00	90.13	95.45		95.56	0.001164	2.66	129.19	55.55	0.23
LMC	Reach 1	6472	10-year	674.00	90.13	96.60		96.80	0.001754	3.77	237.79	218.87	0.30
LMC	Reach 1	6472	25-year	888.00	90.13	96.88		97.12	0.002181	4.35	303.53	255.35	0.33
LMC	Reach 1	6472	100-year	1230.00	90.13	97.23		97.49	0.002505	4.87	397.11	282.15	0.36
LMC	Reach 1	6365	02-year	324.00	89.90	95.20		95.39	0.002227	3.42	95.59	32.10	0.31
LMC	Reach 1	6365	10-year	674.00	89.90	96.36		96.58	0.002598	4.24	250.79	330.68	0.35
LMC	Reach 1	6365	25-year	888.00	89.90	96.71		96.88	0.002143	4.05	373.77	353.15	0.32
LMC	Reach 1	6365	100-year	1230.00	89.90	97.11		97.26	0.001890	4.01	515.86	362.33	0.31
LMC	Reach 1	6199	02-year	324.00	89.81	94.83		95.01	0.002298	3.45	107.16	83.93	0.33
LMC	Reach 1	6199	10-year	674.00	89.81	96.16		96.28	0.001387	3.32	320.69	296.01	0.27
LMC	Reach 1	6199	25-year	888.00	89.81	96.50		96.63	0.001504	3.62	433.84	377.32	0.28
LMC	Reach 1	6199	100-year	1230.00	89.81	96.94		97.05	0.001302	3.55	608.88	413.39	0.27
LMC	Reach 1	6071	02-year	324.00	90.09	94.33		94.62	0.004186	4.33	78.65	39.94	0.43
LMC	Reach 1	6071	10-year	674.00	90.09	95.78		96.04	0.003084	4.67	215.80	188.98	0.39
LMC	Reach 1	6071	25-year	888.00	90.09	96.17		96.40	0.002784	4.70	302.09	259.03	0.38
LMC	Reach 1	6071	100-year	1230.00	90.09	96.71		96.88	0.002093	4.37	480.46	382.42	0.33
LMC	Reach 1	5862	02-year	408.00	89.18	93.53		93.81	0.003629	4.19	98.55	42.48	0.41
LMC	Reach 1	5862	10-year	891.00	89.18	94.91		95.31	0.004093	5.45	218.42	168.30	0.45
LMC	Reach 1	5862	25-year	1190.00	89.18	95.39		95.76	0.003695	5.54	304.80	184.03	0.44
LMC	Reach 1	5862	100-year	1690.00	89.18	95.97		96.33	0.003489	5.79	414.98	194.44	0.43
LMC	Reach 1	5762	02-year	408.00	88.05	93.30		93.51	0.002239	3.69	113.48	38.41	0.32
LMC	Reach 1	5762	10-year	891.00	88.05	94.63		94.93	0.002866	4.82	245.01	149.67	0.38
LMC	Reach 1	5762	25-year	1190.00	88.05	95.10		95.41	0.002837	5.09	323.05	182.06	0.38
LMC	Reach 1	5762	100-year	1690.00	88.05	95.66		96.00	0.002968	5.55	427.97	203.82	0.40
LMC	Reach 1	5593	02-year	437.00	88.01	92.79		93.04	0.003527	4.18	117.99	62.25	0.40
LMC	Reach 1	5593	10-year	948.00	88.01	93.99		94.36	0.004354	5.49	223.58	120.73	0.47
LMC	Reach 1	5593	25-year	1270.00	88.01	94.41		94.84	0.004604	6.00	281.21	164.75	0.49
LMC	Reach 1	5593	100-year	1800.00	88.01	94.93		95.40	0.004871	6.61	384.95	221.03	0.51
LMC	Reach 1	5589	02-year	437.00	88.03	92.82		93.01	0.002798	3.75	134.88	70.76	0.36
LMC	Reach 1	5589	10-year	948.00	88.03	94.03		94.32	0.003410	4.89	243.57	113.17	0.42
LMC	Reach 1	5589	25-year	1270.00	88.03	94.43		94.80	0.003971	5.55	300.39	187.29	0.45
LMC	Reach 1	5589	100-year	1800.00	88.03	94.95		95.36	0.004220	6.14	408.16	221.05	0.48
LMC	Reach 1	5354	02-year	437.00	86.77	92.32		92.49	0.001804	3.28	133.39	39.59	0.29
LMC	Reach 1	5354	10-year	948.00	86.77	93.28		93.60	0.003020	4.83	262.20	193.23	0.39
LMC	Reach 1	5354	25-year	1270.00	86.77	93.66		94.00	0.003262	5.29	335.01	199.50	0.41
LMC	Reach 1	5354	100-year	1800.00	86.77	94.15		94.53	0.003489	5.82	435.01	206.01	0.44
LMC	Reach 1	5232	02-year	437.00	87.31	92.09		92.25	0.002080	3.41	154.38	114.60	0.32

HEC-RAS Plan: Existing (Continued)

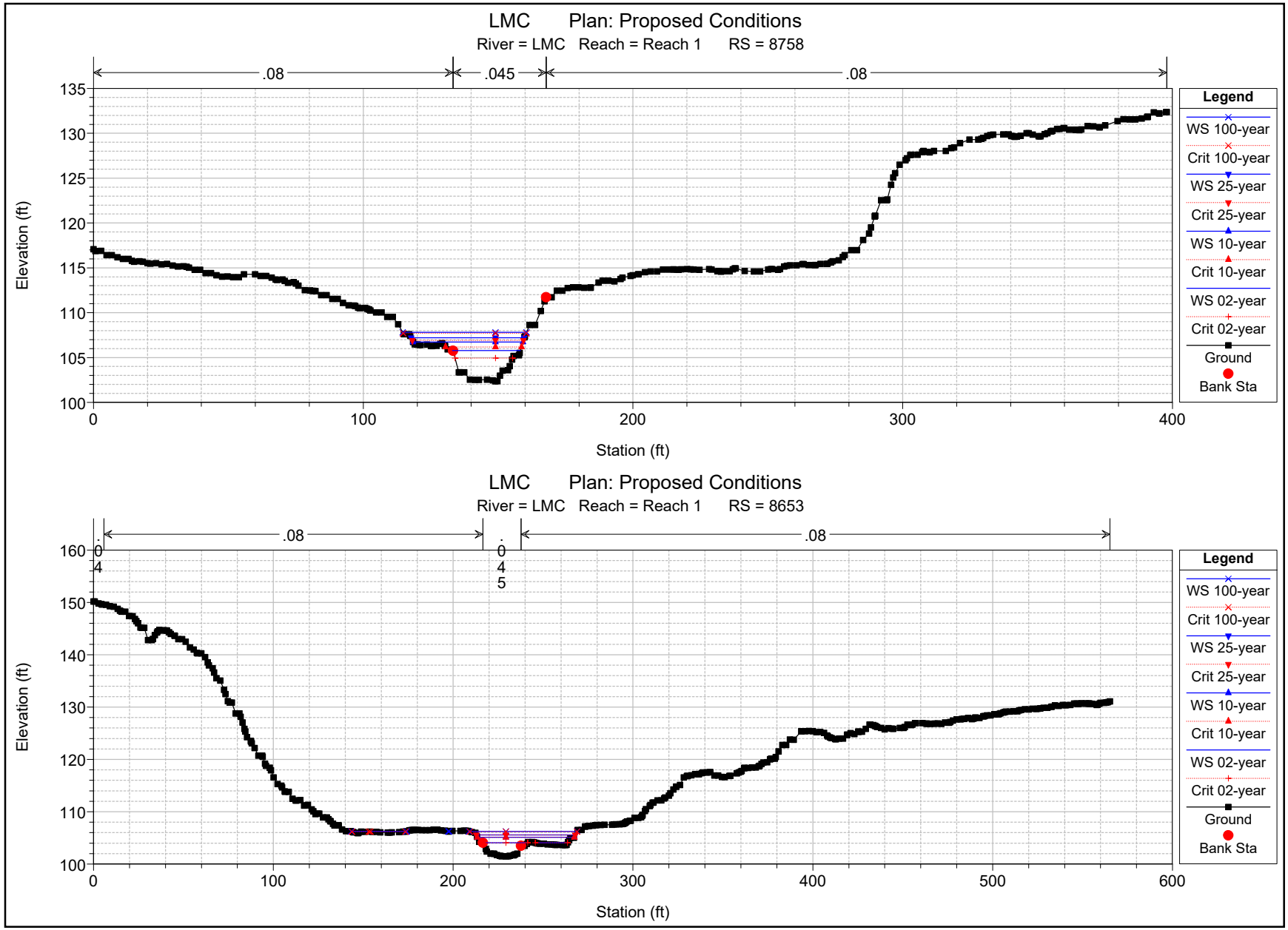
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LMC	Reach 1	5232	10-year	948.00	87.31	93.00		93.23	0.002712	4.41	308.84	208.65	0.37
LMC	Reach 1	5232	25-year	1270.00	87.31	93.36		93.60	0.002841	4.76	385.51	221.28	0.39
LMC	Reach 1	5232	100-year	1800.00	87.31	93.84		94.11	0.002975	5.19	494.23	233.62	0.40
LMC	Reach 1	5114	02-year	437.00	87.07	91.83		91.99	0.002307	3.46	168.28	148.21	0.32
LMC	Reach 1	5114	10-year	948.00	87.07	92.76		92.92	0.002200	3.93	345.06	219.09	0.33
LMC	Reach 1	5114	25-year	1270.00	87.07	93.09		93.28	0.002378	4.29	421.39	235.34	0.34
LMC	Reach 1	5114	100-year	1800.00	87.07	93.55		93.77	0.002564	4.73	532.39	252.00	0.36
LMC	Reach 1	4671	02-year	437.00	86.32	90.17		90.54	0.005635	4.87	91.33	39.12	0.51
LMC	Reach 1	4671	10-year	948.00	86.32	91.92		92.14	0.002531	4.48	321.03	231.62	0.37
LMC	Reach 1	4671	25-year	1270.00	86.32	92.17		92.44	0.003076	5.12	381.79	246.54	0.41
LMC	Reach 1	4671	100-year	1800.00	86.32	92.61		92.92	0.003417	5.71	499.95	292.59	0.44
LMC	Reach 1	4585	02-year	437.00	85.78	90.05		90.19	0.002084	3.43	153.37	73.61	0.32
LMC	Reach 1	4585	10-year	948.00	85.78	91.91		91.99	0.000849	2.91	509.21	308.12	0.22
LMC	Reach 1	4585	25-year	1270.00	85.78	92.17		92.26	0.001015	3.28	592.97	336.76	0.24
LMC	Reach 1	4585	100-year	1800.00	85.78	92.62		92.73	0.001043	3.50	751.95	360.69	0.25
LMC	Reach 1	4568	02-year	437.00	86.27	89.55	88.86	90.09	0.008912	5.90	74.11	29.87	0.63
LMC	Reach 1	4568	10-year	948.00	86.27	91.85	90.85	91.97	0.000704	2.48	400.71	326.22	0.20
LMC	Reach 1	4568	25-year	1270.00	86.27	92.10	91.17	92.24	0.000803	2.73	482.58	342.99	0.21
LMC	Reach 1	4568	100-year	1800.00	86.27	92.55	91.63	92.71	0.000772	2.83	642.74	365.37	0.21
LMC	Reach 1	4561		Bridge									
LMC	Reach 1	4555	02-year	437.00	86.25	89.57		89.94	0.005990	4.91	92.62	40.40	0.52
LMC	Reach 1	4555	10-year	948.00	86.25	90.58	89.87	91.35	0.009170	7.31	149.07	97.71	0.68
LMC	Reach 1	4555	25-year	1270.00	86.25	91.36	91.21	91.85	0.005518	6.45	286.23	246.13	0.54
LMC	Reach 1	4555	100-year	1800.00	86.25	92.47		92.63	0.001680	4.14	655.02	375.07	0.31
LMC	Reach 1	4537	02-year	437.00	86.03	89.55		89.82	0.004194	4.19	104.58	39.94	0.44
LMC	Reach 1	4537	10-year	948.00	86.03	90.55	89.43	91.16	0.006569	6.41	170.73	124.40	0.57
LMC	Reach 1	4537	25-year	1270.00	86.03	91.32		91.74	0.004280	5.83	304.55	257.93	0.48
LMC	Reach 1	4537	100-year	1800.00	86.03	92.45		92.60	0.001512	4.01	680.29	380.32	0.29
LMC	Reach 1	4328	02-year	437.00	84.27	89.09		89.22	0.001866	3.30	170.44	103.24	0.29
LMC	Reach 1	4328	10-year	948.00	84.27	90.40		90.50	0.001315	3.34	478.99	335.73	0.26
LMC	Reach 1	4328	25-year	1270.00	84.27	91.31		91.36	0.000632	2.58	852.80	452.05	0.18
LMC	Reach 1	4328	100-year	1800.00	84.27	92.40		92.44	0.000353	2.16	1357.17	482.77	0.14
LMC	Reach 1	4058	02-year	497.00	83.48	88.67		88.79	0.001358	3.04	235.51	157.88	0.26
LMC	Reach 1	4058	10-year	1070.00	83.48	90.03		90.15	0.001221	3.47	523.07	263.65	0.26
LMC	Reach 1	4058	25-year	1420.00	83.48	91.11		91.19	0.000655	2.86	835.34	306.36	0.20
LMC	Reach 1	4058	100-year	2010.00	83.48	92.26		92.32	0.000471	2.70	1203.02	333.18	0.17
LMC	Reach 1	3989	02-year	497.00	82.88	88.62		88.71	0.001037	2.85	256.68	164.83	0.23
LMC	Reach 1	3989	10-year	1070.00	82.88	89.97		90.07	0.000958	3.24	531.13	229.26	0.23
LMC	Reach 1	3989	25-year	1420.00	82.88	91.08		91.15	0.000561	2.78	797.80	251.52	0.18
LMC	Reach 1	3989	100-year	2010.00	82.88	92.23		92.29	0.000459	2.77	1099.42	274.52	0.17
LMC	Reach 1	3960	02-year	497.00	82.18	88.46	85.82	88.66	0.001693	3.85	192.02	151.81	0.30
LMC	Reach 1	3960	10-year	1070.00	82.18	89.89	87.44	90.04	0.001289	3.95	479.81	225.28	0.27
LMC	Reach 1	3960	25-year	1420.00	82.18	91.04	87.72	91.13	0.000690	3.22	751.87	245.72	0.20
LMC	Reach 1	3960	100-year	2010.00	82.18	92.20	89.51	92.28	0.000537	3.11	1043.87	258.86	0.18
LMC	Reach 1	3949		Bridge									
LMC	Reach 1	3939	02-year	497.00	82.81	88.26		88.45	0.002151	3.68	171.10	145.51	0.32
LMC	Reach 1	3939	10-year	1070.00	82.81	89.85		89.98	0.001233	3.48	471.92	214.21	0.26
LMC	Reach 1	3939	25-year	1420.00	82.81	91.02		91.10	0.000653	2.88	735.42	233.58	0.19
LMC	Reach 1	3939	100-year	2010.00	82.81	92.18		92.26	0.000515	2.84	1013.15	244.14	0.18
LMC	Reach 1	3908	02-year	497.00	83.41	88.22		88.38	0.001749	3.44	185.73	127.11	0.29
LMC	Reach 1	3908	10-year	1070.00	83.41	89.82		89.94	0.001106	3.38	469.52	200.51	0.25
LMC	Reach 1	3908	25-year	1420.00	83.41	91.00		91.08	0.000610	2.83	715.31	214.68	0.19
LMC	Reach 1	3908	100-year	2010.00	83.41	92.16		92.25	0.000502	2.85	971.16	225.62	0.17
LMC	Reach 1	3779	02-year	497.00	82.71	87.95		88.14	0.002099	3.77	171.16	107.76	0.32
LMC	Reach 1	3779	10-year	1070.00	82.71	89.62		89.77	0.001440	3.87	402.87	167.87	0.28
LMC	Reach 1	3779	25-year	1420.00	82.71	90.90		91.00	0.000760	3.19	631.78	189.65	0.21
LMC	Reach 1	3779	100-year	2010.00	82.71	92.08		92.18	0.000603	3.14	858.54	195.23	0.19
LMC	Reach 1	3641	02-year	497.00	82.79	87.70		87.85	0.001851	3.34	206.71	163.53	0.30
LMC	Reach 1	3641	10-year	1070.00	82.79	89.52		89.61	0.000801	2.85	518.01	176.71	0.21
LMC	Reach 1	3641	25-year	1420.00	82.79	90.84		90.90	0.000455	2.46	754.90	183.09	0.16
LMC	Reach 1	3641	100-year	2010.00	82.79	92.02		92.10	0.000416	2.62	974.83	188.73	0.16
LMC	Reach 1	3396	02-year	497.00	82.31	87.12		87.35	0.002476	3.91	165.37	124.07	0.35
LMC	Reach 1	3396	10-year	1070.00	82.31	89.28		89.41	0.001153	3.56	511.90	178.02	0.25
LMC	Reach 1	3396	25-year	1420.00	82.31	90.71		90.80	0.000654	3.08	778.11	193.40	0.20
LMC	Reach 1	3396	100-year	2010.00	82.31	91.91		92.01	0.000607	3.28	1016.06	202.93	0.20
LMC	Reach 1	3217	02-year	497.00	80.84	86.42	84.57	86.77	0.004266	4.82	125.44	95.64	0.43

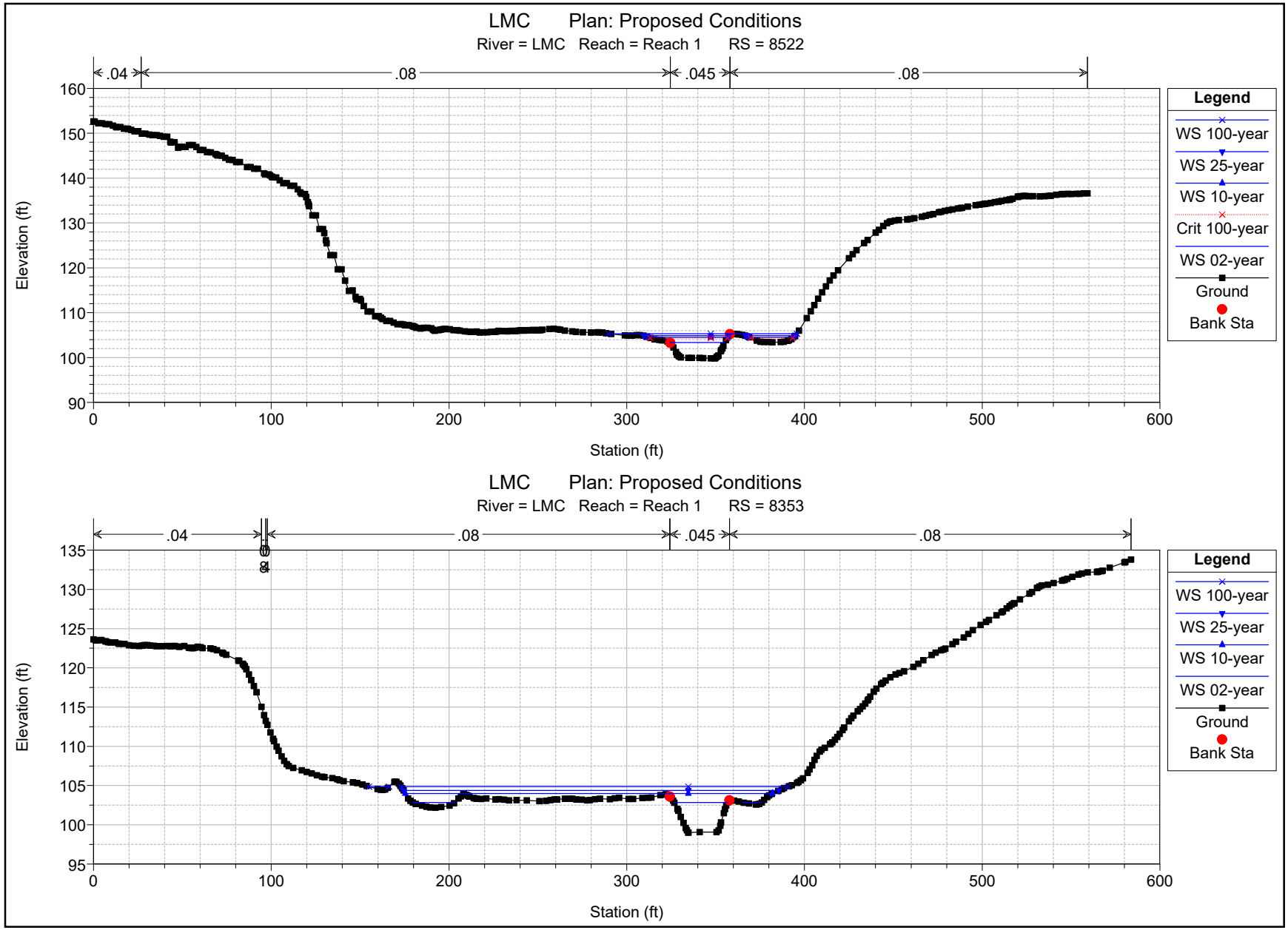
HEC-RAS Plan: Existing (Continued)

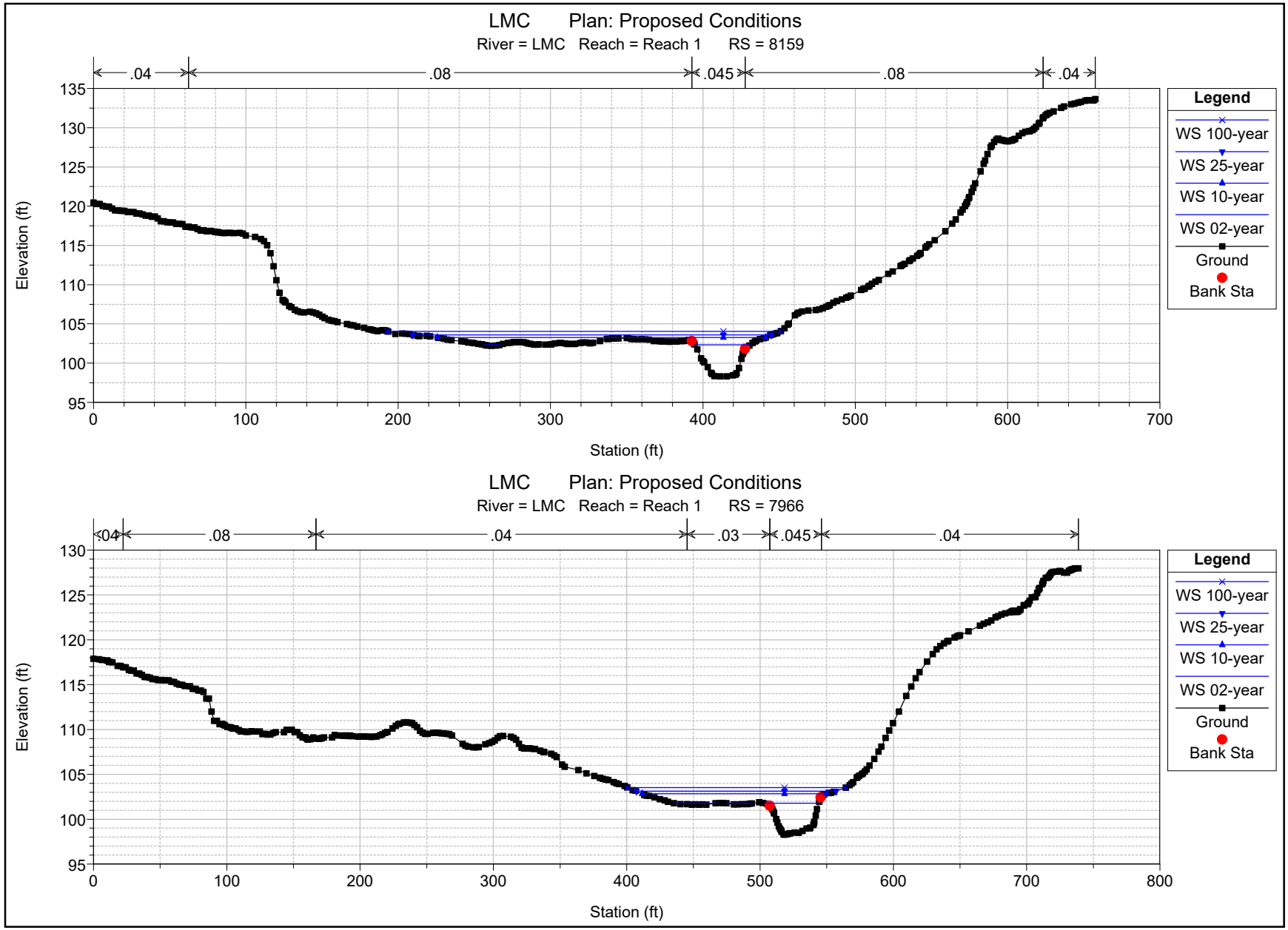
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LMC	Reach 1	3217	10-year	1070.00	80.84	89.14		89.23	0.000942	3.15	617.74	201.43	0.22
LMC	Reach 1	3217	25-year	1420.00	80.84	90.64		90.70	0.000514	2.67	929.01	212.60	0.17
LMC	Reach 1	3217	100-year	2010.00	80.84	91.85		91.91	0.000490	2.87	1190.00	220.51	0.17
LMC	Reach 1	3002	02-year	497.00	80.53	86.18		86.30	0.001060	2.74	207.84	103.14	0.23
LMC	Reach 1	3002	10-year	1070.00	80.53	89.06		89.12	0.000388	2.30	647.49	172.03	0.15
LMC	Reach 1	3002	25-year	1420.00	80.53	90.59		90.64	0.000253	2.11	924.65	189.74	0.13
LMC	Reach 1	3002	100-year	2010.00	80.53	91.79		91.85	0.000266	2.36	1159.51	200.65	0.13
LMC	Reach 1	2916	02-year	497.00	80.75	85.97		86.17	0.002042	3.63	160.79	86.26	0.32
LMC	Reach 1	2916	10-year	1070.00	80.75	89.00		89.08	0.000515	2.64	569.48	149.65	0.18
LMC	Reach 1	2916	25-year	1420.00	80.75	90.55		90.61	0.000335	2.43	809.23	161.47	0.15
LMC	Reach 1	2916	100-year	2010.00	80.75	91.74		91.82	0.000369	2.78	1027.46	228.14	0.16
LMC	Reach 1	2762	02-year	497.00	80.64	85.81		85.92	0.001055	2.72	194.40	106.69	0.23
LMC	Reach 1	2762	10-year	1070.00	80.64	88.97		89.01	0.000282	2.04	670.71	202.12	0.13
LMC	Reach 1	2762	25-year	1420.00	80.64	90.53		90.57	0.000168	1.79	1029.70	271.65	0.11
LMC	Reach 1	2762	100-year	2010.00	80.64	91.74		91.78	0.000154	1.86	1444.14	379.93	0.10
LMC	Reach 1	2668	02-year	497.00	79.37	85.81		85.85	0.000308	1.69	353.04	153.43	0.13
LMC	Reach 1	2668	10-year	1070.00	79.37	88.96		88.99	0.000145	1.59	927.10	291.08	0.10
LMC	Reach 1	2668	25-year	1420.00	79.37	90.53		90.55	0.000089	1.39	1495.79	442.85	0.08
LMC	Reach 1	2668	100-year	2010.00	79.37	91.74		91.76	0.000068	1.32	2070.54	500.98	0.07
LMC	Reach 1	2545	02-year	497.00	79.47	85.63	82.47	85.76	0.001120	2.98	181.84	55.32	0.24
LMC	Reach 1	2545	10-year	1070.00	79.47	88.82	84.24	88.93	0.000556	2.94	423.04	120.19	0.18
LMC	Reach 1	2545	25-year	1420.00	79.47	90.42	84.95	90.51	0.000394	2.80	696.87	179.09	0.16
LMC	Reach 1	2545	100-year	2010.00	79.47	91.63	85.89	91.72	0.000383	2.98	932.85	210.12	0.16
LMC	Reach 1	2469		Bridge									
LMC	Reach 1	2289	02-year	497.00	80.96	85.20	83.51	85.37	0.002075	3.43	180.89	319.29	0.32
LMC	Reach 1	2289	10-year	1070.00	80.96	86.07	84.57	86.43	0.003690	5.30	278.39	425.47	0.45
LMC	Reach 1	2289	25-year	1420.00	80.96	86.43	85.08	86.90	0.004544	6.20	322.50	448.50	0.50
LMC	Reach 1	2289	100-year	2010.00	80.96	86.92	86.12	87.59	0.005862	7.52	385.86	481.48	0.58
LMC	Reach 1	2231	02-year	497.00	80.75	85.15	83.13	85.24	0.001345	2.69	258.39	426.43	0.26
LMC	Reach 1	2231	10-year	1070.00	80.75	85.99	84.45	86.18	0.002226	4.02	424.79	497.16	0.35
LMC	Reach 1	2231	25-year	1420.00	80.75	86.36	84.95	86.59	0.002634	4.61	504.80	516.77	0.38
LMC	Reach 1	2231	100-year	2010.00	80.75	86.87	85.57	87.17	0.003077	5.36	624.49	534.05	0.42
LMC	Reach 1	1797	02-year	497.00	80.06	84.39	82.81	84.54	0.002512	3.46	272.63	406.34	0.34
LMC	Reach 1	1797	10-year	1070.00	80.06	85.26	84.56	85.39	0.002252	3.86	649.98	613.31	0.34
LMC	Reach 1	1797	25-year	1420.00	80.06	85.66	84.85	85.78	0.002087	3.96	840.86	629.09	0.33
LMC	Reach 1	1797	100-year	2010.00	80.06	86.26	85.16	86.37	0.001868	4.08	1131.74	645.43	0.32
LMC	Reach 1	1553	02-year	497.00	80.14	83.89	82.48	83.99	0.001983	2.82	311.79	310.63	0.30
LMC	Reach 1	1553	10-year	1070.00	80.14	84.77	83.79	84.88	0.002037	3.44	608.33	459.77	0.32
LMC	Reach 1	1553	25-year	1420.00	80.14	85.18	84.05	85.30	0.002031	3.70	759.65	510.86	0.33
LMC	Reach 1	1553	100-year	2010.00	80.14	85.78	84.43	85.91	0.002004	4.03	992.33	535.10	0.33
LMC	Reach 1	1432	02-year	497.00	79.91	83.48	82.84	83.66	0.003640	3.84	236.70	239.00	0.41
LMC	Reach 1	1432	10-year	1070.00	79.91	84.32	83.69	84.53	0.003893	4.74	445.23	259.63	0.44
LMC	Reach 1	1432	25-year	1420.00	79.91	84.72	83.94	84.95	0.003970	5.13	550.14	398.54	0.45
LMC	Reach 1	1432	100-year	2010.00	79.91	85.29	84.31	85.56	0.004112	5.71	710.75	428.14	0.47
LMC	Reach 1	1199	02-year	497.00	78.94	82.68	81.45	82.88	0.003539	3.96	227.25	255.70	0.40
LMC	Reach 1	1199	10-year	1070.00	78.94	83.62	82.95	83.82	0.003306	4.59	476.78	281.15	0.41
LMC	Reach 1	1199	25-year	1420.00	78.94	84.03	83.20	84.24	0.003300	4.91	594.76	288.83	0.42
LMC	Reach 1	1199	100-year	2010.00	78.94	84.61	83.60	84.84	0.003379	5.40	766.63	331.79	0.43
LMC	Reach 1	1047	02-year	497.00	77.53	82.34		82.47	0.001991	3.28	288.60	284.48	0.31
LMC	Reach 1	1047	10-year	1070.00	77.53	83.27		83.41	0.002208	3.98	574.98	329.79	0.33
LMC	Reach 1	1047	25-year	1420.00	77.53	83.68		83.84	0.002242	4.26	713.79	337.74	0.34
LMC	Reach 1	1047	100-year	2010.00	77.53	84.26		84.43	0.002348	4.70	911.01	350.87	0.36
LMC	Reach 1	839	02-year	497.00	77.59	81.92		82.04	0.002513	3.23	299.29	321.60	0.34
LMC	Reach 1	839	10-year	1070.00	77.59	82.93		83.02	0.002040	3.37	662.77	386.87	0.31
LMC	Reach 1	839	25-year	1420.00	77.59	83.36		83.45	0.001942	3.54	836.39	411.11	0.31
LMC	Reach 1	839	100-year	2010.00	77.59	83.94		84.05	0.001877	3.82	1081.52	422.40	0.31
LMC	Reach 1	682	02-year	497.00	77.10	81.71		81.77	0.001143	2.25	358.76	262.75	0.23
LMC	Reach 1	682	10-year	1070.00	77.10	82.66		82.75	0.001469	2.88	629.41	301.18	0.27
LMC	Reach 1	682	25-year	1420.00	77.10	83.08		83.18	0.001648	3.18	755.53	309.38	0.29
LMC	Reach 1	682	100-year	2010.00	77.10	83.63		83.76	0.001844	3.61	929.97	316.30	0.31
LMC	Reach 1	449	02-year	497.00	76.92	81.11		81.29	0.004327	3.96	214.15	179.16	0.43
LMC	Reach 1	449	10-year	1070.00	76.92	81.83		82.12	0.006152	5.43	371.64	244.47	0.53
LMC	Reach 1	449	25-year	1420.00	76.92	82.13		82.47	0.006762	6.04	447.16	251.40	0.57
LMC	Reach 1	449	100-year	2010.00	76.92	82.57		82.98	0.007438	6.85	557.83	257.52	0.61
LMC	Reach 1	374	02-year	497.00	76.61	81.07	78.93	81.11	0.000927	2.00	323.66	229.82	0.20
LMC	Reach 1	374	10-year	1070.00	76.61	81.78	79.86	81.86	0.001330	2.76	506.63	283.28	0.25
LMC	Reach 1	374	25-year	1420.00	76.61	82.08	80.30	82.18	0.001480	3.06	591.58	291.61	0.27

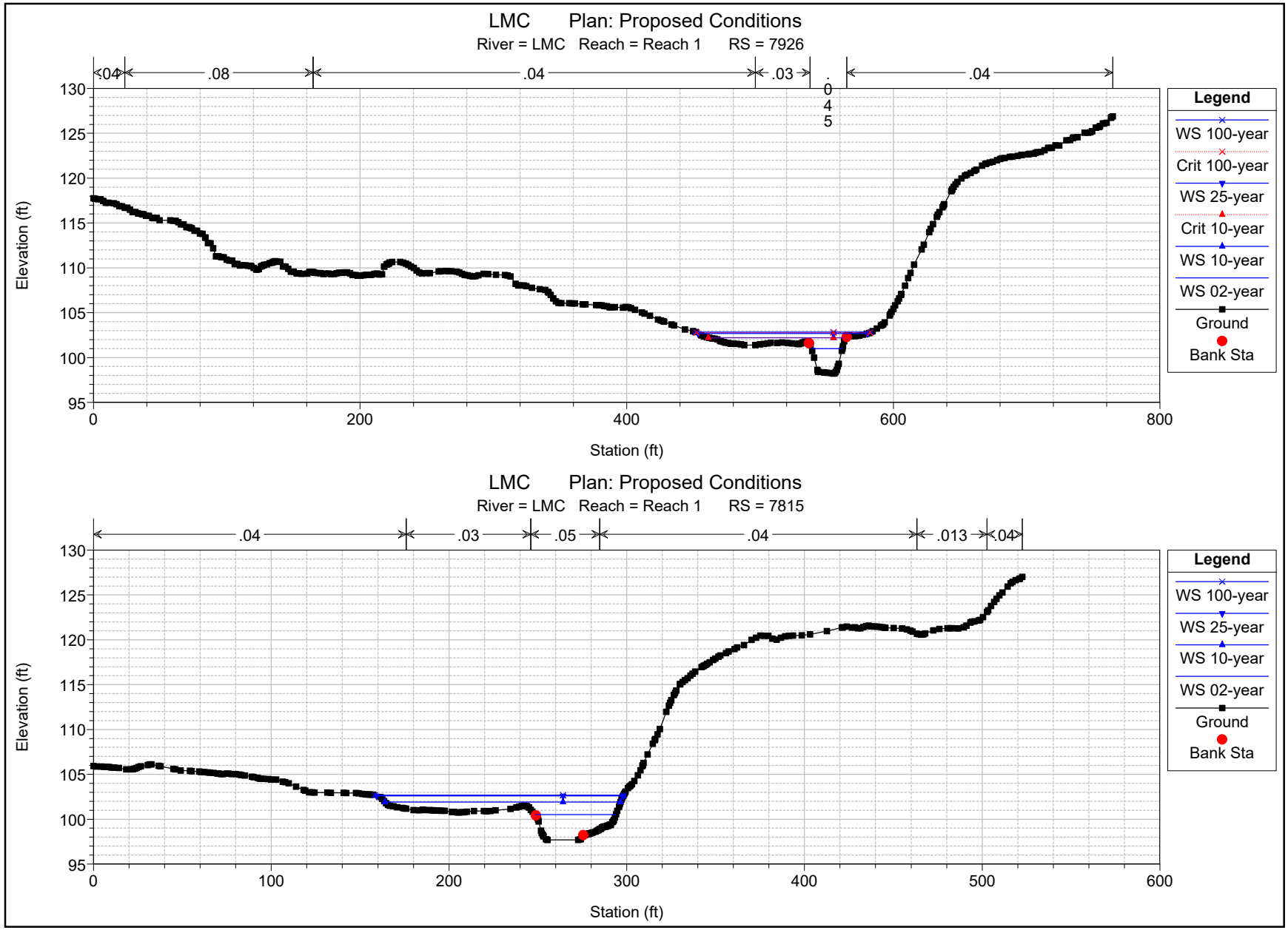
HEC-RAS Plan: Existing (Continued)

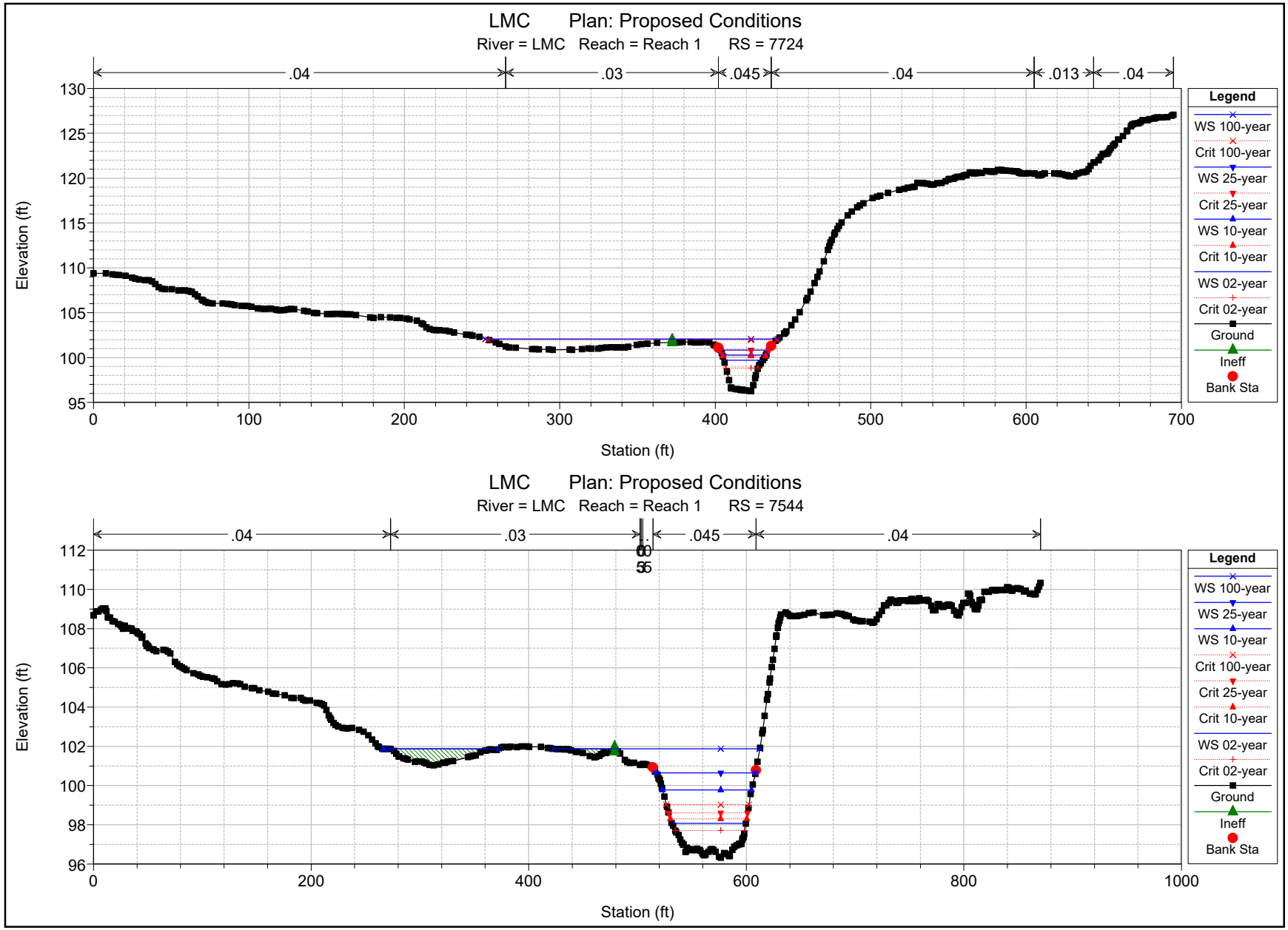
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LMC	Reach 1	374	100-year	2010.00	76.61	82.51	81.11	82.64	0.001671	3.49	717.01	317.43	0.29
LMC	Reach 1	138	02-year	497.00	77.16	80.58	80.27	80.68	0.003900	3.49	352.23	428.50	0.41
LMC	Reach 1	138	10-year	1070.00	77.16	81.20	80.64	81.30	0.003901	4.10	633.31	474.67	0.42
LMC	Reach 1	138	25-year	1420.00	77.16	81.48	80.80	81.58	0.003902	4.36	764.51	480.60	0.43
LMC	Reach 1	138	100-year	2010.00	77.16	81.88	81.07	82.00	0.003904	4.72	962.01	539.65	0.44

