STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE: December 1, 2023

FROM:	Joshua Brown Wetlands Program Analyst	**AT (OFFICE):**	Department of Transportation
SUBJECT	Standard Dredge & Fill Application Nashua-Merrimack-Bedford, 13761A		Bureau of Environment
TO	Karl Benedict, Public Works Permitting Officer New Hampshire Wetlands Bureau 29 Hazen Drive, P.O. Box 95 Concord, NH 03302-0095		

Forwarded herewith is the application package prepared by NH DOT Bureau of Highway Design for the subject major impact project. The proposed NHDOT 13761A project is part of the larger Nashua-Merrimack-Bedford, 13761 project that involves widening three (3) segments of the existing two-lane portions of the F.E. Everett Turnpike in Nashua, Merrimack, and Bedford, New Hampshire. The 13761A is the southernmost segment located in Nashua and Merrimack. The project begins just north of the Tinker Road overpass at Exit 8 in Nashua, and continues north for approximately 2.2 miles, ending approximately 400 feet north of the Industrial Drive overpass at Exit 10 in Merrimack.

This project was reviewed at the Natural Resource Agency Coordination Meeting on May 17, 2023. A copy of the minutes has been included with this application package. A copy of this application and plans can be accessed on the Departments website via the following link: https://www.dot.nh.gov/projects-plans-and-programs/programs/environmental-management-system/project-management-section-0.

NHDOT anticipates and request that this project be reviewed and permitted by the Army Corp of Engineers through the State Programmatic General Permit process. A copy of the application has been sent to the Army Corp of Engineers.

Mitigation is required due to impacts to Priority Resource Areas.

Erosion Control Plans contained within this application should be considered the final erosion control plans in accordance with Env-Wt 527.05(a).

A mixing zone has been prepared for approval as enclosed in the application.

The lead people to contact for this project are Wendy Johnson, Bureau of Highway Design (271-3909 or Wendy.A.Johnson@dot.nh.gov) or Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment (271-3226 or Andrew.O'Sullivan@dot.nh.gov).

A payment voucher has been processed for this application (Voucher #76865) in the amount of $27,050.40.

If and when this application meets with the approval of the Bureau, please send the permit directly to Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment.

JRB;
cc:
BOE Original
Towns of Nashua & Merrimack (4 copies via certified mail)
Marika Labash, NH Division of Historic Resources (Cultural Review Within)
James Tilley & Erin Holmes, NHDES (via electronic notification)
Mike Dionne & Kevin Newton, NH Fish & Game (via electronic notification)
Maria Tur, US Fish & Wildlife (via electronic notification)
Jeanie Brochi, US Environmental Protection Agency (via electronic notification)
Michael Hicks & Rick Kristoff, US Army Corp of Engineers (via electronic notification)
Kevin Nyhan, BOE (via electronic notification)

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Nashua-Merrimack-
Bedford, 13761A

NHDES Standard Dredge & Fill Application

Prepared By:

McFarland Johnson

F.E. Everett Turnpike
Widening Project:
Southern Segment

November 2023

New Hampshire Department of Transportation

Nashua-Merrimack-Bedford, 13761A

F.E. Everett Turnpike Widening Project: Southern Segment

NHDES Standard Dredge & Fill Permit Application

November 2023

Contents

NHDES Standard Dredge and Fill Wetlands Permit Application Form

STANDARD DREDGE AND FILL WETLANDS PERMIT APPLICATION

Water Division/Land Resources Management
Wetlands Bureau
Check the Status of your Application

RSA/Rule: RSA 482-A/Env-Wt 100-900

APPLICANT'S NAME: NH DEPARTMENT OF TRANSPORTATION **TOWN NAME:** NASHUA & MERRIMACK

Administrative Use Only	Administrative Use Only	Administrative Use Only	File No.:
			Check No.:
			Amount:
			Initials:

A person may request a waiver of the requirements in Rules Env-Wt 100-900 to accommodate situations where strict adherence to the requirements would not be in the best interest of the public or the environment but is still in compliance with RSA 482-A. A person may also request a waiver of the standards for existing dwellings over water pursuant to RSA 482-A:26, III(b). For more information, please consult the Waiver Request Form.

SECTION 1 - REQUIRED PLANNING FOR ALL PROJECTS (Env-Wt 306.05; RSA 482-A:3, I(d)(2)) Please use the Wetland Permit Planning Tool (WPPT), the Natural Heritage Bureau (NHB) DataCheck Tool, the Aquatic Restoration Mapper, or other sources to assist in identifying key features such as: priority resource areas (PRAs), protected species or habitats, coastal areas, designated rivers, or designated prime wetlands.	
Has the required planning been completed?	☒ Yes ☐ No
Does the property contain a PRA? If yes, provide the following information:	☒ Yes ☐ No
• Does the project qualify for an Impact Classification Adjustment (e.g. NH Fish and Game Department (NHF&G) and NHB agreement for a classification downgrade) or a Project-Type Exception (e.g. Maintenance or Statutory Permit-by-Notification (SPN) project)? See Env-Wt 407.02 and Env-Wt 407.04.	☐ Yes ☒ No
• Protected species or habitat? ○ If yes, species or habitat name(s): See attached NHB DataCheck Results Letter ○ NHB Project ID #: NHB23-0523	☒ Yes ☐ No
• Bog?	☐ Yes ☒ No
• Floodplain wetland contiguous to a tier 3 or higher watercourse?	☒ Yes ☐ No
• Designated prime wetland or duly-established 100-foot buffer?	☒ Yes ☐ No
• Sand dune, tidal wetland, tidal water, or undeveloped tidal buffer zone?	☐ Yes ☒ No
Is the property within a Designated River corridor? If yes, provide the following information: • Name of Local River Management Advisory Committee (LAC): N/A • A copy of the application was sent to the LAC on Month: -- Day: -- Year: ----	☐ Yes ☒ No

For dredging projects, is the subject property contaminated? • If yes, list contaminant: N/A	☐ Yes ☒ No
Is there potential to impact impaired waters, class A waters, or outstanding resource waters?	☐ Yes ☒ No
For stream crossing projects, provide watershed size (see WPPT or Stream Stats): Pennichuck Brook = 23.9 square miles	

SECTION 2 - PROJECT DESCRIPTION (Env-Wt 311.04(i))

Provide a **brief** description of the project and the purpose of the project, outlining the scope of work to be performed and whether impacts are temporary or permanent. DO NOT reply "See attached"; please use the space provided below.

The proposed NHDOT 13761A project is part of the larger Nashua-Merrimack-Bedford 13761 project that involves widening three segments of the existing two-lane portions of the F.E. Everett Turnpike in Nashua, Merrimack, and Bedford, New Hampshire. The purpose of the overall project is to improve safety and capacity along the F.E. Everett Turnpike. The 13761 project has been divided into five separate construction contracts. Based on prior discussions and agreements with NHDES and the U.S. Army Corps of Engineers (Corps), each contract will be permitted separately, and cumulative impacts and mitigation will be tracked for the entire project. The 13761A contract includes the southernmost segment located in Nashua and Merrimack, New Hampshire. The project begins just north of the Tinker Road overpass at Exit 8 in Nashua, and continues north for approximately 2.2 miles, ending approximately 400' north of the Industrial Drive overpass at Exit 10 in Merrimack. The 13761A project proposes to widen the roadway from two to three lanes in each direction with the addition of a northbound and southbound travel lane. The project also includes stormwater and drainage improvements that will meet MS4 and AOT requirements to the extent practicable. The existing bridges over Pennichuck Brook will be replaced. The project is scheduled to advertise in January 2024. The proposed project will require 39,246 SF of permanent impacts and 28,380 SF of temporary impacts to palustrine wetlands, lacustrine surface waters, and banks associated with the roadway widening, required grading, and bridge replacements.

SECTION 3 - PROJECT LOCATION

Separate wetland permit applications must be submitted for each municipality within which wetland impacts occur.

ADDRESS: F.E. Everett Turnpike	
TOWN/CITY: Nashua & Merrimack	
TAX MAP/BLOCK/LOT/UNIT: ROW	
US GEOLOGICAL SURVEY (USGS) TOPO MAP WATERBODY NAME: Pennichuck Brook ☐ N/A	
(Optional) LATITUDE/LONGITUDE in decimal degrees (to five decimal places):	42.80467,° North -71.49891° West

SECTION 4 - APPLICANT (DESIRED PERMIT HOLDER) INFORMATION (Env-Wt 311.04(a)) If the applicant is a trust or a company, then complete with the trust or company information.		
NAME: New Hampshire Department of Transportation - Attn: Wendy Johnson		
MAILING ADDRESS: 7 Hazen Drive		
TOWN/CITY: Concord	STATE: NH	ZIP CODE: 03302
EMAIL ADDRESS: Wendy.A.Johnson@dot.nh.gov		
FAX:	PHONE: (603) 271-3909	
ELECTRONIC COMMUNICATION: By initialing here: WAJ, I hereby authorize NHDES to communicate all matters relative to this application electronically.		
SECTION 5 - AUTHORIZED AGENT INFORMATION (Env-Wt 311.04(c)) ☐ N/A		
LAST NAME, FIRST NAME, M.I.: Hoffmann, Stephen		
COMPANY NAME: McFarland-Johnson, Inc.		
MAILING ADDRESS: 53 Regional Drive		
TOWN/CITY: Concord	STATE: NH	ZIP CODE: 03301
EMAIL ADDRESS: shoffmann@mjinc.com		
FAX:	PHONE: (802) 862-9381	
ELECTRONIC COMMUNICATION: By initialing here SCH, I hereby authorize NHDES to communicate all matters relative to this application electronically.		
SECTION 6 - PROPERTY OWNER INFORMATION (IF DIFFERENT THAN APPLICANT) (Env-Wt 311.04(b)) If the owner is a trust or a company, then complete with the trust or company information. ☒ Same as applicant		
NAME:		
MAILING ADDRESS:		
TOWN/CITY:	STATE:	ZIP CODE:
EMAIL ADDRESS:		
FAX:	PHONE:	
ELECTRONIC COMMUNICATION: By initialing here WAJ, I hereby authorize NHDES to communicate all matters relative to this application electronically.		

SECTION 7 - RESOURCE-SPECIFIC CRITERIA ESTABLISHED IN Env-Wt 400, Env-Wt 500, Env-Wt 600, Env-Wt 700, OR Env-Wt 900 HAVE BEEN MET (Env-Wt 313.01(a)(3))
Describe how the resource-specific criteria have been met for each chapter listed above (please attach information about stream crossings, coastal resources, prime wetlands, or non-tidal wetlands and surface waters): Env-Wt 400: Wetland boundaries and the ordinary high water/top of bank of water courses located within the project corridor were delineated in 2016-2017, and reviewed/updated in 2022. Wetlands and surface waters have been classified using the USFWS (Cowardin et al.) Wetland Classification System. PRAs in the project area include Prime Wetlands and floodplain wetlands contiguous with a Tier 3 watercourse. Based on the proposed permanent wetland and stream impacts, the proposed project is classified as a major impact project. Env-Wt 500: The proposed project falls under Env-Wt 527 Public Highways. The proposed project has been designed in accordance with the criteria specified in Env-Wt 527.04 and is consistent with RSA 482-A:1, 483, 483-B, 485-A, and 212-A. The purpose of the proposed project is to provide improved mobility, congestion relief, and improved safety along the project corridor. The proposed project is anticipated to result in fill within the floodplain and regulatory floodway of Pennichuck Brook. However, due to the existing dams and impounded conditions, the proposed project is not anticipated to result in a change in the base flood elevation or substantially impact the flood storage function of wetlands. Impacts have been minimized and avoided to the maximum extent practicable. Env-Wt 600: N/A - No coastal or tidal wetlands. Env-Wt 700: In Nashua the surface water associated with Pennichuck Brook and adjacent wetlands are designated Prime Wetlands. Env-Wt 900: Env-Wt 904.09 The project includes replacement of a Tier 3 stream crossing, carrying the F.E. Everett Turnpike over Pennichuck Brook. The bridge replacements meets the criteria of Env-Wt 904.09.

SECTION 8 - AVOIDANCE AND MINIMIZATION
Impacts within wetland jurisdiction must be avoided to the maximum extent practicable (Env-Wt 313.03(a)).* Any project with unavoidable jurisdictional impacts must then be minimized as described in the Wetlands Best Management Practice Techniques For Avoidance and Minimization and the Wetlands Permitting: Avoidance, Minimization and Mitigation Fact Sheet. For minor or major projects, a functional assessment of all wetlands on the project site is required (Env-Wt 311.03(b)(10)).* Please refer to the application checklist to ensure you have attached all documents related to avoidance and minimization, as well as functional assessment (where applicable). Use the Avoidance and Minimization Checklist, the Avoidance and Minimization Narrative, or your own avoidance and minimization narrative. **See Env-Wt 311.03(b)(6) and Env-Wt 311.03(b)(10) for shoreline structure exemptions.*

SECTION 9 - MITIGATION REQUIREMENT (Env-Wt 311.02) If unavoidable jurisdictional impacts require mitigation, a mitigation pre-application meeting must occur at least 30 days but not more than 90 days prior to submitting this Standard Dredge and Fill Permit Application.
Mitigation Pre-Application Meeting Date: Month: 05 Day: 17 Year: 2023 (☐ N/A - Mitigation is not required)

SECTION 10 - THE PROJECT MEETS COMPENSATORY MITIGATION REQUIREMENTS (Env-Wt 313.01(a)(1)c)
Confirm that you have submitted a compensatory mitigation proposal that meets the requirements of Env-Wt 800 for all permanent unavoidable impacts that will remain after avoidance and minimization techniques have been exercised to the maximum extent practicable: ☒ I confirm submittal. (☐ N/A – Compensatory mitigation is not required)

SECTION 11 - IMPACT AREA (Env-Wt 311.04(g))

For each jurisdictional area that will be/has been impacted, provide square feet (SF) and, if applicable, linear feet (LF) of impact, and note whether the impact is after-the-fact (ATF; i.e., work was started or completed without a permit).