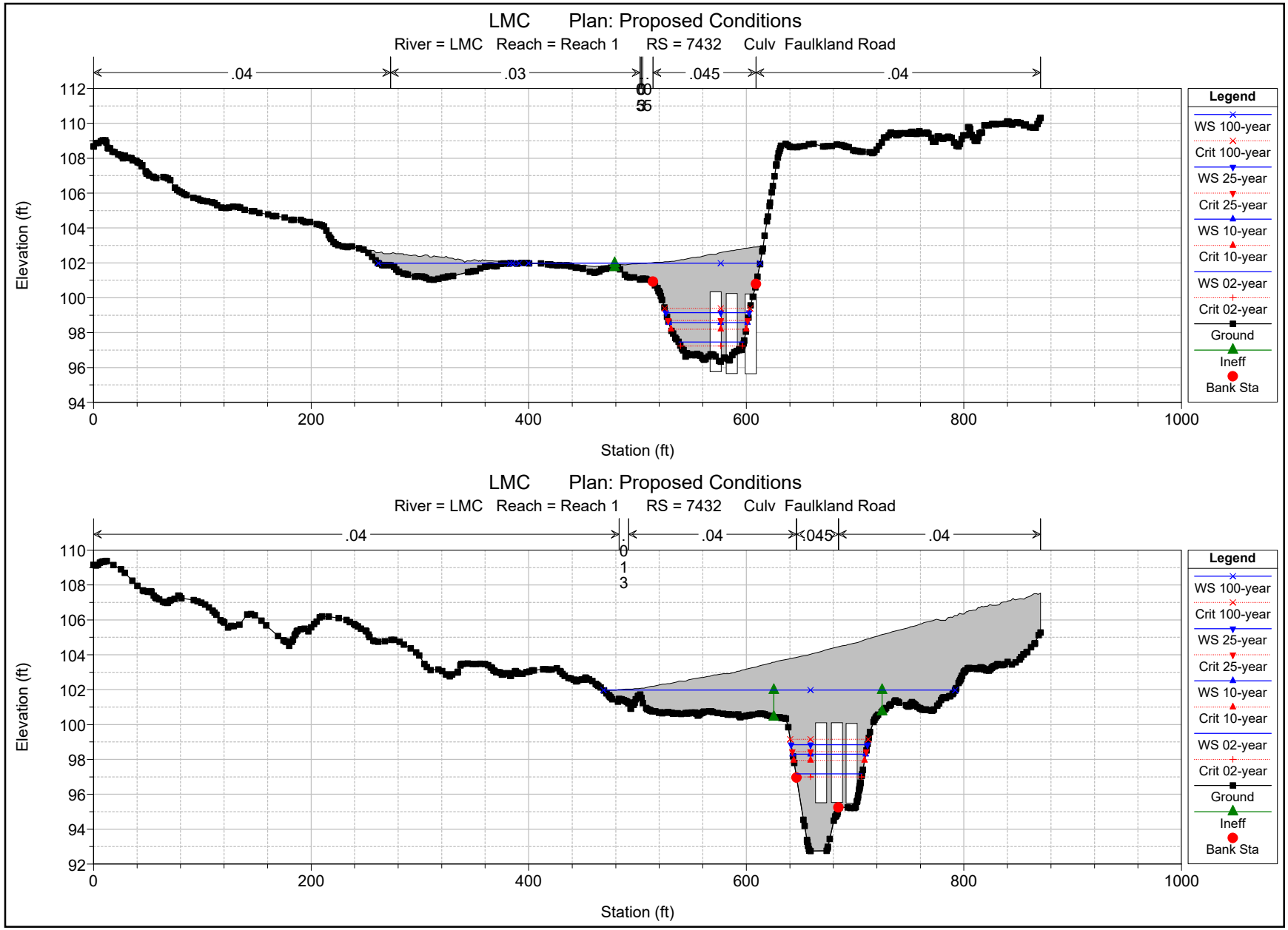

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 8758
.08
.045
.08
Elevation (ft)
135
130
125
120
115
110
105
100
0
100
200
300
400
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 8653
.08
.045
.08
Elevation (ft)
160
150
140
130
120
110
100
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta

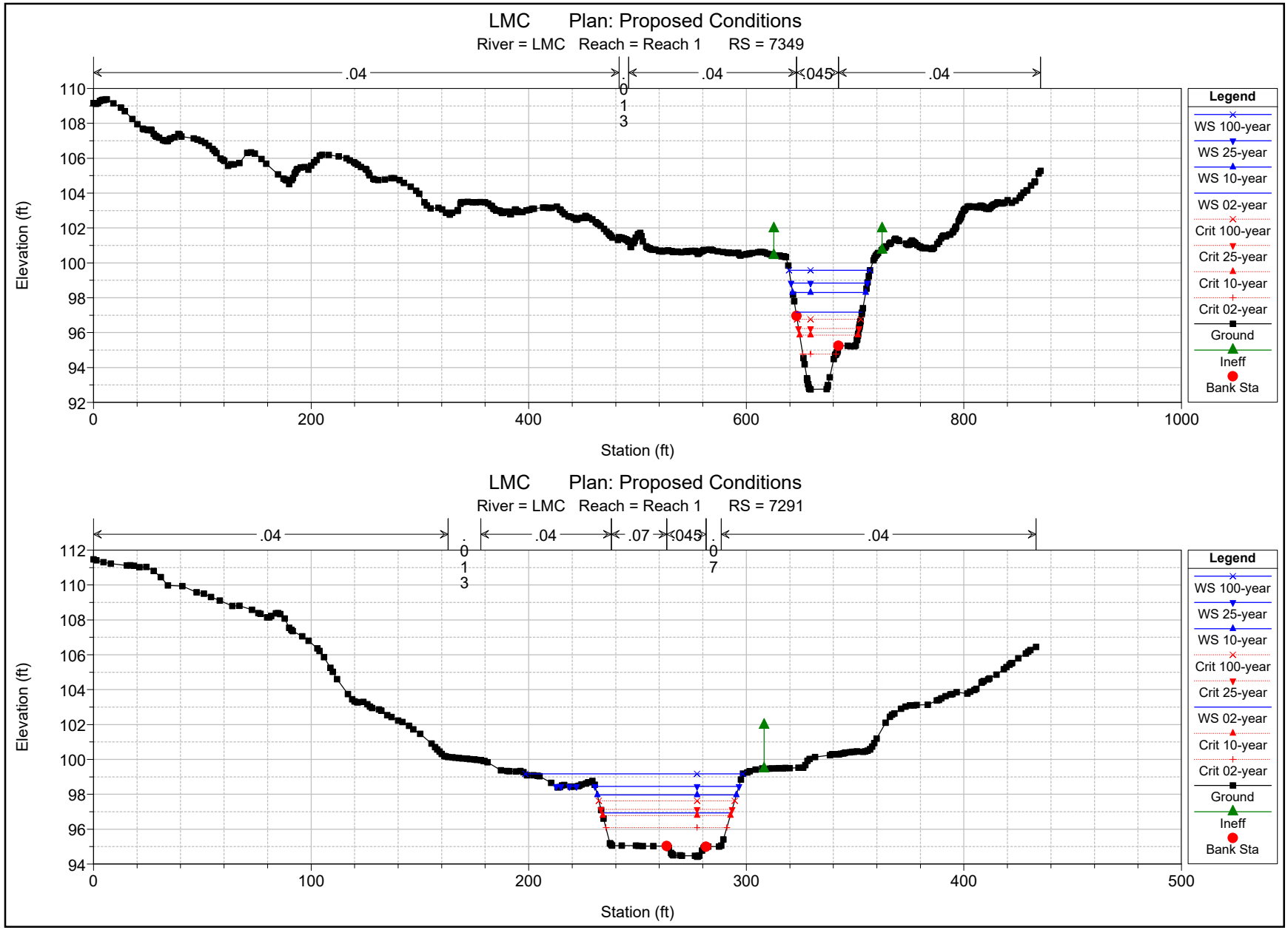

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 8522
.04
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 8353
.04
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

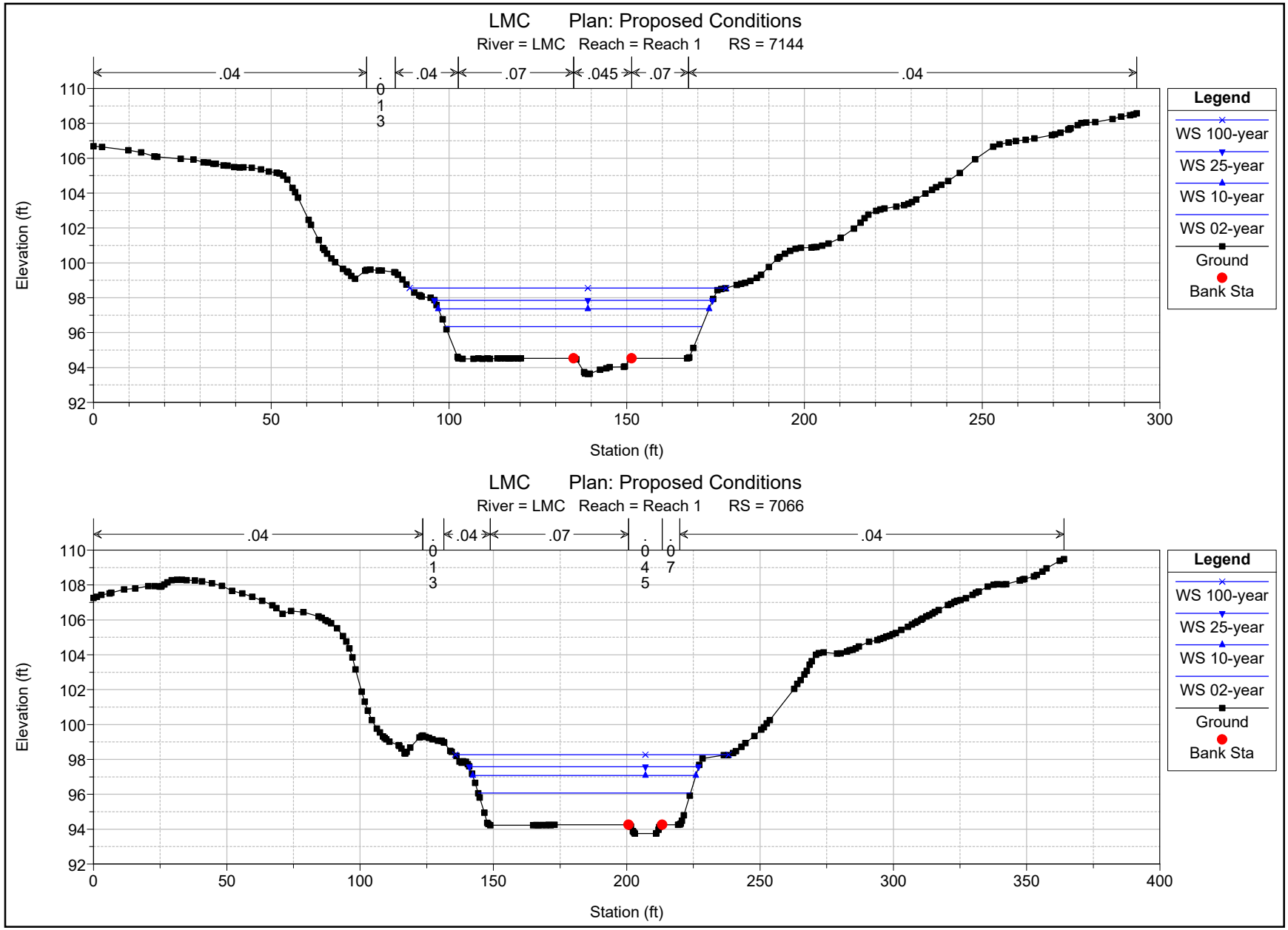

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 8159
.04
.08
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7966
.04
.08
.04
.03
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

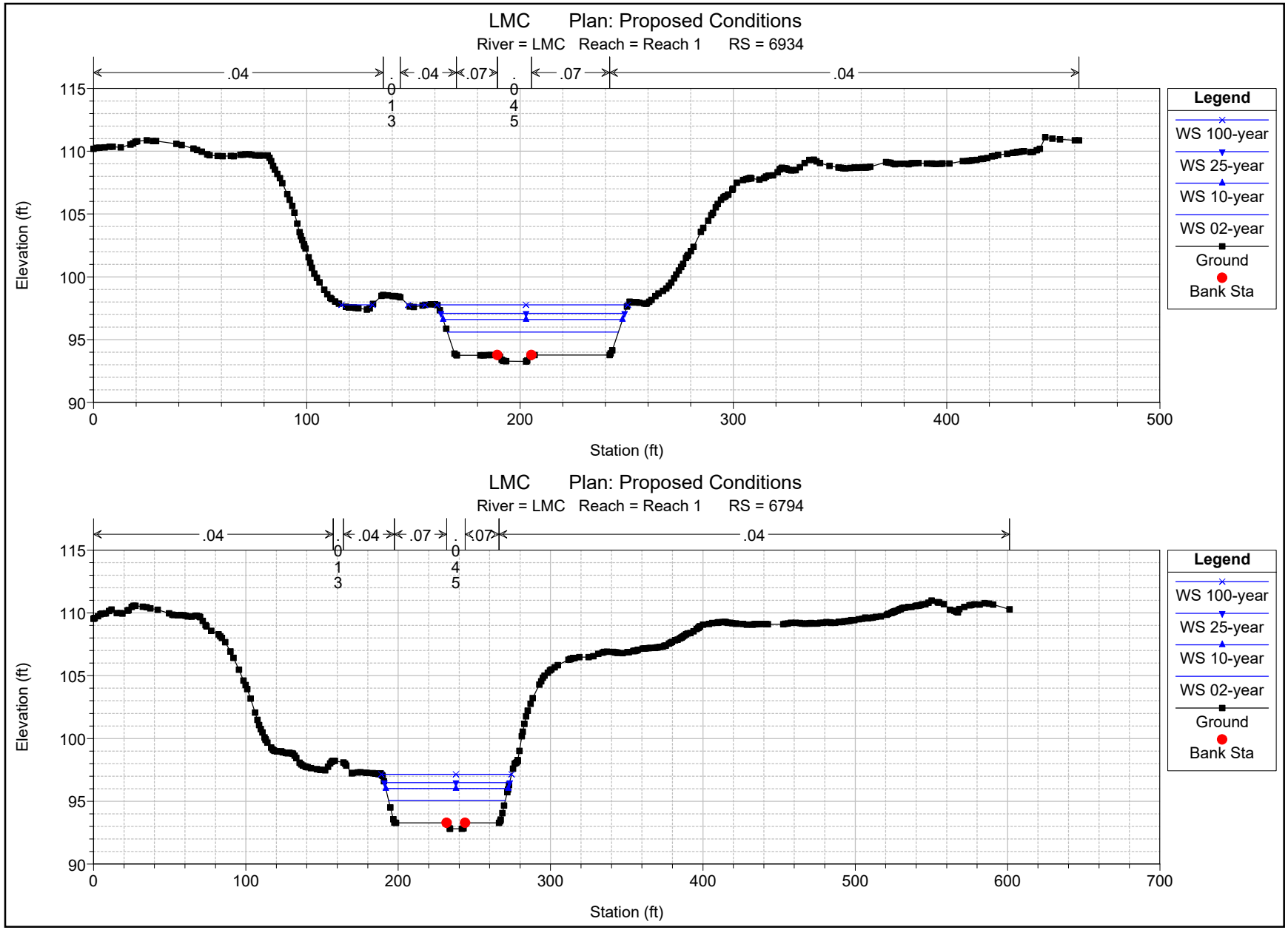

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7926
.04
.08
.04
.03
.045
.04
Elevation (ft)
130
125
120
115
110
105
100
95
0
200
400
600
800
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 10-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7815
.04
.03
.05
.04
.013
.04
Elevation (ft)
130
125
120
115
110
105
100
95
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

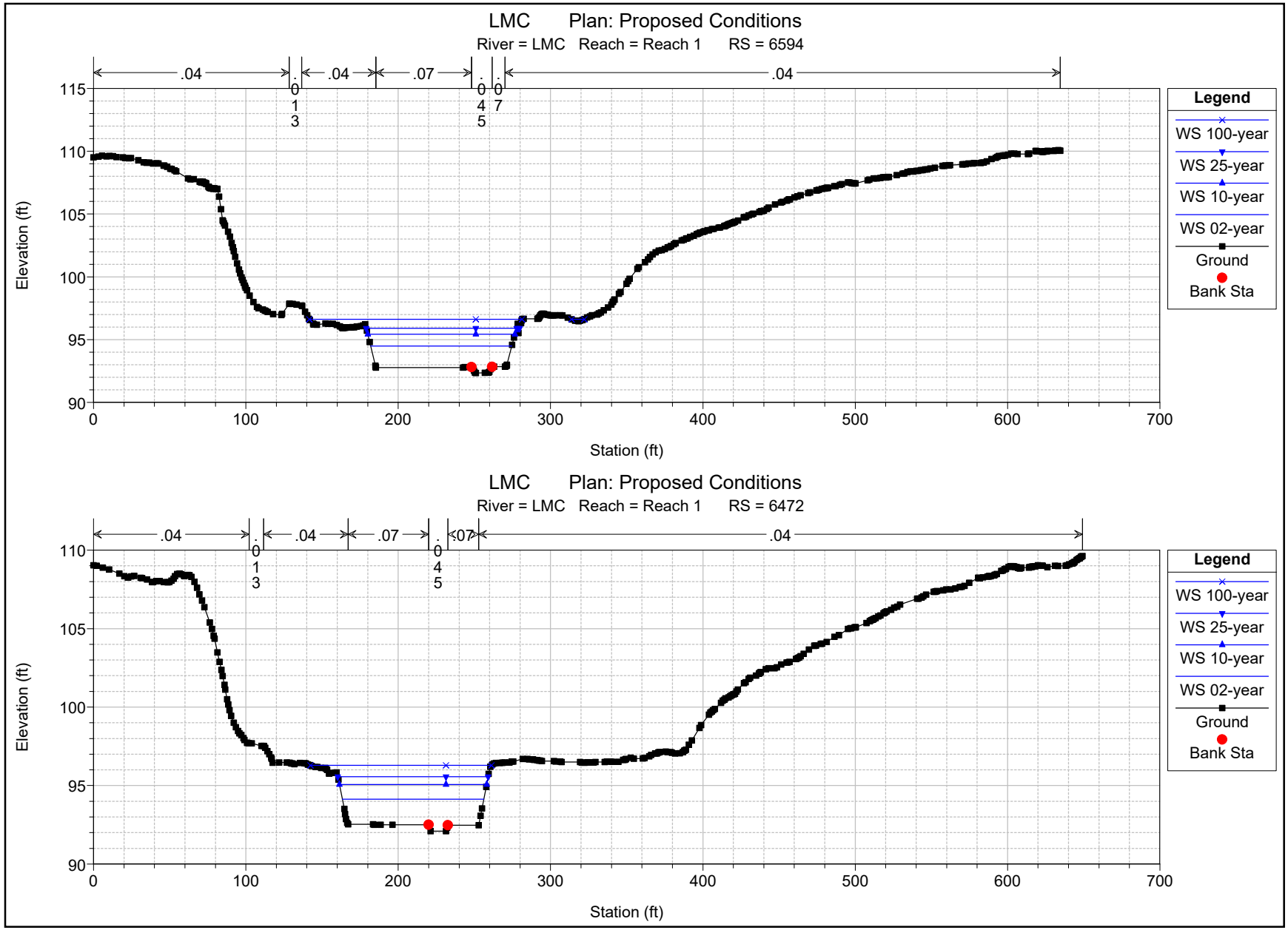

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7724
.04
.03
.045
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7544
.04
.03
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

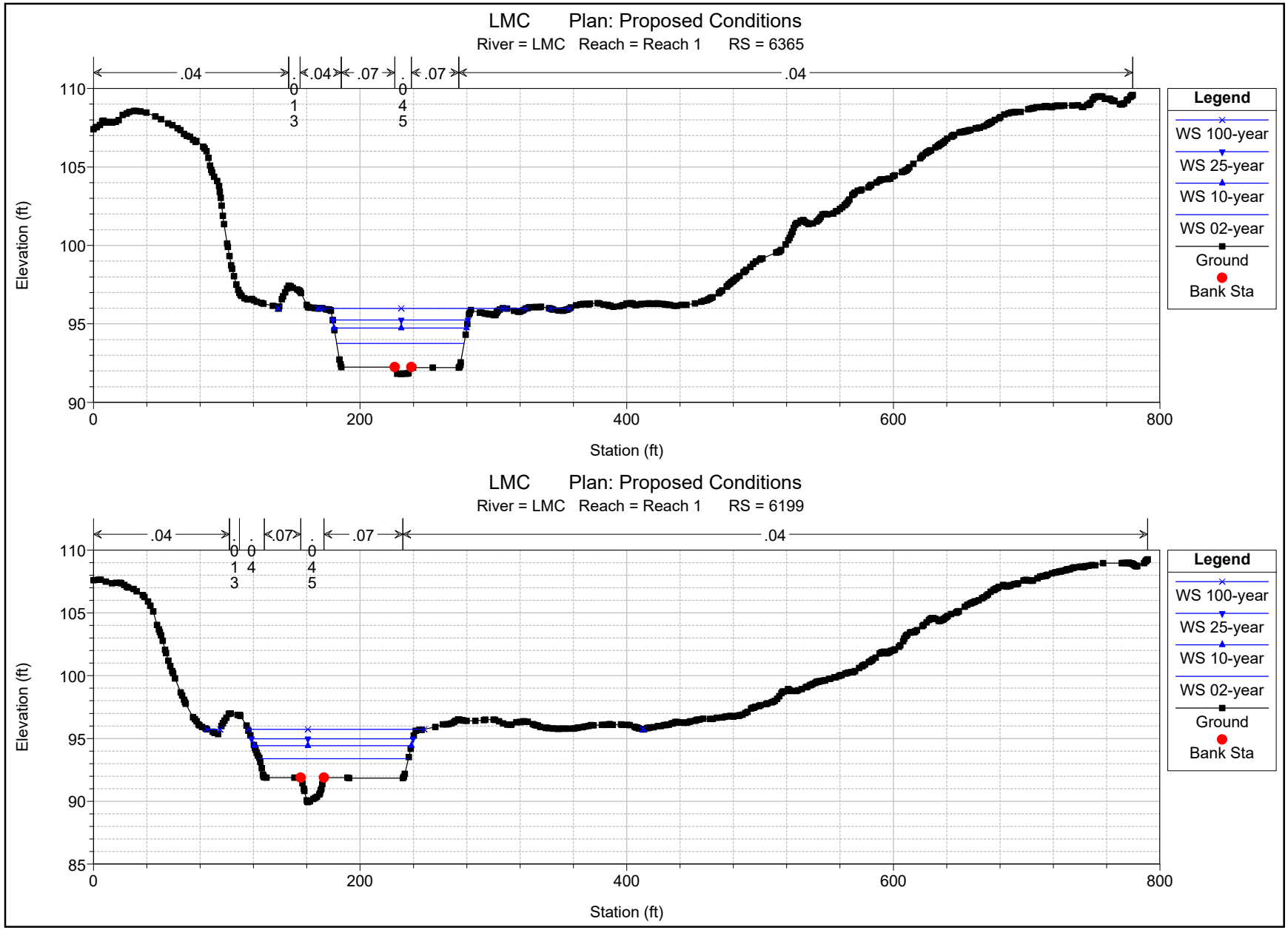

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7432 Culv Faulkland Road
.04
.03
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7432 Culv Faulkland Road
.04
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

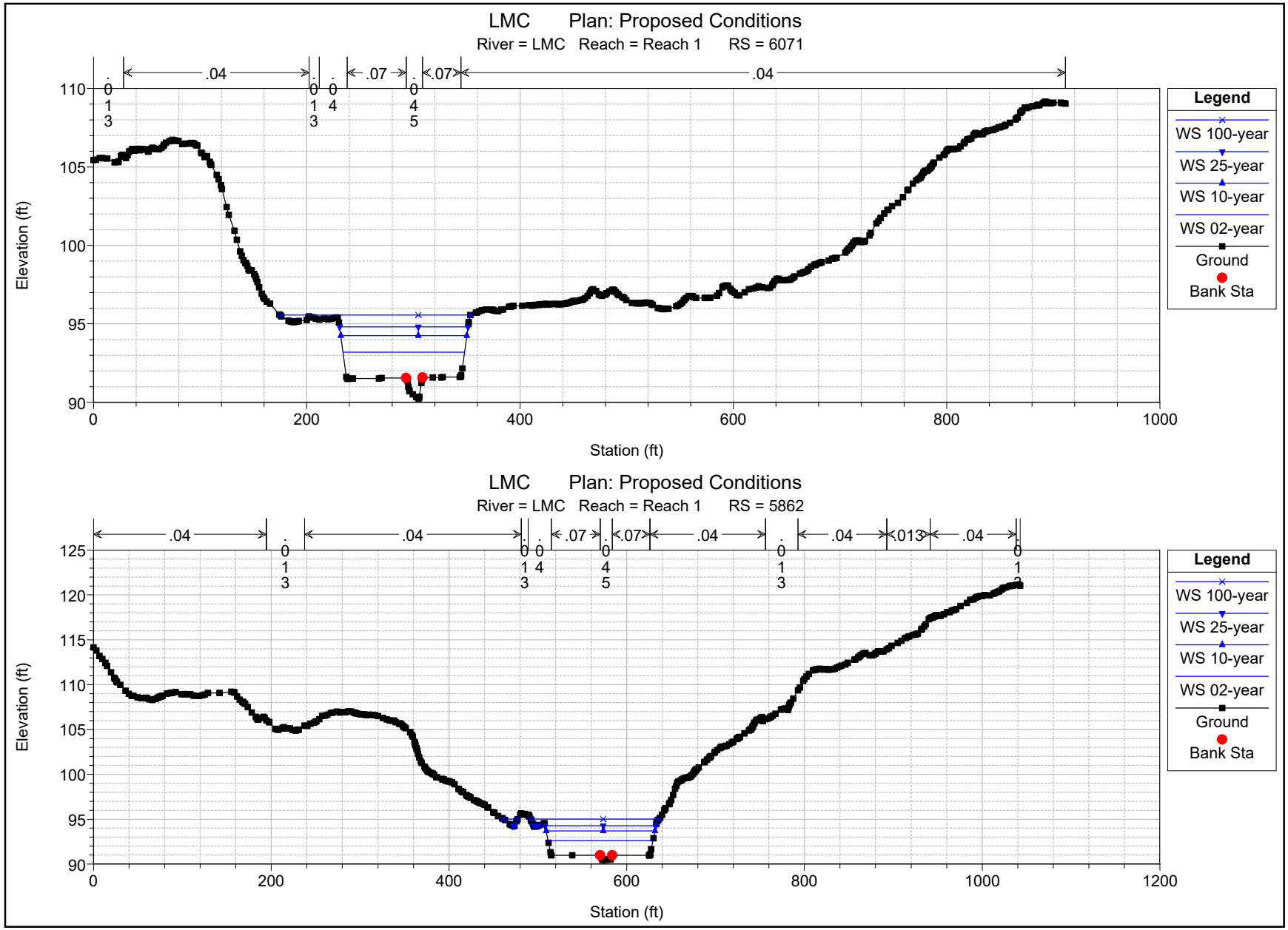

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7349
.04
.013
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7291
.04
.013
.04
.07
.045
.07
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
WS 02-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

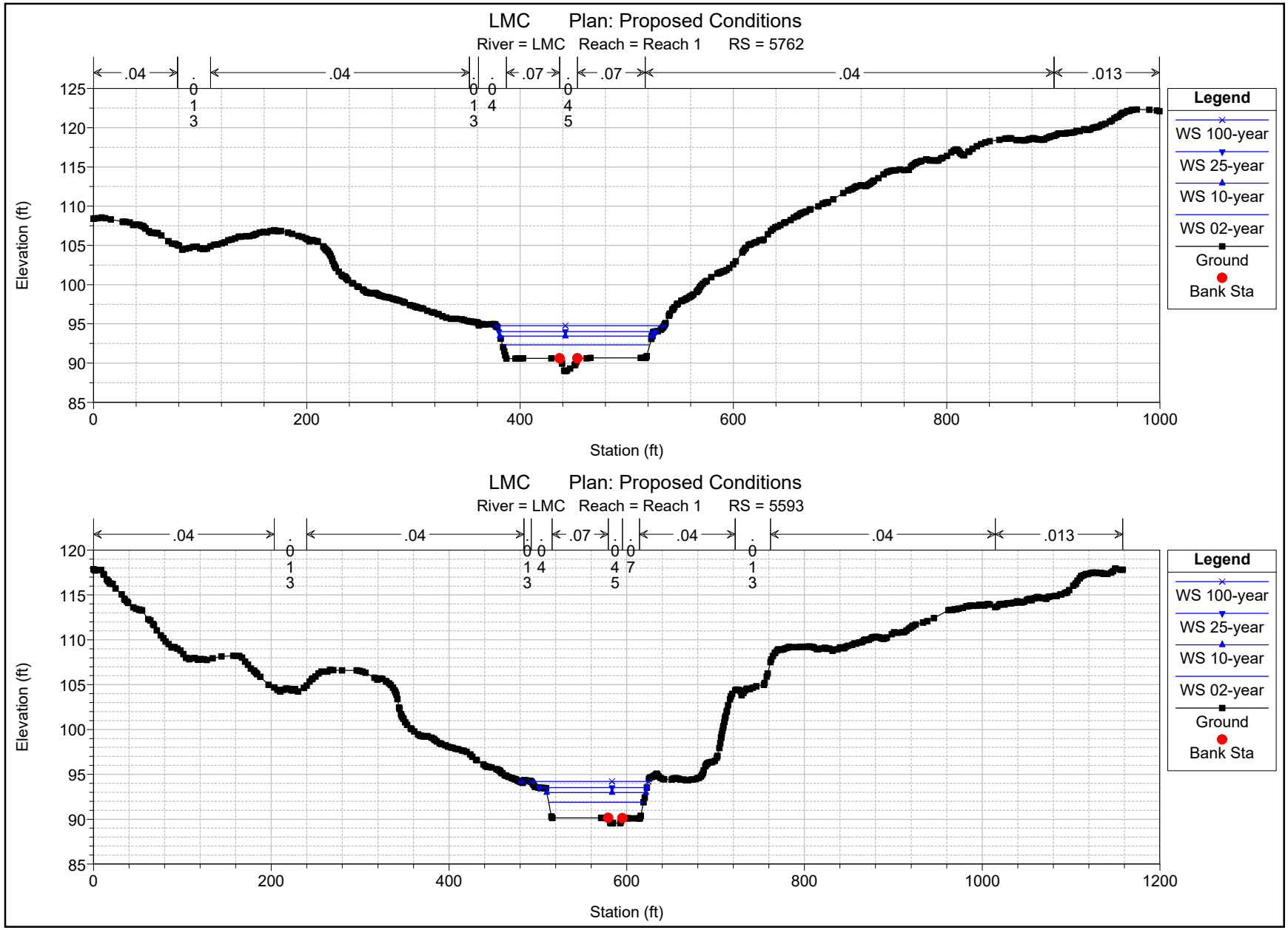

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7144
.04
.013
.04
.07
.045
.07
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 7066
.04
.013
.04
.07
.045
.07
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

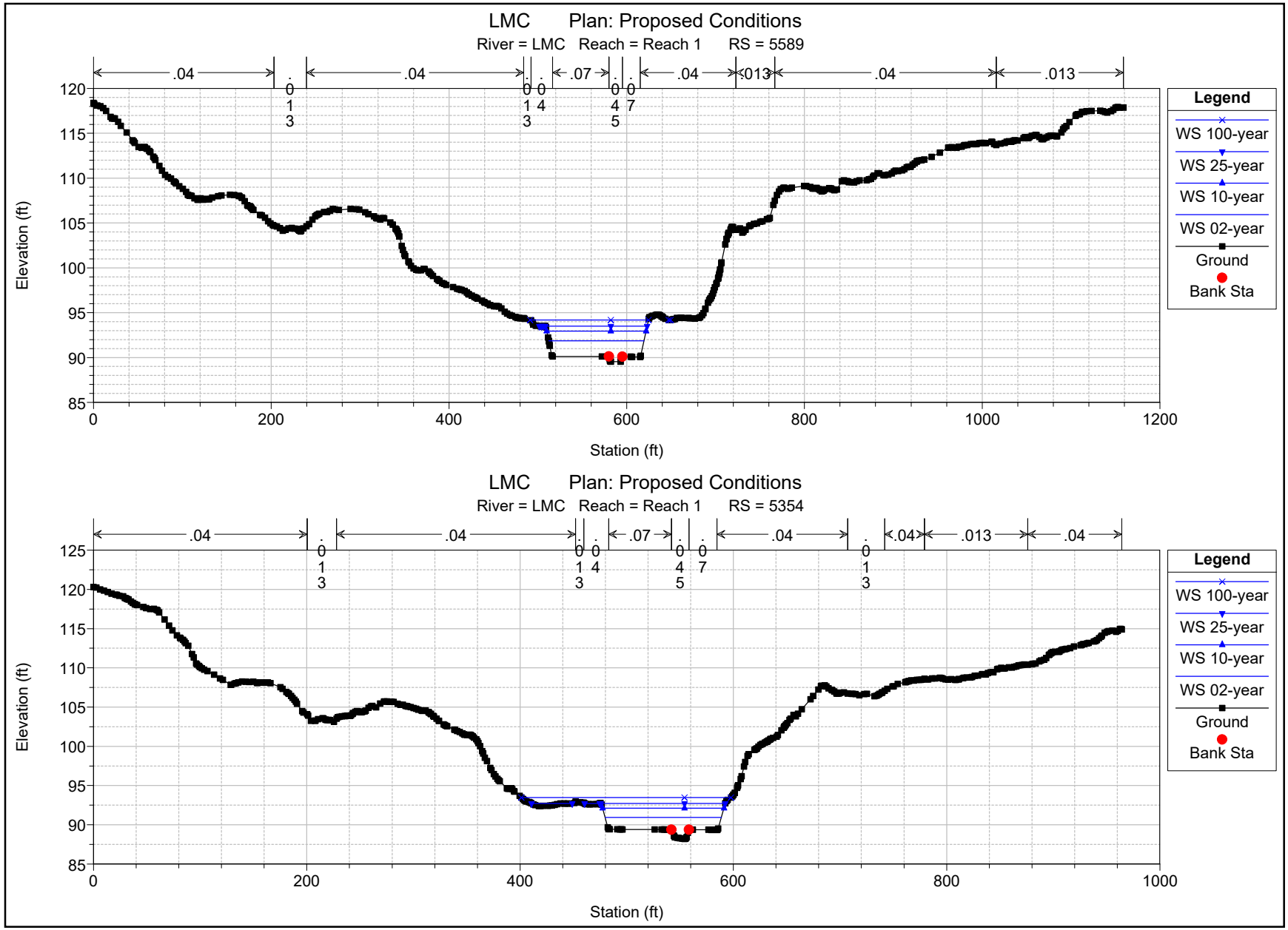

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 6934
.04
.04
.07
.07
.04
.013
.045
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 6794
.04
.04
.07
.07
.04
.013
.045
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

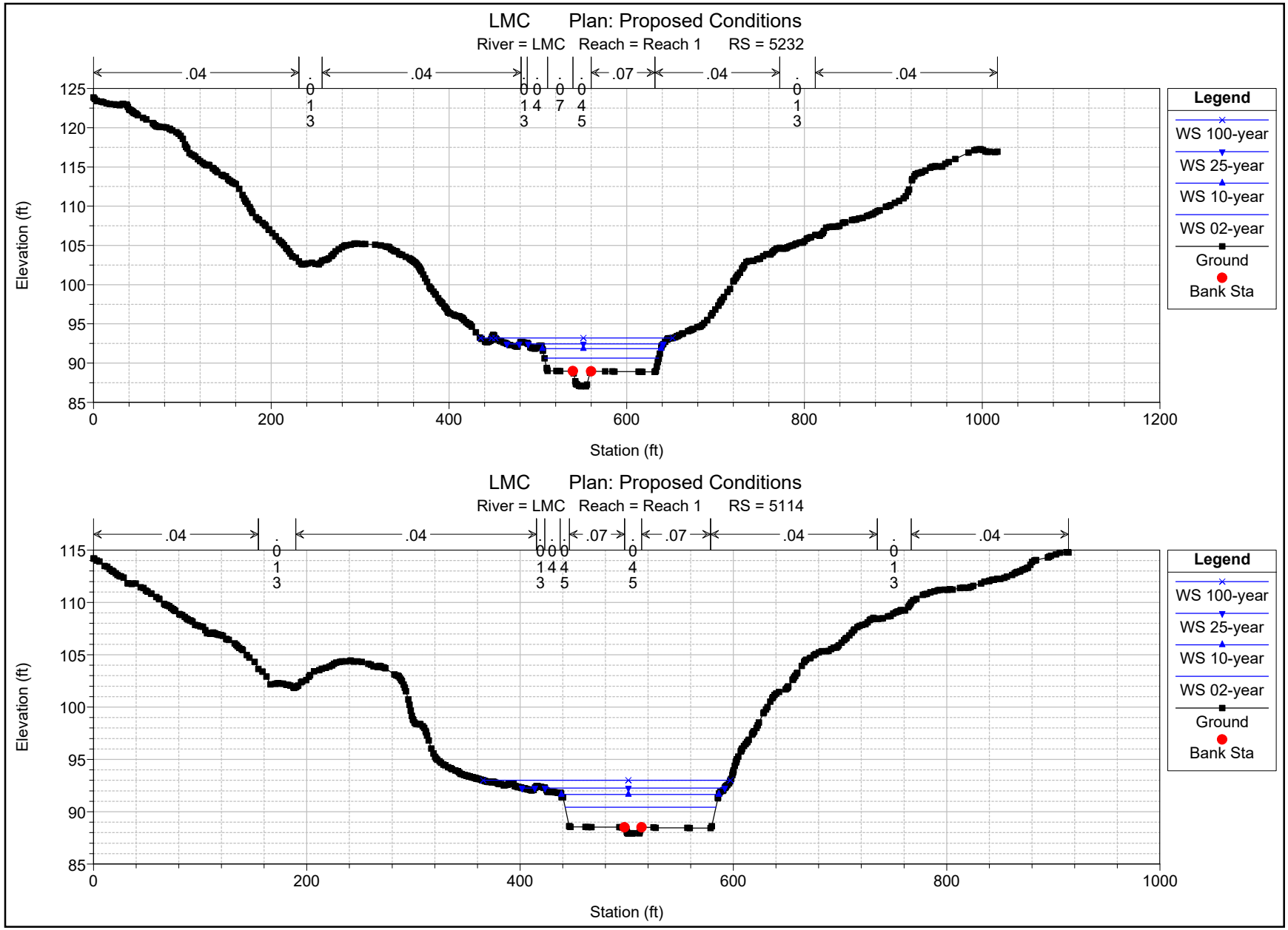

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 6594
.04
.04
.07
.04
.013
.045
.07
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 6472
.04
.04
.07
.07
.04
.013
.045
Elevation (ft)
110
105
100
95
90
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

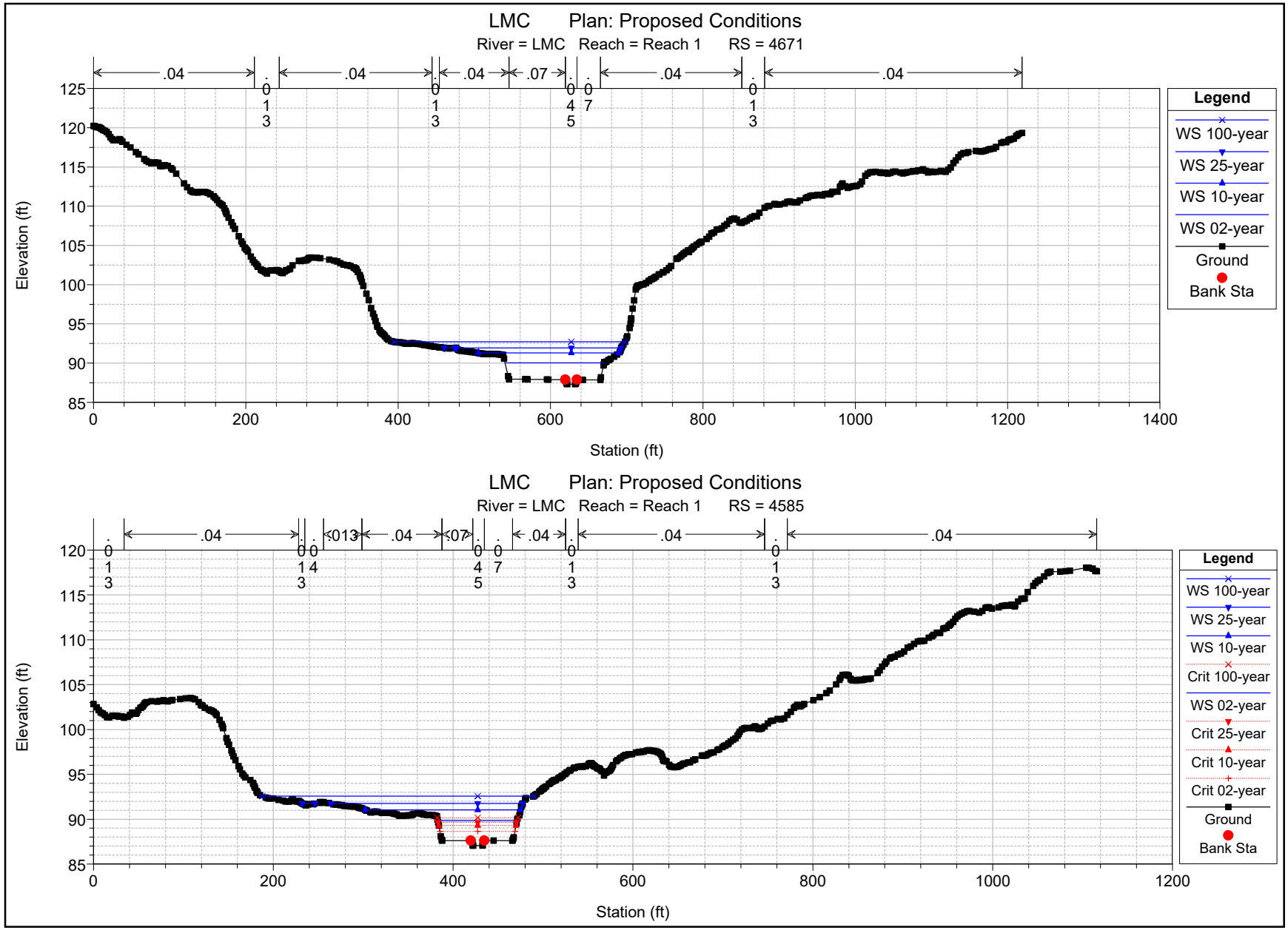

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 6365
.04
.04
.07
.07
.04
.013
.045
110
105
100
95
90
Elevation (ft)
0
200
400
600
800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 6199
.04
.013
.04
.07
.045
.07
.04
110
105
100
95
90
85
Elevation (ft)
0
200
400
600
800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