For intermittent and ephemeral streams, the linear footage of impact is measured along the thread of the channel. *Please note, installation of a stream crossing in an ephemeral stream may be undertaken without a permit per Rule Env-Wt 309.02(d), however other dredge or fill impacts should be included below.*

For perennial streams/rivers, the linear footage of impact is calculated by summing the lengths of disturbances to the channel and banks.

Permanent impacts are impacts that will remain after the project is complete (e.g., changes in grade or surface materials).

Temporary impacts are impacts not intended to remain (and will be restored to pre-construction conditions) after the project is completed.

JURISDICTIONAL AREA		PERMANENT			TEMPORARY		
		SF	LF	ATF	SF	LF	ATF
Wetlands	Forested Wetland	2,100		☐	1,387		☐
Wetlands	Scrub-shrub Wetland			☐			☐
Wetlands	Emergent Wetland			☐			☐
Wetlands	Wet Meadow			☐			☐
Wetlands	Vernal Pool			☐			☐
Wetlands	Designated Prime Wetland	16,665		☐	16,243		☐
Wetlands	Duly-established 100-foot Prime Wetland Buffer			☐			☐
Surface Water	Intermittent / Ephemeral Stream			☐			☐
Surface Water	Perennial Stream or River			☐			☐
Surface Water	Lake / Pond	5,553		☐	7,067		☐
Surface Water	Docking - Lake / Pond			☐			☐
Surface Water	Docking - River			☐			☐
Banks	Bank - Intermittent Stream			☐			☐
Banks	Bank - Perennial Stream / River			☐			☐
Banks	Bank / Shoreline - Lake / Pond	14,928		☐	3,683		☐
Tidal	Tidal Waters			☐			☐
Tidal	Tidal Marsh			☐			☐
Tidal	Sand Dune			☐			☐
Tidal	Undeveloped Tidal Buffer Zone (TBZ)			☐			☐
Tidal	Previously-developed TBZ			☐			☐
Tidal	Docking - Tidal Water			☐			☐
TOTAL		39,246			**28,380**		

SECTION 12 - APPLICATION FEE (RSA 482-A:3, I)

☐ **MINIMUM IMPACT FEE**: Flat fee of $400.

☐ **NON-ENFORCEMENT RELATED, PUBLICLY-FUNDED AND SUPERVISED RESTORATION PROJECTS, REGARDLESS OF IMPACT CLASSIFICATION:** Flat fee of $400 (refer to RSA 482-A:3, 1(c) for restrictions).

☒ **MINOR OR MAJOR IMPACT FEE:** Calculate using the table below:

Permanent and temporary (non-docking):	67,626 SF	× $0.40 =	$ 27,050.40
Seasonal docking structure:	0 SF	× $2.00 =	$ 0
Permanent docking structure:	0 SF	× $4.00 =	$ 0
Projects proposing shoreline structures (including docks) add $400		=	$ 0

Total =	$ 27,050.40
The application fee for minor or major impact is the above calculated total or $400, whichever is greater =	$ 27,050.40

SECTION 13 - PROJECT CLASSIFICATION (Env-Wt 306.05)
Indicate the project classification.

☐ Minimum Impact Project	☐ Minor Project	☒ Major Project

SECTION 14 - REQUIRED CERTIFICATIONS (Env-Wt 311.11)

Initial each box below to certify:

Initials: SCH WAJ	To the best of the signer's knowledge and belief, all required notifications have been provided.
Initials: SCH WAJ	The information submitted on or with the application is true, complete, and not misleading to the best of the signer's knowledge and belief.
Initials: SCH WAJ	The signer understands that: • The submission of false, incomplete, or misleading information constitutes grounds for NHDES to: 1. Deny the application. 2. Revoke any approval that is granted based on the information. 3. If the signer is a certified wetland scientist, licensed surveyor, or professional engineer licensed to practice in New Hampshire, refer the matter to the joint board of licensure and certification established by RSA 310-A:1. • The signer is subject to the penalties specified in New Hampshire law for falsification in official matters, currently RSA 641. • The signature shall constitute authorization for the municipal conservation commission and the Department to inspect the site of the proposed project, except for minimum impact forestry SPN projects and minimum impact trail projects, where the signature shall authorize only the Department to inspect the site pursuant to RSA 482-A:6, II.
Initials: SCH WAJ	If the applicant is not the owner of the property, each property owner signature shall constitute certification by the signer that he or she is aware of the application being filed and does not object to the filing.

SECTION 15 - REQUIRED SIGNATURES (Env-Wt 311.04(d); Env-Wt 311.11)

SIGNATURE (OWNER): Wendy A. Johnson	PRINT NAME LEGIBLY: Wendy A. Johnson	DATE: 11/29/23
SIGNATURE (APPLICANT, IF DIFFERENT FROM OWNER):	PRINT NAME LEGIBLY:	DATE:
SIGNATURE (AGENT, IF APPLICABLE): Stephen Hoffmann	PRINT NAME LEGIBLY: Stephen Hoffmann	DATE: 11/13/2023

SECTION 16 - TOWN / CITY CLERK SIGNATURE (Env-Wt 311.04(f))

As required by RSA 482-A:3, I(a)(1), I hereby certify that the applicant has filed four application forms, four detailed plans, and four USGS location maps with the town/city indicated below.	
TOWN/CITY CLERK SIGNATURE:	PRINT NAME LEGIBLY: N/A - RSA482-A:3 I(a) Exempt, State Agency 4 copies sent ceritfied mail.
TOWN/CITY: Nashua & Merrimack	DATE: N/A

DIRECTIONS FOR TOWN/CITY CLERK:
Per RSA 482-A:3, I(a)(1)

1. IMMEDIATELY sign the original application form and four copies in the signature space provided above.
2. Return the signed original application form and attachments to the applicant so that the applicant may submit the application form and attachments to NHDES by mail or hand delivery.
3. IMMEDIATELY distribute a copy of the application with one complete set of attachments to each of the following bodies: the municipal Conservation Commission, the local governing body (Board of Selectmen or Town/City Council), and the Planning Board.
4. Retain one copy of the application form and one complete set of attachments and make them reasonably accessible for public review.