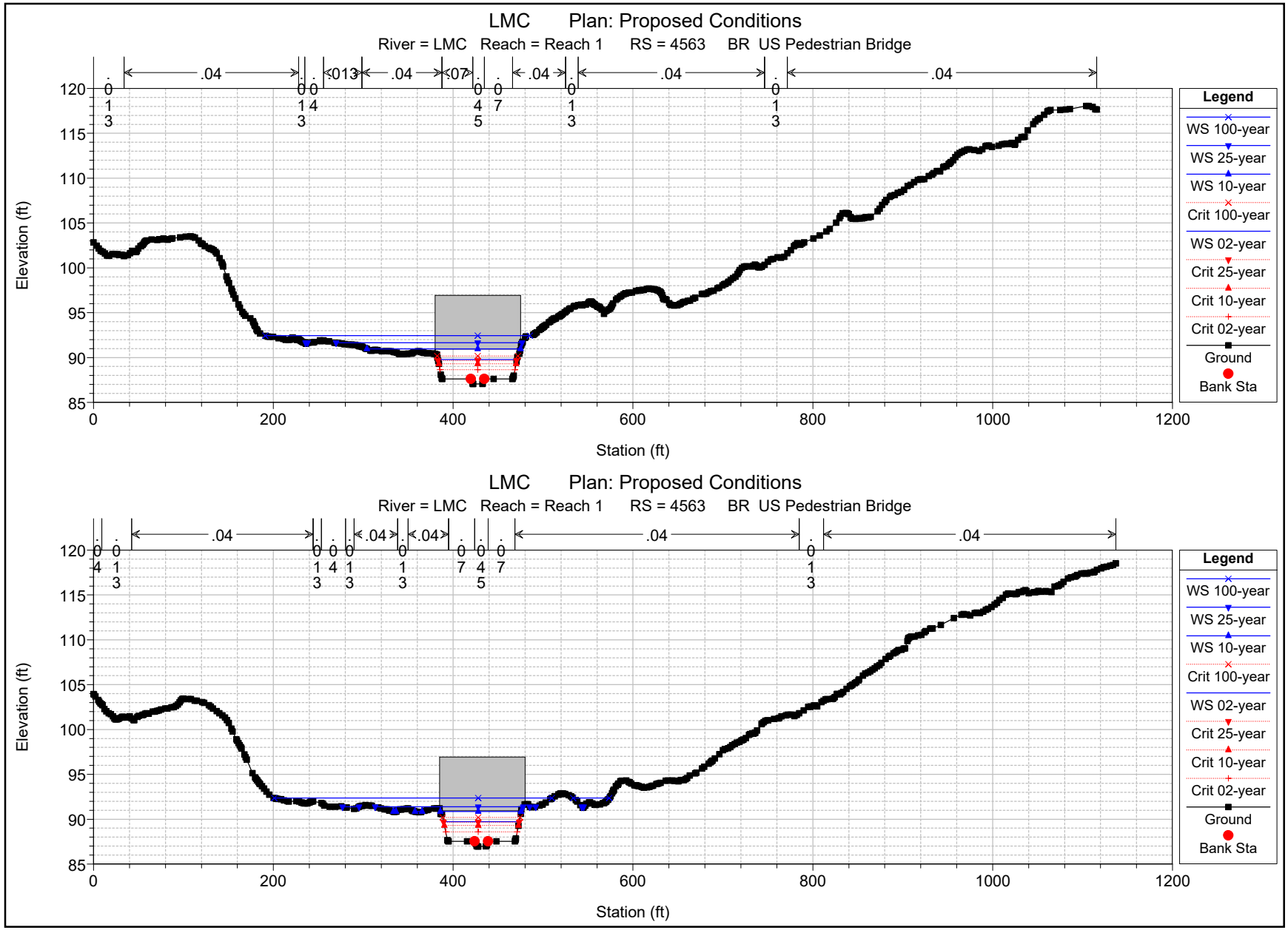

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 6071
.04
.07
.07
.04
.013
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 5862
.04
.04
.07
.07
.04
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

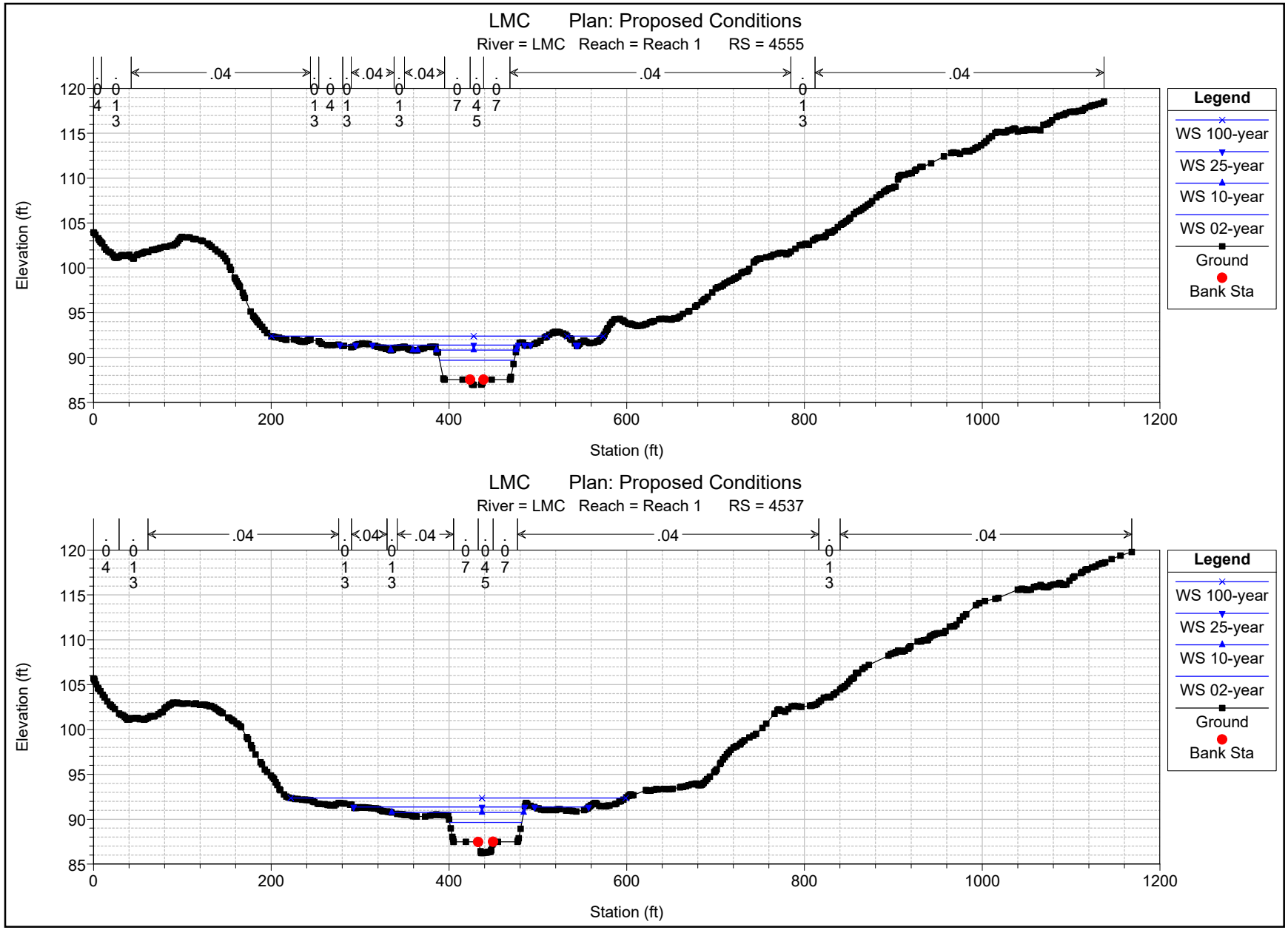

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 5762
.04
.04
.07
.07
.04
.013
.013
.04
.045
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 5593
.04
.04
.07
.04
.04
.013
.013
.014
.045
.047
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

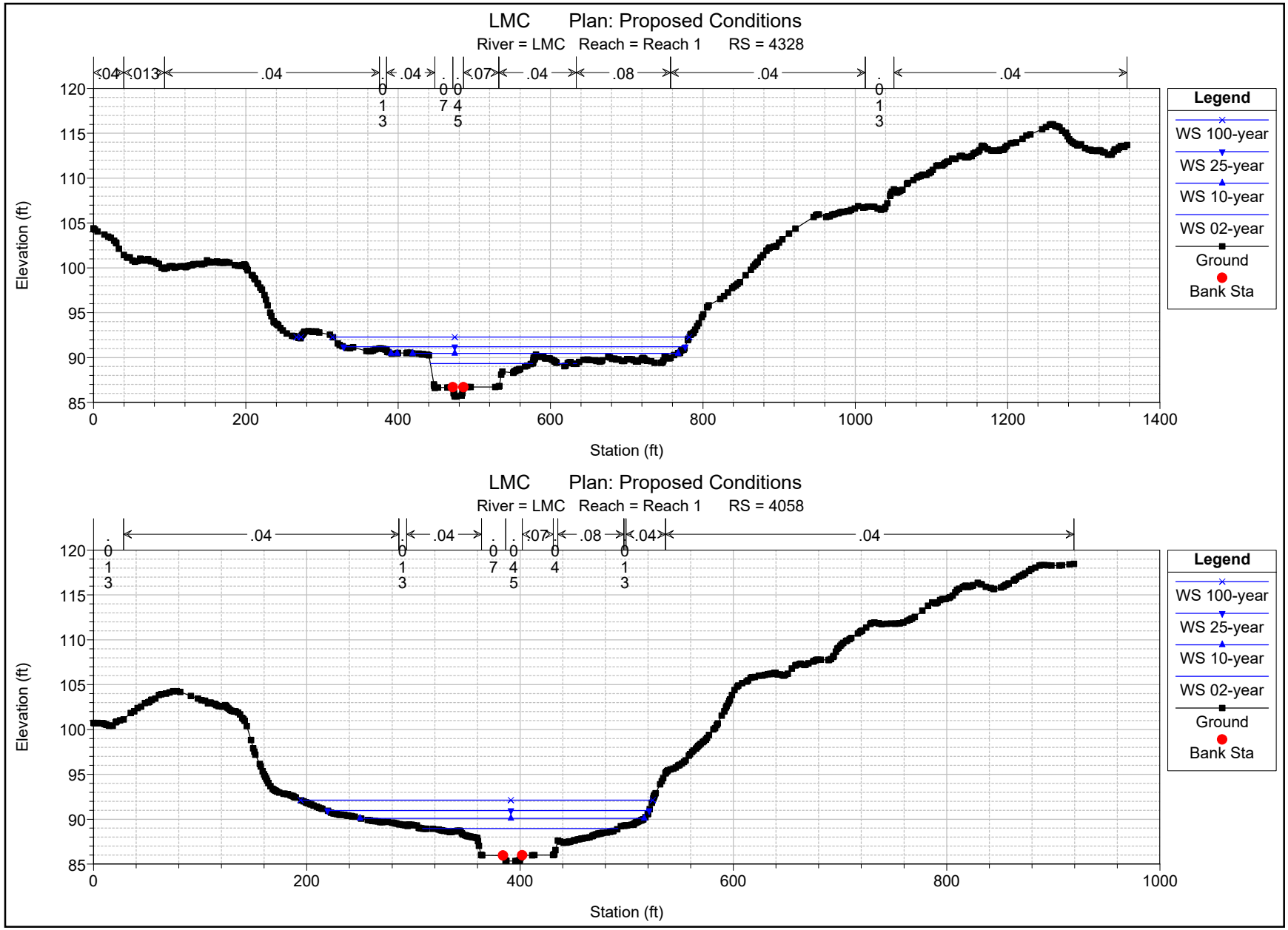

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 5589
.04
.04
.07
.04
.013
.04
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 5354
.04
.04
.07
.04
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

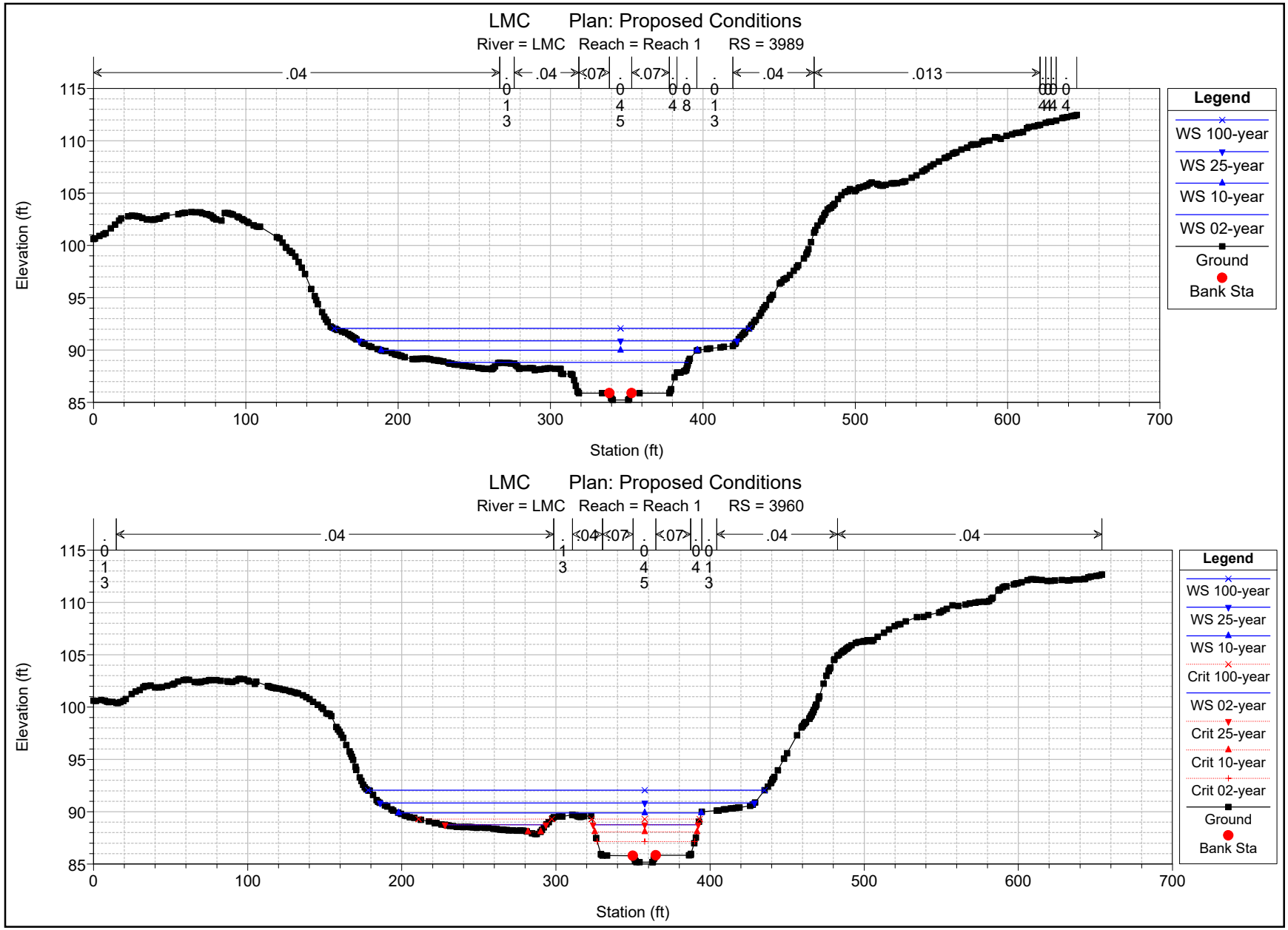

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 5232
.04
.04
.013
.013
.014
.07
.045
.04
.013
.04
Elevation (ft)
125
120
115
110
105
100
95
90
85
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 5114
.04
.013
.04
.013
.014
.045
.07
.045
.07
.04
.013
.04
Elevation (ft)
115
110
105
100
95
90
85
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

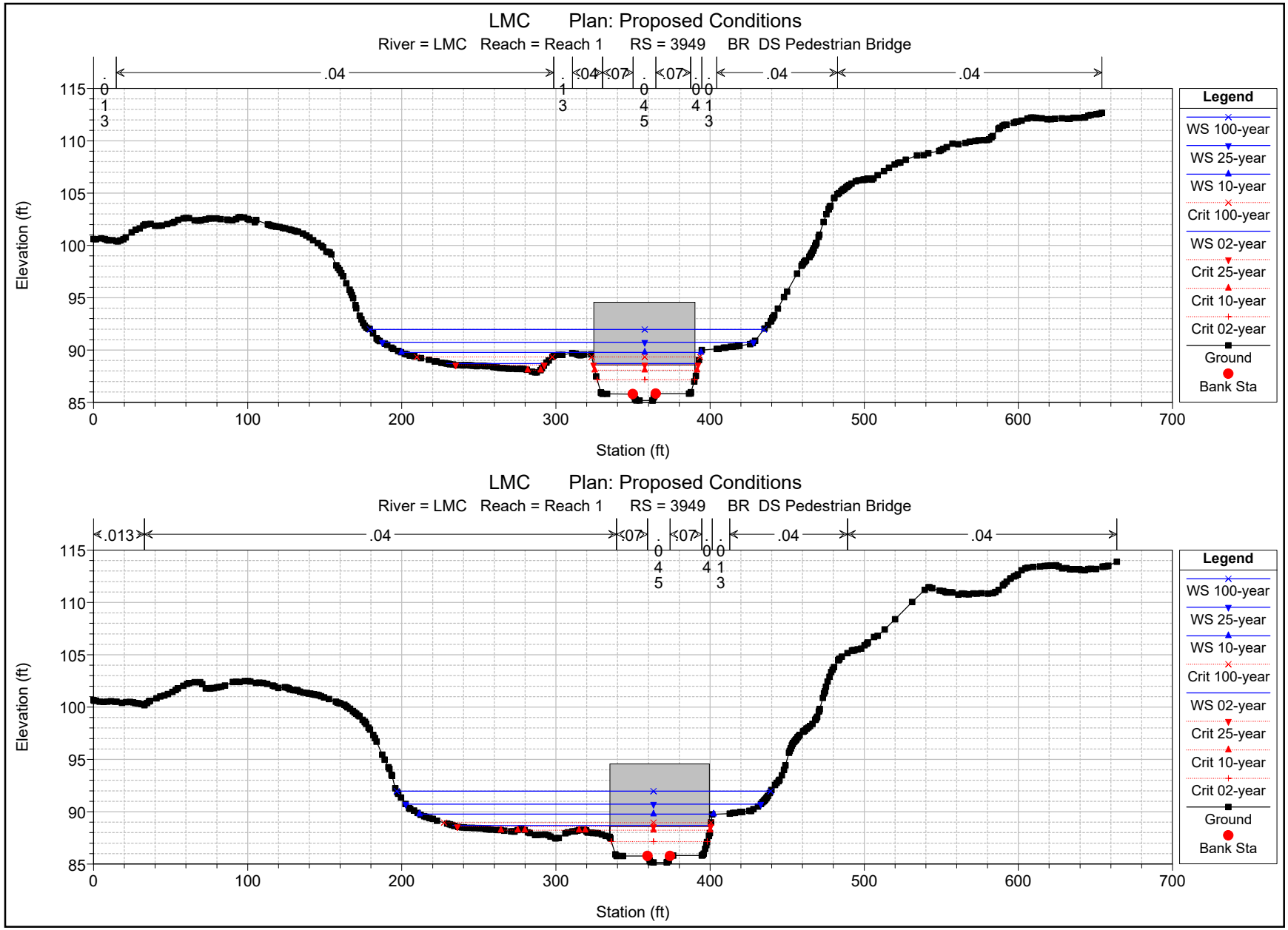

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 4671
.04
.04
.04
.07
.04
.04
.013
.013
.045
.07
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 4585
.04
.013
.04
.07
.04
.04
.04
.013
.014
.013
.045
.07
.013
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Bank Sta

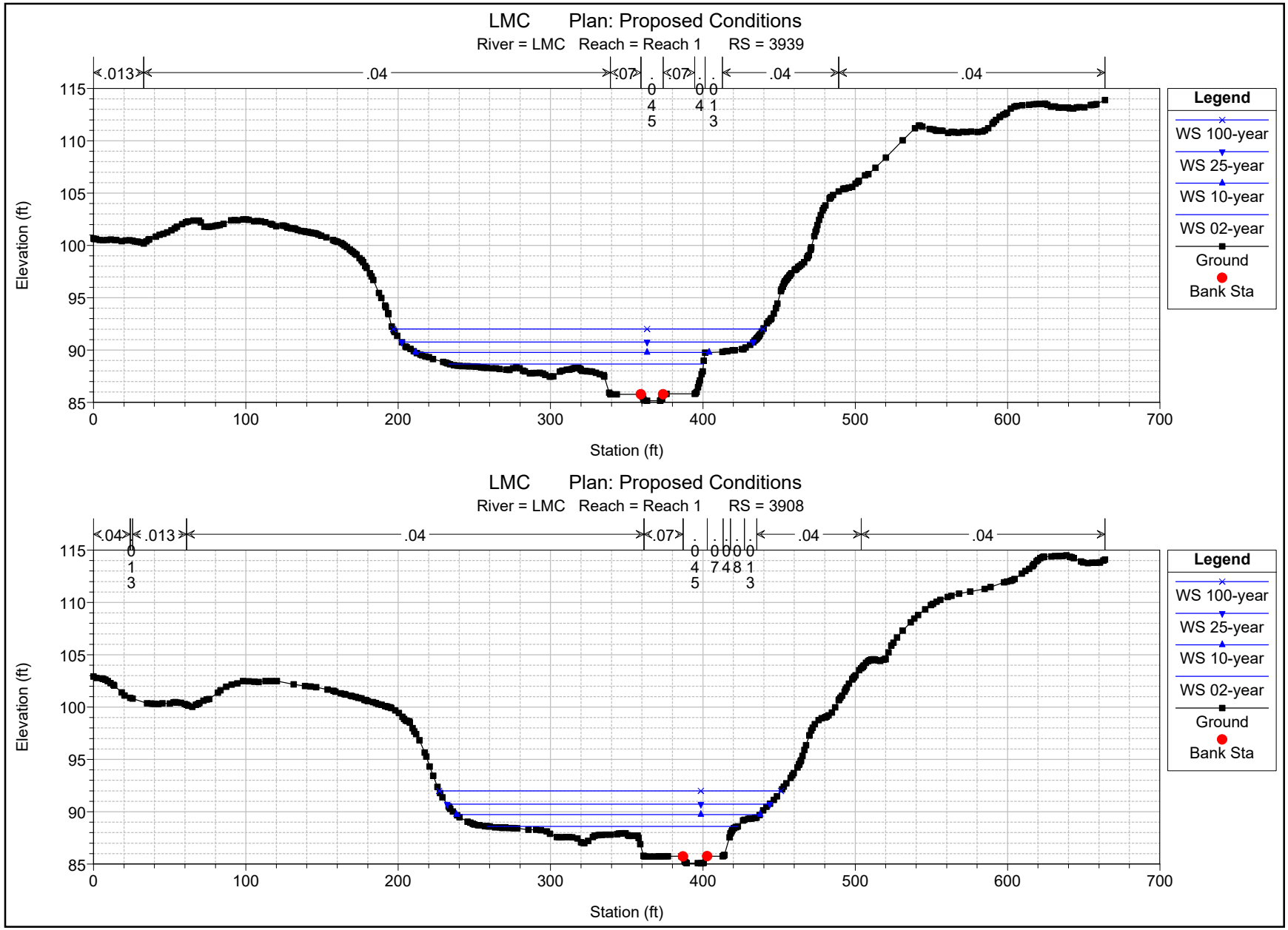

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 4563 BR US Pedestrian Bridge
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 4563 BR US Pedestrian Bridge
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Bank Sta

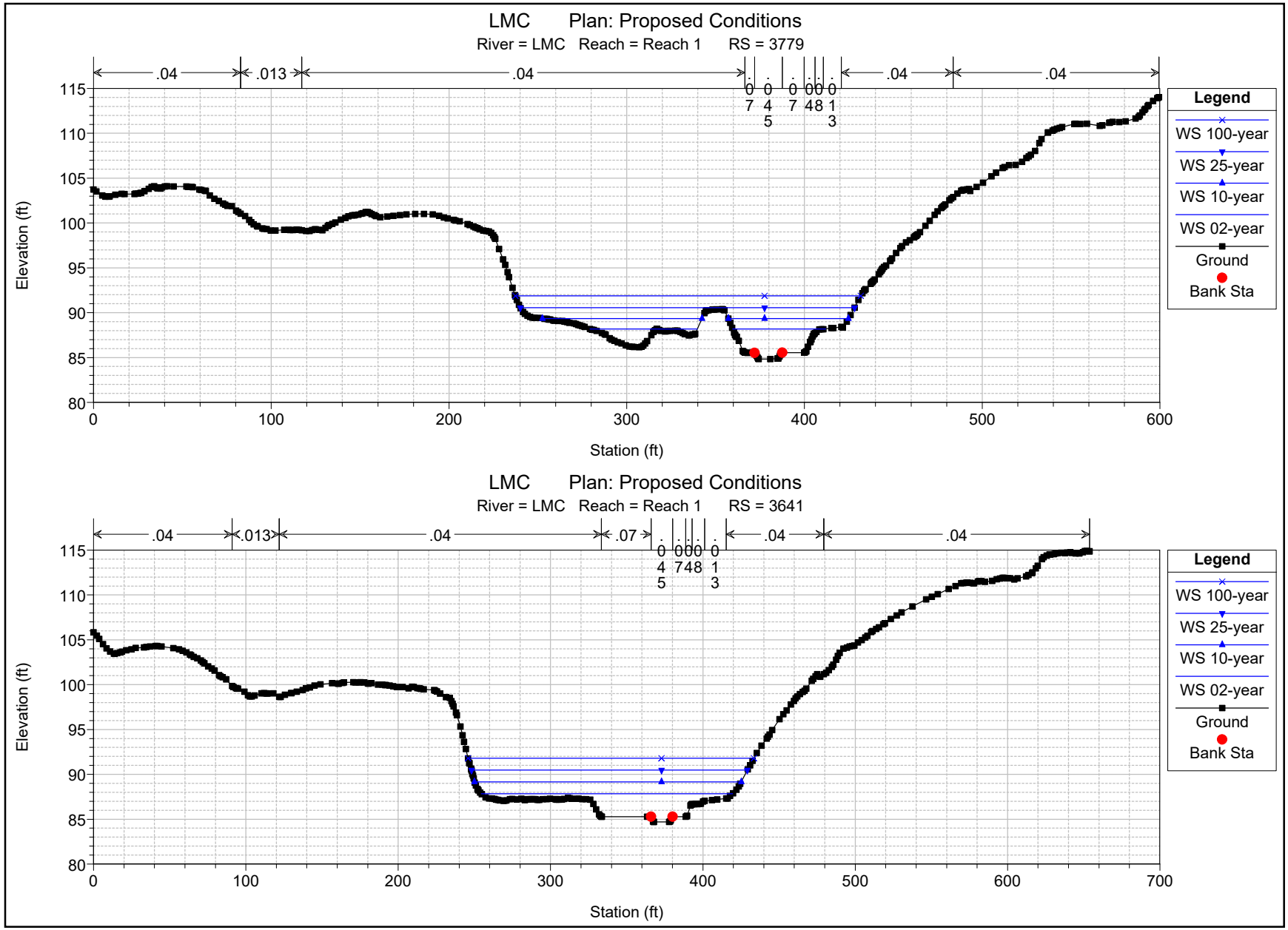

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 4555
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 4537
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

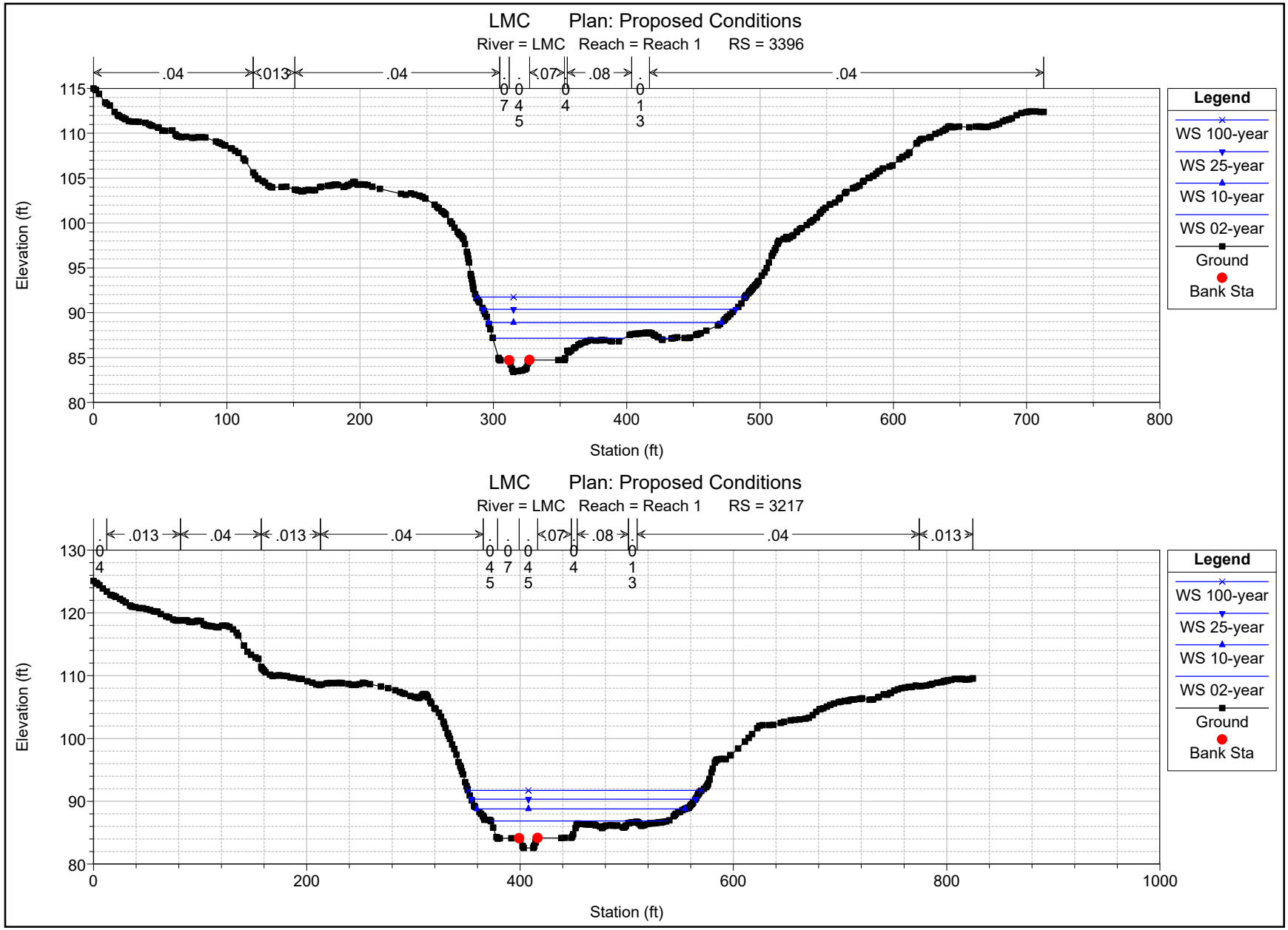

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 4328
.04
.013
.04
.013
.045
.07
.04
.08
.04
.013
.04
Elevation (ft)
120
115
110
105
100
95
90
85
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 4058
.013
.04
.013
.04
.045
.07
.04
.08
.04
.04
Elevation (ft)
120
115
110
105
100
95
90
85
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

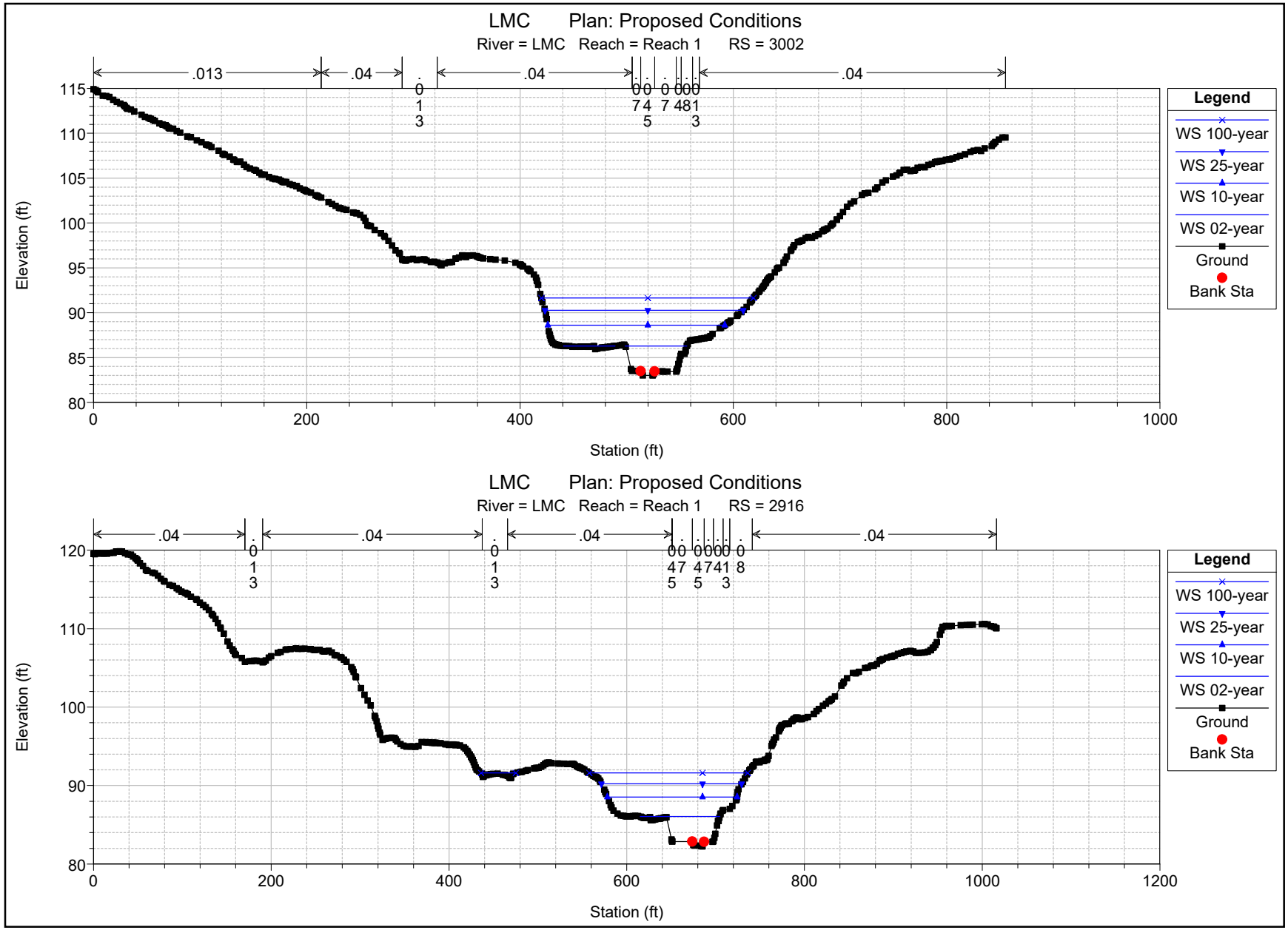

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3989
.04
.04
.07
.07
.04
.013
Elevation (ft)
Station (ft)
115
110
105
100
95
90
85
0
100
200
300
400
500
600
700
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3960
.04
.04
.07
.07
.04
.04
Elevation (ft)
Station (ft)
115
110
105
100
95
90
85
0
100
200
300
400
500
600
700
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Bank Sta

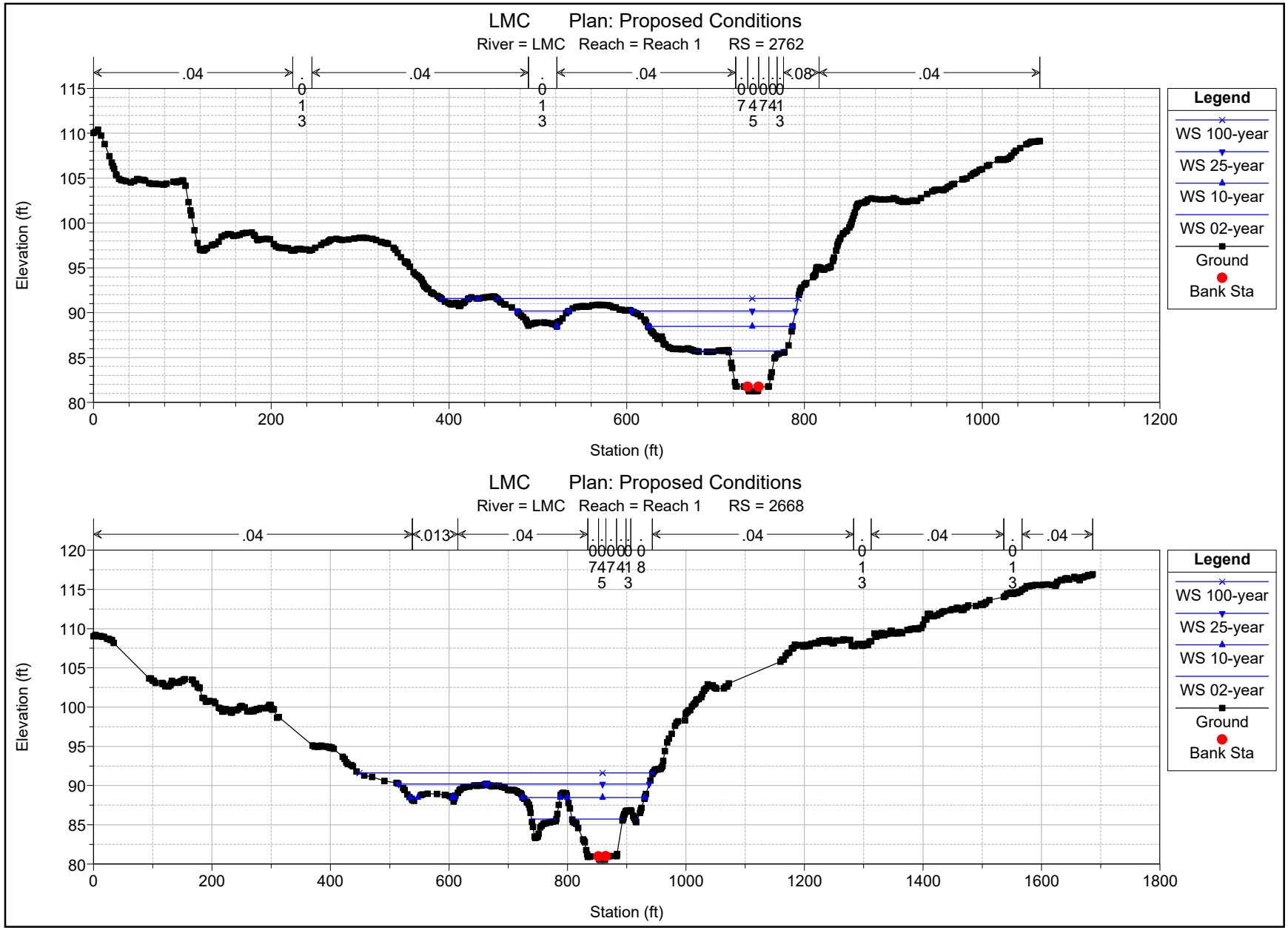

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3949 BR DS Pedestrian Bridge
.013
.04
.07
.045
.04
.113
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3949 BR DS Pedestrian Bridge
.013
.04
.07
.045
.04
.113
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Bank Sta

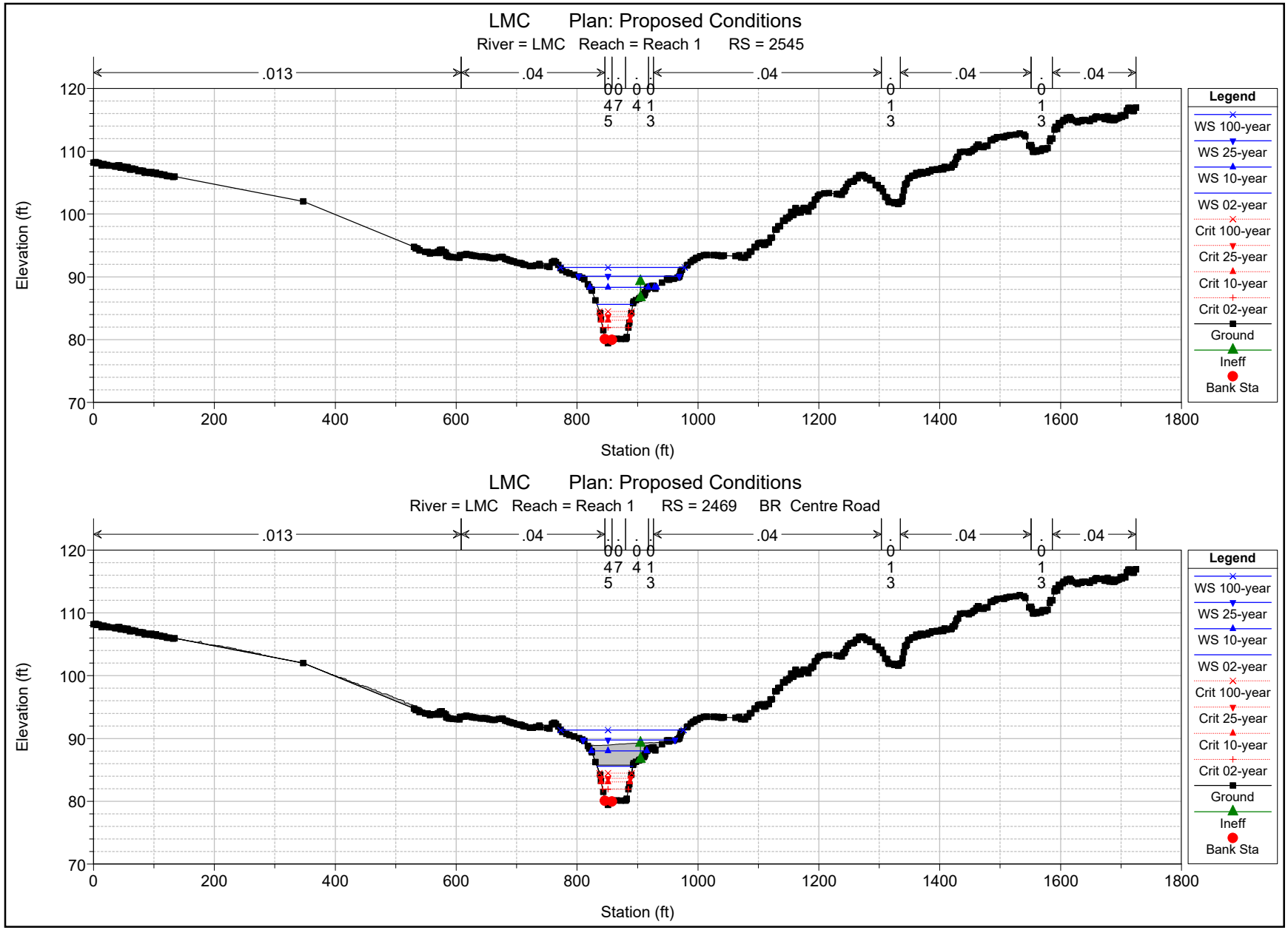

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3939
.013
.04
.07
.045
.07
.041
.013
.04
.04
Elevation (ft)
115
110
105
100
95
90
85
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3908
.04
.013
.04
.07
.045
.074
.08
.081
.013
.04
.04
Elevation (ft)
115
110
105
100
95
90
85
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

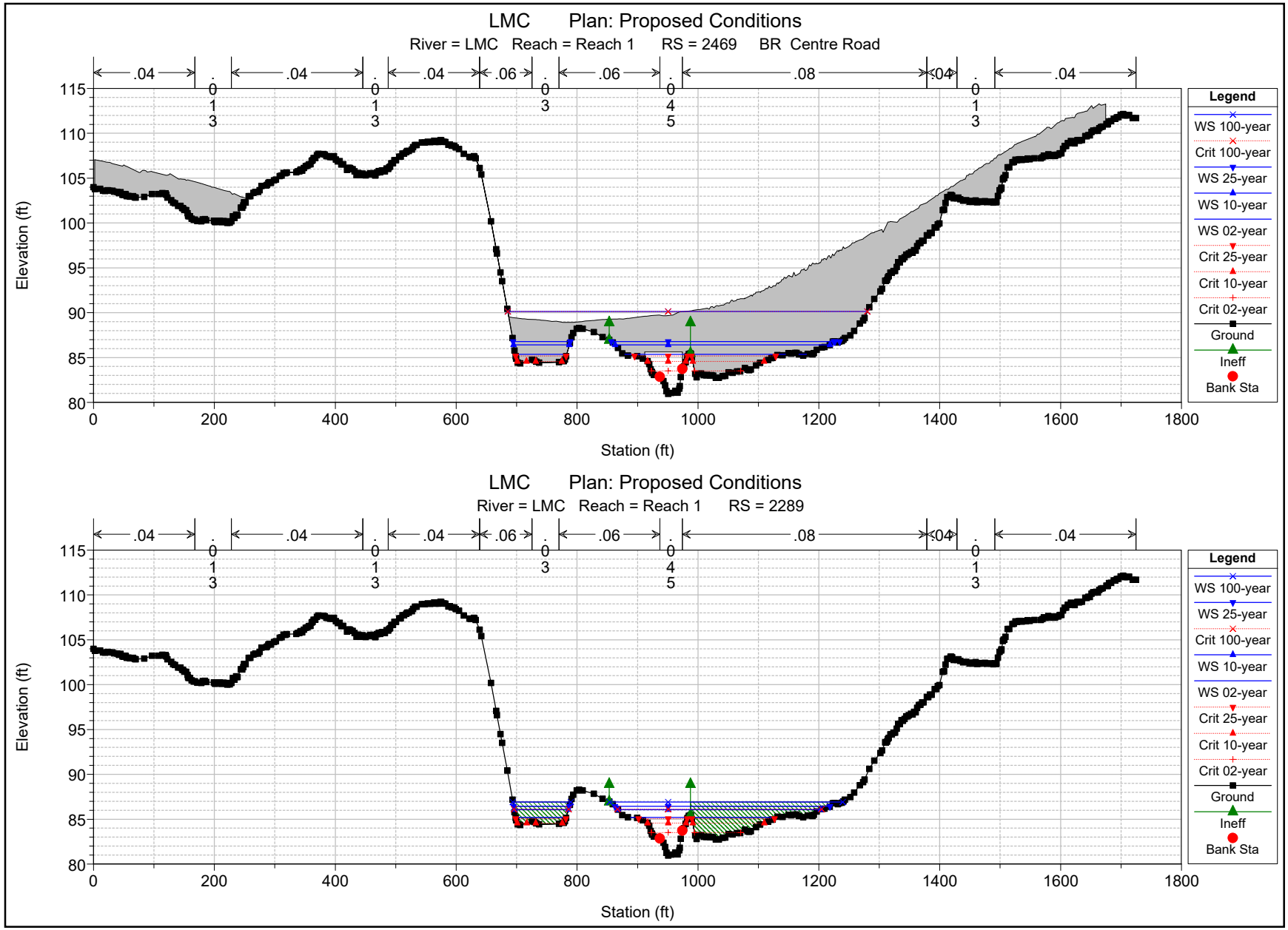

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3779
.04
.013
.04
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3641
.04
.013
.04
.07
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

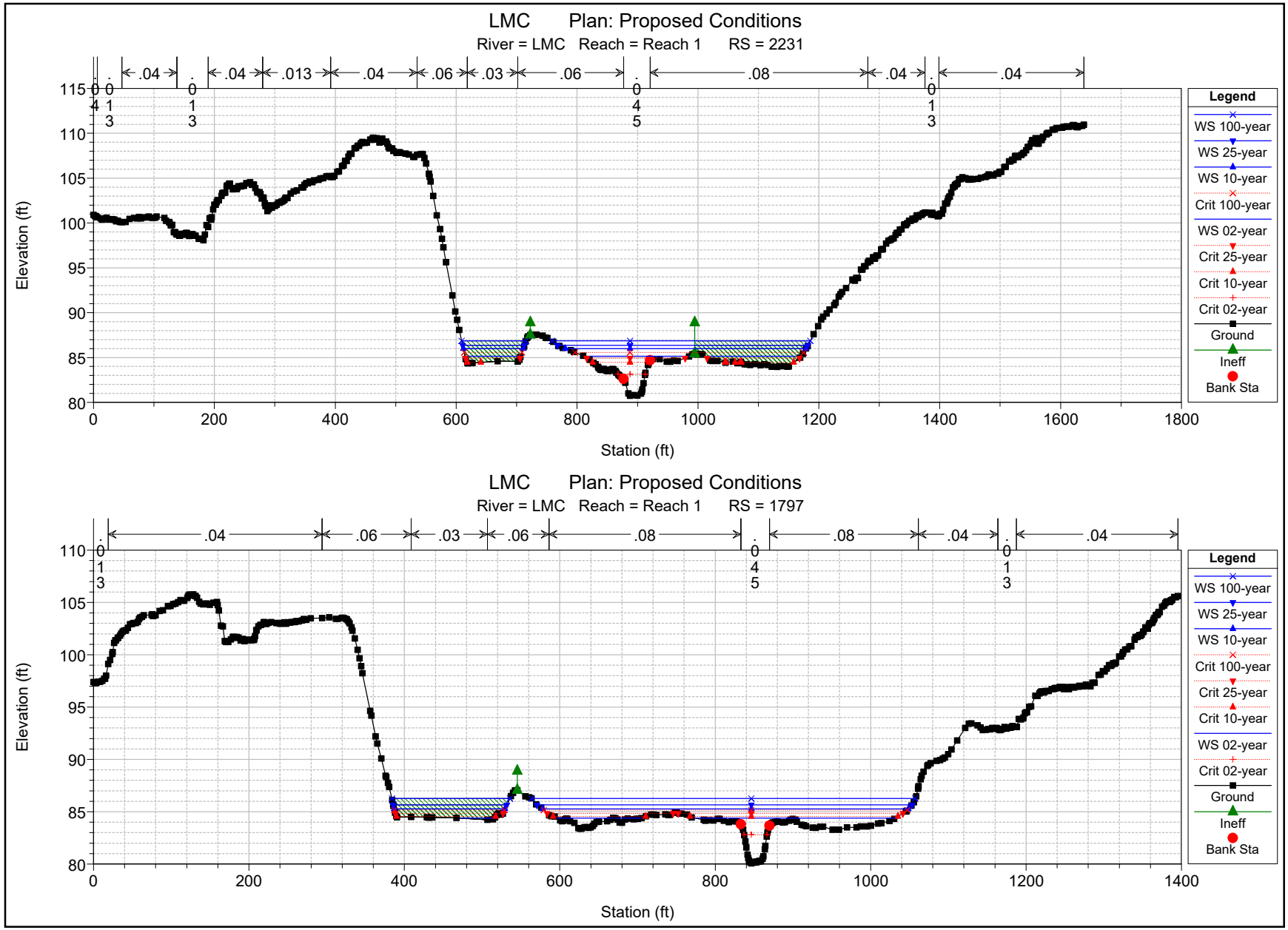

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3396
.04
.013
.04
.045
.07
.04
.08
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3217
.04
.013
.04
.013
.04
.045
.07
.045
.04
.08
.013
.04
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

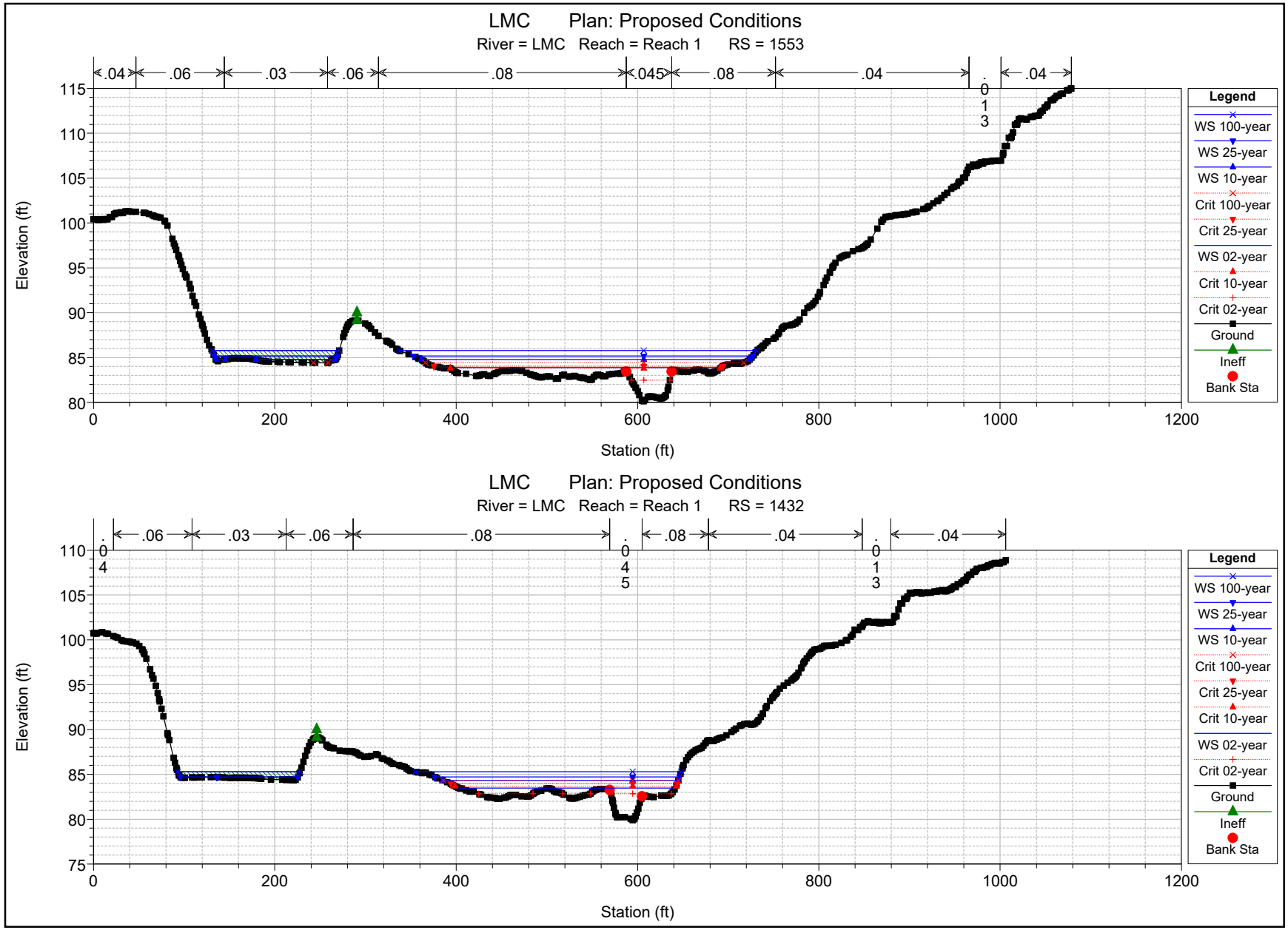

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 3002
.013
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 2916
.04
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

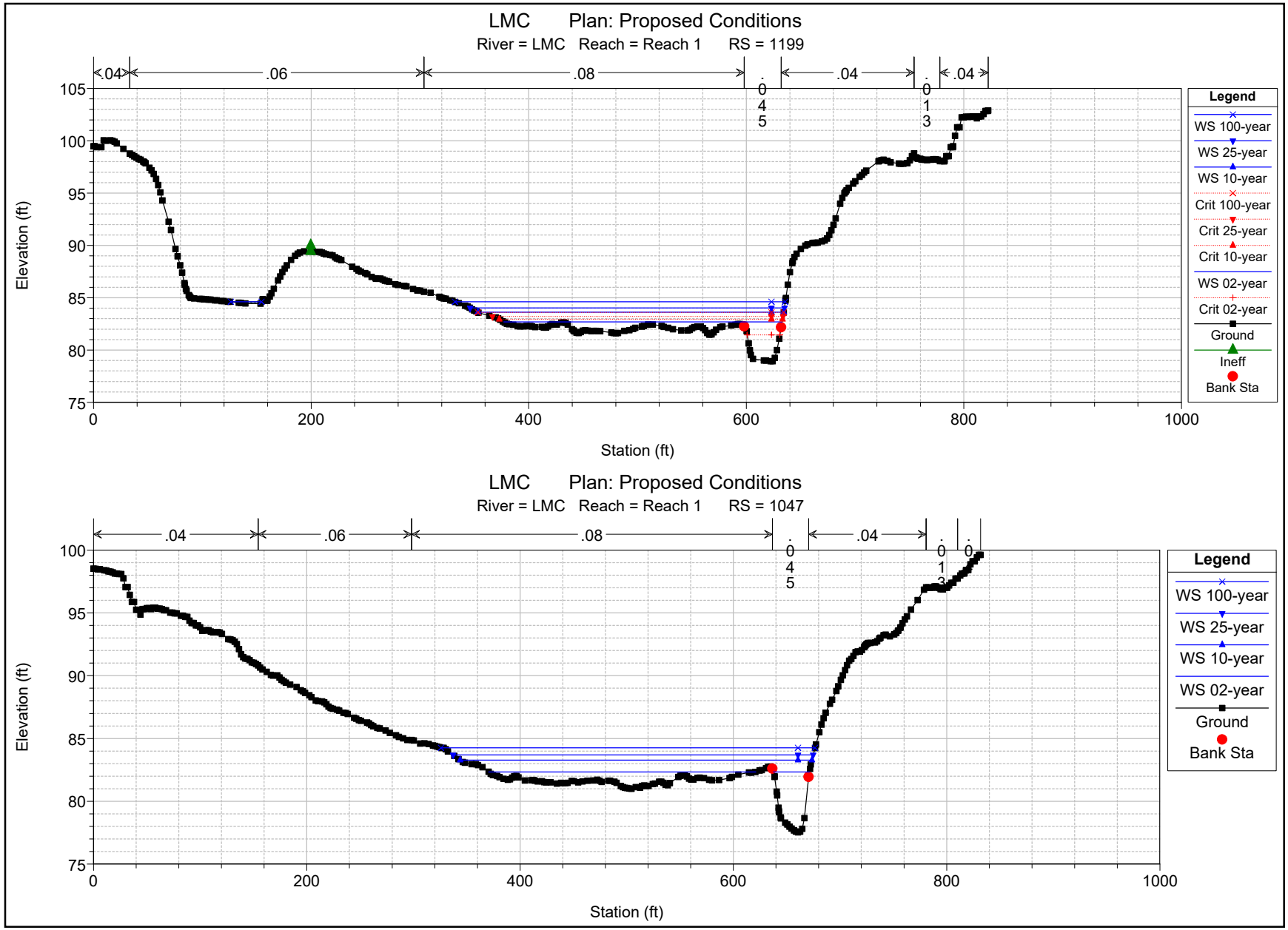

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 2762
.04
.04
.04
.08
.04
.013
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 2668
.04
.013
.04
.04
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

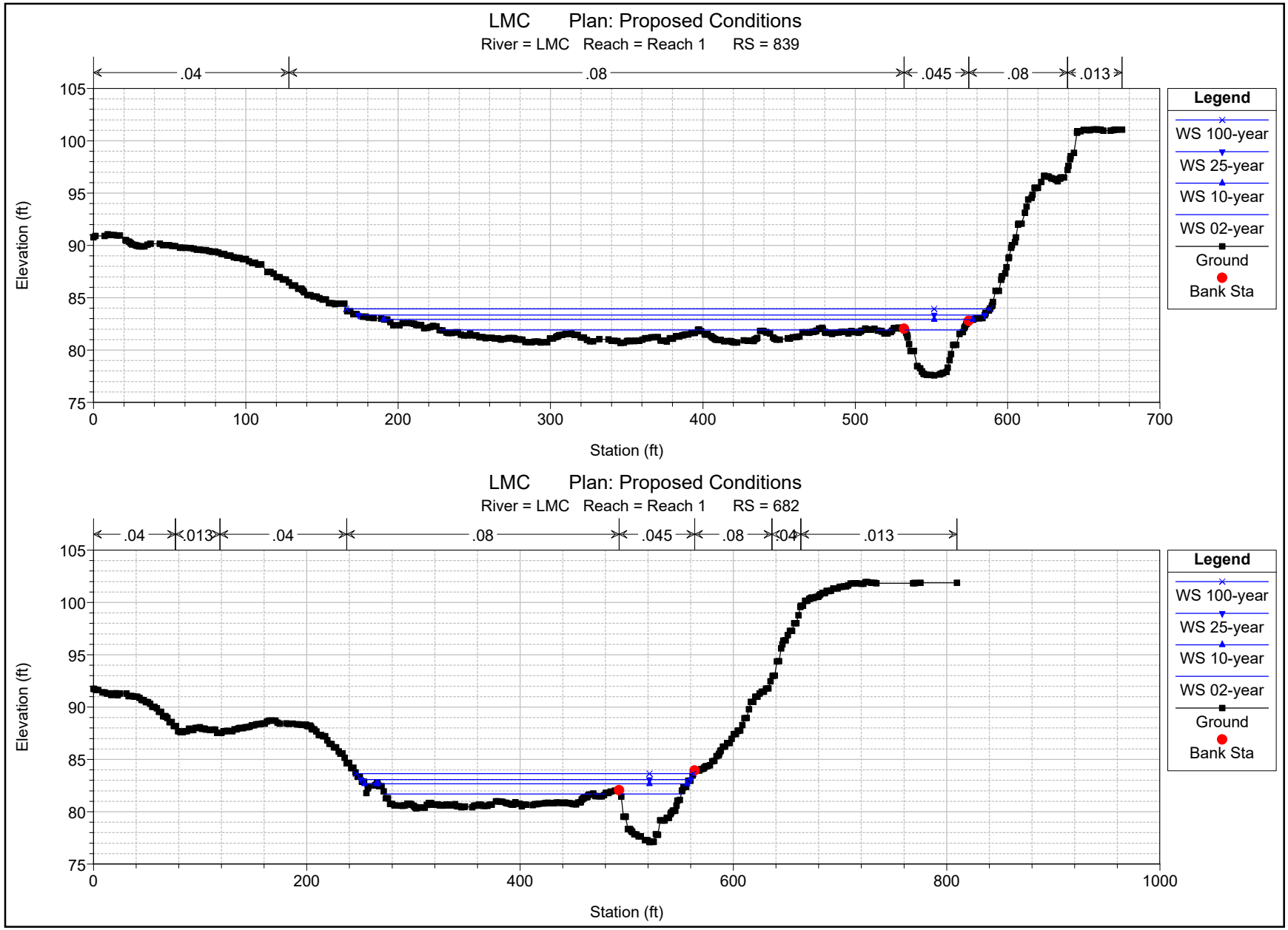

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 2545
.013
.04
.04
.04
.04
.047
.041
.013
.013
Elevation (ft)
120
110
100
90
80
70
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 2469 BR Centre Road
.013
.04
.04
.04
.04
.047
.041
.013
.013
Elevation (ft)
120
110
100
90
80
70
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

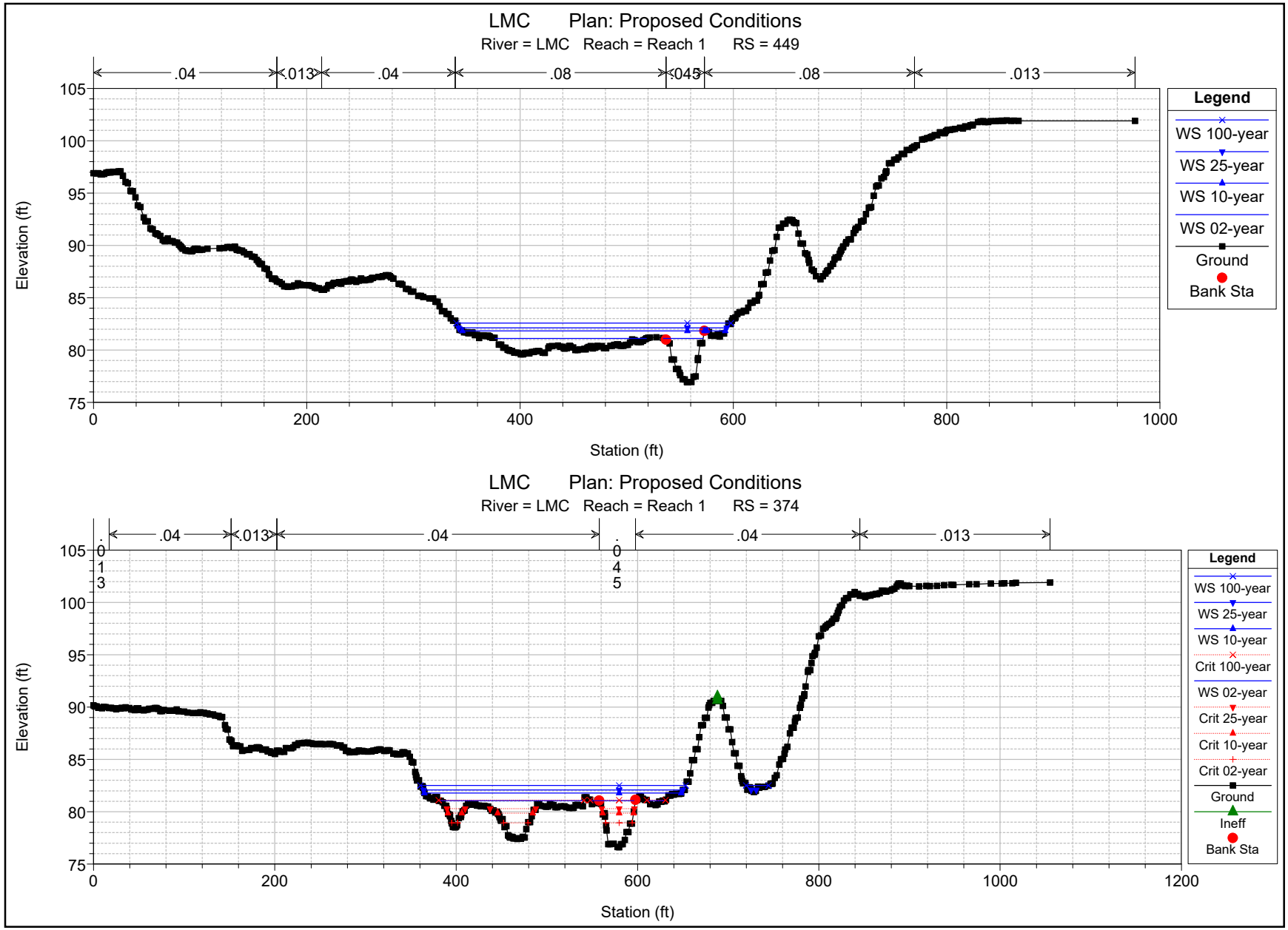

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 2469 BR Centre Road
.04
.04
.04
.06
.06
.08
.04
.04
.013
.013
.03
.045
.013
Elevation (ft)
115
110
105
100
95
90
85
80
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 2289
.04
.04
.04
.06
.06
.08
.04
.04
.013
.013
.03
.045
.013
Elevation (ft)
115
110
105
100
95
90
85
80
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

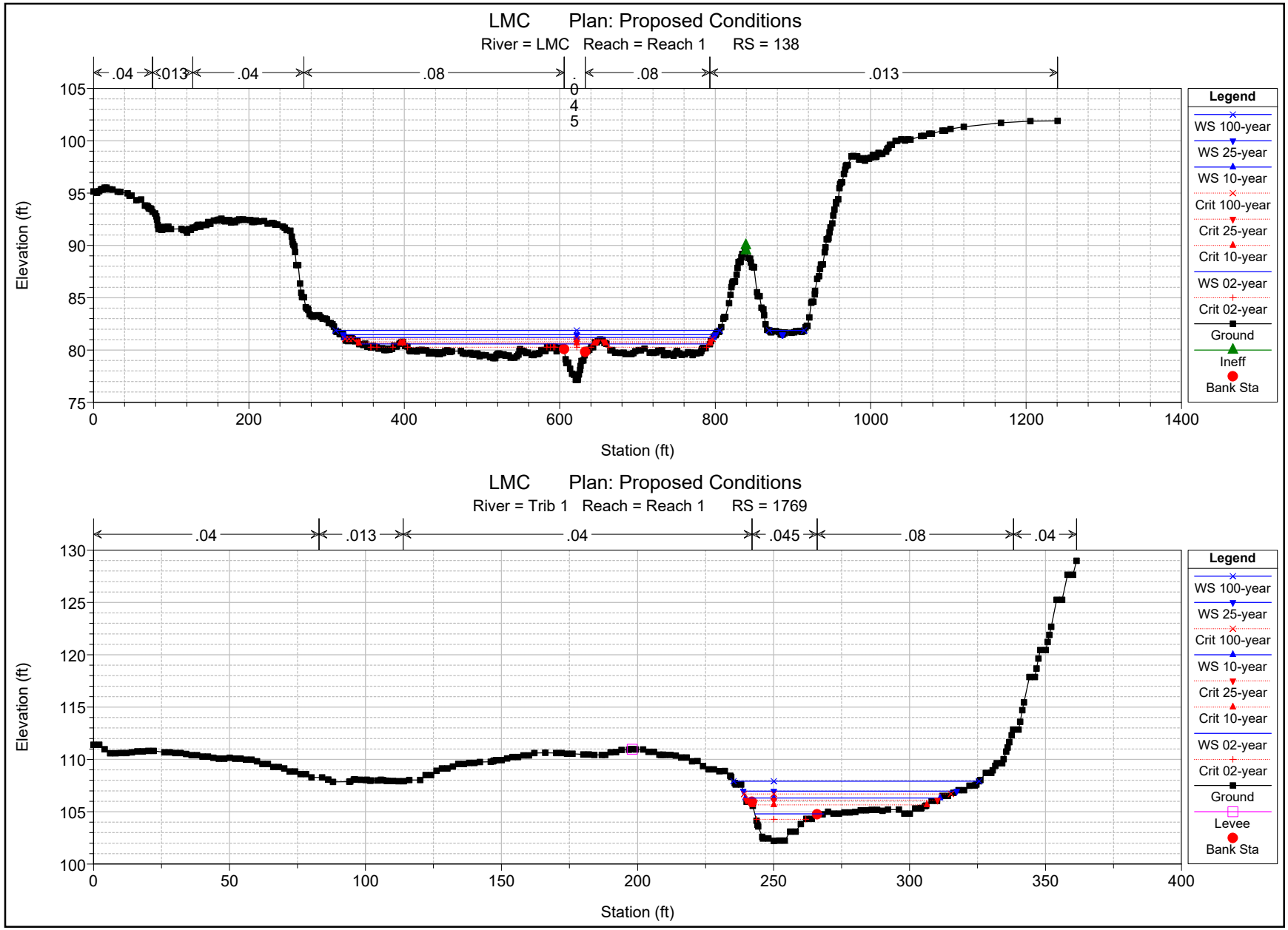

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 2231
.04
.013
.06
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 1797
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

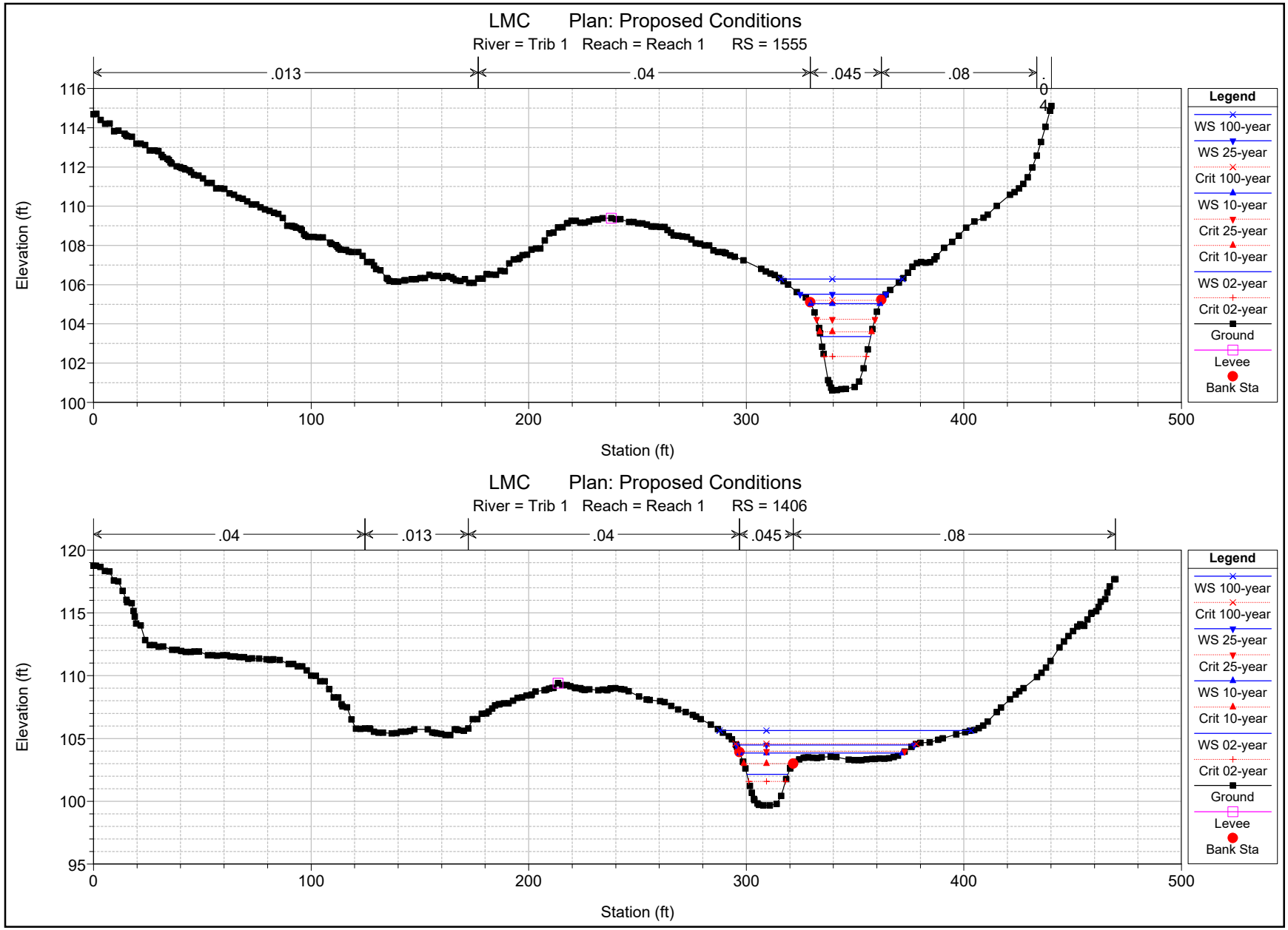

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 1553
.04
.06
.03
.06
.08
.045
.08
.04
.013
.04
Elevation (ft)
115
110
105
100
95
90
85
80
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
WS 02-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 1432
.04
.06
.03
.06
.08
.045
.08
.04
.013
.04
Elevation (ft)
110
105
100
95
90
85
80
75
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

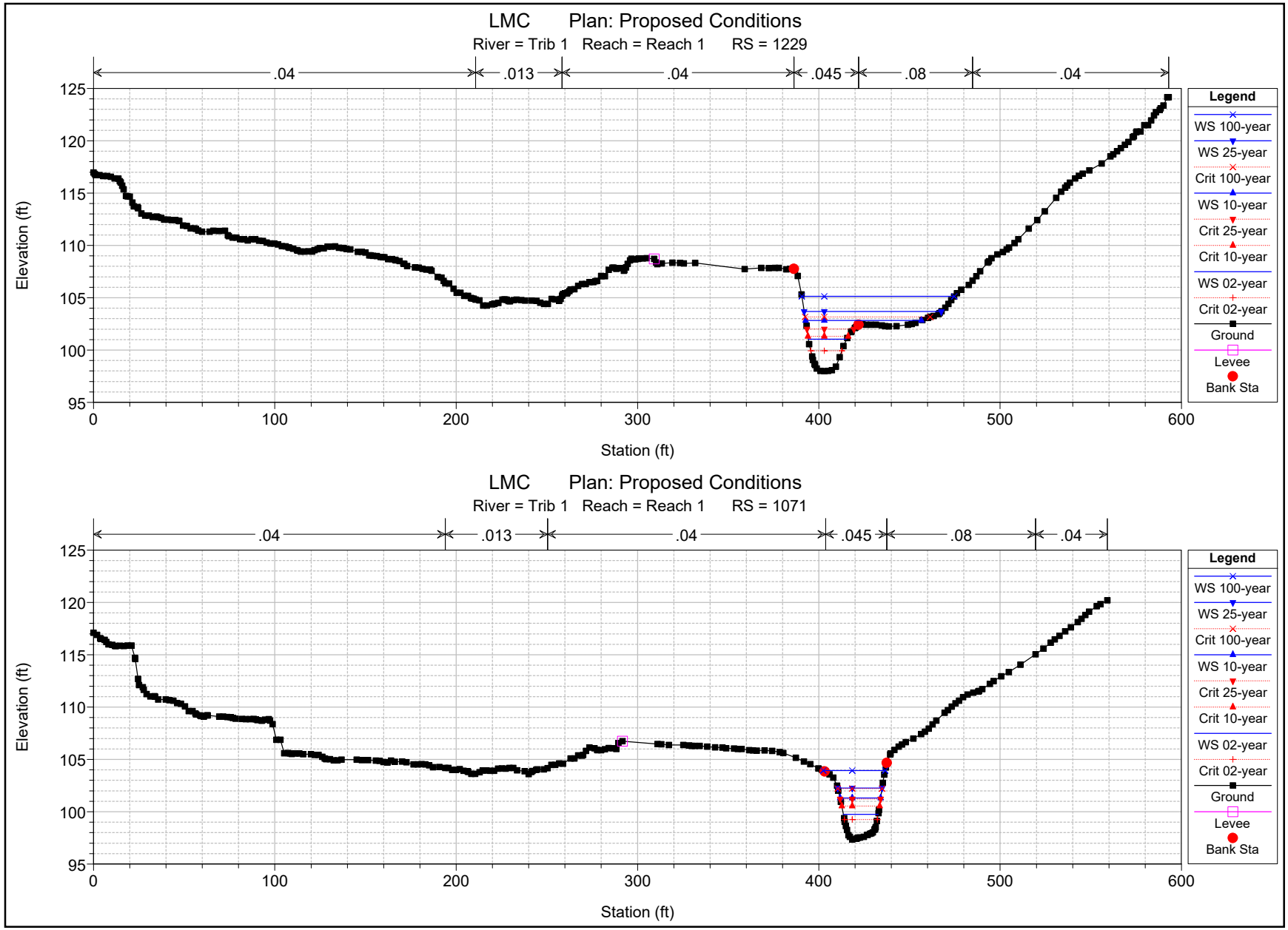

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 1199
.04
.06
.08
.045
.04
.013
.04
Elevation (ft)
105
100
95
90
85
80
75
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 1047
.04
.06
.08
.045
.04
.013
Elevation (ft)
100
95
90
85
80
75
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

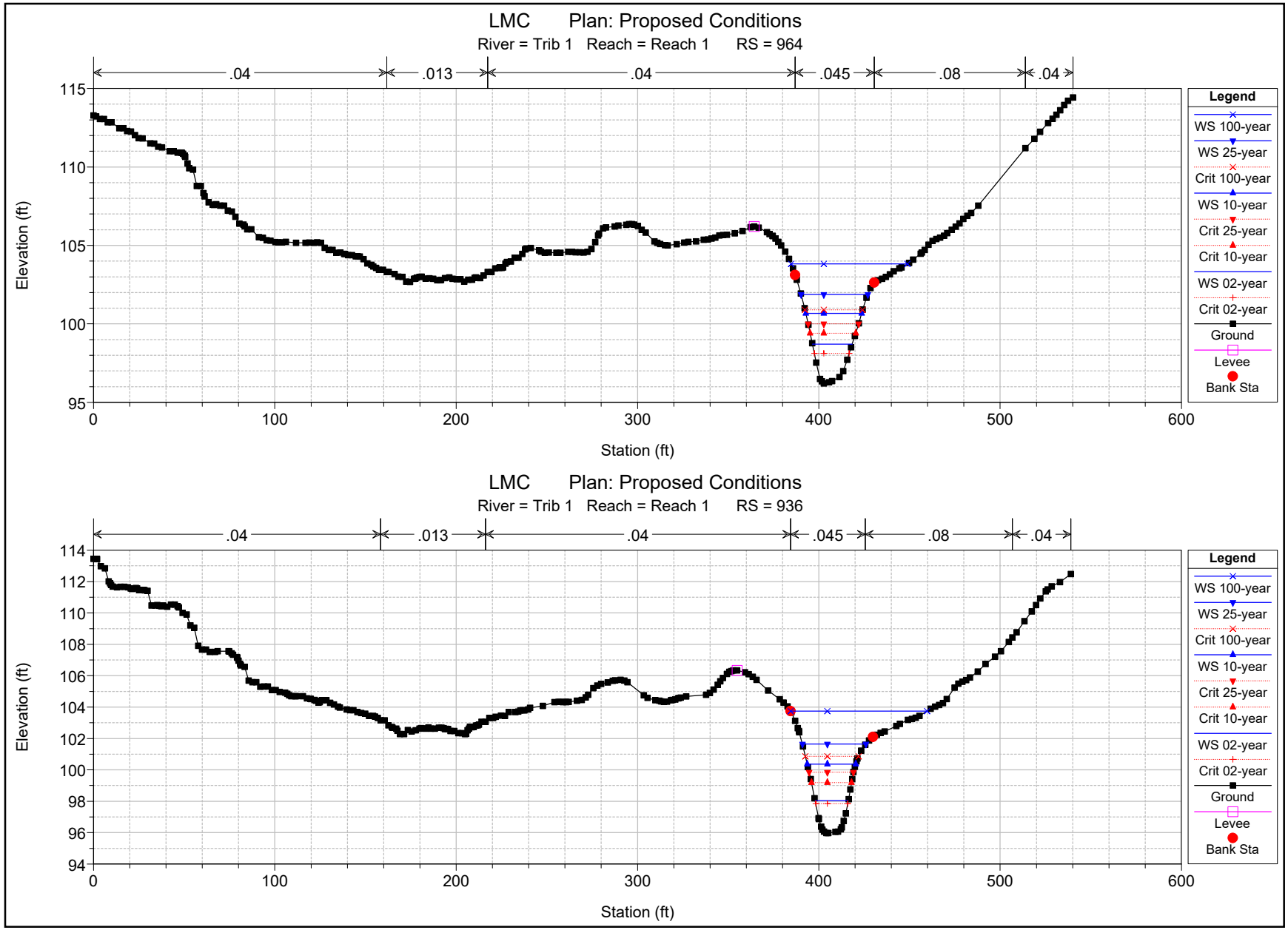

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 839
.04
.08
.045
.08
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 682
.04
.013
.04
.08
.045
.08
.04
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