DIRECTIONS FOR APPLICANT:
Submit the original permit application form bearing the signature of the Town/City Clerk, additional materials, and the application fee to NHDES by mail or hand delivery at the address at the bottom of this page. Make check or money order payable to “Treasurer – State of NH”.

Supplemental Project Description

STANDARD DREDGE AND FILL WETLANDS PERMIT APPLICATION

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

NASHUA-MERRIMACK-BEDFORD, 13761A

F.E. EVERETT TURNPIKE WIDENING PROJECT – SOUTHERN SEGMENT

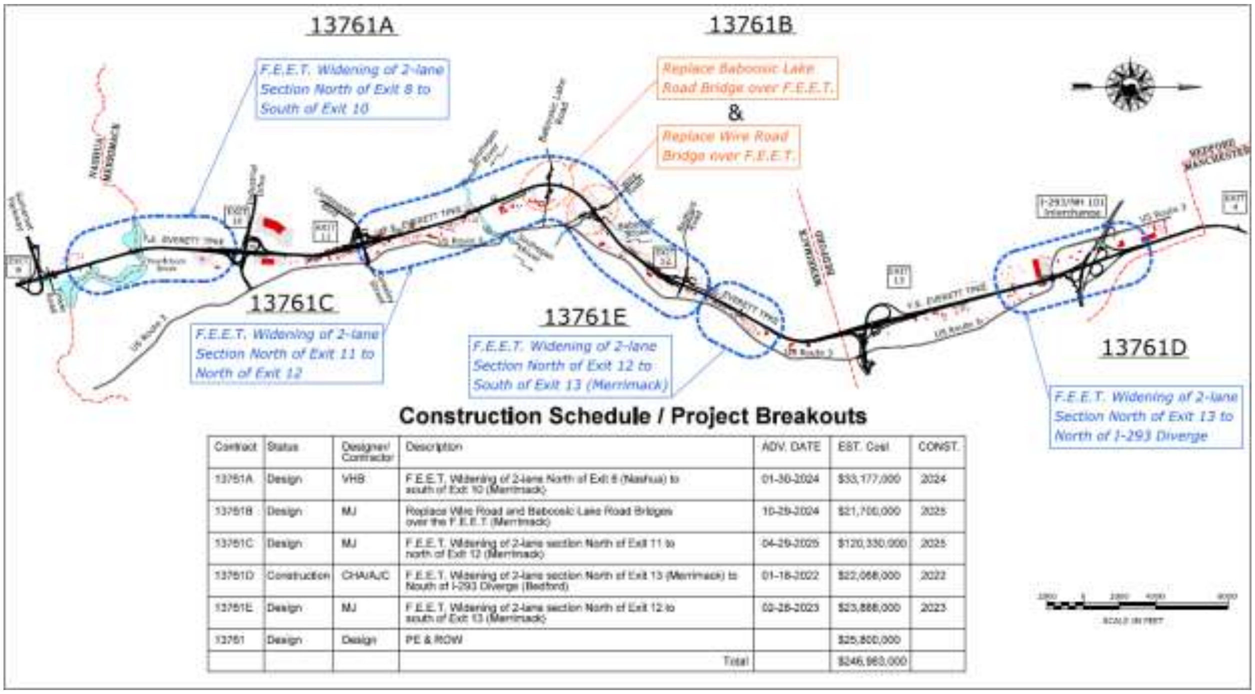
NASHUA & MERRIMACK, NEW HAMPSHIRE

SUPPLEMENTAL NARRATIVE

Contents

Introduction

The proposed NHDOT 13761A project is part of the larger Nashua-Merrimack-Bedford 13761 project that involves widening three (3) segments of the existing two-lane portions of the F.E. Everett Turnpike (F.E.E.T.) in Nashua, Merrimack, and Bedford, New Hampshire. The 13761 project has been divided into five (5) separate construction contracts. Based on prior discussions with NHDES and the US Army Corps of Engineers, each construction contract will be permitted separately, and cumulative impacts will be tracked for the entire project. This permit application is for the 13761A contract, which includes the southernmost segment located in the City of Nashua and the Town of Merrimack. The project begins just north of the Tinker Road overpass at Exit 8 in Nashua, and continues north for approximately 2.2 miles, ending approximately 400 feet north of the Industrial Drive overpass at Exit 10 in Merrimack.



Contract	Status	Designer/ Contractor	Description	ADV. DATE	EST. Cost	CONST.
13761A	Design	VHB	F.E.E.T. Widening of 2-lane North of Exit 8 (Nashua) to south of Exit 10 (Merrimack)	01-30-2024	$33,177,000	2024
13761B	Design	MJ	Replace Wire Road and Baboosic Lake Road Bridges over the F.E.E.T. (Merrimack)	10-29-2024	$21,700,000	2025
13761C	Design	MJ	F.E.E.T. Widening of 2-lane section North of Exit 11 to north of Exit 12 (Merrimack)	04-29-2025	$120,330,000	2025
13761D	Construction	CHA/AJC	F.E.E.T. Widening of 2-lane section North of Exit 13 (Merrimack) to Nouth of I-293 Diverge (Bedford)	01-18-2022	$22,068,000	2022
13761E	Design	MJ	F.E.E.T. Widening of 2-lane section North of Exit 12 to south of Exit 13 (Merrimack)	02-28-2023	$23,888,000	2023
13761	Design	Design	PE & ROW		$25,800,000	
			Total		$246,963,000	

Purpose & Need

The purpose of the F.E.E.T. Widening Project is to improve transportation efficiency and reduce safety problems associated with turnpike congestion in Nashua, Merrimack, and Bedford for all users of the turnpike while being sensitive to the needs of local communities, residents, and natural and cultural resources.

The F.E.E.T. is a principal north-south arterial highway within the State of New Hampshire and is part of the New Hampshire Turnpike System. The F.E.E.T. begins at the New Hampshire-Massachusetts State Line, where it is a continuation of US Route 3, and continues north 39.5 miles to Exit 14 in Concord, NH. It includes portions of Interstates 93 and 293 and provides a vital link for north-south travel. The F.E.E.T. carries a mix of traffic including trucks, cars, and buses, as well as commercial traffic vital to the region's economy. The F.E.E.T. corridor serves as a regional commuting route for residents of New Hampshire and

Massachusetts as well as an important local route for the communities of Nashua, Merrimack, Bedford, and other surrounding municipalities. It also serves as an important link for New England-wide travel to population centers such as Nashua, Manchester, and Concord, as well as to tourist destinations such as the New Hampshire Lakes Region, White Mountains, and ski areas. As one of the main arterials in the New Hampshire highway system, it is important to maintain the mobility of people, goods, and services through this corridor.