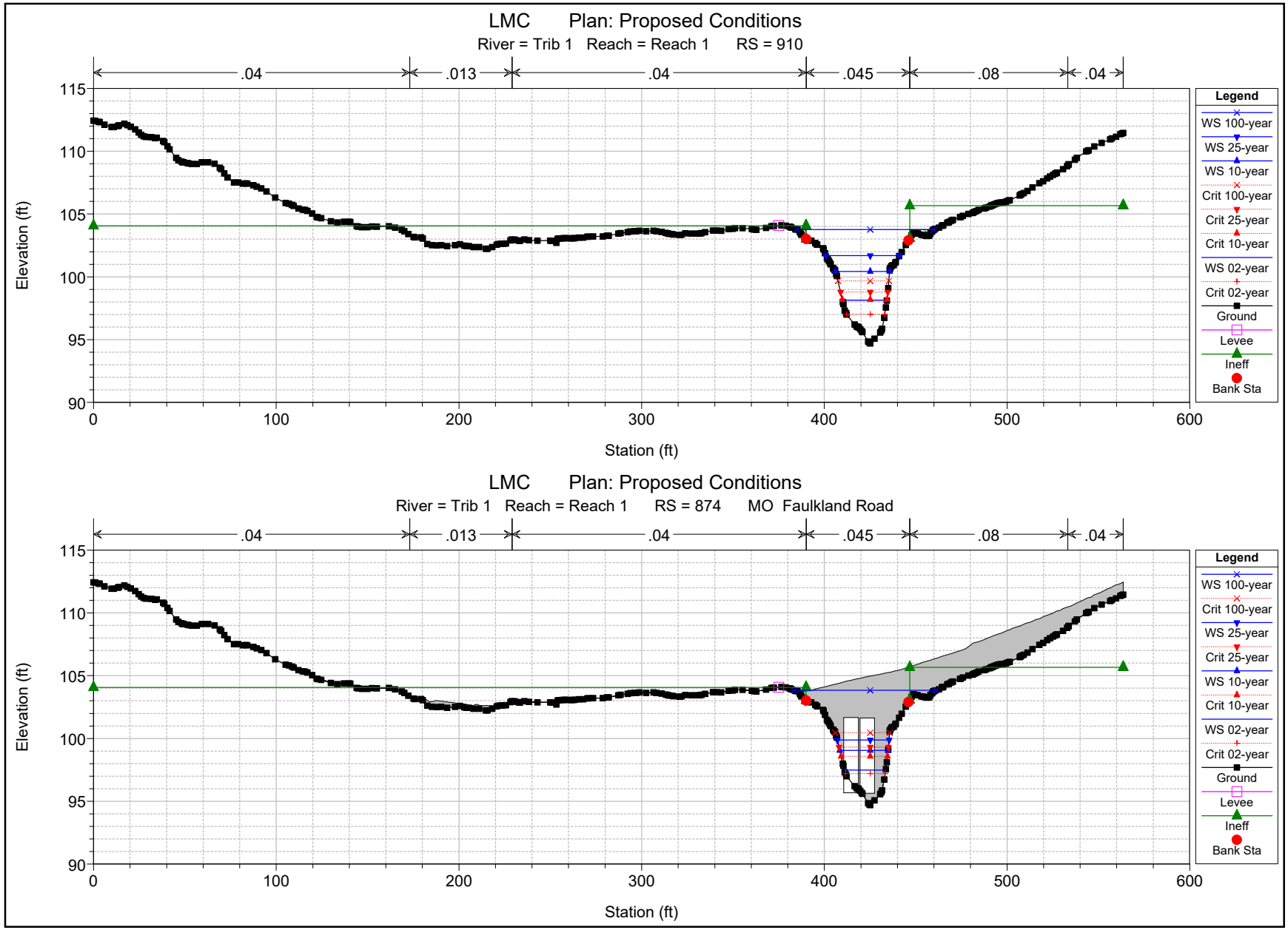

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 449
.04
.013
.04
.08
.045
.08
.013
Elevation (ft)
105
100
95
90
85
80
75
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 374
.04
.013
.04
.013
.04
.013
Elevation (ft)
105
100
95
90
85
80
75
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
WS 02-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta

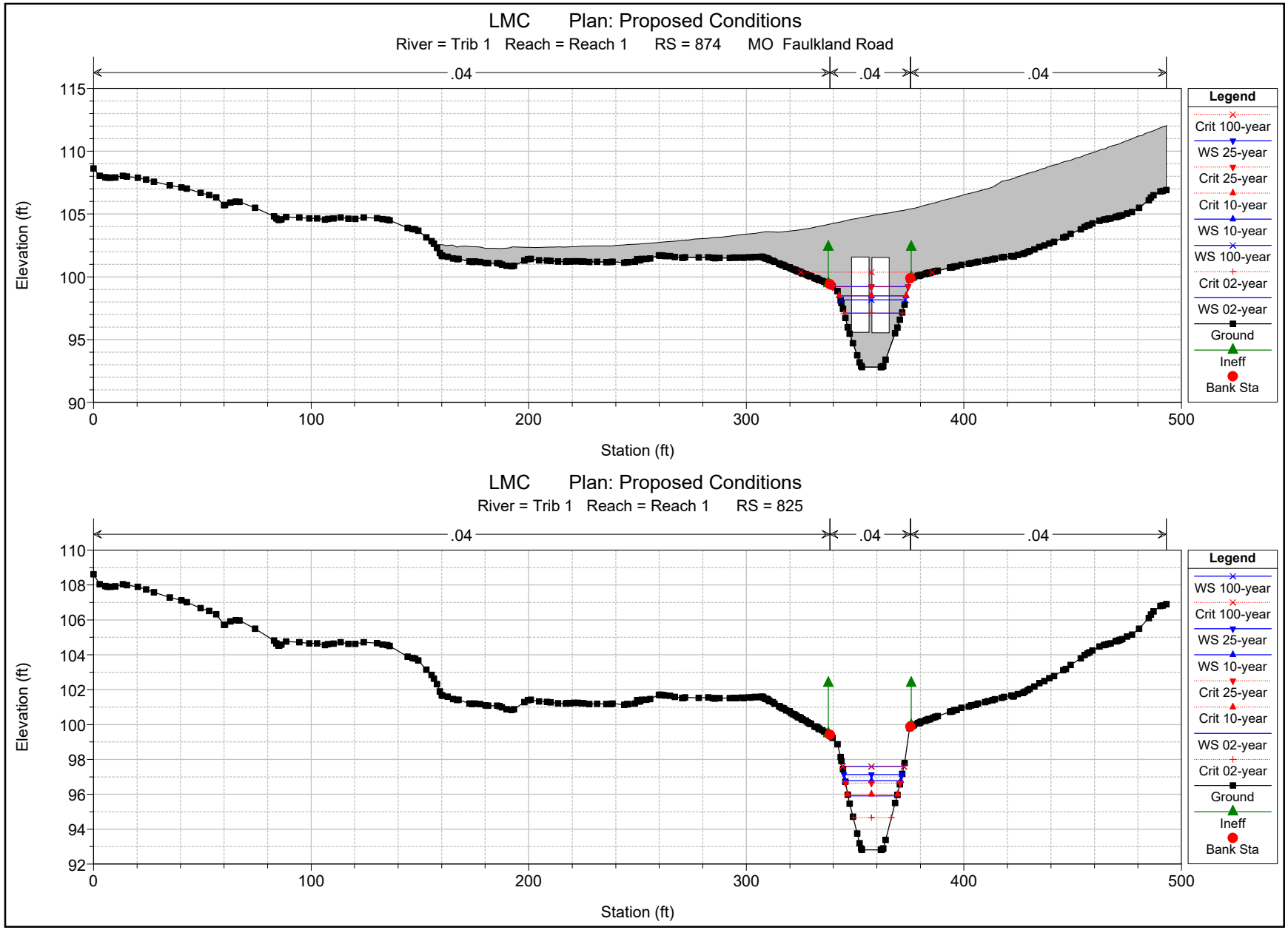

LMC Plan: Proposed Conditions
River = LMC Reach = Reach 1 RS = 138
.04
.013
.04
.08
.045
.08
.013
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 1769
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta

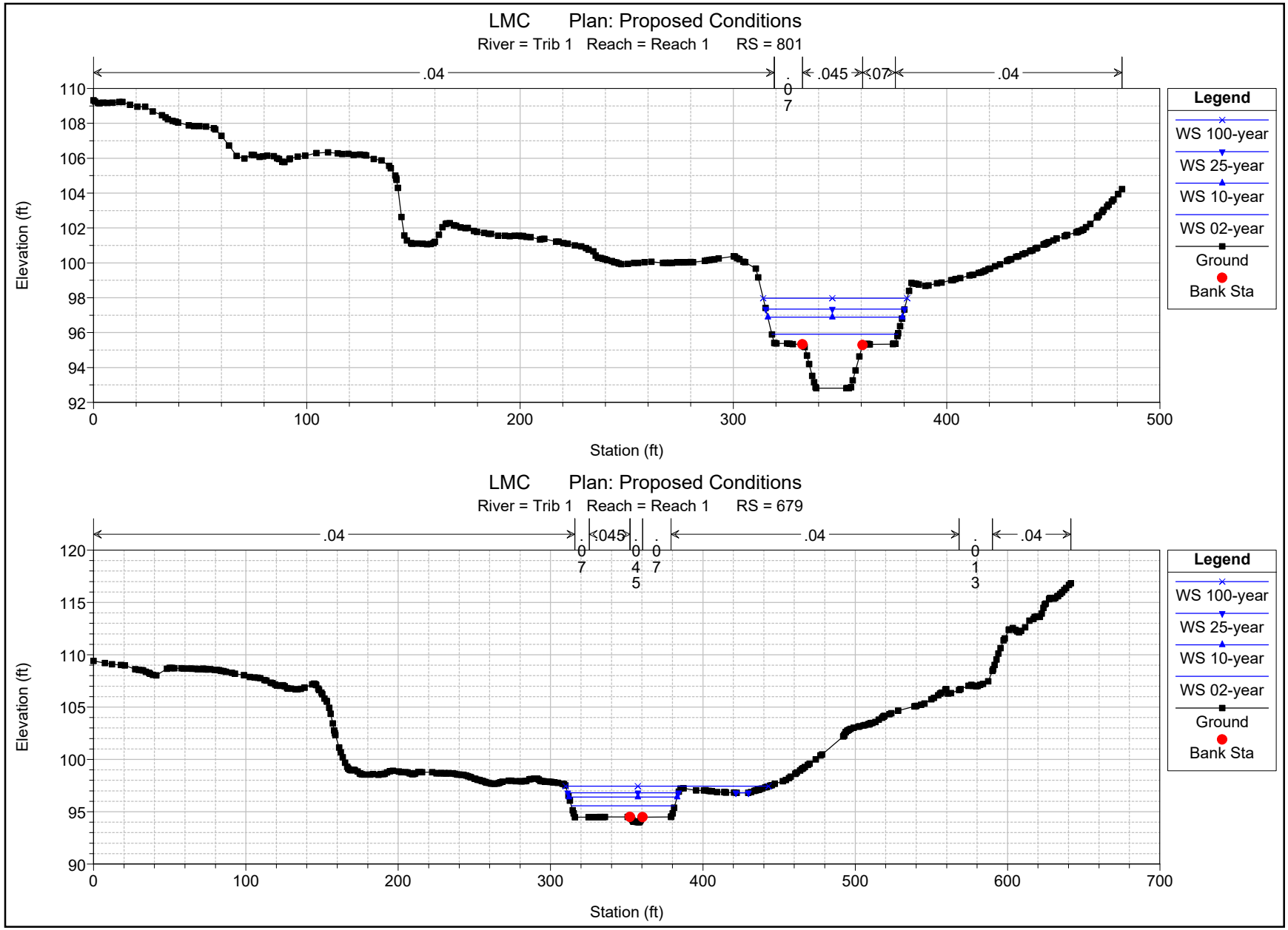

LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 1555
.013
.04
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 1406
.04
.013
.04
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta

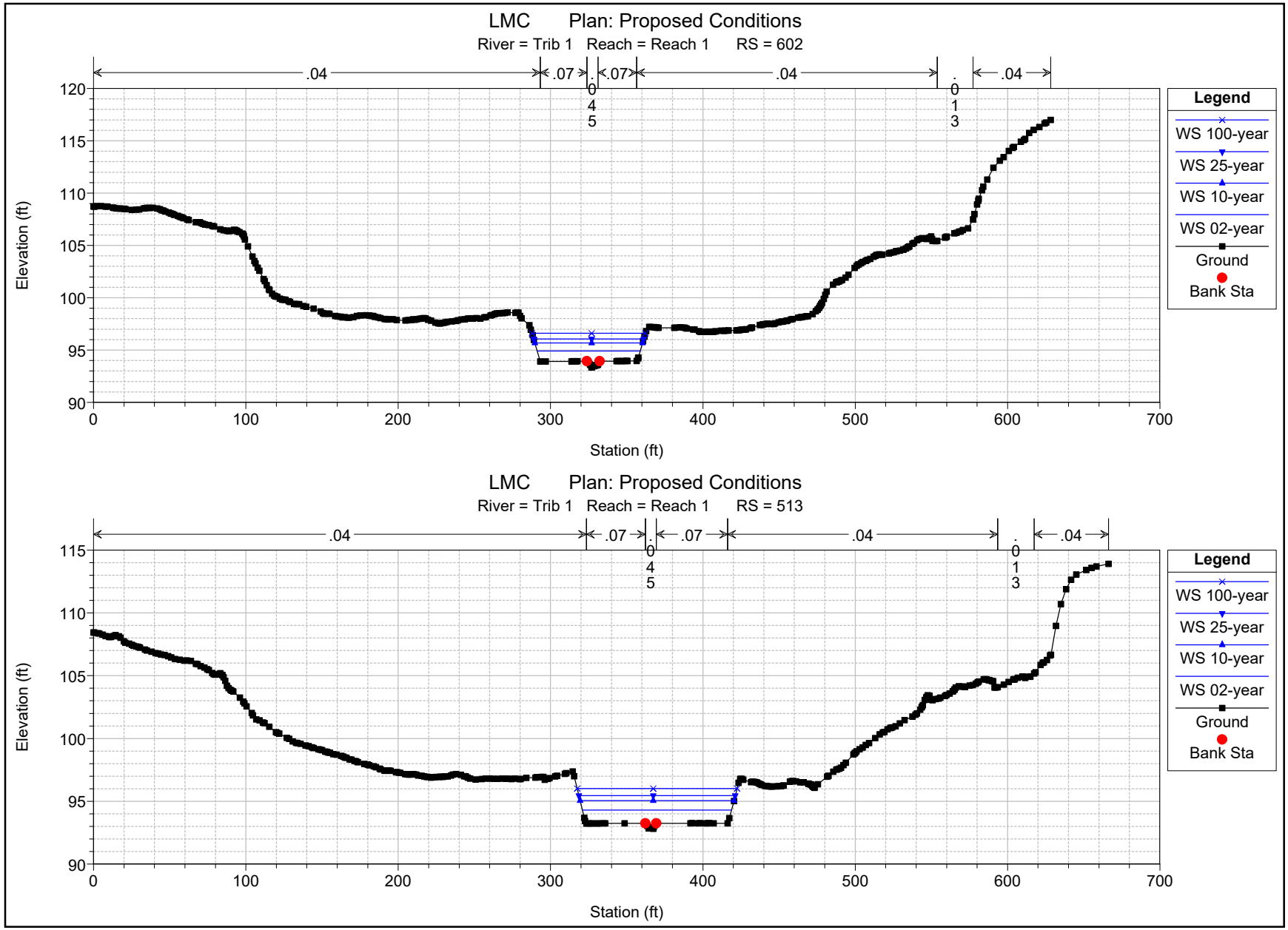

LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 1229
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 1071
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta

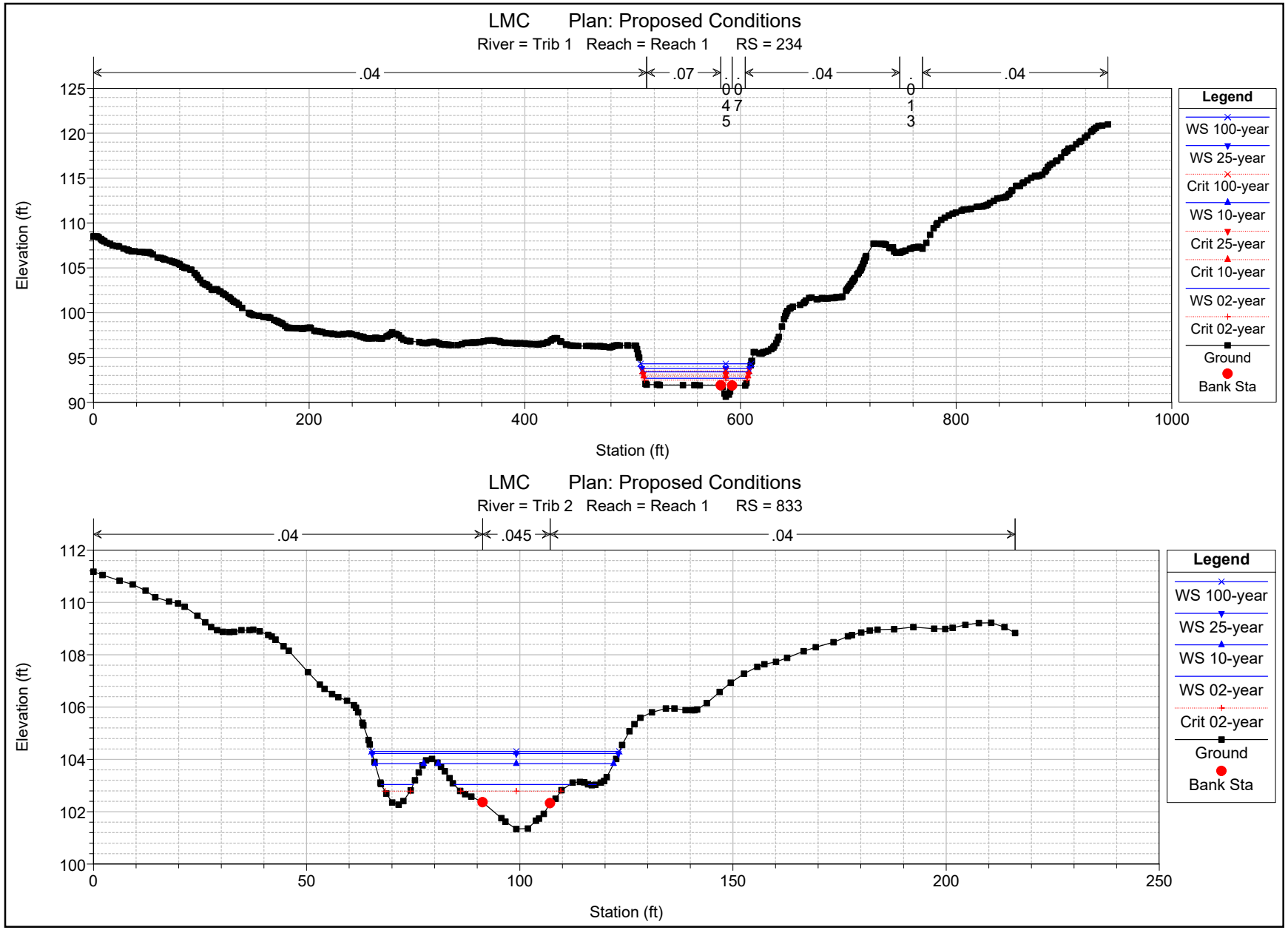

LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 964
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 936
.04
.013
.04
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Bank Sta

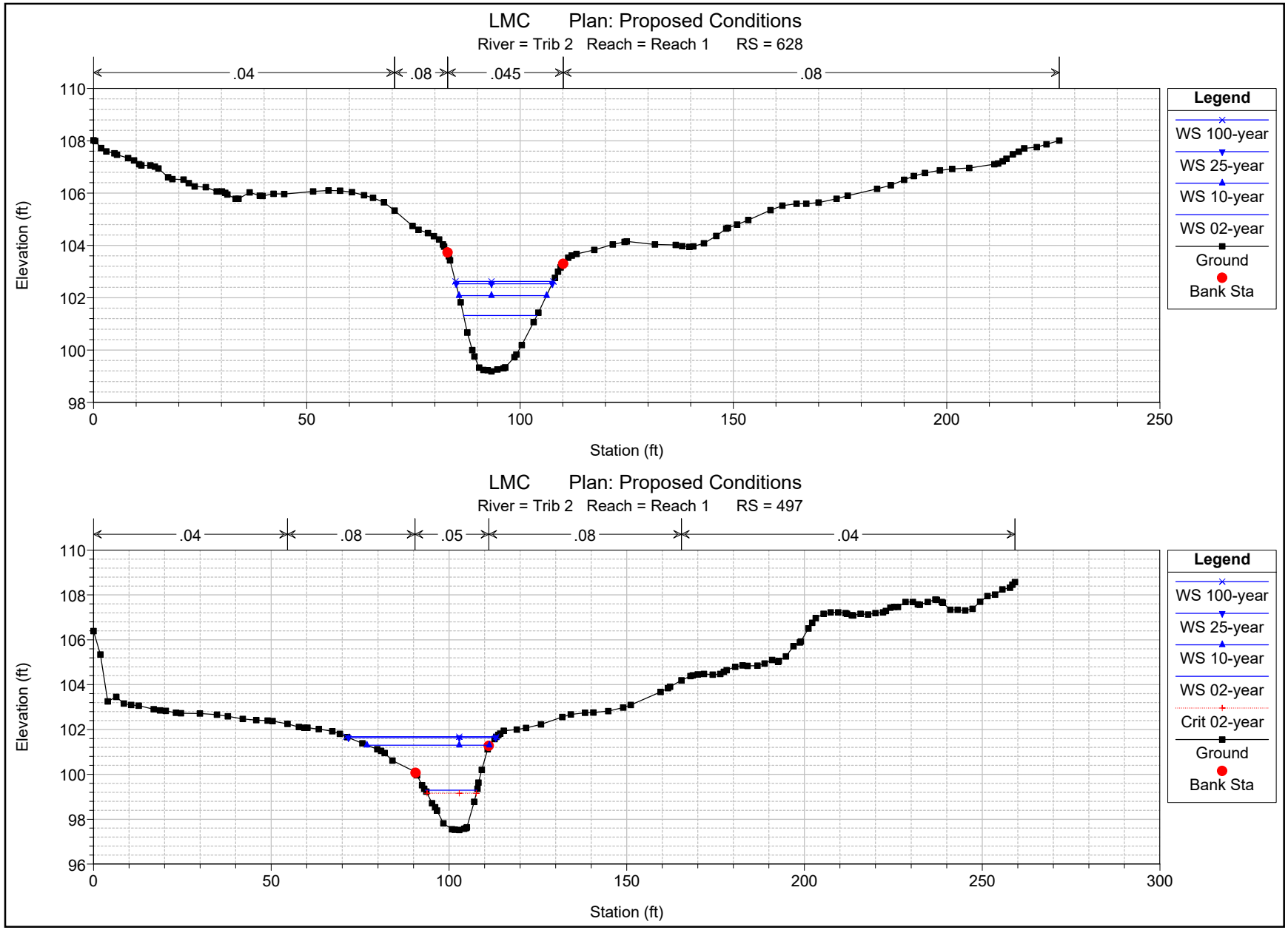

LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 910
.04
.013
.04
.045
.08
.04
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 874 MO Faulkland Road
.04
.013
.04
.045
.08
.04
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Levee
Ineff
Bank Sta

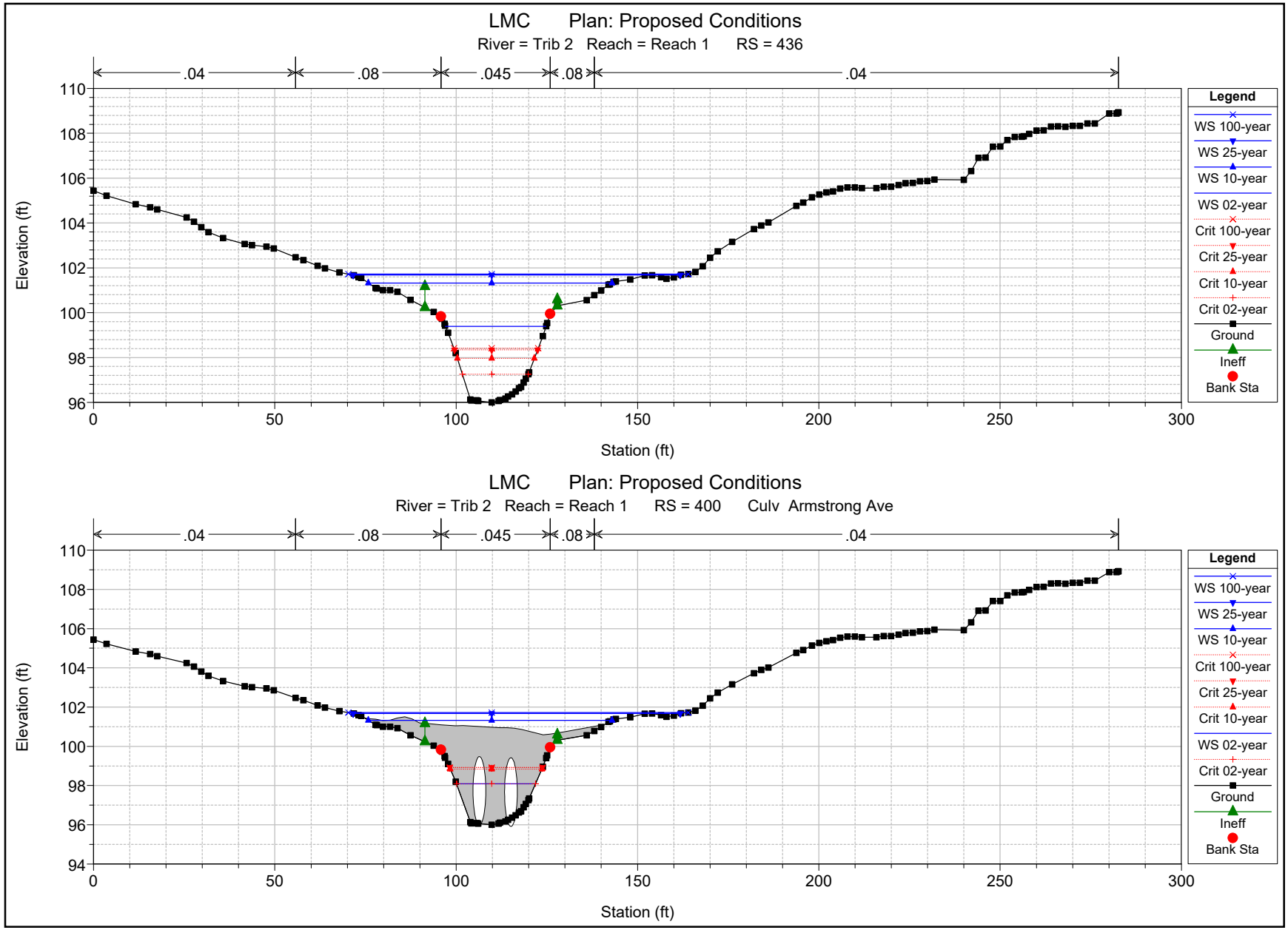

LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 874 MO Faulkland Road
.04
.04
.04
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
Station (ft)
Legend
Crit 100-year
WS 25-year
Crit 25-year
Crit 10-year
WS 10-year
WS 100-year
Crit 02-year
WS 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 825
.04
.04
.04
Elevation (ft)
110
108
106
104
102
100
98
96
94
92
0
100
200
300
400
500
Station (ft)
Legend
WS 100-year
Crit 100-year
WS 25-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

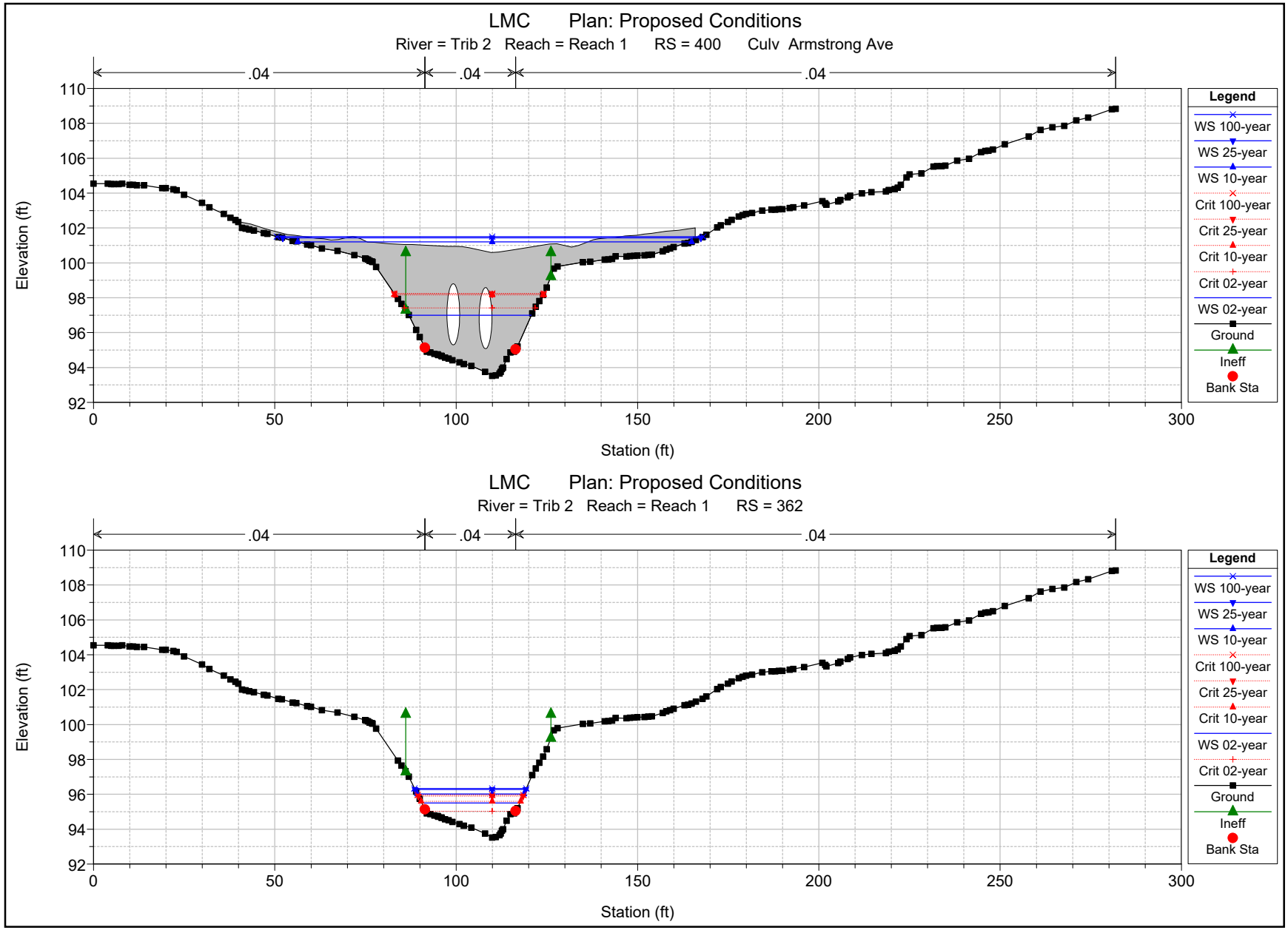

LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 801
.04
.07
.045
.07
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 679
.04
.07
.045
.045
.07
.04
.013
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

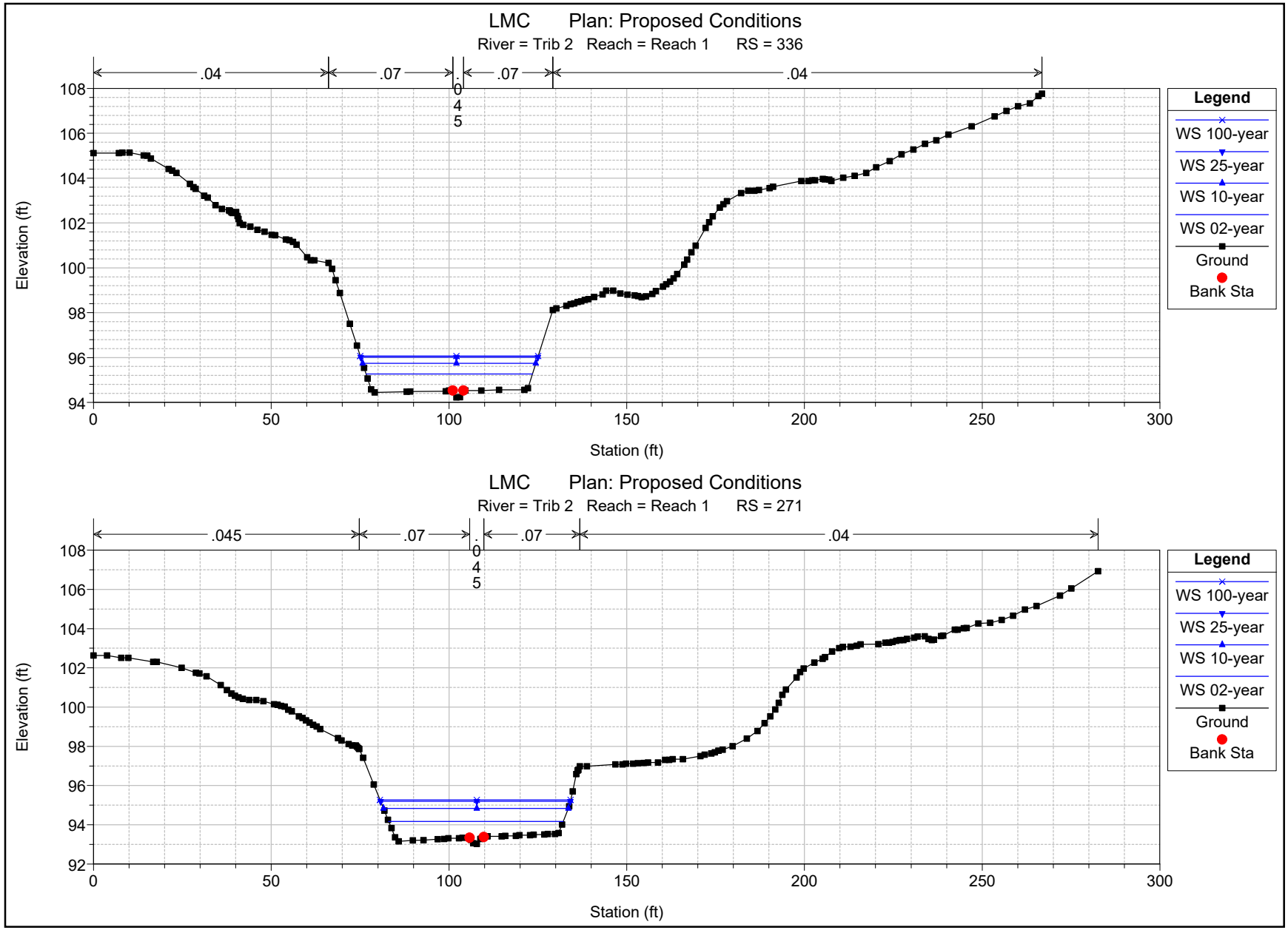

LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 602
.04
.07
.045
.07
.04
.013
.04
Elevation (ft)
120
115
110
105
100
95
90
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 513
.04
.07
.045
.07
.04
.013
.04
Elevation (ft)
115
110
105
100
95
90
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta

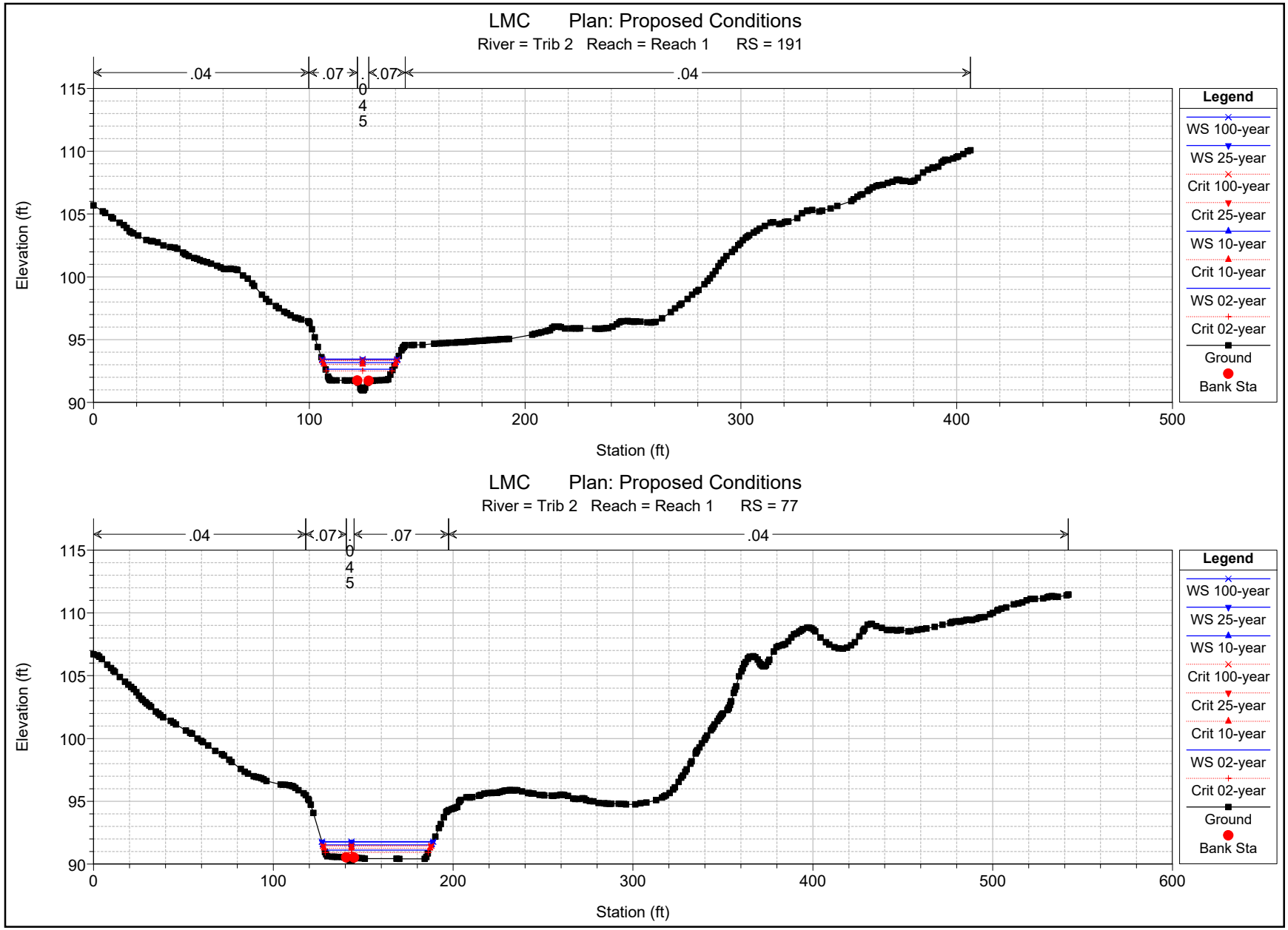

LMC Plan: Proposed Conditions
River = Trib 1 Reach = Reach 1 RS = 234
.04
.07
.045
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
WS 10-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 833
.04
.045
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta

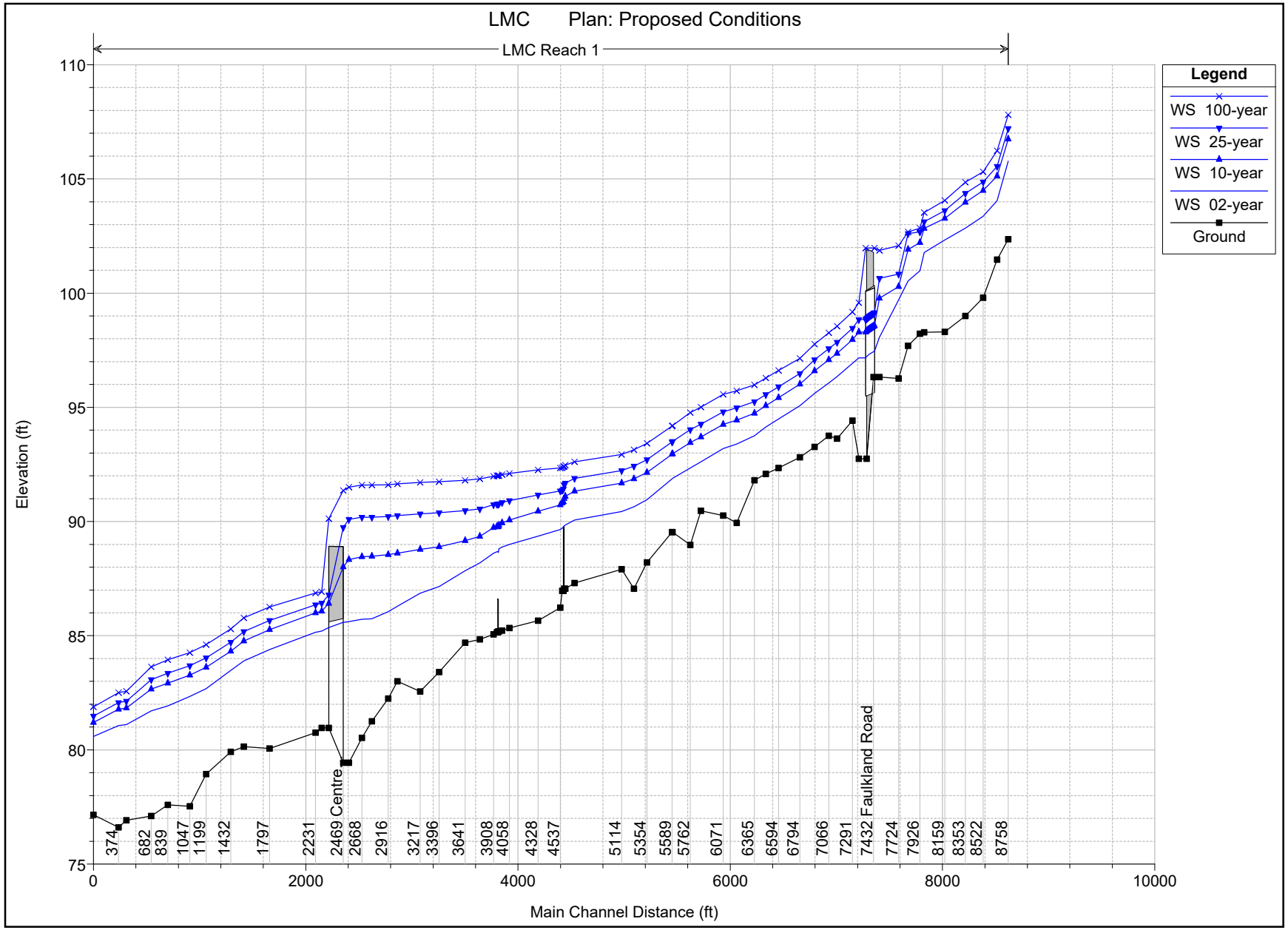

LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 628
.04
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 497
.04
.08
.05
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta

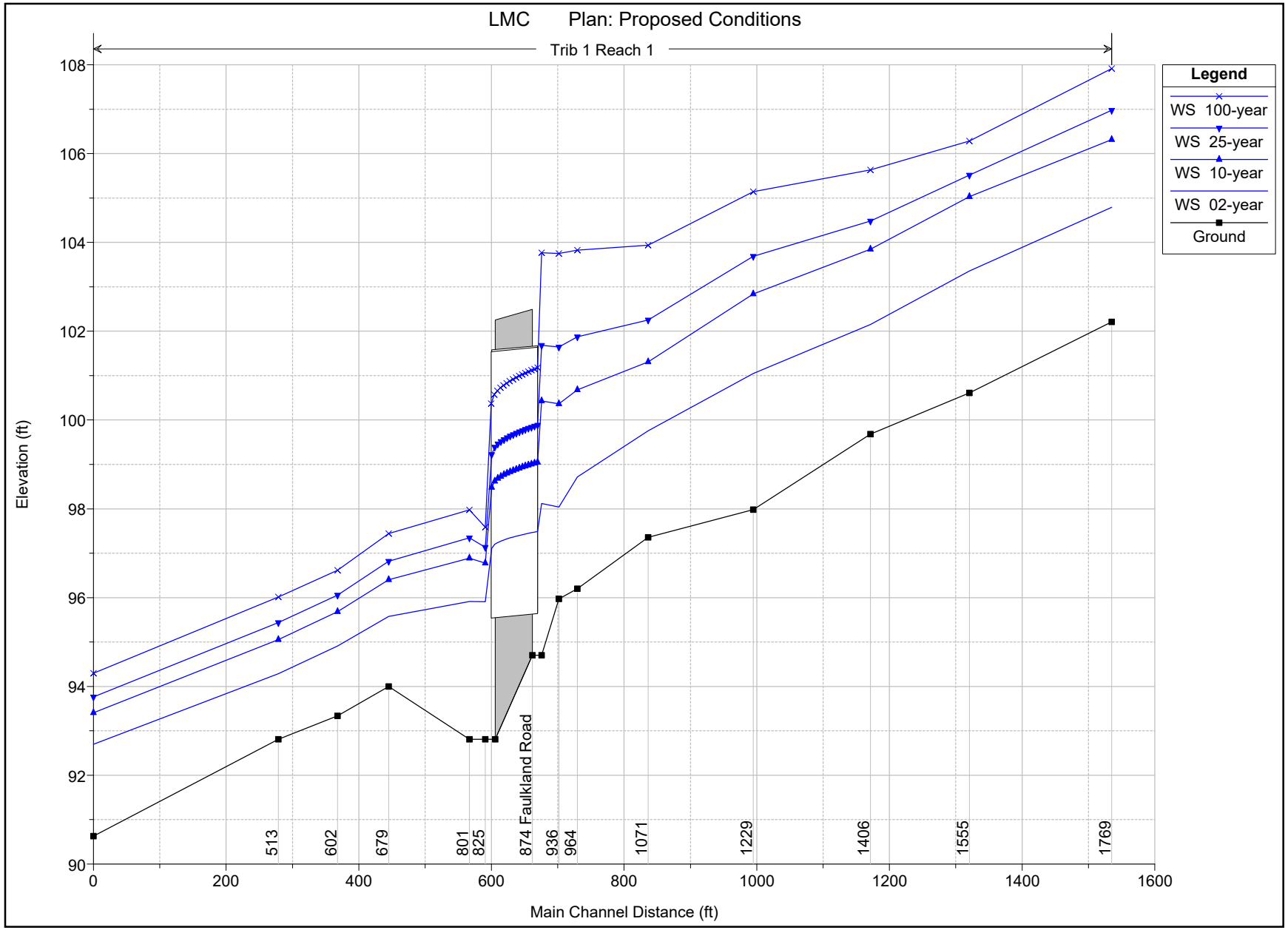

LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 436
.04
.08
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 400 Culv Armstrong Ave
.04
.08
.045
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta

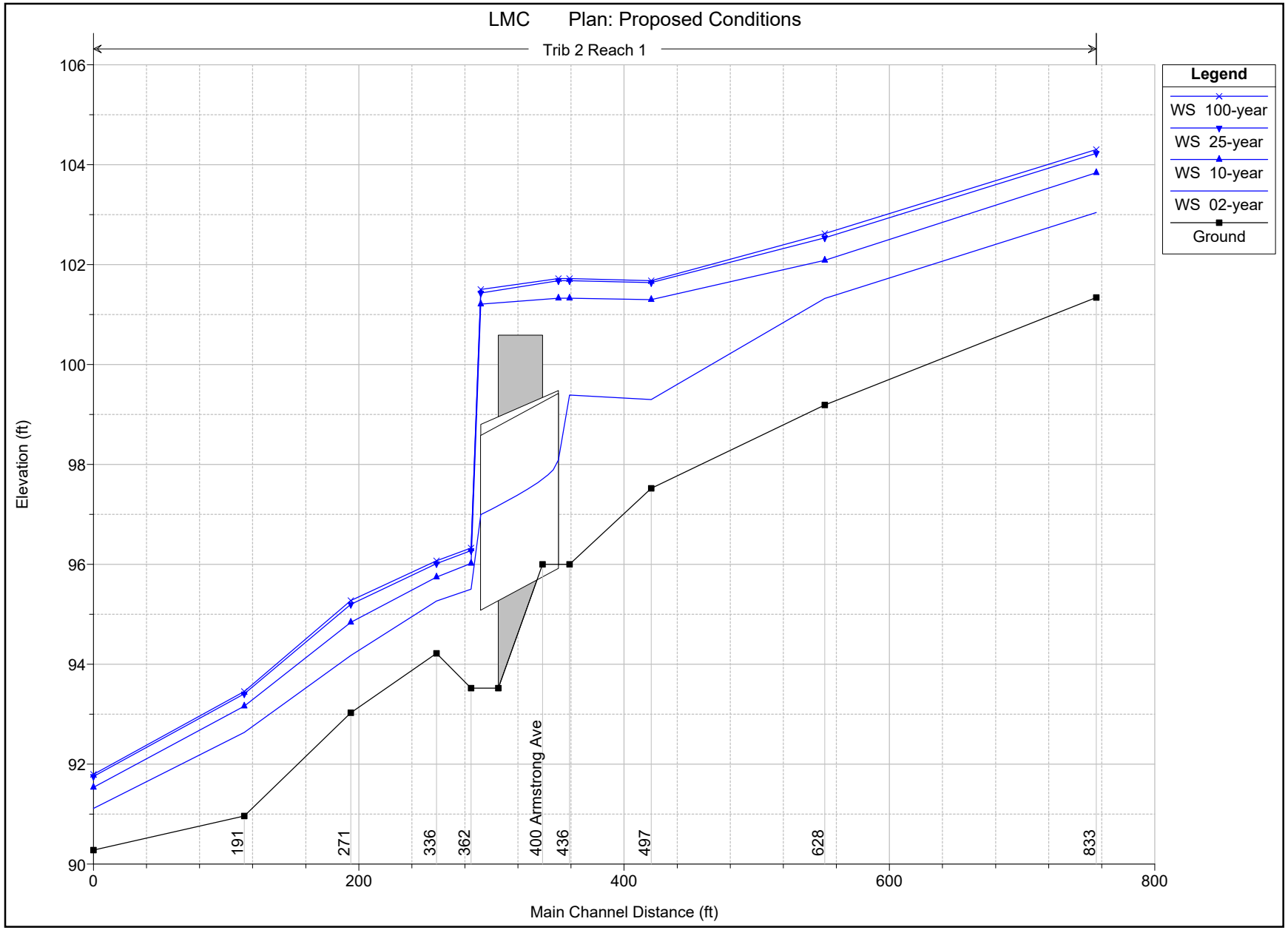

LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 400 Culv Armstrong Ave
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
Crit 02-year
WS 02-year
Ground
Ineff
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 362
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Ineff
Bank Sta


LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 336
.04
.07
.045
.07
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 271
.045
.07
.045
.07
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Bank Sta


LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 191
.04
.07
.045
.07
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
Crit 100-year
Crit 25-year
WS 10-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta
LMC Plan: Proposed Conditions
River = Trib 2 Reach = Reach 1 RS = 77
.04
.07
.045
.07
.04
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
Crit 100-year
Crit 25-year
Crit 10-year
WS 02-year
Crit 02-year
Ground
Bank Sta


LMC Plan: Proposed Conditions
LMC Reach 1
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Elevation (ft)
Main Channel Distance (ft)
110
105
100
95
90
85
80
75
0
2000
4000
6000
8000
10000
374
682
839
1047
1199
1432
1797
2231
2469 Centre
2668
2916
3217
3396
3641
3908
4058
4328
4537
5114
5354
5589
5762
6071
6365
6594
6794
7066
7291
7432 Faulkland Road
7724
7926
8159
8353
8522
8758


LMC Plan: Proposed Conditions
Trib 1 Reach 1
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Elevation (ft)
Main Channel Distance (ft)
874 Faulkland Road
513
602
679
801
825
936
964
1071
1229
1406
1555
1769


LMC Plan: Proposed Conditions
Trib 2 Reach 1
Legend
WS 100-year
WS 25-year
WS 10-year
WS 02-year
Ground
Elevation (ft)
Main Channel Distance (ft)
106
104
102
100
98
96
94
92
90
0
200
400
600
800
191
271
336
362
400 Armstrong Ave
436
497
628
833

HEC-RAS Plan: Proposed Conditions

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Trib 2	Reach 1	833	02-year	92.80	101.34	103.04	102.78	103.23	0.008967	3.73	28.68	36.58	0.57
Trib 2	Reach 1	833	10-year	213.00	101.34	103.84		104.03	0.005391	3.96	65.96	52.65	0.48
Trib 2	Reach 1	833	25-year	291.00	101.34	104.23		104.42	0.004535	4.07	87.77	57.79	0.45
Trib 2	Reach 1	833	100-year	308.00	101.34	104.31		104.50	0.004377	4.08	92.24	58.12	0.45
Trib 2	Reach 1	628	02-year	92.80	99.19	101.32		101.54	0.008107	3.70	25.06	17.22	0.54
Trib 2	Reach 1	628	10-year	213.00	99.19	102.09		102.54	0.012072	5.40	39.43	20.52	0.69
Trib 2	Reach 1	628	25-year	291.00	99.19	102.53		103.08	0.012370	5.93	49.08	22.54	0.71
Trib 2	Reach 1	628	100-year	308.00	99.19	102.62		103.19	0.012446	6.03	51.05	22.92	0.71
Trib 2	Reach 1	497	02-year	92.80	97.52	99.30	99.15	99.74	0.027051	5.33	17.41	14.61	0.86
Trib 2	Reach 1	497	10-year	213.00	97.52	101.30		101.52	0.004885	3.79	62.22	34.45	0.41
Trib 2	Reach 1	497	25-year	291.00	97.52	101.64		101.94	0.005839	4.50	75.10	41.42	0.46
Trib 2	Reach 1	497	100-year	308.00	97.52	101.68		102.00	0.006229	4.68	76.72	42.19	0.48
Trib 2	Reach 1	436	02-year	92.80	96.00	99.39	97.25	99.42	0.000619	1.41	65.65	27.78	0.16
Trib 2	Reach 1	436	10-year	213.00	96.00	101.33	97.97	101.37	0.000411	1.66	149.30	67.17	0.14
Trib 2	Reach 1	436	25-year	291.00	96.00	101.68	98.34	101.74	0.000555	2.04	175.93	90.22	0.17
Trib 2	Reach 1	436	100-year	308.00	96.00	101.72	98.42	101.79	0.000598	2.13	179.84	93.74	0.18
Trib 2	Reach 1	400		Culvert									
Trib 2	Reach 1	362	02-year	92.80	93.52	95.50	95.02	95.64	0.005085	3.01	31.16	27.03	0.48
Trib 2	Reach 1	362	10-year	213.00	93.52	96.02	95.59	96.37	0.008048	4.78	45.77	29.38	0.64
Trib 2	Reach 1	362	25-year	291.00	93.52	96.28	95.90	96.76	0.009330	5.65	53.47	30.55	0.70
Trib 2	Reach 1	362	100-year	308.00	93.52	96.33	95.96	96.84	0.009564	5.81	55.05	30.78	0.72
Trib 2	Reach 1	336	02-year	92.80	94.22	95.27		95.40	0.021381	4.54	34.75	46.80	0.83
Trib 2	Reach 1	336	10-year	213.00	94.22	95.75		95.98	0.022522	6.13	57.60	48.75	0.91
Trib 2	Reach 1	336	25-year	291.00	94.22	96.02		96.31	0.021775	6.77	70.94	49.84	0.92
Trib 2	Reach 1	336	100-year	308.00	94.22	96.07		96.38	0.021564	6.89	73.77	50.07	0.92
Trib 2	Reach 1	271	02-year	92.80	93.03	94.18		94.28	0.014576	3.92	39.32	49.16	0.69
Trib 2	Reach 1	271	10-year	213.00	93.03	94.84		94.99	0.010959	4.78	72.88	52.03	0.65
Trib 2	Reach 1	271	25-year	291.00	93.03	95.20		95.38	0.009892	5.18	91.85	53.40	0.64
Trib 2	Reach 1	271	100-year	308.00	93.03	95.27		95.46	0.009705	5.26	95.83	53.66	0.64
Trib 2	Reach 1	191	02-year	92.80	90.96	92.64	92.50	92.89	0.019349	5.45	28.19	31.09	0.82
Trib 2	Reach 1	191	10-year	213.00	90.96	93.16	93.03	93.65	0.025417	7.76	45.08	33.56	1.00
Trib 2	Reach 1	191	25-year	291.00	90.96	93.41	93.31	94.04	0.028563	8.93	53.53	34.72	1.08
Trib 2	Reach 1	191	100-year	308.00	90.96	93.45	93.37	94.12	0.029287	9.18	55.16	34.93	1.10
Trib 2	Reach 1	77	02-year	92.80	90.28	91.11	90.93	91.22	0.023107	4.05	36.94	58.34	0.84
Trib 2	Reach 1	77	10-year	213.00	90.28	91.53	91.26	91.74	0.023103	5.49	62.03	60.54	0.90
Trib 2	Reach 1	77	25-year	291.00	90.28	91.75	91.43	92.01	0.023109	6.16	75.45	61.68	0.93
Trib 2	Reach 1	77	100-year	308.00	90.28	91.80	91.47	92.07	0.023108	6.30	78.20	61.91	0.93
Trib 1	Reach 1	1769	02-year	173.00	102.21	104.79	104.26	105.13	0.011424	4.68	37.08	25.33	0.65
Trib 1	Reach 1	1769	10-year	453.00	102.21	106.32	105.66	106.65	0.005864	5.06	126.33	71.60	0.51
Trib 1	Reach 1	1769	25-year	636.00	102.21	106.98	106.10	107.32	0.005043	5.35	175.97	78.50	0.49
Trib 1	Reach 1	1769	100-year	961.00	102.21	107.91	106.70	108.29	0.004448	5.84	255.29	90.27	0.48
Trib 1	Reach 1	1555	02-year	173.00	100.61	103.36	102.35	103.56	0.004869	3.62	47.82	23.08	0.44
Trib 1	Reach 1	1555	10-year	453.00	100.61	105.03	103.60	105.40	0.005676	4.89	92.66	31.74	0.50
Trib 1	Reach 1	1555	25-year	636.00	100.61	105.52	104.23	106.05	0.006864	5.86	109.54	39.44	0.57
Trib 1	Reach 1	1555	100-year	961.00	100.61	106.28	105.20	107.04	0.007512	7.04	146.00	55.80	0.61
Trib 1	Reach 1	1406	02-year	173.00	99.68	102.15	101.57	102.52	0.010378	4.91	35.26	18.85	0.63
Trib 1	Reach 1	1406	10-year	453.00	99.68	103.85	102.99	104.37	0.008367	5.95	93.78	74.60	0.61
Trib 1	Reach 1	1406	25-year	636.00	99.68	104.48	103.97	105.01	0.007132	6.23	143.37	81.79	0.58
Trib 1	Reach 1	1406	100-year	961.00	99.68	105.63	104.57	106.07	0.004697	6.09	256.97	115.45	0.49
Trib 1	Reach 1	1229	02-year	173.00	97.98	101.05	99.93	101.26	0.004855	3.73	46.43	21.06	0.44
Trib 1	Reach 1	1229	10-year	453.00	97.98	102.84	101.31	103.19	0.005070	4.80	106.88	63.87	0.48
Trib 1	Reach 1	1229	25-year	636.00	97.98	103.69	102.01	104.03	0.004025	4.90	166.72	75.58	0.44
Trib 1	Reach 1	1229	100-year	961.00	97.98	105.14	103.17	105.42	0.002605	4.70	283.34	84.12	0.36
Trib 1	Reach 1	1071	02-year	173.00	97.36	99.76	99.26	100.14	0.010975	4.94	35.03	19.29	0.65
Trib 1	Reach 1	1071	10-year	453.00	97.36	101.31	100.55	102.01	0.011030	6.72	67.40	22.44	0.68
Trib 1	Reach 1	1071	25-year	636.00	97.36	102.25	101.22	103.04	0.009706	7.10	89.59	24.50	0.65
Trib 1	Reach 1	1071	100-year	961.00	97.36	103.94	102.22	104.71	0.007999	7.04	136.60	34.12	0.61
Trib 1	Reach 1	964	02-year	173.00	96.20	98.72	98.13	99.03	0.009348	4.51	38.33	21.88	0.60
Trib 1	Reach 1	964	10-year	453.00	96.20	100.68	99.40	101.07	0.005970	5.03	90.14	30.85	0.52
Trib 1	Reach 1	964	25-year	636.00	96.20	101.88	100.01	102.24	0.004357	4.87	130.53	36.82	0.46
Trib 1	Reach 1	964	100-year	961.00	96.20	103.83	100.90	104.14	0.002428	4.50	223.87	64.21	0.36
Trib 1	Reach 1	936	02-year	173.00	95.97	98.04	97.85	98.60	0.019187	6.01	28.80	18.27	0.84
Trib 1	Reach 1	936	10-year	453.00	95.97	100.36	99.19	100.86	0.007389	5.63	80.43	26.69	0.57
Trib 1	Reach 1	936	25-year	636.00	95.97	101.65	99.86	102.09	0.005498	5.33	119.36	35.00	0.51
Trib 1	Reach 1	936	100-year	961.00	95.97	103.75	100.86	104.06	0.002701	4.56	231.27	75.33	0.38
Trib 1	Reach 1	910	02-year	173.00	94.70	98.12	97.01	98.30	0.003936	3.32	52.18	24.30	0.40
Trib 1	Reach 1	910	10-year	453.00	94.70	100.43	98.18	100.67	0.002744	3.96	114.50	29.73	0.36

HEC-RAS Plan: Proposed Conditions (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Trib 1	Reach 1	910	25-year	636.00	94.70	101.68	98.78	101.94	0.002679	4.02	158.29	40.13	0.36
Trib 1	Reach 1	910	100-year	961.00	94.70	103.77	99.67	103.98	0.001722	3.66	262.83	75.19	0.30
Trib 1	Reach 1	874		Mult Open									
Trib 1	Reach 1	825	02-year	173.00	92.81	95.91	94.66	96.09	0.003192	3.44	50.35	22.65	0.41
Trib 1	Reach 1	825	10-year	453.00	92.81	96.78	96.01	97.40	0.008183	6.35	71.29	25.54	0.67
Trib 1	Reach 1	825	25-year	636.00	92.81	97.13	96.65	98.10	0.011453	7.89	80.60	26.75	0.80
Trib 1	Reach 1	825	100-year	961.00	92.81	97.59	97.59	99.24	0.017429	10.32	93.16	28.20	1.00
Trib 1	Reach 1	801	02-year	173.00	92.81	95.91		95.99	0.001434	2.28	88.59	59.10	0.25
Trib 1	Reach 1	801	10-year	453.00	92.81	96.89		97.08	0.002645	3.84	148.20	63.11	0.36
Trib 1	Reach 1	801	25-year	636.00	92.81	97.35		97.62	0.003153	4.55	177.81	65.02	0.40
Trib 1	Reach 1	801	100-year	961.00	92.81	97.98		98.38	0.003962	5.63	219.50	67.55	0.46
Trib 1	Reach 1	679	02-year	173.00	94.00	95.57		95.67	0.005979	3.20	73.78	67.78	0.47
Trib 1	Reach 1	679	10-year	453.00	94.00	96.41		96.61	0.006352	4.48	131.51	71.12	0.53
Trib 1	Reach 1	679	25-year	636.00	94.00	96.82		97.08	0.006513	5.08	161.27	81.09	0.55
Trib 1	Reach 1	679	100-year	961.00	94.00	97.44		97.76	0.006176	5.69	233.44	133.18	0.55
Trib 1	Reach 1	602	02-year	173.00	93.34	94.91		95.04	0.011932	4.14	66.83	67.70	0.64
Trib 1	Reach 1	602	10-year	453.00	93.34	95.68		95.94	0.012331	5.71	120.43	70.85	0.70
Trib 1	Reach 1	602	25-year	636.00	93.34	96.06		96.39	0.012675	6.46	147.43	72.32	0.73
Trib 1	Reach 1	602	100-year	961.00	93.34	96.62		97.07	0.013193	7.54	188.26	74.48	0.77
Trib 1	Reach 1	513	02-year	173.00	92.81	94.29		94.34	0.005259	2.86	101.45	97.91	0.44
Trib 1	Reach 1	513	10-year	453.00	92.81	95.05		95.17	0.005817	4.08	177.55	101.10	0.50
Trib 1	Reach 1	513	25-year	636.00	92.81	95.44		95.59	0.005976	4.63	216.87	102.67	0.52
Trib 1	Reach 1	513	100-year	961.00	92.81	96.01		96.22	0.006209	5.42	276.31	105.00	0.55
Trib 1	Reach 1	234	02-year	173.00	90.63	92.70	92.47	92.82	0.009104	3.99	80.08	95.78	0.58
Trib 1	Reach 1	234	10-year	453.00	90.63	93.40	92.93	93.60	0.009106	5.17	148.88	98.66	0.62
Trib 1	Reach 1	234	25-year	636.00	90.63	93.76	93.15	94.00	0.009101	5.72	184.36	100.11	0.63
Trib 1	Reach 1	234	100-year	961.00	90.63	94.30	93.51	94.60	0.009101	6.50	238.77	102.34	0.65
LMC	Reach 1	8758	02-year	324.00	102.36	105.78	104.93	106.22	0.008791	5.30	61.13	25.25	0.60
LMC	Reach 1	8758	10-year	674.00	102.36	106.74	106.19	107.67	0.012934	7.79	91.90	40.70	0.76
LMC	Reach 1	8758	25-year	888.00	102.36	107.21	106.91	108.38	0.014289	8.81	111.15	41.92	0.81
LMC	Reach 1	8758	100-year	1230.00	102.36	107.81	107.72	109.36	0.016471	10.23	137.50	45.95	0.88
LMC	Reach 1	8653	02-year	324.00	101.47	104.05	104.05	104.85	0.019805	7.26	50.27	42.68	0.89
LMC	Reach 1	8653	10-year	674.00	101.47	105.13	105.13	106.15	0.016242	8.70	104.12	53.97	0.87
LMC	Reach 1	8653	25-year	888.00	101.47	105.55	105.55	106.76	0.016790	9.63	127.24	55.12	0.90
LMC	Reach 1	8653	100-year	1230.00	101.47	106.23	106.19	107.61	0.015939	10.54	169.93	91.41	0.90
LMC	Reach 1	8522	02-year	324.00	99.80	103.36		103.56	0.003087	3.60	90.09	31.07	0.37
LMC	Reach 1	8522	10-year	674.00	99.80	104.50		104.89	0.004342	5.13	153.51	69.21	0.46
LMC	Reach 1	8522	25-year	888.00	99.80	104.87		105.40	0.005424	6.02	180.35	75.96	0.52
LMC	Reach 1	8522	100-year	1230.00	99.80	105.32	104.38	106.08	0.007204	7.33	222.35	105.90	0.61
LMC	Reach 1	8353	02-year	324.00	99.00	102.85		103.04	0.003030	3.57	100.94	64.58	0.37
LMC	Reach 1	8353	10-year	674.00	99.00	103.98		104.21	0.003183	4.31	269.51	206.58	0.39
LMC	Reach 1	8353	25-year	888.00	99.00	104.37		104.61	0.003193	4.61	350.70	211.33	0.40
LMC	Reach 1	8353	100-year	1230.00	99.00	104.86		105.12	0.003325	5.06	457.83	228.72	0.42
LMC	Reach 1	8159	02-year	324.00	98.31	102.33		102.50	0.002523	3.31	99.40	46.95	0.34
LMC	Reach 1	8159	10-year	674.00	98.31	103.27		103.56	0.003571	4.60	231.27	215.68	0.42
LMC	Reach 1	8159	25-year	888.00	98.31	103.61		103.94	0.003861	5.07	307.95	235.50	0.44
LMC	Reach 1	8159	100-year	1230.00	98.31	104.06		104.42	0.004076	5.58	420.78	258.14	0.46
LMC	Reach 1	7966	02-year	324.00	98.28	101.78		101.96	0.003133	3.40	99.85	93.09	0.37
LMC	Reach 1	7966	10-year	674.00	98.28	102.83		102.99	0.002189	3.49	228.03	138.14	0.33
LMC	Reach 1	7966	25-year	888.00	98.28	103.13		103.32	0.002390	3.84	270.82	149.94	0.35
LMC	Reach 1	7966	100-year	1230.00	98.28	103.53		103.76	0.002611	4.29	333.36	163.58	0.37
LMC	Reach 1	7926	02-year	324.00	98.22	100.98		101.67	0.016135	6.65	48.71	23.09	0.81
LMC	Reach 1	7926	10-year	674.00	98.22	102.22	102.22	102.78	0.010364	6.62	125.11	103.29	0.69
LMC	Reach 1	7926	25-year	888.00	98.22	102.68		103.13	0.007460	6.14	178.66	127.19	0.59
LMC	Reach 1	7926	100-year	1230.00	98.22	102.85	102.78	103.53	0.010541	7.55	200.99	131.81	0.71
LMC	Reach 1	7815	02-year	324.00	97.69	100.53		100.71	0.004163	3.52	97.25	45.43	0.39
LMC	Reach 1	7815	10-year	674.00	97.69	101.92		102.06	0.002181	3.40	234.24	132.53	0.30
LMC	Reach 1	7815	25-year	888.00	97.69	102.61		102.73	0.001429	3.07	327.83	138.74	0.25
LMC	Reach 1	7815	100-year	1230.00	97.69	102.68		102.89	0.002520	4.12	337.31	140.00	0.33
LMC	Reach 1	7724	02-year	324.00	96.26	99.70	98.82	100.15	0.008808	5.34	60.65	25.01	0.60
LMC	Reach 1	7724	10-year	674.00	96.26	100.29	100.17	101.51	0.020896	8.86	76.06	28.03	0.95
LMC	Reach 1	7724	25-year	888.00	96.26	100.84	100.81	102.27	0.021924	9.61	92.44	31.35	0.99
LMC	Reach 1	7724	100-year	1230.00	96.26	102.08	101.98	102.54	0.006171	6.19	254.35	188.04	0.55
LMC	Reach 1	7544	02-year	324.00	96.33	98.07	97.71	98.30	0.010672	3.89	83.38	68.23	0.62
LMC	Reach 1	7544	10-year	674.00	96.33	99.78	98.31	99.94	0.002653	3.18	211.68	81.81	0.35
LMC	Reach 1	7544	25-year	888.00	96.33	100.65	98.60	100.80	0.001955	3.10	286.32	91.49	0.31
LMC	Reach 1	7544	100-year	1230.00	96.33	101.87	99.03	102.01	0.001215	3.00	426.16	290.98	0.26

HEC-RAS Plan: Proposed Conditions (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LMC	Reach 1	7432		Culvert									
LMC	Reach 1	7349	02-year	324.00	92.75	97.17	94.77	97.23	0.000771	2.05	168.99	60.91	0.20
LMC	Reach 1	7349	10-year	674.00	92.75	98.30	95.85	98.42	0.001134	3.00	241.24	67.17	0.25
LMC	Reach 1	7349	25-year	888.00	92.75	98.84	96.24	99.01	0.001283	3.44	278.50	70.19	0.27
LMC	Reach 1	7349	100-year	1230.00	92.75	99.58	96.76	99.80	0.001468	4.03	331.80	74.32	0.29
LMC	Reach 1	7291	02-year	324.00	94.42	96.93	96.09	97.09	0.004604	3.94	112.73	59.39	0.45
LMC	Reach 1	7291	10-year	674.00	94.42	97.96	96.78	98.24	0.004952	5.21	176.21	63.94	0.50
LMC	Reach 1	7291	25-year	888.00	94.42	98.46	97.13	98.80	0.005090	5.79	208.72	71.54	0.52
LMC	Reach 1	7291	100-year	1230.00	94.42	99.17	97.63	99.58	0.005137	6.51	271.50	100.00	0.54
LMC	Reach 1	7144	02-year	324.00	93.63	96.35		96.47	0.003792	3.57	133.82	72.16	0.41
LMC	Reach 1	7144	10-year	674.00	93.63	97.36		97.56	0.004044	4.68	208.71	76.22	0.45
LMC	Reach 1	7144	25-year	888.00	93.63	97.85		98.10	0.004136	5.18	246.89	78.24	0.46
LMC	Reach 1	7144	100-year	1230.00	93.63	98.56		98.87	0.004261	5.88	305.40	89.00	0.49
LMC	Reach 1	7066	02-year	324.00	93.75	96.07		96.16	0.003800	3.43	143.56	79.62	0.41
LMC	Reach 1	7066	10-year	674.00	93.75	97.08		97.24	0.003841	4.43	226.13	83.75	0.44
LMC	Reach 1	7066	25-year	888.00	93.75	97.57		97.77	0.003878	4.90	268.13	85.99	0.45
LMC	Reach 1	7066	100-year	1230.00	93.75	98.27		98.52	0.004057	5.62	331.44	102.61	0.47
LMC	Reach 1	6934	02-year	324.00	93.27	95.61		95.70	0.003363	3.27	146.97	80.19	0.38
LMC	Reach 1	6934	10-year	674.00	93.27	96.60		96.76	0.003570	4.30	228.36	84.14	0.42
LMC	Reach 1	6934	25-year	888.00	93.27	97.09		97.29	0.003649	4.77	269.72	86.09	0.44
LMC	Reach 1	6934	100-year	1230.00	93.27	97.77		98.02	0.003701	5.37	333.95	112.22	0.45
LMC	Reach 1	6794	02-year	324.00	92.81	95.07		95.18	0.004380	3.64	135.54	76.60	0.43
LMC	Reach 1	6794	10-year	674.00	92.81	96.01		96.20	0.004726	4.80	209.24	80.35	0.48
LMC	Reach 1	6794	25-year	888.00	92.81	96.48		96.72	0.004810	5.32	247.34	82.21	0.50
LMC	Reach 1	6794	100-year	1230.00	92.81	97.15		97.44	0.004858	5.99	303.04	85.54	0.51
LMC	Reach 1	6594	02-year	324.00	92.34	94.49		94.57	0.003604	3.18	156.56	92.71	0.39
LMC	Reach 1	6594	10-year	674.00	92.34	95.42		95.56	0.003702	4.14	244.66	96.58	0.42
LMC	Reach 1	6594	25-year	888.00	92.34	95.90		96.07	0.003656	4.55	291.81	99.72	0.43
LMC	Reach 1	6594	100-year	1230.00	92.34	96.62		96.81	0.003426	4.99	382.82	148.12	0.43
LMC	Reach 1	6472	02-year	324.00	92.09	94.14		94.22	0.004114	3.34	151.33	92.90	0.42
LMC	Reach 1	6472	10-year	674.00	92.09	95.07		95.22	0.004031	4.27	239.92	96.69	0.44
LMC	Reach 1	6472	25-year	888.00	92.09	95.56		95.73	0.003891	4.65	287.94	98.74	0.44
LMC	Reach 1	6472	100-year	1230.00	92.09	96.28		96.49	0.003745	5.18	364.15	118.68	0.45
LMC	Reach 1	6365	02-year	324.00	91.81	93.75		93.85	0.005085	3.52	143.98	95.53	0.46
LMC	Reach 1	6365	10-year	674.00	91.81	94.74		94.88	0.004214	4.27	240.09	99.49	0.45
LMC	Reach 1	6365	25-year	888.00	91.81	95.25		95.42	0.003898	4.59	291.82	101.55	0.44
LMC	Reach 1	6365	100-year	1230.00	91.81	95.99		96.18	0.003724	5.12	377.74	166.75	0.45
LMC	Reach 1	6199	02-year	324.00	89.94	93.39		93.47	0.002104	2.93	187.86	111.66	0.31
LMC	Reach 1	6199	10-year	674.00	89.94	94.44		94.54	0.002042	3.56	307.63	118.10	0.32
LMC	Reach 1	6199	25-year	888.00	89.94	94.98		95.09	0.001961	3.81	372.51	121.19	0.32
LMC	Reach 1	6199	100-year	1230.00	89.94	95.73		95.87	0.001915	4.19	468.12	143.60	0.33
LMC	Reach 1	6071	02-year	324.00	90.26	93.19		93.25	0.002263	2.83	192.74	113.93	0.32
LMC	Reach 1	6071	10-year	674.00	90.26	94.25		94.34	0.002052	3.42	316.16	118.24	0.32
LMC	Reach 1	6071	25-year	888.00	90.26	94.81		94.91	0.001949	3.67	382.16	120.48	0.32
LMC	Reach 1	6071	100-year	1230.00	90.26	95.57		95.69	0.001881	4.04	490.44	179.02	0.32
LMC	Reach 1	5862	02-year	408.00	90.47	92.61		92.69	0.004135	3.39	193.05	117.93	0.42
LMC	Reach 1	5862	10-year	891.00	90.47	93.70		93.84	0.003680	4.26	324.14	122.36	0.42
LMC	Reach 1	5862	25-year	1190.00	90.47	94.27		94.43	0.003493	4.63	394.24	131.16	0.43
LMC	Reach 1	5862	100-year	1690.00	90.47	95.02		95.22	0.003485	5.24	504.94	160.55	0.44
LMC	Reach 1	5762	02-year	408.00	88.98	92.34		92.40	0.002033	2.87	247.16	138.13	0.30
LMC	Reach 1	5762	10-year	891.00	88.98	93.45		93.55	0.002076	3.64	403.20	142.62	0.33
LMC	Reach 1	5762	25-year	1190.00	88.98	94.03		94.15	0.002056	3.97	486.32	147.10	0.33
LMC	Reach 1	5762	100-year	1690.00	88.98	94.78		94.93	0.002168	4.52	600.81	157.86	0.35
LMC	Reach 1	5593	02-year	437.00	89.54	91.89		92.00	0.004222	3.64	188.17	106.88	0.43
LMC	Reach 1	5593	10-year	948.00	89.54	92.96		93.14	0.004211	4.72	305.27	111.54	0.46
LMC	Reach 1	5593	25-year	1270.00	89.54	93.52		93.74	0.004256	5.26	367.93	121.62	0.47
LMC	Reach 1	5593	100-year	1800.00	89.54	94.22		94.50	0.004415	5.98	457.71	136.08	0.49
LMC	Reach 1	5589	02-year	437.00	89.53	91.87		91.98	0.004145	3.63	189.80	107.13	0.43
LMC	Reach 1	5589	10-year	948.00	89.53	92.94		93.12	0.004166	4.72	307.17	111.76	0.46
LMC	Reach 1	5589	25-year	1270.00	89.53	93.50		93.71	0.004130	5.21	370.00	119.19	0.47
LMC	Reach 1	5589	100-year	1800.00	89.53	94.19		94.47	0.004402	6.00	459.55	135.62	0.49
LMC	Reach 1	5354	02-year	437.00	88.21	90.95		91.09	0.004737	4.06	179.04	109.03	0.46
LMC	Reach 1	5354	10-year	948.00	88.21	92.13		92.32	0.003967	4.83	310.51	113.83	0.45
LMC	Reach 1	5354	25-year	1270.00	88.21	92.73		92.94	0.003744	5.20	387.60	169.34	0.45
LMC	Reach 1	5354	100-year	1800.00	88.21	93.46		93.69	0.003493	5.58	524.72	196.58	0.44
LMC	Reach 1	5232	02-year	437.00	87.06	90.64		90.72	0.002032	3.07	240.80	128.46	0.31