Existing Conditions

Wetlands and Surface Waters

The southern segment of the F.E.E.T. Widening Project is located in Nashua and Merrimack, New Hampshire. Wetlands and surface waters proximal to the proposed project were originally delineated by McFarland-Johnson, Inc. (MJ) in 2016-2017 and wetland boundaries were confirmed by an additional field review in 2022. The majority of the wetlands in the vicinity of the project consist of palustrine forested wetlands.

Pennichuck Brook is the most prominent surface water in the project area. At the location of the F.E.E.T. crossing Pennichuck Brook is an impoundment, also known as Bowers Pond, formed by a series of dams located downstream (east) of the crossing. The Merrimack River is located east of the F.E.E.T. and will not be impacted by the proposed project. The segment of the Merrimack River east of the project is a part of the Lower Merrimack River, a New Hampshire Designated River. However, the proposed project is located outside the Designated River Corridor and no additional coordination with the Local River Management Advisory Committee is required. Pennichuck Brook is also a drinking water supply for the City of Nashua and surrounding municipalities. Pennichuck Water Works owns and operates the existing reservoirs and surrounding lands. Coordination with Pennichuck Water Works regarding the proposed project, impacts, stormwater treatment, and protection of water quality has been completed by VHB. Pennichuck Brook is not a Class A surface water or an Outstanding Resource Water. Based on coordination with New Hampshire Fish and Game (NHFG) Pennichuck Brook supports a warm water fishery.

Bowers Pond (AUID: NHLAK700061001-04-02) is located within the project area and is listed as impaired for iron (aquatic life integrity) on the NHDES 2020/2022 303(d) List (most recent available). Impaired surface waters located within one mile downstream of the proposed project include Harris Pond. Harris Pond is located downstream (east) of the project area, below the Bowers Dam and upstream from the Harris Dam along Pennichuck Brook. According to the NHDES 2020/2022 303(d) List, Harris Pond is impaired for cyanobacteria hepatotoxic microcystins (primary contact recreation) and iron (aquatic life integrity).

Pennichuck Brook is included on the NHDES Consolidated List of Waterbodies Subject to RSA 482-B, the Shoreland Water Quality Protection Act (SWQPA). Therefore, the portions of the project located within the Protected Shoreland of Pennichuck Brook (lands within 250 feet of the reference line, or ordinary high water) are subject to jurisdiction under the SWQPA.

At the location of the F.E.E.T. crossing, Pennichuck Brook has a total watershed size of 23.9 square miles (Figure 2 – Watershed Map). Based on prior coordination with NHDES the crossing is considered a Tier 3 stream crossing based on the watershed size. FEMA mapped 100-year floodplain and regulatory floodway associated with Pennichuck Brook are also located within the 13761A project area.

The following provides a brief summary of the delineated wetlands identified in the vicinity of the 13761A project:

W-1: Wetland W-1 is a small palustrine scrub-shrub (PSS1E) depression location adjacent to W-2. This area is located on the east side of the F.E. Everett Turnpike, north of the Tinker Road overpass. Dominant vegetation found in this wetland included red maple and white pine in the tree stratum; glossy buckthorn in the sapling/shrub stratum; and cinnamon fern, broad-leaf cattail, poison ivy, and purple loosestrife in the herbaceous stratum. Indicators of hydrology included saturation within 12 inches of the surface.

W-2: Wetland W-2 consists of a finger of the Pennichuck Brook impoundment (L1UBHh), constructed stormwater treatment areas, and a ditch/swale (PEM1Ed) along the toe-of-slope of the F.E. Everett Turnpike. These areas are all hydrologically connected, but primarily consist of constructed treatment areas designed to capture and convey stormwater runoff. Dominant vegetation occurring in this wetland included glossy buckthorn and willows along the edges of the open water areas, and soft rush, purple loosestrife, American bur-reed, and tussock sedge in the herbaceous layer. Hydrology indicators included surface water and saturation.

W-3: Wetland W-3 is a palustrine forested (PFO1E) wetland depression located on the west side of the F.E. Everett Turnpike. This wetland extends outside the study area and appears to be hydrologically connected to Pennichuck Brook according to NWI wetland mapping. This wetland is also located within the 100-year floodplain of Pennichuck Brook. Dominant vegetation includes red maple and white pine in the tree stratum. The herbaceous layer was sparse and consisted of marsh fern and small-spiked false nettle. Soils were saturated. Wetland W-3 is located within the mapped floodplain and appears to be contiguous with Pennichuck Brook based on existing wetland and floodplain mapping. Therefore, W-3 would be considered a floodplain wetland adjacent to a Tier 3 watercourse, a Priority Resource Area (PRA) type under the NHDES Wetland Rules.

W-4: Wetland W-4 is a palustrine forested (PFO1E) fringe wetland along the Pennichuck Brook impoundment located in the southwest quadrant of the bridge crossing. Dominant vegetation in this wetland included red maple and American elm in the tree stratum; winterberry and maleberry in the sapling/shrub stratum; and marsh fern, sensitive fern, awl-fruited sedge, bladder sedge, and common arrowhead in the herbaceous stratum. Indicators of hydrology included saturation at a depth of approximately 8 inches. Soils were sandy loams with a layer of mucky mineral soil at the surface. These soils met the hydric soil indicator A11: Depleted Below Dark Surface. Wetland W-4 is also a PRA located within the floodplain of Pennichuck Brook. In Nashua, the Pennichuck Brook surface water and adjacent wetlands have been designated Prime Wetlands. Therefore, W-4 is also a Prime Wetland, another PRA type.

W-5: Wetland W-5 is a palustrine forested (PFO1E) fringe wetland along the Pennichuck Brook impoundment located in the northwest quadrant of the bridge crossing. Dominant vegetation in this wetland included red maple, white pine and green ash in the tree stratum; red oak in the sapling/shrub stratum; and cinnamon fern, hay-scented fern, and New York fern in the herbaceous stratum. This wetland area is located within the 100-year floodplain of Pennichuck Brook and therefore, the wetland is considered a PRA. Soils were silty loams with a depleted matrix.

W-6: Wetland W-6 is a palustrine forested (PFO1E) fringe wetland along the Pennichuck Brook impoundment located in the northeast quadrant of the bridge crossing. Dominant vegetation in this wetland included red maple and white pine in the tree stratum; red maple in the sapling/shrub stratum; and cinnamon fern in the herbaceous stratum. This wetland area is also located within the 100-year floodplain of Pennichuck Brook, making this wetland a PRA.