HEC-RAS Plan: Proposed Conditions (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LMC	Reach 1	5232	10-year	948.00	87.06	91.85		91.97	0.002025	3.83	399.98	133.52	0.33
LMC	Reach 1	5232	25-year	1270.00	87.06	92.46		92.60	0.002034	4.19	491.35	166.32	0.33
LMC	Reach 1	5232	100-year	1800.00	87.06	93.19		93.36	0.002099	4.67	630.35	211.98	0.35
LMC	Reach 1	5114	02-year	437.00	87.91	90.42		90.47	0.001942	2.57	271.74	141.38	0.29
LMC	Reach 1	5114	10-year	948.00	87.91	91.65		91.73	0.001807	3.28	449.03	147.72	0.30
LMC	Reach 1	5114	25-year	1270.00	87.91	92.27		92.36	0.001779	3.61	548.72	180.52	0.31
LMC	Reach 1	5114	100-year	1800.00	87.91	93.00		93.12	0.001811	4.05	700.80	231.89	0.32
LMC	Reach 1	4671	02-year	437.00	87.31	90.04		90.09	0.001662	2.56	273.47	130.16	0.28
LMC	Reach 1	4671	10-year	948.00	87.31	91.29		91.37	0.001704	3.35	454.81	184.30	0.30
LMC	Reach 1	4671	25-year	1270.00	87.31	91.95		92.03	0.001503	3.49	590.00	230.13	0.29
LMC	Reach 1	4671	100-year	1800.00	87.31	92.71		92.80	0.001374	3.70	791.59	302.96	0.28
LMC	Reach 1	4585	02-year	437.00	87.06	89.82	88.64	89.91	0.003106	3.35	190.65	88.00	0.36
LMC	Reach 1	4585	10-year	948.00	87.06	91.04	89.30	91.19	0.003174	4.34	336.56	172.76	0.39
LMC	Reach 1	4585	25-year	1270.00	87.06	91.76	89.65	91.89	0.002267	4.11	474.09	227.73	0.34
LMC	Reach 1	4585	100-year	1800.00	87.06	92.58	90.17	92.69	0.001512	3.74	696.04	302.24	0.28
LMC	Reach 1	4563		Bridge									
LMC	Reach 1	4555	02-year	437.00	86.96	89.70		89.82	0.003366	3.63	179.81	83.99	0.39
LMC	Reach 1	4555	10-year	948.00	86.96	90.82		91.04	0.004054	5.05	276.84	95.76	0.46
LMC	Reach 1	4555	25-year	1270.00	86.96	91.39		91.64	0.004168	5.62	354.79	190.64	0.48
LMC	Reach 1	4555	100-year	1800.00	86.96	92.38		92.53	0.002122	4.60	641.23	350.73	0.35
LMC	Reach 1	4537	02-year	437.00	86.23	89.64		89.76	0.002775	3.64	182.70	81.32	0.36
LMC	Reach 1	4537	10-year	948.00	86.23	90.75		90.97	0.003616	5.10	293.63	148.68	0.44
LMC	Reach 1	4537	25-year	1270.00	86.23	91.36		91.56	0.002941	5.03	413.97	253.55	0.40
LMC	Reach 1	4537	100-year	1800.00	86.23	92.37		92.49	0.001464	4.03	743.67	376.75	0.29
LMC	Reach 1	4328	02-year	437.00	85.66	89.34		89.39	0.001215	2.58	277.43	150.76	0.24
LMC	Reach 1	4328	10-year	948.00	85.66	90.47		90.53	0.001211	3.12	576.62	356.70	0.26
LMC	Reach 1	4328	25-year	1270.00	85.66	91.20		91.24	0.000788	2.77	870.47	448.54	0.21
LMC	Reach 1	4328	100-year	1800.00	85.66	92.29		92.32	0.000430	2.32	1372.04	473.95	0.16
LMC	Reach 1	4058	02-year	497.00	85.34	88.96		89.02	0.001417	2.74	299.52	183.40	0.26
LMC	Reach 1	4058	10-year	1070.00	85.34	90.10		90.17	0.001347	3.22	554.67	266.60	0.26
LMC	Reach 1	4058	25-year	1420.00	85.34	90.95		91.01	0.000841	2.84	798.99	301.56	0.21
LMC	Reach 1	4058	100-year	2010.00	85.34	92.13		92.18	0.000532	2.57	1172.39	330.19	0.18
LMC	Reach 1	3989	02-year	497.00	85.22	88.83		88.91	0.001809	3.22	248.21	158.60	0.30
LMC	Reach 1	3989	10-year	1070.00	85.22	89.98		90.08	0.001527	3.57	463.23	207.56	0.29
LMC	Reach 1	3989	25-year	1420.00	85.22	90.88		90.96	0.000880	3.05	673.54	248.10	0.23
LMC	Reach 1	3989	100-year	2010.00	85.22	92.08		92.15	0.000521	2.67	985.61	272.49	0.18
LMC	Reach 1	3960	02-year	497.00	85.19	88.75	87.16	88.86	0.002178	3.50	219.64	133.97	0.33
LMC	Reach 1	3960	10-year	1070.00	85.19	89.89	88.08	90.03	0.002278	4.32	404.10	196.50	0.36
LMC	Reach 1	3960	25-year	1420.00	85.19	90.83	88.75	90.93	0.001276	3.66	613.54	242.75	0.27
LMC	Reach 1	3960	100-year	2010.00	85.19	92.05	89.30	92.13	0.000752	3.21	919.59	257.18	0.22
LMC	Reach 1	3949		Bridge									
LMC	Reach 1	3939	02-year	497.00	85.15	88.67		88.76	0.002009	3.34	244.34	166.96	0.32
LMC	Reach 1	3939	10-year	1070.00	85.15	89.77		89.88	0.001788	3.79	441.91	192.74	0.31
LMC	Reach 1	3939	25-year	1420.00	85.15	90.76		90.84	0.000959	3.16	658.59	230.71	0.24
LMC	Reach 1	3939	100-year	2010.00	85.15	92.01		92.08	0.000590	2.84	954.29	242.86	0.19
LMC	Reach 1	3908	02-year	497.00	85.06	88.61		88.70	0.001984	3.31	242.05	164.59	0.32
LMC	Reach 1	3908	10-year	1070.00	85.06	89.73		89.83	0.001674	3.67	447.79	199.36	0.30
LMC	Reach 1	3908	25-year	1420.00	85.06	90.73		90.81	0.000904	3.08	654.74	211.80	0.23
LMC	Reach 1	3908	100-year	2010.00	85.06	91.98		92.06	0.000596	2.86	928.00	224.23	0.19
LMC	Reach 1	3779	02-year	497.00	84.84	88.19		88.36	0.003527	4.25	169.60	112.50	0.42
LMC	Reach 1	3779	10-year	1070.00	84.84	89.35		89.55	0.002907	4.73	327.09	157.39	0.40
LMC	Reach 1	3779	25-year	1420.00	84.84	90.55		90.67	0.001221	3.60	535.46	187.99	0.27
LMC	Reach 1	3779	100-year	2010.00	84.84	91.87		91.97	0.000712	3.17	786.71	194.37	0.21
LMC	Reach 1	3641	02-year	497.00	84.69	87.85		87.94	0.002323	3.34	232.39	165.01	0.34
LMC	Reach 1	3641	10-year	1070.00	84.69	89.16		89.26	0.001233	3.08	457.28	175.11	0.26
LMC	Reach 1	3641	25-year	1420.00	84.69	90.47		90.55	0.000551	2.45	690.67	181.06	0.18
LMC	Reach 1	3641	100-year	2010.00	84.69	91.81		91.89	0.000405	2.42	937.08	187.80	0.16
LMC	Reach 1	3396	02-year	497.00	83.41	87.15		87.36	0.004267	4.76	164.49	108.25	0.46
LMC	Reach 1	3396	10-year	1070.00	83.41	88.89		89.02	0.001774	4.05	435.07	174.93	0.32
LMC	Reach 1	3396	25-year	1420.00	83.41	90.38		90.45	0.000687	2.99	705.87	189.53	0.21
LMC	Reach 1	3396	100-year	2010.00	83.41	91.75		91.82	0.000494	2.87	974.22	201.79	0.18
LMC	Reach 1	3217	02-year	497.00	82.56	86.86		86.95	0.001506	3.10	272.63	165.68	0.28
LMC	Reach 1	3217	10-year	1070.00	82.56	88.78		88.84	0.000703	2.76	620.04	195.29	0.20
LMC	Reach 1	3217	25-year	1420.00	82.56	90.33		90.37	0.000345	2.27	937.37	210.26	0.15
LMC	Reach 1	3217	100-year	2010.00	82.56	91.71		91.76	0.000290	2.33	1233.20	219.10	0.14
LMC	Reach 1	3002	02-year	497.00	83.00	86.29		86.51	0.004513	4.81	149.17	106.32	0.47

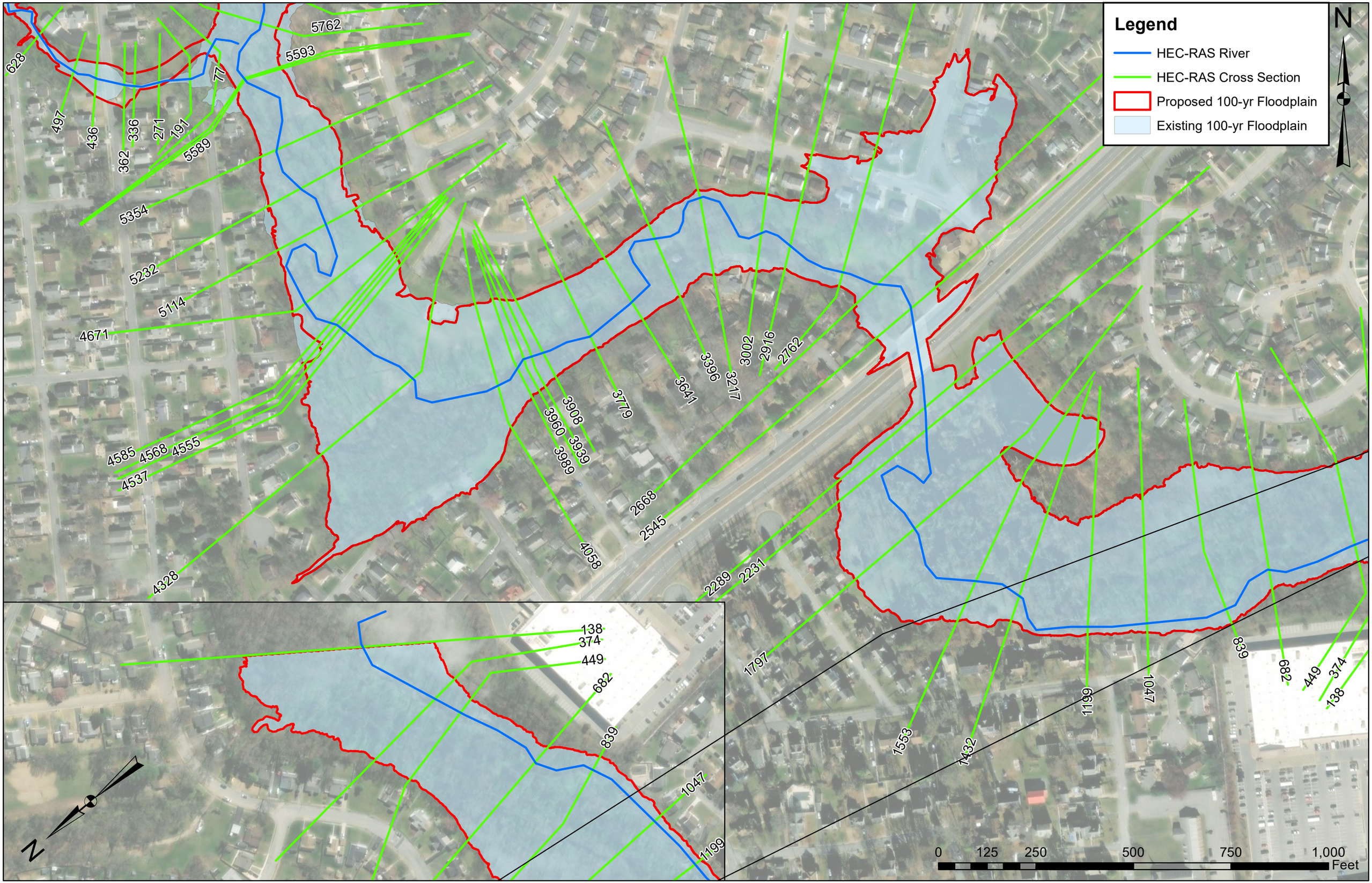
HEC-RAS Plan: Proposed Conditions (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LMC	Reach 1	3002	10-year	1070.00	83.00	88.62		88.70	0.000965	3.19	488.06	165.97	0.24
LMC	Reach 1	3002	25-year	1420.00	83.00	90.26		90.31	0.000408	2.47	777.02	185.93	0.16
LMC	Reach 1	3002	100-year	2010.00	83.00	91.65		91.71	0.000329	2.49	1045.10	198.92	0.15
LMC	Reach 1	2916	02-year	497.00	82.25	86.05		86.20	0.002757	4.06	181.27	89.50	0.38
LMC	Reach 1	2916	10-year	1070.00	82.25	88.55		88.63	0.000754	3.01	508.81	146.04	0.21
LMC	Reach 1	2916	25-year	1420.00	82.25	90.22		90.28	0.000373	2.48	760.91	157.80	0.16
LMC	Reach 1	2916	100-year	2010.00	82.25	91.61		91.68	0.000343	2.66	1002.03	217.53	0.15
LMC	Reach 1	2762	02-year	497.00	81.25	85.74		85.87	0.001734	3.68	190.30	89.33	0.31
LMC	Reach 1	2762	10-year	1070.00	81.25	88.47		88.53	0.000460	2.61	585.03	162.77	0.17
LMC	Reach 1	2762	25-year	1420.00	81.25	90.19		90.23	0.000213	2.05	941.56	243.48	0.12
LMC	Reach 1	2762	100-year	2010.00	81.25	91.60		91.63	0.000172	2.03	1386.44	373.19	0.11
LMC	Reach 1	2668	02-year	497.00	80.53	85.72		85.76	0.000509	2.20	347.02	131.70	0.17
LMC	Reach 1	2668	10-year	1070.00	80.53	88.46		88.49	0.000244	2.03	801.55	211.57	0.13
LMC	Reach 1	2668	25-year	1420.00	80.53	90.19		90.21	0.000122	1.64	1339.47	419.94	0.09
LMC	Reach 1	2668	100-year	2010.00	80.53	91.60		91.62	0.000078	1.43	1989.84	494.90	0.08
LMC	Reach 1	2545	02-year	497.00	79.44	85.62	81.92	85.68	0.000599	2.63	261.46	59.53	0.19
LMC	Reach 1	2545	10-year	1070.00	79.44	88.33	83.08	88.43	0.000572	3.31	462.58	101.03	0.20
LMC	Reach 1	2545	25-year	1420.00	79.44	90.09	83.66	90.17	0.000383	3.06	706.47	166.65	0.17
LMC	Reach 1	2545	100-year	2010.00	79.44	91.50	84.50	91.58	0.000351	3.19	972.29	206.34	0.16
LMC	Reach 1	2469		Bridge									
LMC	Reach 1	2289	02-year	497.00	80.96	85.20	83.51	85.37	0.002075	3.43	180.89	319.29	0.32
LMC	Reach 1	2289	10-year	1070.00	80.96	86.07	84.57	86.43	0.003690	5.30	278.39	425.47	0.45
LMC	Reach 1	2289	25-year	1420.00	80.96	86.43	85.08	86.90	0.004544	6.20	322.50	448.50	0.50
LMC	Reach 1	2289	100-year	2010.00	80.96	86.92	86.12	87.59	0.005862	7.52	385.86	481.48	0.58
LMC	Reach 1	2231	02-year	497.00	80.75	85.15	83.13	85.24	0.001345	2.69	258.39	426.43	0.26
LMC	Reach 1	2231	10-year	1070.00	80.75	85.99	84.45	86.18	0.002226	4.02	424.79	497.16	0.35
LMC	Reach 1	2231	25-year	1420.00	80.75	86.36	84.95	86.59	0.002634	4.61	504.80	516.77	0.38
LMC	Reach 1	2231	100-year	2010.00	80.75	86.87	85.57	87.17	0.003077	5.36	624.49	534.05	0.42
LMC	Reach 1	1797	02-year	497.00	80.06	84.39	82.81	84.54	0.002512	3.46	272.63	406.34	0.34
LMC	Reach 1	1797	10-year	1070.00	80.06	85.26	84.56	85.39	0.002252	3.86	649.98	613.31	0.34
LMC	Reach 1	1797	25-year	1420.00	80.06	85.66	84.85	85.78	0.002087	3.96	840.86	629.09	0.33
LMC	Reach 1	1797	100-year	2010.00	80.06	86.26	85.16	86.37	0.001868	4.08	1131.74	645.43	0.32
LMC	Reach 1	1553	02-year	497.00	80.14	83.89	82.48	83.99	0.001983	2.82	311.79	310.63	0.30
LMC	Reach 1	1553	10-year	1070.00	80.14	84.77	83.79	84.88	0.002037	3.44	608.33	459.77	0.32
LMC	Reach 1	1553	25-year	1420.00	80.14	85.18	84.05	85.30	0.002031	3.70	759.65	510.86	0.33
LMC	Reach 1	1553	100-year	2010.00	80.14	85.78	84.43	85.91	0.002004	4.03	992.33	535.10	0.33
LMC	Reach 1	1432	02-year	497.00	79.91	83.48	82.84	83.66	0.003640	3.84	236.70	239.00	0.41
LMC	Reach 1	1432	10-year	1070.00	79.91	84.32	83.69	84.53	0.003893	4.74	445.23	259.63	0.44
LMC	Reach 1	1432	25-year	1420.00	79.91	84.72	83.94	84.95	0.003970	5.13	550.14	398.54	0.45
LMC	Reach 1	1432	100-year	2010.00	79.91	85.29	84.31	85.56	0.004112	5.71	710.75	428.14	0.47
LMC	Reach 1	1199	02-year	497.00	78.94	82.68	81.45	82.88	0.003539	3.96	227.25	255.70	0.40
LMC	Reach 1	1199	10-year	1070.00	78.94	83.62	82.95	83.82	0.003306	4.59	476.78	281.15	0.41
LMC	Reach 1	1199	25-year	1420.00	78.94	84.03	83.20	84.24	0.003300	4.91	594.76	288.83	0.42
LMC	Reach 1	1199	100-year	2010.00	78.94	84.61	83.60	84.84	0.003379	5.40	766.63	331.79	0.43
LMC	Reach 1	1047	02-year	497.00	77.53	82.34		82.47	0.001991	3.28	288.60	284.48	0.31
LMC	Reach 1	1047	10-year	1070.00	77.53	83.27		83.41	0.002208	3.98	574.98	329.79	0.33
LMC	Reach 1	1047	25-year	1420.00	77.53	83.68		83.84	0.002242	4.26	713.79	337.74	0.34
LMC	Reach 1	1047	100-year	2010.00	77.53	84.26		84.43	0.002348	4.70	911.01	350.87	0.36
LMC	Reach 1	839	02-year	497.00	77.59	81.92		82.04	0.002513	3.23	299.29	321.60	0.34
LMC	Reach 1	839	10-year	1070.00	77.59	82.93		83.02	0.002040	3.37	662.77	386.87	0.31
LMC	Reach 1	839	25-year	1420.00	77.59	83.36		83.45	0.001942	3.54	836.39	411.11	0.31
LMC	Reach 1	839	100-year	2010.00	77.59	83.94		84.05	0.001877	3.82	1081.52	422.40	0.31
LMC	Reach 1	682	02-year	497.00	77.10	81.71		81.77	0.001143	2.25	358.76	262.75	0.23
LMC	Reach 1	682	10-year	1070.00	77.10	82.66		82.75	0.001469	2.88	629.41	301.18	0.27
LMC	Reach 1	682	25-year	1420.00	77.10	83.08		83.18	0.001648	3.18	755.53	309.38	0.29
LMC	Reach 1	682	100-year	2010.00	77.10	83.63		83.76	0.001844	3.61	929.97	316.30	0.31
LMC	Reach 1	449	02-year	497.00	76.92	81.11		81.29	0.004327	3.96	214.15	179.16	0.43
LMC	Reach 1	449	10-year	1070.00	76.92	81.83		82.12	0.006152	5.43	371.64	244.47	0.53
LMC	Reach 1	449	25-year	1420.00	76.92	82.13		82.47	0.006762	6.04	447.16	251.40	0.57
LMC	Reach 1	449	100-year	2010.00	76.92	82.57		82.98	0.007438	6.85	557.83	257.52	0.61
LMC	Reach 1	374	02-year	497.00	76.61	81.07	78.93	81.11	0.000927	2.00	323.66	229.82	0.20
LMC	Reach 1	374	10-year	1070.00	76.61	81.78	79.86	81.86	0.001330	2.76	506.63	283.28	0.25
LMC	Reach 1	374	25-year	1420.00	76.61	82.08	80.30	82.18	0.001480	3.06	591.58	291.61	0.27
LMC	Reach 1	374	100-year	2010.00	76.61	82.51	81.11	82.64	0.001671	3.49	717.01	317.43	0.29
LMC	Reach 1	138	02-year	497.00	77.16	80.58	80.27	80.68	0.003900	3.49	352.23	428.50	0.41
LMC	Reach 1	138	10-year	1070.00	77.16	81.20	80.64	81.30	0.003901	4.10	633.31	474.67	0.42
LMC	Reach 1	138	25-year	1420.00	77.16	81.48	80.80	81.58	0.003902	4.36	764.51	480.60	0.43

HEC-RAS Plan: Proposed Conditions (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LMC	Reach 1	138	100-year	2010.00	77.16	81.88	81.07	82.00	0.003904	4.72	962.01	539.65	0.44


N
8758
8653
8522
8353
8159
1769
1555
1406
1229
1071
964
936
910
825
801
679
602
513
234
833
628
497
191
77
7926
7966
7724
7544
7349
7291
7144
7066
6934
6794
6594
6472
6365
6199
6071
5862
5762
Legend
HEC-RAS River
HEC-RAS Cross Section
Proposed 100-yr Floodplain
Existing 100-yr Floodplain
0
125
250
500
750
1,000
Feet


Legend
HEC-RAS River
HEC-RAS Cross Section
Proposed 100-yr Floodplain
Existing 100-yr Floodplain
N
628
497
436
362
336
271
191
77
5589
5762
5593
5354
5232
5114
4671
4585
4568
4555
4537
4328
4555
3989
3939
3908
3960
3779
3641
3396
3217
3002
2916
2762
4058
2668
2545
2289
2231
1797
1553
1432
1199
1047
839
682
449
374
138
0
125
250
500
750
1,000
Feet

APPENDIX J
TMDL CREDIT CALCULATIONS

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Credit Summary

Protocol 1			Protocol 2			Protocol 3			Total (Protocols 1-3)		
TSS (lb/yr)	TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	TP (lb/yr)	TN (lb/yr)
231,048	59.7	163.7	-	-	643.4	15,866	83.5	1936.1	246,914	143.1	2743.2

F_{TN}	F_{TP}	F_{TSS}	EIA_f (acres)
18.08	2.23	8046	82.2

Equation 5. EIA_f Calculation for Alternative BMPs

$$EIA_f = \frac{\left(\frac{TN\ Load\ Red.}{1-F_{TN}}\right)+\left(\frac{TP\ Load\ Red.}{1-F_{TP}}\right)+\left(\frac{TSS\ Load\ Red.}{1-F_{TSS}}\right)}{3}$$

Where:

EIA_f = Equivalent impervious acre conversion factor
TN Load Red. = BMP load reduction for TN (lbs/unit/yr)
TP Load Red. = BMP load reduction for TP (lbs/unit/yr)
TSS Load Red. = BMP load reduction for TSS (lbs/unit/yr)
$I - F_{TN}$ = Aggregate impervious unit load minus true forest unit load for TN (lbs/acre/yr)
$I - F_{TP}$ = Aggregate impervious unit load minus true forest unit load for TP (lbs/acre/yr)
$I - F_{TSS}$ = Aggregate impervious unit load minus true forest unit load for TSS (lbs/acre/yr)

Alternative Protocol - Non-Riparian Forest Planting			Alternative Protocol - Riparian Forest Planting			Total (Alternative Protocols)
New Forest Planting Area (Ac)	EIA per Acre of Land	EIA Credits	New Forest Planting Area (Ac)	EIA per Acre of Land	EIA Credits	5.5
1.3	1.1	1.4	2.7	1.5	4.1	

Table 9. Load Reductions and EIA_f for Non-Riparian Land Cover Conversion BMPs

Non-Riparian Land Cover Conversion BMP	Load Reduced (lbs/acre/yr)			EIA_f per Acre of Land Cover Converted
	TN	TP	TSS	
Forest Planting	11.12	1.78	2,805	1.10

Table 11. Enhanced Load Reductions and EIA_f for Riparian Land Cover Conversion BMPs

Land Cover Conversion BMP	Total Load Reduced (lbs/acre/yr)			EIA_f per Acre of Land Cover Converted[1]
	TN	TP	TSS	
Riparian Forest Buffers	14.34	2.50	4,411	1.50

Total EIA_f (acres)
87.7

**Total EIA_f = 82.2 + 5.5

Little Mill Creek Erosion Summary Table - January 2022

Stability Assessment Reach	BEHI Rating (Value)		*Predicted Lateral Erosion Rate (ft/yr)	Study Bank Length (ft)	Study Bank Height (ft)	Predicted Erosion Volume (cf/yr)	**Predicted Erosion (tons/yr)
1-1 L	Very High (40.9)	Very High	0.40	70	3.84	107.52	3.77
1-1 R	High (36.5)	High	0.55	116	3.03	193.314	6.78
2-1 L	Moderate (21.6)	Moderate	0.09	150	3.99	53.87	1.89
2-1 R	High (30.6)	High	0.40	45	4.01	72.18	2.53
3-1 L	High (33.9)	High	0.55	81	5.08	226.31	7.94
3-1 R	High (30.0)	High	0.40	41	3.43	56.252	1.97
4-1 L	High (33.8)	High	0.40	53	3.6	76.32	2.68
4-1 R	High (37.0)	High	0.55	66	4.47	162.261	5.69
5-1 L	Moderate (27.7)	Moderate	0.13	47	5.06	29.7275	1.04
5-1 R	Moderate (26.7)	Moderate	0.13	54	3.85	25.9875	0.91
6-1 L	Moderate (23.3)	Moderate	0.30	156	4.59	214.812	7.53
6-1 R	High (34.5)	High	1.00	158	4.9	774.2	27.15
7-1 L	Low (11.2)	Low	0.02	157	1.96	6.1544	0.22
7-1 R	High (35.2)	High	0.40	38	4.41	67.032	2.35
8-1 L	High (30.2)	High	0.40	62	3.66	90.768	3.18
8-1 R	High (37.1)	High	0.40	24	4.39	42.144	1.48
9-1 L	Low (15.5)	Low	0.15	34	3.39	17.289	0.61
9-1 R	Low (16.6)	Low	0.15	41	3.98	24.477	0.86
10-1 L	Very High (42.3)	Very High	1.00	47	5.88	276.36	9.69
10-1 R	Moderate (24.5)	Moderate	0.30	50	4.64	69.6	2.44
11-1 L	Moderate (29.7)	Moderate	0.80	67	4.04	216.544	7.59
11-1 R	High (34.5)	High	1.00	35	3.7	129.5	4.54
UT 1-1 L	High (30.9)	High	1.00	25	2.62	65.5	2.30
UT 1-1 R	High (33.1)	High	1.00	65	3.06	198.9	6.97
UT 2-1 L	High (33.6)	High	0.40	34	3.6	48.96	1.72
UT 2-1 R	High (33.9)	High	0.40	42	2.9	48.72	1.71

Ave Bulk Density	70.13	lb/cf

0.02	N/A
0.09	N/A
0.125	Low
0.15	Low
0.3	moderate
0.4	moderate
0.55	High
0.8	very high
1	very high

****Predicted Erosion Total (tons/yr)**	**115.52**

Project:	Little Mill Creek	Calculated by:	NSR
Date:	3/1/2024	Checked by:	REP

Protocol 1

Step 1 - Estimate Stream Sediment Erosion Rate

	Bulk Density (lb/ft^3)	Estimated Erosion (tn/yr)*	Estimated Erosion (lb/yr)
Little Mill Creek	70.13	115.52	231,047.76
	Total	115.52	231,047.76

Step 2 - Convert Bank Erosion to Nutrient Loading

	Nitrogen (lb/yr) **	Phosphorus (lb/yr)**
Little Mill Creek	163.66	59.67

Step 3 - Estimate Stream Restoration Efficiency

Assume 100% efficiency

Protocol 1 Credits:	***TSS***	115.5	tn/yr
	TSS	231,047.8	lb/yr
	TP	59.7	lb/yr
	TN	163.7	lb/yr

Assume 50% efficiency

Protocol 1 Credits:	***TSS***	57.8	tn/yr
	TSS	115,523.9	lb/yr
	TP	29.8	lb/yr
	TN	81.8	lb/yr

Notes

1. * See Little Mill Creek Erosion Summary Worksheet for detail calculations

2. **Nitrogen and phosphorus reductions are based on site specific data.

3. ***Efficiency may be reduced by up to 50% after 3 years of post-construction monitoring by NCC.

Project:	Little Mill Creek	Calculated by:	NSR/NLB
Date:	4/2/2025	Checked by:	REP

Protocol 2

Proposed Conditions Nitrate Removal

Step 1 - Define the extent of the EHZ components

	EHZ Area (sqft)
LMC Channel Upstream	14624.8698
LMC Channel Downstream	40125.0929
Trib 1 Channel	4306.1569
Trib 2 Channel	1010.2
Floodplain	298555.04

Step 2 - Apply the denitrification rate to the EHZ

	EHZ Area (sqft)	Removal Rate (lb/sqft/yr)	TN Load Reduction (lb/yr)
Channel	60066	0.00269	161.58
Floodplain	298555	0.00269	803.11

Step 3 - Apply the Site Specific Discount Factors

	Baseflow Reduction Factor	Floodplain Height Factor	Aquifer Conductivity Reduction Factor	TN Load Reduction (lb/yr)
Channel	1.0	1.00	1.00	161.58
Floodplain	1.0	1.00	0.60	481.87

Step 4 - Calculate the Total Nitrate Removed

Proposed Protocol 2 Credits, Concept 3:	***TN***	643.4	lb/yr

Existing Conditions Nitrate Removal

Step 1 - Define the extent of the EHZ components

	EHZ Area (sqft)
Existing Channel	112546.83

Step 2 - Apply the denitrification rate to the EHZ

	EHZ Area (sqft)	Removal Rate (lb/sqft/yr)	TN Load Reduction (lb/yr)
Existing Channel	112547	0.00269	302.75

Step 3 - Apply the Site Specific Discount Factors

	Baseflow Reduction Factor	Floodplain Height Factor	Aquifer Conductivity Reduction Factor	TN Load Reduction (lb/yr)
Existing Channel	1.00	0.00	0.60	0.00

Step 4 - Calculate the Total Nitrate Removed

Existing Protocol 2 Credits:	***TN***	0.0	lb/yr

	Total Nitrate Removal Concept 3
Proposed Protocol 2 Credits	643.4
- Existing Protocol 2 Credits	0.0
Total Protocol 2 Credits	643.4

Restoration Pollutant Load Reductions

Protocol 3 Credit Calculation Summary

From
Consensus

		Existing LMC US+	Existing LMC DS+	Existing Trib 1+	Existing Trib 2+	Prop-LMC US	Prop-LMC DS	Prop-Trib 1	Prop-Trib 2	
Channel Capacity Discharge:		300	308	173	303	6.3	8.2	1.8	1.1	cfs
Baseflow Discharge:		1.7	2.7	0.7	0.1	1.7	2.7	0.7	0.1	cfs
Treatable Floodplain Flow Depth:	ft.*	0	0	0	0	324	437	173	120	cfs

+ computed from detailed 1D or 2D hydraulic modeling

* if greater than one foot, then floodplain velocity must be less than 2 fps.
Depth is capped at 3 ft. max or the 10-year storm discharge depth if less than 3 ft.

From flow duration curve analysis (attached):	Existing LMC DS+	Existing LMCUS+	Existing Trib 1+	Existing Trib 2+	Prop-LMC US	Prop-LMC DS	Prop-Trib 1	Prop-Trib 2	
Percent Flow Treated:	0%	0%	0%	0%	31%	37%	43%	40%	
Treatable Flow Credit:	0%	0%	0%	0%	31%	37%	43%	40%	(Prop. - Exst. % Flow Treated)

	Prop-LMC US	Prop-LMC DS	Prop-Trib 1	Prop-Trib 2	
Drainage Area	1228.8	185.6	492.8	96	acres
% Impervious	6.60%	39.4%	12.3%	34%	

*Loading Rates	**Impervious**	**Pervious**	
TN	12.4	8.7	lb/yr
TP	1.09	0.25	lb/yr
TSS	*0.18*	*0.021*	*tons/yr*

Nutrient Loading:

LMC US			*LMC DS*			*Trib 1*			*Trib 2*		
TN (lb/yr)	TP (lb/yr)	TSS (tons/yr)	TN (lb/yr)	TP (lb/yr)	TSS (tons/yr)	TN (lb/yr)	TP (lb/yr)	TSS (tons/yr)	TN (lb/yr)	TP (lb/yr)	TSS (tons/yr)
10990.6	375.3	38.7	1885.3	107.8	15.5	4511.6	174.1	20.0	957.0	51.7	7.3

Treatable Loads (Nutrient Loading x Treatable Flow Credit):

LMC US			*LMC DS*			*Trib 1*			*Trib 2*		
TN (lb/yr)	TP (lb/yr)	TSS (tons/yr)	TN (lb/yr)	TP (lb/yr)	TSS (tons/yr)	TN (lb/yr)	TP (lb/yr)	TSS (tons/yr)	TN (lb/yr)	TP (lb/yr)	TSS (tons/yr)
3408.8	116.4	12.0	706.9	40.4	5.8	1956.7	75.5	8.7	381.4	20.6	2.9

Efficiency Rates (from Table 14 of Stream Protocol Document): Restoration

TN	TP	TSS
30%	33%	27%

Nutrient Reduction Credit (Treatable Loads x Efficiency Rate):

LMC US			*LMC DS*			*Trib 1*			*Trib 2*		
TN (lb/yr)	**TP (lb/yr)**	**TSS (ton/yr)**	**TN (lb/yr)**	**TP (lb/yr)**	**TSS (ton/yr)**	**TN (lb/yr)**	**TP (lb/yr)**	**TSS (ton/yr)**	**TN (lb/yr)**	**TP (lb/yr)**	**TSS (ton/yr)**
1022.6	38.4	3.2	212.1	13.3	1.6	587.0	24.9	2.3	114.4	6.8	0.8

*Notes: *Rates from Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects - CBWM v. 5.3.2*

Sum		
TN (lb/yr)	**TP (lb/yr)**	**TSS (ton/yr)**
1936.1	83.5	7.9

Little Mill Creek Stream Restoration
Additional Forest Planting Credits

Legend

- Limit of Construction
- Existing Stream 100-ft Riparian Buffer
- Existing Forest Stand Boundary
- Proposed Forest Plantings (Within Existing 100-ft Stream Riparian Buffer)
- Proposed Forest Plantings (Outside Existing 100-ft Stream Riparian Buffer)
- Proposed Floodplain (Not Included in Additional Forest Plantings)
- Proposed Shared Use Path

0 50 100 200 300 400 Feet

N

Centre Road

Wagoner Road

Faulkland Road

APPENDIX K
OUTFALL PROTECTION COMPUTATIONS

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Channel Analysis: Outfall 1

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 1.2500 ft
Longitudinal Slope: 0.0041 ft/ft
Manning's n: 0.0120
Depth: 1.2500 ft

Result Parameters

Flow: 4.4810 cfs
Area of Flow: 1.2272 ft^2
Wetted Perimeter: 3.9270 ft
Hydraulic Radius: 0.3125 ft
Average Velocity: 3.6514 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 0.8582 ft
Critical Velocity: 4.9892 ft/s
Critical Slope: 0.0062 ft/ft
Critical Top Width: 1.16 ft
Calculated Max Shear Stress: 0.3198 lb/ft^2
Calculated Avg Shear Stress: 0.0800 lb/ft^2

Channel Analysis: Outfall 2

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 2.0000 ft

Result Parameters

Flow: 24.5076 cfs

Area of Flow: 3.1416 ft^2

Wetted Perimeter: 6.2832 ft

Hydraulic Radius: 0.5000 ft

Average Velocity: 7.8010 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.7490 ft

Critical Velocity: 8.4113 ft/s

Critical Slope: 0.0091 ft/ft

Critical Top Width: 1.33 ft

Calculated Max Shear Stress: 1.2480 lb/ft^2

Calculated Avg Shear Stress: 0.3120 lb/ft^2

Channel Analysis: Outfall 3

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0240

Depth: 1.5000 ft

Result Parameters

Flow: 5.6898 cfs

Area of Flow: 1.7671 ft^2

Wetted Perimeter: 4.7124 ft

Hydraulic Radius: 0.3750 ft

Average Velocity: 3.2198 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 0.9199 ft

Critical Velocity: 5.0075 ft/s

Critical Slope: 0.0207 ft/ft

Critical Top Width: 1.46 ft

Calculated Max Shear Stress: 0.9360 lb/ft^2

Calculated Avg Shear Stress: 0.2340 lb/ft^2

Channel Analysis: Outfall 4

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 1.5000 ft

Result Parameters

Flow: 11.3797 cfs

Area of Flow: 1.7671 ft^2

Wetted Perimeter: 4.7124 ft

Hydraulic Radius: 0.3750 ft

Average Velocity: 6.4396 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.2876 ft

Critical Velocity: 7.0495 ft/s

Critical Slope: 0.0093 ft/ft

Critical Top Width: 1.05 ft

Calculated Max Shear Stress: 0.9360 lb/ft^2

Calculated Avg Shear Stress: 0.2340 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title: Outfall 5
Designer:
Project Date: Monday, October 14, 2024
Project Units: U.S. Customary Units
Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter 1.50 ft
Longitudinal Slope: 0.0132 ft/ft
Manning's n: 0.0130
Depth 1.5000 ft

Result Parameters

Flow 12.0686 cfs
Area of Flow 1.7671 ft^2
Wetted Perimeter 4.7124 ft
Hydraulic Radius 0.3750 ft
Average Velocity 6.8294 ft/s
Top Width 0.0000 ft
Froude Number: 0.0000
Critical Depth 1.3169 ft
Critical Velocity 7.3410 ft/s
Critical Slope: 0.0119 ft/ft
Critical Top Width 0.98 ft
Calculated Max Shear Stress 1.2355 lb/ft^2
Calculated Avg Shear Stress 0.3089 lb/ft^2

Channel Analysis: Outfall 6

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 2.0000 ft
Longitudinal Slope: 0.0100 ft/ft
Manning's n: 0.0120
Depth: 2.0000 ft

Result Parameters

Flow: 24.5076 cfs
Area of Flow: 3.1416 ft^2
Wetted Perimeter: 6.2832 ft
Hydraulic Radius: 0.5000 ft
Average Velocity: 7.8010 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 1.7490 ft
Critical Velocity: 8.4113 ft/s
Critical Slope: 0.0091 ft/ft
Critical Top Width: 1.33 ft
Calculated Max Shear Stress: 1.2480 lb/ft^2
Calculated Avg Shear Stress: 0.3120 lb/ft^2

Channel Analysis: Outfall 7

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 3.5000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 3.5000 ft

Result Parameters

Flow: 108.9939 cfs

Area of Flow: 9.6211 ft^2

Wetted Perimeter: 10.9956 ft

Hydraulic Radius: 0.8750 ft

Average Velocity: 11.3286 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 3.1616 ft

Critical Velocity: 11.9189 ft/s

Critical Slope: 0.0088 ft/ft

Critical Top Width: 2.07 ft

Calculated Max Shear Stress: 2.1840 lb/ft^2

Calculated Avg Shear Stress: 0.5460 lb/ft^2

Channel Analysis: Outfall 8

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.0000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 1.0000 ft

Result Parameters

Flow: 3.8597 cfs

Area of Flow: 0.7854 ft^2

Wetted Perimeter: 3.1416 ft

Hydraulic Radius: 0.2500 ft

Average Velocity: 4.9143 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 0.8350 ft

Critical Velocity: 5.5094 ft/s

Critical Slope: 0.0097 ft/ft

Critical Top Width: 0.74 ft

Calculated Max Shear Stress: 0.6240 lb/ft^2

Calculated Avg Shear Stress: 0.1560 lb/ft^2

Channel Analysis: Outfall 9

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 1.5000 ft

Result Parameters

Flow: 11.3797 cfs

Area of Flow: 1.7671 ft^2

Wetted Perimeter: 4.7124 ft

Hydraulic Radius: 0.3750 ft

Average Velocity: 6.4396 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.2876 ft

Critical Velocity: 7.0495 ft/s

Critical Slope: 0.0093 ft/ft

Critical Top Width: 1.05 ft

Calculated Max Shear Stress: 0.9360 lb/ft^2

Calculated Avg Shear Stress: 0.2340 lb/ft^2

Channel Analysis: Outfall 10

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 1.5000 ft

Result Parameters

Flow: 11.3797 cfs

Area of Flow: 1.7671 ft^2

Wetted Perimeter: 4.7124 ft

Hydraulic Radius: 0.3750 ft

Average Velocity: 6.4396 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.2876 ft

Critical Velocity: 7.0495 ft/s

Critical Slope: 0.0093 ft/ft

Critical Top Width: 1.05 ft

Calculated Max Shear Stress: 0.9360 lb/ft^2

Calculated Avg Shear Stress: 0.2340 lb/ft^2

Channel Analysis: Outfall 11

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 2.0000 ft
Longitudinal Slope: 0.0100 ft/ft
Manning's n: 0.0240
Depth: 2.0000 ft

Result Parameters

Flow: 12.2538 cfs
Area of Flow: 3.1416 ft^2
Wetted Perimeter: 6.2832 ft
Hydraulic Radius: 0.5000 ft
Average Velocity: 3.9005 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 1.2578 ft
Critical Velocity: 5.8894 ft/s
Critical Slope: 0.0192 ft/ft
Critical Top Width: 1.93 ft
Calculated Max Shear Stress: 1.2480 lb/ft^2
Calculated Avg Shear Stress: 0.3120 lb/ft^2

Channel Analysis: Outfall 12

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 2.5000 ft

Result Parameters

Flow: 44.4352 cfs

Area of Flow: 4.9087 ft^2

Wetted Perimeter: 7.8540 ft

Hydraulic Radius: 0.6250 ft

Average Velocity: 9.0523 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 2.2156 ft

Critical Velocity: 9.6596 ft/s

Critical Slope: 0.0089 ft/ft

Critical Top Width: 1.59 ft

Calculated Max Shear Stress: 1.5600 lb/ft^2

Calculated Avg Shear Stress: 0.3900 lb/ft^2

Channel Analysis: Outfall 13

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 1.5000 ft

Result Parameters

Flow: 11.3797 cfs

Area of Flow: 1.7671 ft^2

Wetted Perimeter: 4.7124 ft

Hydraulic Radius: 0.3750 ft

Average Velocity: 6.4396 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.2876 ft

Critical Velocity: 7.0495 ft/s

Critical Slope: 0.0093 ft/ft

Critical Top Width: 1.05 ft

Calculated Max Shear Stress: 0.9360 lb/ft^2

Calculated Avg Shear Stress: 0.2340 lb/ft^2

Channel Analysis: Outfall 14

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.0000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 1.0000 ft

Result Parameters

Flow: 3.8597 cfs

Area of Flow: 0.7854 ft^2

Wetted Perimeter: 3.1416 ft

Hydraulic Radius: 0.2500 ft

Average Velocity: 4.9143 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 0.8350 ft

Critical Velocity: 5.5094 ft/s

Critical Slope: 0.0097 ft/ft

Critical Top Width: 0.74 ft

Calculated Max Shear Stress: 0.6240 lb/ft^2

Calculated Avg Shear Stress: 0.1560 lb/ft^2

Channel Analysis: Outfall 15

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.2500 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0120

Depth: 1.2500 ft

Result Parameters

Flow: 6.9981 cfs

Area of Flow: 1.2272 ft^2

Wetted Perimeter: 3.9270 ft

Hydraulic Radius: 0.3125 ft

Average Velocity: 5.7026 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.0596 ft

Critical Velocity: 6.3095 ft/s

Critical Slope: 0.0095 ft/ft

Critical Top Width: 0.90 ft

Calculated Max Shear Stress: 0.7800 lb/ft^2

Calculated Avg Shear Stress: 0.1950 lb/ft^2

Channel Analysis: Outfall 16

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 1.2500 ft
Longitudinal Slope: 0.0100 ft/ft
Manning's n: 0.0120
Depth: 1.2500 ft

Result Parameters

Flow: 6.9981 cfs
Area of Flow: 1.2272 ft^2
Wetted Perimeter: 3.9270 ft
Hydraulic Radius: 0.3125 ft
Average Velocity: 5.7026 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 1.0596 ft
Critical Velocity: 6.3095 ft/s
Critical Slope: 0.0095 ft/ft
Critical Top Width: 0.90 ft
Calculated Max Shear Stress: 0.7800 lb/ft^2
Calculated Avg Shear Stress: 0.1950 lb/ft^2

Outfall 1 Riprap Apron

Input data	
Output data	

Pipe Size	15	inches
Q10	4.5	cfs
Tailwater Computed		feet
Tailwater Assumed	0.5	feet
d50	0.22	feet
Apron Length	6.25	feet

Riprap apron stone sizing:

$d_{50} = 0.02 / Tw * (Q / PD)^{1.33}$

d_{50} – Median riprap size (ft)

Tw – Tailwater depth above the invert of the culvert (ft). (If Tw is unknown or < 0.4 * PD, then use 0.4 * PD.)