W-7: Wetland W-7 is a small palustrine forested (PFO1E) wetland located on the west side of the F.E. Everett Turnpike near the northern terminus of the 13761A project. This area is a small ditch that drains into a culvert flowing east underneath the F.E. Everett Turnpike (the outlet was not delineated because it is located outside of the proposed project area). The wetland is separated from a small pond to the west by a berm, and is hydrologically connected via a culvert through the berm. Dominant vegetation in this wetland included red maple and gray birch in the tree stratum; speckled alder in the sapling/shrub stratum; and spotted touch-me-not, small-spike false nettle, and several species of sedges in the herbaceous stratum. Indicators of hydrology included saturation and surface water. Soils were mucky sandy loams underlain by sand, and met hydric soil indicator A4: Hydrogen Sulfide Odor.

Proposed Project

The 13761A project proposes to widen the roadway from two to three lanes in each direction through the addition of a northbound and southbound travel lane. The proposed project also includes the complete replacement of existing bridges 107/042 and 106/042 carrying the northbound and southbound barrels of the F.E.E.T. respectively. The project also includes stormwater and drainage improvements to meet MS4 and AOT requirements. A total of four stormwater treatment BMPs are proposed that are anticipated to treat approximately 14.8 acres of pavement area. The project is scheduled to advertise in January 2024.

Impacts

Wetlands and Surface Waters

The proposed project will require approximately 2,100 SF of permanent impacts to palustrine wetlands associated with the proposed roadway widening and required grading. In addition, the project will require approximately 1,387 SF of temporary impacts to palustrine wetlands associated with construction access and installation of perimeter controls. Wetland impacts are limited to wetlands W-4 and W-6 and are summarized in Table 1 below:

Table 1. Wetland Impact Summary

Wetland ID	Prime Wetland	PRA	Permanent (SF)	Temporary (SF)
W-4	YES	YES	0	242
W-6	NO	YES	2,100	1,145
		TOTALS	**2,100**	**1,387**

The replacement of the Pennichuck Brook bridges and associated widening along the existing causeways is anticipated to result in 22,218 SF permanent impacts located below the OHW of Pennichuck Brook. The surface water impacts are associated with required stone fill for the widening of the existing causeways to accommodate the additional travel lanes. This work will also require 14,928 SF of permanent bank impacts along the previously constructed causeways. Temporary surface water (23,310 SF) and bank (3,683 SF) impacts are also required for construction access as well as the installation of soil erosion and sediment controls and the turbidity curtains.

In Nashua, the surface water of Pennichuck Brook is considered part of the Designated Prime Wetland. A total of 16,665 SF out of the 22,218 SF of permanent lacustrine surface water impacts are located within Nashua. These impacts are considered Prime Wetland impacts for permitting purposes and have been broken out separately as Prime Wetland Impacts on the Wetlands Permit Application Form. In order to remain consistent with the USACE's federal mitigation requirements and NHDES mitigation requirements (Env-Wt 800), mitigation for the Prime Wetland impacts associated with Pennichuck Brook will be provided on a square foot basis (refer to the Mitigation Narrative included with this submittal for additional information on the approved mitigation approach). Surface water impacts are summarized in Table 2 below:

Table 2. Surface Waters Impact Summary

Waterbody ID	Prime Wetland	Permanent (SF)	Temporary (SF)
Pennichuck Brook (Lacustrine) - Nashua	YES	16,665	16,243
Pennichuck Brook (Lacustrine) - Merrimack	NO	5,553	7,067
	TOTAL:	**22,218**	**23,310**
Pennichuck Brook Banks - Nashua & Merrimack		14,928	3,683

Threatened, Endangered, and Species of Special Concern

The US Fish and Wildlife Service Information for Planning and Consultation (IPaC) Tool Official Species List indicated that the proposed project area is within the documented range of the northern long-eared bat (NLEB). The proposed project is anticipated to require approximately 11.2 acres of tree clearing. An acoustic survey for the 13761A project was conducted between July 21 through July 28, 2021. Four detectors were deployed for a total of seven nights, three of which experienced unsuitable weather conditions as defined by the USFWS Range-Wide Indiana Bat & Northern Long Eared Bat Summer Survey Guidelines (Survey Guidelines). Based on an analysis of the data collected during all seven nights, no acoustic files were manually identified as NLEB at any detector site. An inspection of both bridges (107/042 and 106/042) was completed on May 23, 2023, for evidence of use by bats and the Bridge/Structure Bat Assessment Form was completed. No evidence of bats (visual, audible, odor, staining, or guano) was observed. Since NLEB was not detected during the acoustic survey, it seems unlikely that NLEB would be present within the project area during the active season when tree clearing is proposed. Therefore, the project would be not likely to cause adverse effects on the NLEB. The NHDOT would implement the following measures to further minimize and avoid effects to NLEB:

- The project would only clear the trees necessary to achieve project objectives and would mark all trees prior to clearing; and

- The contractor would report any dead or sick bats.

Based on the information above, NHDOT is making a not likely to adversely affect determination on behalf of the Army Corps (the lead federal agency) for NLEB.

The NH Natural Heritage Bureau (NHB) reviewed the project area and identified documented records of the following species in the vicinity of the proposed project area (NHB23-0523):

- Bird-Foot Violet
- Clasping Milkweed
- Long-Spined Sandbur
- Blanding's Turtle
- Eastern Hognose Snake
- Northern Black Racer

A survey for bird's foot violet and clasping milkweed was completed by McFarland-Johnson, Inc. in September 2021. Based on coordination with NHB, surveys were not required for the long-spined sandbur. Three populations of bird-foot violet were documented in the Contract A project area in Nashua. No clasping milkweed was identified in the survey area. Impacts to the existing bird's foot violet population on the west side of the turnpike in Nashua (Population 3) could not be avoided due to the close proximity of the existing plants to the existing edge of pavement. However, impacts to Populations 1 and 2 have been avoided. Consultation with the NHB resulted in the recommendation of transplanting the impacted population on the west side of the turnpike in between Populations 1 and 2 on the east side of the turnpike. A transplanting protocol will be prepared based on NHB's recommendations, which will be included in the construction contract.

Coordination with NHFG has occurred, and based on NHFG's input and recommendations, the following measures will be implemented to avoid or minimize impacts to wildlife species:

- All manufactured erosion and sediment control products, with the exception of turf reinforcement mats, utilized for, but not limited to, slope protection, runoff diversion, slope interruption, perimeter control, inlet protection, check dams, and sediment traps shall not contain plastic, or multifilament or monofilament polypropylene netting or mesh with an opening size of greater than 1/8 inches.

- All observations of threatened or endangered species on the project site shall be reported to the NHFG nongame and endangered wildlife environmental review program by phone at 603-271-2461 and by email at NHFGreview@wildlife.nh.gov, with the email subject line containing the NHB DataCheck tool results letter assigned number, the project name, and the term Wildlife Species Observation.

- Photographs of the observed species and nearby elements of habitat or areas of land disturbance shall be provided to NHFG in digital format at the above email address for verification, as feasible.