Q – Calculated design storm flow in pipe (cfs)

PD – Pipe diameter (ft) (Note: if elliptical pipe, use the pipe width measurement)

Riprap apron depth: (This is the same as Table 2.)

d_{50}	Minimum Design Depth
6" (R-4)	18" (1.5')
9" (R-5)	24" (2')
12" (R-6)	30" (2.5')
18" (R-7)	42" (3.5')

Table 3. Riprap apron length:

d_{50}	Apron Lengton (ft)*
6" (R-4)	4 * PD
9" (R-5)	5 * PD
12" (R-6)	6 * PD
18" (R-7)	7 * PD

Outfall 2 Riprap Apron

Input data
Output data

Pipe Size	24	inches
Q10	24.5	cfs
Tailwater Computed		feet
Tailwater Assumed	0.8	feet
d50	0.70	feet
Apron Length	10	feet

Riprap apron stone sizing:

$d_{50} = 0.02 / Tw * (Q / PD)^{1.33}$

d_{50} – Median riprap size (ft)

Tw – Tailwater depth above the invert of the culvert (ft). (If Tw is unknown or < 0.4 * PD, then use 0.4 * PD.)

Q – Calculated design storm flow in pipe (cfs)

PD – Pipe diameter (ft) (Note: if elliptical pipe, use the pipe width measurement)

Riprap apron depth: (This is the same as Table 2.)

d_{50}	Minimum Design Depth
6" (R-4)	18" (1.5')
9" (R-5)	24" (2')
12" (R-6)	30" (2.5')
18" (R-7)	42" (3.5')

Table 3. Riprap apron length:

d_{50}	Apron Lengton (ft)*
6" (R-4)	4 * PD
9" (R-5)	5 * PD
12" (R-6)	6 * PD
18" (R-7)	7 * PD

Outfall 3 Riprap Apron

Input data	
Output data	

Pipe Size	18	inches
Q10	5.7	cfs
Tailwater Computed		feet
Tailwater Assumed	0.6	feet
d50	0.20	feet
Apron Length	7.5	feet

Riprap apron stone sizing:

$d_{50} = 0.02 / Tw * (Q / PD)^{1.33}$

d_{50} – Median riprap size (ft)

Tw – Tailwater depth above the invert of the culvert (ft). (If Tw is unknown or < 0.4 * PD, then use 0.4 * PD.)

Q – Calculated design storm flow in pipe (cfs)

PD – Pipe diameter (ft) (Note: if elliptical pipe, use the pipe width measurement)

Riprap apron depth: (This is the same as Table 2.)

d_{50}	Minimum Design Depth
6" (R-4)	18" (1.5')
9" (R-5)	24" (2')
12" (R-6)	30" (2.5')
18" (R-7)	42" (3.5')

Table 3. Riprap apron length:

d_{50}	Apron Lengton (ft)*
6" (R-4)	4 * PD
9" (R-5)	5 * PD
12" (R-6)	6 * PD
18" (R-7)	7 * PD

Outfall 4 Riprap Apron

Input data	
Output data	

Pipe Size	18	inches
Q10	11.4	cfs
Tailwater Computed		feet
Tailwater Assumed	0.6	feet
d50	0.49	feet
Apron Length	7.5	feet

Riprap apron stone sizing:

$d_{50} = 0.02 / Tw * (Q / PD)^{1.33}$

d_{50} – Median riprap size (ft)

Tw – Tailwater depth above the invert of the culvert (ft). (If Tw is unknown or < 0.4 * PD, then use 0.4 * PD.)

Q – Calculated design storm flow in pipe (cfs)

PD – Pipe diameter (ft) (Note: if elliptical pipe, use the pipe width measurement)

Riprap apron depth: (This is the same as Table 2.)

d_{50}	Minimum Design Depth
6" (R-4)	18" (1.5')
9" (R-5)	24" (2')
12" (R-6)	30" (2.5')
18" (R-7)	42" (3.5')

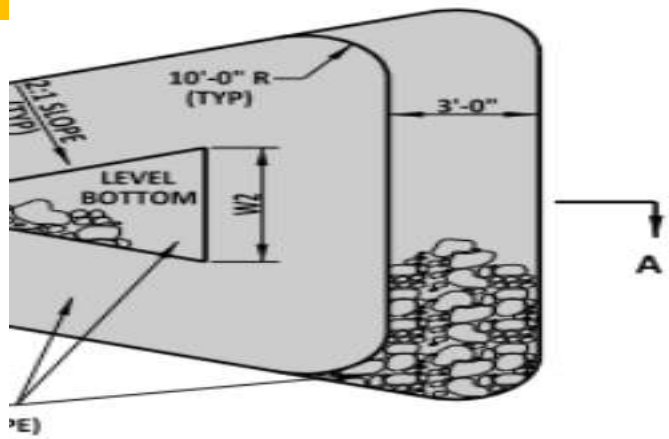
Table 3. Riprap apron length:

d_{50}	Apron Lengton (ft)*
6" (R-4)	4 * PD
9" (R-5)	5 * PD
12" (R-6)	6 * PD
18" (R-7)	7 * PD

Outfall 5 Plunge Pool

Input data
Output data

Pipe Size	18	inches
Q10	12.1	cfs
Tailwater Computed		feet
Tailwater Assumed	0.6	feet
D (pool depth)	1.5	feet
W1	1.5	feet
W2	3	feet
L	4.5	feet
d50	0.2	feet
d50	3	inches



VIEW

20, Riprap Energy Dissipator)

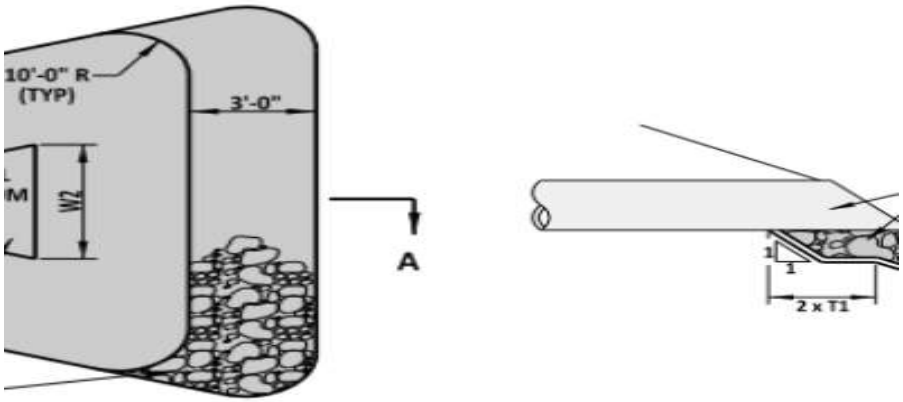
e the folowing:	
	L = 3 * PD
	L = 3.5 * PD

imum design depth chart.

$_{50}$ = ((0.0082*PD^2)/Tw) * (Q/PD$^{2.5}$)$^{4/3}$

* (Q/PD$^{2.5}$)$^{4/3}$

< 0.4 * PD, then use 0.4 * PD.



Energy Dis

wing:

PD

* PD

sign depth

82*PD²)/Tv

.5)4/3

), then use (

Table 1. Riprap Sizing Gradation Table

NSSGA* Rock Size	R-7	R-6	R-5	R-4
30"	100	---	---	---
24"	---	100	---	---
18"	15-50	---	100	---
12"	---	15-50	---	100
9"	0-15	---	15-50	---
6"	---	0-15	---	15-50
4"	---	---	0-15	---
3"	---	---	---	0-15

* National Stone, Sand, and Gravel Association

Table 2. Riprap Min. Design Depth

Riprap Size	Minimum Design Depth
R-4	18" (1.5')
R-5	24" (2')
R-6	30" (2.5')
R-7	42" (3.5')

Outfall 10 Riprap Apron

Input data
Output data

Pipe Size	18	inches
Q10	11.4	cfs
Tailwater Computed		feet
Tailwater Assumed	0.6	feet
d50	0.49	feet
Apron Length	7.5	feet

Riprap apron stone sizing:

$$d_{50} = 0.02 / Tw * (Q / PD)^{1.33}$$

d_{50} – Median riprap size (ft)

Tw – Tailwater depth above the invert of the culvert (ft). (If Tw is unknown or < 0.4 * PD, then use 0.4 * PD.)

Q – Calculated design storm flow in pipe (cfs)

PD – Pipe diameter (ft) (Note: if elliptical pipe, use the pipe width measurement)

Riprap apron depth: (This is the same as Table 2.)

d_{50}	Minimum Design Depth
6" (R-4)	18" (1.5')
9" (R-5)	24" (2')
12" (R-6)	30" (2.5')
18" (R-7)	42" (3.5')

Table 3. Riprap apron length:

d_{50}	Apron Lengton (ft)*
6" (R-4)	4 * PD
9" (R-5)	5 * PD
12" (R-6)	6 * PD
18" (R-7)	7 * PD

Outfall 13 Riprap

Input data	
Output data	

Pipe Size	18	inches
Q10	11.4	cfs
Tailwater Computed		feet
Tailwater Assumed	0.6	feet
d50	0.49	feet
Apron Length	7.5	feet

Riprap apron stone sizing:

$$d_{50} = 0.02 / Tw * (Q / PD)^{1.33}$$

d_{50} – Median riprap size (ft)

Tw – Tailwater depth above the invert of the culvert (ft). (If Tw is unknown or < 0.4 * PD, then use 0.4 * PD.)

Q – Calculated design storm flow in pipe (cfs)

PD – Pipe diameter (ft) (Note: if elliptical pipe, use the pipe width measurement)

Riprap apron depth: (This is the same as Table 2.)

d_{50}	Minimum Design Depth
6" (R-4)	18" (1.5')
9" (R-5)	24" (2')
12" (R-6)	30" (2.5')
18" (R-7)	42" (3.5')

Table 3. Riprap apron length:

d_{50}	Apron Lengton (ft)*
6" (R-4)	4 * PD
9" (R-5)	5 * PD
12" (R-6)	6 * PD
18" (R-7)	7 * PD

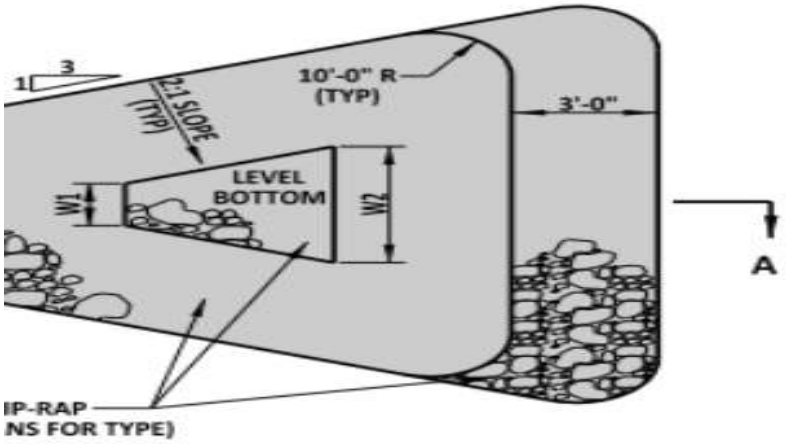
Outfall 14 Plunge Pool

Input data
Output data

Pipe Size	12	inches	circular eq. one cell
Q10	3.9	cfs	3.9
Tailwater Computed		feet	1.28666667
Tailwater Assumed	0.4	feet	95.43
D (pool depth)	1	feet	94.43
W1	1	feet	
W2	2	feet	
L	3	feet	
d50	0.1	feet	
d50	1	inches	

One Box Cell

W (ft)	H (ft)	A	D (ft)	D (in)
10.17	4.58	46.5786	7.70	92.4
			8	96.0



PLAN VIEW

Detail E-20, Riprap Energy Dissipator)

pipe, use the folowing:	
= 2 * PD	L = 3 * PD
ng:	
= 2 * PD	L = 3.5 * PD

and minimum design depth chart.

wing: $d_{50} = ((0.0082*PD^2)/Tw) * (Q/PD^{2.5})^{4/3}$

$PD^2)/Tw) * (Q/PD^{2.5})^{4/3}$

nown or < 0.4 * PD, then use 0.4 * PD.

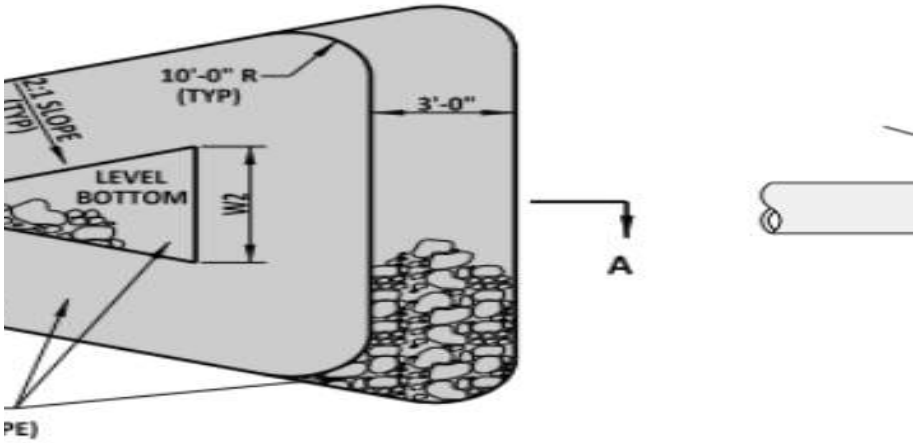


Table 1. Riprap Sizing Gradation Table

NSSGA* Rock Size	R-7	R-6	R-5	R-4
30"	100	---	---	---
24"	---	100	---	---
18"	15-50	---	100	---
12"	---	15-50	---	100
9"	0-15	---	15-50	---
6"	---	0-15	---	15-50
4"	---	---	0-15	---
3"	---	---	---	0-15

* National Stone, Sand, and Gravel Association

Table 2. Riprap Min. Design Depth

Riprap Size	Minimum Design Depth
R-4	18" (1.5')
R-5	24" (2')
R-6	30" (2.5')
R-7	42" (3.5')

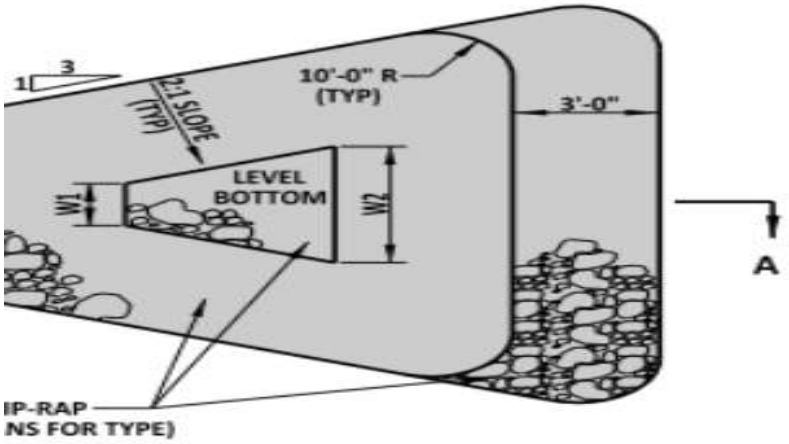
Outfall 15 Plunge Pool

Input data
Output data

Pipe Size	15	inches	circular eq. one cell
Q10	7.0	cfs	7.0
Tailwater Computed		feet	2.33266667
Tailwater Assumed	0.5	feet	92.27
D (pool depth)	1.25	feet	91.02
W1	1.25	feet	
W2	2.5	feet	
L	3.75	feet	
d50	0.2	feet	
d50	2	inches	

One Box Cell

W (ft)	H (ft)	A	D (ft)	D (in)
10.17	4.58	46.5786	7.70	92.4
			8	96.0



PLAN VIEW

Detail E-20, Riprap Energy Dissipator)

pipe, use the folowing:	
= 2 * PD	L = 3 * PD
ng:	
= 2 * PD	L = 3.5 * PD

and minimum design depth chart.

wing: $d_{50} = ((0.0082*PD^2)/Tw) * (Q/PD^{2.5})^{4/3}$

$PD^2)/Tw) * (Q/PD^{2.5})^{4/3}$

nown or < 0.4 * PD, then use 0.4 * PD.

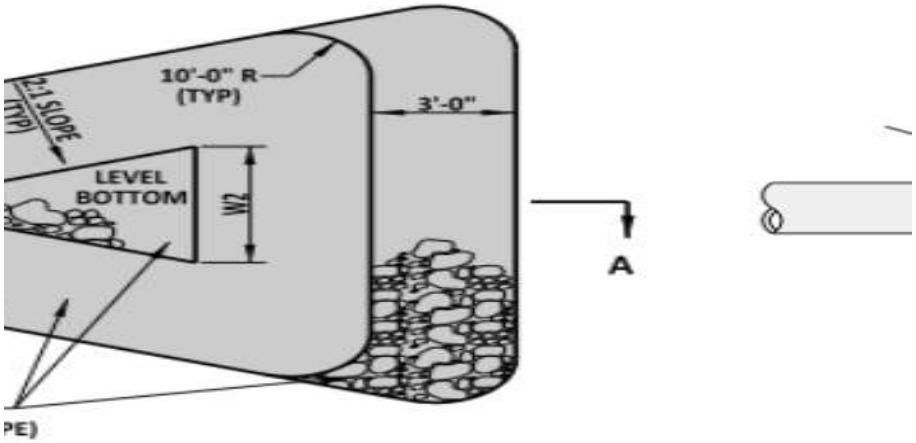


Table 1. Riprap Sizing Gradation Table

NSSGA* Rock Size	R-7	R-6	R-5	R-4
30"	100	---	---	---
24"	---	100	---	---
18"	15-50	---	100	---
12"	---	15-50	---	100
9"	0-15	---	15-50	---
6"	---	0-15	---	15-50
4"	---	---	0-15	---
3"	---	---	---	0-15

* National Stone, Sand, and Gravel Association

Table 2. Riprap Min. Design Depth

Riprap Size	Minimum Design Depth
R-4	18" (1.5')
R-5	24" (2')
R-6	30" (2.5')
R-7	42" (3.5')

Outfall 16 Riprap Apron

Input data	
Output data	

Pipe Size	15	inches
Q10	7.0	cfs
Tailwater Computed		feet
Tailwater Assumed	0.5	feet
d50	0.40	feet
Apron Length	6.25	feet

Riprap apron stone sizing:

$$d_{50} = 0.02 / Tw * (Q / PD)^{1.33}$$

d_{50} – Median riprap size (ft)

Tw – Tailwater depth above the invert of the culvert (ft). (If Tw is unknown or < 0.4 * PD, then use 0.4 * PD.)

Q – Calculated design storm flow in pipe (cfs)

PD – Pipe diameter (ft) (Note: if elliptical pipe, use the pipe width measurement)

Riprap apron depth: (This is the same as Table 2.)

d_{50}	Minimum Design Depth
6" (R-4)	18" (1.5')
9" (R-5)	24" (2')
12" (R-6)	30" (2.5')
18" (R-7)	42" (3.5')

Table 3. Riprap apron length:

d_{50}	Apron Lengton (ft)*
6" (R-4)	4 * PD
9" (R-5)	5 * PD
12" (R-6)	6 * PD
18" (R-7)	7 * PD

ATTACHMENT F

Adjacent Property Owner Information

Property Owner Information

PARCELNO	PROPERTY ADDRESS	PROPERTY CITY	PROPERTY STATE	PROPERTY ZIP	OWNER	OWNER ADDRESS	OWNER ADDRESS 2	OWNER CITY	OWNER STATE	OWNER ZIP
0703420345	102 ROTHWELL RD	WILMINGTON	DE	19805-	LENDERMAN SARAH B	102 ROTHWELL ROAD		WILMINGTON	DE	19805
0703420346	2135 FAULKLAND RD	WILMINGTON	DE	19805-	MCELRONE ALYSE N	2135 FAULKLAND ROAD		WILMINGTON	DE	19808
0703420380	2117 FAULKLAND RD	WILMINGTON	DE	19805-	BUYCKS DEANO M & CHADEIA R	2117 FAULKLAND ROAD		WILMINGTON	DE	19805
0703420381	2115 FAULKLAND RD	WILMINGTON	DE	19805-	GANAKIS THEODORE M & LINDA J	2115 FAULKLAND RD	WOODLAND PARK	WILMINGTON	DE	19805
0703420455	2113 FAULKLAND RD	WILMINGTON	DE	19805-	TALIAFERRO BEVERLY C	2113 FAULKLAND RD		WILMINGTON	DE	19805
0703420456	2111 FAULKLAND RD	WILMINGTON	DE	19805-	CORRIGAN JAMES T & PAMELA K	2111 FAULKLAND RD		WILMINGTON	DE	19805
0703420457	2109 FAULKLAND RD	WILMINGTON	DE	19805-	RAINEY ROBERT G & WF	2109 FAULKLAND RD		WILMINGTON	DE	19805
0703420458	2107 FAULKLAND RD	WILMINGTON	DE	19805-	CARLSON LINDA JEAN TRUSTEE	2107 FAULKLAND RD		WILMINGTON	DE	19805
0703420471	710 HILLSIDE AVE	WILMINGTON	DE	19805-	GLYNN DEBORAH K	710 HILLSIDE AV		WILMINGTON	DE	19805
0703420472	714 HILLSIDE AVE	WILMINGTON	DE	19805-	STATE OF DELAWARE	DIV OF HISTORICAL & CULTURAL AFFAIRS	21 THE GREEN	DOVER	DE	19901
0703420473	2118 FAULKLAND RD	WILMINGTON	DE	19805-	LIZAMA EVER V R	2118 FAULKLAND RD		WILMINGTON	DE	19805
0703420474	2114 FAULKLAND RD	WILMINGTON	DE	19805-	ZINK LOIS M	2114 FAULKLAND ROAD		WILMINGTON	DE	19805
0703420475	2108 FAULKLAND RD	WILMINGTON	DE	19805-	PARIKH NIRAL	2108 FAULKLAND RD		WILMINGTON	DE	19805
0703420476	2116 FAULKLAND RD	WILMINGTON	DE	19805-	SMITH CARLTON C JR	2116 FAULKLAND RD		WILMINGTON	DE	19805
0703440336	615 ARMSTRONG AVE	WILMINGTON	DE	19805-	HAWKE DEBORAH E	615 ARMSTRONG AV		WILMINGTON	DE	19805
0703440469	624 ARMSTRONG AVE	WILMINGTON	DE	19805-	GOTT RICHARD M & JOANNE L	C/O FRANK & REGINA GENTRY	2414 TAPLEY LA	WILMINGTON	DE	19808
0703440470	620 ARMSTRONG AVE	WILMINGTON	DE	19805-	HAMILL JAMES L & MICHELLE L	620 ARMSTRONG AVE	BROOKLAND TERRACE	WILMINGTON	DE	19805
0703440471	618 ARMSTRONG AVE	WILMINGTON	DE	19805-	WALKER MARIE J	618 ARMSTRONG AVE	BROOKLAND TERR	WILMINGTON	DE	19805
0703440472	616 ARMSTRONG AVE	WILMINGTON	DE	19805-	SWEENEY BRIAN H	616 ARMSTRONG AVENUE		WILMINGTON	DE	19805
0703440473	614 ARMSTRONG AVE	WILMINGTON	DE	19805-	WOODROW ALBERT RALPH & LINDA LEE	2100 WALMSLEY DR		WILMINGTON	DE	19808
0703440474	612 ARMSTRONG AVE	WILMINGTON	DE	19805-	MURRAY BARBARA A & MASISHIN JEFFREY	612 ARMSTRONG AV		WILMINGTON	DE	19805
0703440475	610 ARMSTRONG AVE	WILMINGTON	DE	19805-	UNKNOWN					
0703440476	606 ARMSTRONG AVE	WILMINGTON	DE	19805-	GLENN LESLIE A	606 ARMSTRONG AVE		WILMINGTON	DE	19805
0703440477	602 ARMSTRONG AVE	WILMINGTON	DE	19805-	BLANSFIELD EILEEN	602 ARMSTRONG AVE		WILMINGTON	DE	19805
0703440478	601 HILLSIDE AVE	WILMINGTON	DE	19805-	MUCHA JOHN H & KIRSTEN L	601 HILLSIDE AVE		WILMINGTON	DE	19805
0703440479	605 HILLSIDE AVE	WILMINGTON	DE	19805-	BURTON MICHAEL STEPHEN II	605 HILLSIDE AVE		WILMINGTON	DE	19805
0703440480	615 HILLSIDE AVE	WILMINGTON	DE	19805-	IRELAN NANCY C	615 HILLSIDE AV		WILMINGTON	DE	19805
0703440481	613 HILLSIDE AVE	WILMINGTON	DE	19805-	CRESCI KENNETH J	127 BROMLEY DRIVE		WILMINGTON	DE	19808
0703440482	706 HILLSIDE AVE	WILMINGTON	DE	19805-	DAUPHIN PAUL & KATHLEEN E	706 HILLSIDE AV		WILMINGTON	DE	19805
0703440483	700 HILLSIDE AVE	WILMINGTON	DE	19805-	DAUPHIN DONNA A	700 HILLSIDE AV		WILMINGTON	DE	19805
0703440484	616 HILLSIDE AVE	WILMINGTON	DE	19805-	COLLER DELBERT F III	954 NEW LONDON RD		NEWARK	DE	19711
0703440485	612 HILLSIDE AVE	WILMINGTON	DE	19805-	SWAIN MARVIN T & BETTY A	144 WILLAMETTE DR		BEAR	DE	19701
0703440486	606 HILLSIDE AVE	WILMINGTON	DE	19805-	KUSHNER LEA N	606 HILLSIDE AV		WILMINGTON	DE	19805
0703440487	602 HILLSIDE AVE	WILMINGTON	DE	19805-	FOSTER SUSAN M	602 HILLSIDE AVE		WILMINGTON	DE	19805
0703440488	512 HILLSIDE AVE	WILMINGTON	DE	19805-	EDMISTEN MARK L	512 HILLSIDE AVE		WILMINGTON	DE	19805
0703440489	508 HILLSIDE AVE	WILMINGTON	DE	19805-	SCHWARZ STEPHANIE K & REITMANN CODY M	508 HILLSIDE AVENUE		WILMINGTON	DE	19805
0703440490	506 HILLSIDE AVE	WILMINGTON	DE	19805-	ROBINSON SUSAN	506 HILLSIDE AVE	BROOKLAND TERRACE	WILMINGTON	DE	19808
0703440491	504 HILLSIDE AVE	WILMINGTON	DE	19805-	STEVENSON KIMBERLY T	504 HILLSIDE AVENUE		WILMINGTON	DE	19805
0703440492	500 HILLSIDE AVE	WILMINGTON	DE	19805-	BOHN HERMAN W & WF	500 HILLSIDE AVE		WILMINGTON	DE	19805
0703440493	410 HILLSIDE AVE	WILMINGTON	DE	19805-	MORA-BENAVIDES ALEXANDER D &	NEGREIROS-ARREDONDO DIANA M	410 HILLSIDE AVE	WILMINGTON	DE	19805
0703440494	406 HILLSIDE AVE	WILMINGTON	DE	19805-	LEGO KATHRYN M & TAPIMENE-SONKOUE FRANCINE	406 HILLSIDE AVENUE		WILMINGTON	DE	19805
0703440495	406 A HILLSIDE AVE	WILMINGTON	DE	19805-	MELLEN WILLIAM M	406 A HILLSIDE AV		WILMINGTON	DE	19805
0703440496	404 HILLSIDE AVE	WILMINGTON	DE	19805-	FANNIN ERICA J	404 HILLSIDE AV		WILMINGTON	DE	19805
0703440497	402 HILLSIDE AVE	WILMINGTON	DE	19805-	JONES EDWARD GOODEN & ELAINE M	0402 HILLSIDE AVE		WILMINGTON	DE	19805
0703440498	1046 WAGONER DR	WILMINGTON	DE	19805-	RHOADES JAMES E & WF	1542 CHOPTANK RD		MIDDLETOWN	DE	19709
0703440499	1048 WAGONER DR	WILMINGTON	DE	19805-	OBRION PATRICK L & EDITH M	1048 WAGONER DR		WILMINGTON	DE	19805
0703440500	1050 WAGONER DR	WILMINGTON	DE	19805-	WITTMEYER JAIME C	1050 WAGONER DR		WILMINGTON	DE	19805
0703440501	1052 WAGONER DR	WILMINGTON	DE	19805-	OULY FRANCIS G & WF	1052 WAGONER DR		WILMINGTON	DE	19805
0703440502	1054 WAGONER DR	WILMINGTON	DE	19805-	LAFAZIA JOSEPH V & SHELLI A	1054 WAGONER DRIVE		WILMINGTON	DE	19805
0703440503	1056 WAGONER DR	WILMINGTON	DE	19805-	STILLE JEFFREY K SR & DIANE K	1056 WAGONER DR		WILMINGTON	DE	19805
0703440504	1058 WAGONER DR	WILMINGTON	DE	19805-	CABALLERO MERCEDES D	1058 WAGONER DR		WILMINGTON	DE	19805
0703440505	1060 WAGONER DR	WILMINGTON	DE	19805-	HARRIS DEBORAH R	1060 WAGONER DR		WILMINGTON	DE	19805
0703440506	1062 WAGONER DR	WILMINGTON	DE	19805-	PETRAK DAVID ANTHONY JR & LINDSAY JANE	1062 WAGONER DRIVE		WILMINGTON	DE	19805
0703440507	1064 WAGONER DR	WILMINGTON	DE	19805-	WEIMER ASHLEIGH N	1064 WAGONER DRIVE		WILMINGTON	DE	19805
0703440508	1066 WAGONER DR	WILMINGTON	DE	19805-	JENKINS MARGARET C	1066 WAGONER DR		WILMINGTON	DE	19805
0703440509	1068 WAGONER DR	WILMINGTON	DE	19805-	JOHNSTON ANDREW H	1068 WAGONER DR		WILMINGTON	DE	19805
0703440510	1070 WAGONER DR	WILMINGTON	DE	19805-	CABALLERO MERCEDES D	1058 WAGONER DR		WILMINGTON	DE	19805
0703440511	1072 WAGONER DR	WILMINGTON	DE	19805-	BUONCUORE KATHLEEN A	1072 WAGONER DR		WILMINGTON	DE	19805
0703440529	604 ARMSTRONG AVE	WILMINGTON	DE	19805-	HUTCHINSON REBECCA P	604 ARMSTRONG AV		WILMINGTON	DE	19805
0703440530	400 HILLSIDE AVE	WILMINGTON	DE	19805-	MEHMOOD SUNNY	400 HILLSIDE AVENUE		WILMINGTON	DE	19805
0703440531	398 HILLSIDE AVE	WILMINGTON	DE	19805-	VICKERS ANGELA C	398 HILLSIDE AVENUE		WILMINGTON	DE	19805
0703440532	396 HILLSIDE AVE	WILMINGTON	DE	19805-	KOONS WALLIE E	396 HILLSIDE AVENUE		WILMINGTON	DE	19805
0703440534	2130 FAULKLAND RD	WILMINGTON	DE	19805-	NEW CASTLE COUNTY	DEPT OF PARKS & RECREATION	187 OLD CHURCHMANS RD	NEW CASTLE	DE	19720
0703440535	303 BROOKLAND AVE	WILMINGTON	DE	19805-	GREENZWEIG GREGORY P & JEANETTE W	303 BROOKLAND AV		WILMINGTON	DE	19805
0703510032	2105 FAULKLAND RD	WILMINGTON	DE	19805-	AMPONSAH ERIC K & BAFFOUR-AWUAH	2105 FAULKLAND ROAD		WILMINGTON	DE	19805
0703510033	2103 FAULKLAND RD	WILMINGTON	DE	19805-	PROCAK TIMOTHY J & JOANN	2103 FAULKLAND ROAD		WILMINGTON	DE	19805
0703510034	2101 FAULKLAND RD	WILMINGTON	DE	19805-	KELLY BRUCE D	2101 FAULKLAND RD	WOODLAND PARK	WILMINGTON	DE	19805
0703510035	2013 FAULKLAND RD	WILMINGTON	DE	19805-	ARTESIAN WATER CO	P O BOX 15004		WILMINGTON	DE	19850
0703510036	2001 FAULKLAND RD	WILMINGTON	DE	19805-	NEW CASTLE COUNTY-LEVY COURT	PUBLIC BLDG		NEW CASTLE	DE	19801
0703510042	2130 FAULKLAND RD	WILMINGTON	DE	19805-	NEW CASTLE COUNTY-LEVY COURT	PUBLIC BLDG		NEW CASTLE	DE	19801
0703510063	1020 WAGONER DR	WILMINGTON	DE	19805-	MALGIRE JAMES L	1020 WAGONER DR		WILMINGTON	DE	19805
0703510064	1022 WAGONER DR	WILMINGTON	DE	19805-	SYKES ANN M	1022 WAGONER DR		WILMINGTON	DE	19805
0703510065	1024 WAGONER DR	WILMINGTON	DE	19805-	LOVEKIN STEPHANIE J	1024 WAGONER DR		WILMINGTON	DE	19805
0703510066	1026 WAGONER DR	WILMINGTON	DE	19805-	PARIAG TARYN S	1026 WAGONER DRIVE		WILMINGTON	DE	19805
0703510067	1028 WAGONER DR	WILMINGTON	DE	19805-	BERTOLLO FRANK & AMANDA	1028 WAGONER DR		WILMINGTON	DE	19805-1033
0703510068	1030 WAGONER DR	WILMINGTON	DE	19805-	MARINO SAVIERO T III & KAREN	1030 WAGONER DR		WILMINGTON	DE	19805
0703510069	1032 WAGONER DR	WILMINGTON	DE	19805-	LATHAM JOHN P & THERESA J	1032 WAGONER DR		WILMINGTON	DE	19808
0703510070	1034 WAGONER DR	WILMINGTON	DE	19805-	SAUNDERS SANDRA	1034 WAGONER DR		WILMINGTON	DE	19805
0703510071	1036 WAGONER DR	WILMINGTON	DE	19805-	THOMAS HAROLD F & SUSAN L	P.O.BOX 24		YORKLYN	DE	19736
0703510072	1038 WAGONER DR	WILMINGTON	DE	19805-	VANQUEZ MIGUEL ANGEL	1038 WAGONER DR		WILMINGTON	DE	19805
0703530001	1040 WAGONER DR	WILMINGTON	DE	19805-	WARRANT PAUL C	1040 WAGONER DR		WILMINGTON	DE	19805
0703530002	1042 WAGONER DR	WILMINGTON	DE	19805-	HUNTER PAUL L TRUSTEE	1042 WAGONER DRIVE		WILMINGTON	DE	19805
0703530003	1044 WAGONER DR	WILMINGTON	DE	19805-	TWARDOWSKI JENNIFER L	1044 WAGONER DR		WILMINGTON	DE	19805
0703530103	1136 WAGONER DR	WILMINGTON	DE	19805-	LUCEY PAUL T JR & DIANE M	1136 WAGONER DR		WILMINGTON	DE	19805
0703530104	1134 WAGONER DR	WILMINGTON	DE	19805-	MINELLA ANTHONY & SIOBHAN	1134 WAGONER DR		WILMINGTON	DE	19805
0703530105	1132 WAGONER DR	WILMINGTON	DE	19805-	DEITRICH CHRIS JR & JENNIFER L	1132 WAGONER DR		WILMINGTON	DE	19805
0703530106	1130 WAGONER DR	WILMINGTON	DE	19805-	THOMPSON LOUIS P JR	1130 WAGONER DR		WILMINGTON	DE	19805
0703530107	1128 WAGONER DR	WILMINGTON	DE	19805-	MCCARTHY STEVEN R	1128 WAGONER DRIVE		WILMINGTON	DE	19805
0703530108	1126 WAGONER DR	WILMINGTON	DE	19805-	EFFINGER DWIGHT & LI PEIJU	1126 WAGONEER DR		WILMINGTON	DE	19805
0703530109	1124 WAGONER DR	WILMINGTON	DE	19805-	JACKSON RICHARD L JR & WF	1124 WAGONER RD		WILMINGTON	DE	19805
0703530110	1122 WAGONER DR	WILMINGTON	DE	19805-	JEANDELL THOMAS J & JANE A	1122 WAGONER DR		WILMINGTON	DE	19805
0703530111	1120 WAGONER DR	WILMINGTON	DE	19805-	TORO GILBERTO & GABRIELA	1120 WAGONER DR		WILMINGTON	DE	19805
0703530112	1118 WAGONER DR	WILMINGTON	DE	19805-	CAREY RONALD R	1118 WAGONER DR		WILMINGTON	DE	19805
0703530113	1116 WAGONER DR	WILMINGTON	DE	19805-	LAND CHRISTOPHER R & DANIELLE M	1116 WAGONER DR		WILMINGTON	DE	19805
0703530114	1114 WAGONER DR	WILMINGTON	DE	19805-	BROZOSKI DENNIS P & BARBARA J	HOME COMING	P O BOX 890037	DALLAS	TX	75389
0703530115	1112 WAGONER DR	WILMINGTON	DE	19805-	GOINES JAMES M & MARY E	1112 WAGONER DRIVE		WILMINGTON	DE	19805

0703530116	1110 WAGONER DR	WILMINGTON	DE	19805-	LINDSEY ROSEMARY	1110 WAGONER DR		WILMINGTON	DE	19805
0703530117	1108 WAGONER DR	WILMINGTON	DE	19805-	BAKER NOREEN & HOOVER PATRICIA & DOYLE MARY	1108 WAGONER DR		WILMINGTON	DE	19805
0703530118	1106 WAGONER DR	WILMINGTON	DE	19805-	MCCOURT KENNETH H	1106 WAGONER DR		WILMINGTON	DE	19805
0703530119	1104 WAGONER DR	WILMINGTON	DE	19805-	MCCOURT KENNETH H & BRENDA A	1104 WAGONER DR		WILMINGTON	DE	19805
0703530120	1102 WAGONER DR	WILMINGTON	DE	19805-	LARA SERGIO CAMARENA & GARCIA MARIA DE LA LUZ	1102 WAGONER DR		WILMINGTON	DE	19805
0703530121	1100 WAGONER DR	WILMINGTON	DE	19805-	SNYDER PAULA T	1100 WAGONER DR		WILMINGTON	DE	19805
0703530129	112 N WOODWARD AVE	WILMINGTON	DE	19805-	LATHAM TIM & VICTORIA	112 NORTH WOODWARD AVENUE		WILMINGTON	DE	19805
0703530140	9 WALNUT AVE	WILMINGTON	DE	19805-	AUNGST COLLEEN	9 WALNUT AVENUE		WILMINGTON	DE	19805
0703530141	10 WALNUT AVE	WILMINGTON	DE	19805-	CRISTOFICH LISA	10 WALNUT AVENUE		WILMINGTON	DE	19805
0703530142	8 WALNUT AVE	WILMINGTON	DE	19805-	PELLEGRINI DOROTHY C	6 WALNUT AVENUE		WILMINGTON	DE	19805
0703530152	9 ELM AVE	WILMINGTON	DE	19805-	THOMAS RICHARD M & DIANNA	9 ELM AVE		WILMINGTON	DE	19805
0703530153	11 ELM AVE	WILMINGTON	DE	19805-	HANLEY FRANCIS X	11 ELM AVE		WILMINGTON	DE	19805
0703530154	8 ELM AVE	WILMINGTON	DE	19805-	MAY CAMERON R & MAHOGANY R	8 ELM AVENUE		WILMINGTON	DE	19805
0703530159	7 BEECH AVE	WILMINGTON	DE	19805-	RUSK JOHN C & SALLY J	7 BEECH AVE		WILMINGTON	DE	19805
0703530162	4 BEECH AVE	WILMINGTON	DE	19805-	MAST GREGORY S & ARLESE D	4 BEECH AVENUE		WILMINGTON	DE	19805
0703530163	8 BEECH AVE	WILMINGTON	DE	19805-	KEENAN MARY M & VANDERMAY JULIE	8 BEECH AVE		WILMINGTON	DE	19805
0703530164	10 BEECH AVE	WILMINGTON	DE	19805-	CIAFFI DIANE E	10 BEECH AVE		WILMINGTON	DE	19805
0703530165	9 E BROOKLAND AVE	WILMINGTON	DE	19805-	HDJ HOMES LLC	4261 MILLCREEK RD		HOCKESSIN	DE	19707
0703530166	7 E BROOKLAND AVE	WILMINGTON	DE	19805-	BEARE KAREN M & STEVEN D TRUSTEES	7 E BROOKLAND AVENUE		WILMINGTON	DE	19805
0703530167	5 E BROOKLAND AVE	WILMINGTON	DE	19805-	GATES JOSHUA E & JOANNA C	5 EAST BROOKLAND AVENUE		WILMINGTON	DE	19805
0703530168	3 E BROOKLAND AVE	WILMINGTON	DE	19805-	HRUSKA JANE C REV TR	3 EAST BROOKLAND AVENUE		WILMINGTON	DE	19805
0703530169	2405 FERRIS RD	WILMINGTON	DE	19805-	EVELAND ERIC P & DANIELLE M	2405 FERRIS RD		WILMINGTON	DE	19805
0703530422	2401 FERRIS RD	WILMINGTON	DE	19805-	KING ROSE M	2401 CENTRE RD		WILMINGTON	DE	19805
0703530423	6 ELM AVE	WILMINGTON	DE	19805-	PAVONARIUS THOMAS A	6 ELM AVE		WILMINGTON	DE	19805
0703440537	613 ARMSTRONG AVE	WILMINGTON	DE	19805-	NEW CASTLE COUNTY	DIVISION OF LAW	800 N FRENCH ST	WILMINGTON	DE	19801
0703440538	600 ARMSTRONG AVE	WILMINGTON	DE	19805-	ZAVALA ALFREDO & MARIA GUADALUPE	600 ARMSTRONG AV		WILMINGTON	DE	19805
0703420491	2110 FAULKLAND RD	WILMINGTON	DE	19805-	MEHTA RAJESH R & MITA R & SHYAM R	2110 FAULKLAND ROAD		WILMINGTON	DE	19805
0703510197	2106 FAULKLAND RD	WILMINGTON	DE	19805-	LIN CHUN JIN	2106 FAULKLAND ROAD		WILMINGTON	DE	19805
0703420493	100 ROTHWELL RD	WILMINGTON	DE	19805-	BECKER GRAHAM A & HERTNEKY KATHERINE A	100 ROTHWELL RD		WILMINGTON	DE	19805