- In the event a threatened or endangered species is observed on the project site during the term of the permit, the species shall not be disturbed, handled, or harmed in any way prior to consultation with NHFG and implementation of corrective actions recommended by NHFG.

- Site operators shall be allowed to relocate wildlife encountered if discovered within the active work zone if in direct harm from project activities. Wildlife shall be relocated in close proximity to the capture location but outside of the work zone and in the direction the individual was heading. NHFG shall be contacted immediately if this action occurs.

- NHFG, including its employees and authorized agents, shall have access to the property during the term of the permit.

Water Quality

The proposed highway improvements will result in a 3.35 acre increase in impervious surface associated with the addition travel lanes. Four stormwater treatment areas will be constructed in the project area and will treat runoff from approximately 14.8 acres of pavement, approximately 4.4 times the area of additional pavement. The proposed project is not anticipated to cause or contribute to surface water impairments.

Pennichuck Brook

Pennichuck Brook is considered a Tier 3 stream crossing for the purpose of this wetland permit application based on the watershed size as well as the presence of FEMA mapped 100-year floodplain and regulatory floodway. A full stream geomorphic assessment was not completed due to the impounded conditions of Pennichuck Brook at the project location. The measurements of the open water area would not be representative of the accurate bankfull width. In addition, a full assessment was not feasible due to water depths within Pennichuck Brook.

The proposed project will replace the two existing 87’ single span bridges with a 100’ single span bridge over Pennichuck Brook. The proposed bridge abutments will be constructed behind the existing abutments, and the existing abutments and piles will be removed to a minimum depth of one foot below grade. The proposed bridge structure will also provide improvements to terrestrial wildlife passage at the crossing through the inclusion of two, two-foot-wide wildlife shelves in front of the northern and southern abutments. The vegetated 2:1 slopes along the causeway will be provided to facilitate wildlife passage.

The design team confirmed with NHFG that the vegetated 2:1 slopes would be passable for turtles and other wildlife species.

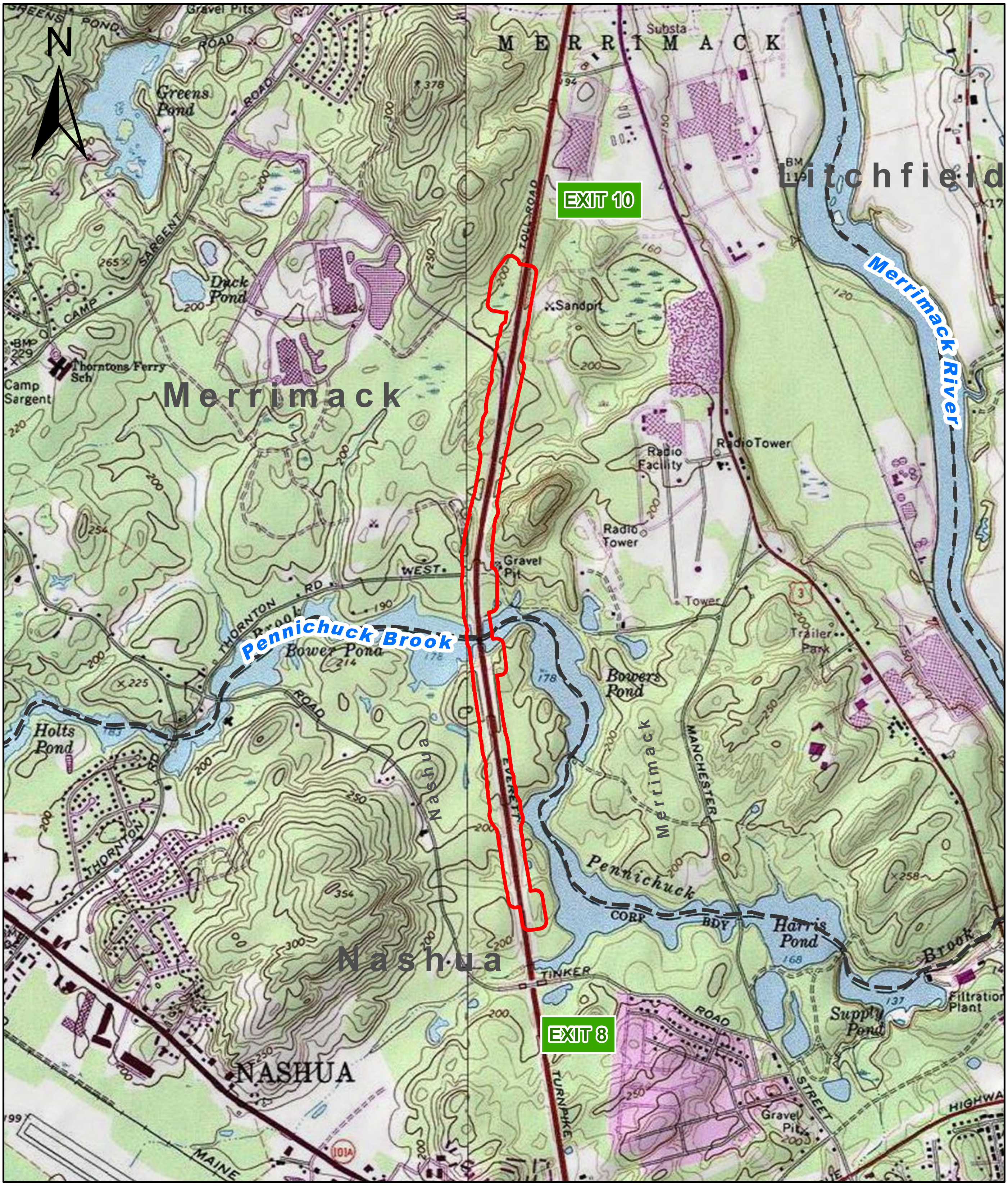
According to NHFG there are no fisheries concerns with Pennichuck Brook. This surface water is assumed to contain a warmwater fish species assemblage. In addition, aquatic organism and fish passage is blocked by a series of dams upstream and downstream from the project area. No time of year restrictions on in-water work are proposed.

The proposed bridge replacement meets the criteria of Env-Wt 904.09, for the Replacement of Tier 3 and Tier 4 Existing Legal Crossings. A summary of how the proposed bridge replacement meets the stream crossing rules is included elsewhere in this application. In addition, the Hydraulic Report included with this submittal demonstrates how the proposed bridge structure meets the hydraulic needs of the crossing.

Easements

The majority of the proposed project will be located within the existing state-owned right-of-way (ROW). All necessary easements will be obtained by the NHDOT Bureau of Right-of-Way prior to the start of construction. Easements will be required within the Pennichuck Water Works properties adjacent to Pennichuck Brook. Coordination with Pennichuck Brook is ongoing and no concerns with securing the necessary easements are anticipated.

Figure 1 – USGS Location Map



13761A Project Area

Town Boundary

0 2,000 4,000
Feet

NHDOT 13761 F.E. EVERETT TURNPIKE WIDENING PROJECT
13761A - SOUTHERN SEGMENT
NASHUA-MERRIMACK, NEW HAMPSHIRE

USGS LOCATION MAP

SCALE :	DATE :	FIGURE :
1 inch = 2,000 feet	MAY 2023	1

McFarland Johnson

M:\18589.00 NHDOT Southern FEET Design\Draw\GIS\13761A\Permitting Figures\Wetlands\Figure 1 - USGS Location Map 13761A.mxd

Attachment A: Minor and Major Projects

STANDARD DREDGE AND FILL WETLANDS PERMIT APPLICATION ATTACHMENT A: MINOR AND MAJOR PROJECTS

Water Division/Land Resources Management
Wetlands Bureau
Check the Status of your Application

RSA/ Rule: RSA 482-A/ Env-Wt 311.10; Env-Wt 313.01(a)(1); Env-Wt 313.03

APPLICANT'S NAME: **NH DEPARTMENT OF TRANSPORTATION** **TOWN NAME:** NASHUA & MERRIMACK

Attachment A is required for *all minor and major projects*, and must be completed *in addition* to the Avoidance and Minimization Narrative or Checklist that is required by Env-Wt 307.11.

For projects involving construction or modification of non-tidal shoreline structures over areas of surface waters having an absence of wetland vegetation, only Sections I.X through I.XV are required to be completed.

PART I: AVOIDANCE AND MINIMIZATION
In accordance with Env-Wt 313.03(a), the Department shall not approve any alteration of any jurisdictional area unless the applicant demonstrates that the potential impacts to jurisdictional areas have been avoided to the maximum extent practicable and that any unavoidable impacts have been minimized, as described in the Wetlands Best Management Practice Techniques For Avoidance and Minimization.
SECTION I.I - ALTERNATIVES (Env-Wt 313.03(b)(1)) Describe how there is no practicable alternative that would have a less adverse impact on the area and environments under the Department's jurisdiction.
THE F.E. EVERETT TURNPIKE WAS ORIGINALLY CONSTRUCTED IN THE 1950S AND 1960S AND HAS BEEN LOCATED ON THE EXISTING ALIGNMENT SINCE THAT TIME. THE PROPOSED PROJECT IS NEEDED TO ADDRESS SAFETY CONCERNS RELATED TO INCREASED TRAFFIC CONGESTION. DUE TO THE LOCATION OF THE EXISTING HIGHWAY AND ASSOCIATED INFRASTRUCTURE, THERE ARE LIMITED ALTERNATIVES FOR THE PROPOSED HIGHWAY WIDENING. IMPACTS TO JURISDICTIONAL RESOURCE AREAS INCLUDING WETLANDS, STREAMS, AND BANKS HAVE BEEN AVOIDED AND MINIMIZED TO THE MAXIMUM EXTENT PRACTICABLE THROUGH STEEPENING ROADWAY SLOPES, AND SITING STORMWATER BMPS AND OTHER INFRASTRUCTURE IN UPLAND AREAS.

SECTION I.II - MARSHES (Env-Wt 313.03(b)(2))

Describe how the project avoids and minimizes impacts to tidal marshes and non-tidal marshes where documented to provide sources of nutrients for finfish, crustacean, shellfish, and wildlife of significant value.

There are no tidal marshes or non-tidal marshes located within the 13761A project area.

Wetlands impacted by the proposed project include forested, floodplain wetlands adjacent to Pennichuck Brook, as well as impacts to the lacustrine surface water and banks of Pennichuck Brook.

SECTION I.III - HYDROLOGIC CONNECTION (Env-Wt 313.03(b)(3))

Describe how the project maintains hydrologic connections between adjacent wetland or stream systems.

Hydrologic connections between adjacent wetlands will be maintained. Pennichuck Brook is the only surface water located within the 13761A project area. The hydrologic connection of the Pennichuck Brook impoundment to the east and west of the F.E. Everett Turnpike will be maintained throughout the duration of construction and post construction. The proposed project will replace the two existing 87' single span NB and SB bridges with a 100' single span bridge structure.

Wetland impacts are located along the edges of larger wetland complexes adjacent to the existing roadway toe-of-slope and previously disturbed areas. The proposed impacts are not anticipated to alter the hydrologic connections between the existing wetlands and surface waters.

SECTION I.IV - JURISDICTIONAL IMPACTS (Env-Wt 313.03(b)(4))

Describe how the project avoids and minimizes impacts to wetlands and other areas of jurisdiction under RSA 482-A, especially those in which there are exemplary natural communities, vernal pools, protected species and habitat, documented fisheries, and habitat and reproduction areas for species of concern, or any combination thereof.

Wetland impacts have been avoided and minimized to the maximum extent practicable through the steepening of roadway slopes and siting stormwater BMPs and other components of the project in upland areas.

The proposed project is not anticipated to impact any exemplary natural communities. A vernal pool was documented near the southern end of the 13761A project, approximately 130' east of the F.E. Everett Turnpike. Impacts to the vernal pool have been avoided. Coordination with NHFG and NHB regarding protected species, habitat, and fisheries has been conducted. There are no fisheries concerns regarding the proposed impacts located within Pennichuck Brook. Additional measures will be implemented to avoid and minimize impacts to species of concern identified in the vicinity of the proposed project area. These measures are described in the Supplemental Narrative included with this submittal.

SECTION I.V - PUBLIC COMMERCE, NAVIGATION, OR RECREATION (Env-Wt 313.03(b)(5))

Describe how the project avoids and minimizes impacts that eliminate, depreciate or obstruct public commerce, navigation, or recreation.

The proposed project is not anticipated to eliminate, depreciate, or obstruct public commerce, navigation, or recreation. Impacts to wetland resource areas are in close proximity to the existing roadway and are primarily located within the existing right-of-way. Pennichuck Brook is a drinking water supply reservoir with restricted access. No boating, fishing, or other recreational opportunities are associated with Pennichuck Brook. The proposed highway widening will reduce traffic congestion and increase safety, improving public commerce and navigation along the F.E. Everett Turnpike travel corridor.

SECTION I.VI - FLOODPLAIN WETLANDS (Env-Wt 313.03(b)(6)) Describe how the project avoids and minimizes impacts to floodplain wetlands that provide flood storage.
Wetlands W-1, W,2, W-3, W-4, W-5, and W-6 are located within the FEMA mapped 100-year floodplain of Pennichuck Brook. Impacts to these floodplain wetlands have been avoided and minimized to the maximum extent practicable. Wetlands W-1, W-2, W-3, and W-5 will not be impacted by the proposed project. Impacts to W-4 and W-6 were unavoidable, but have been minimized to the maximum extent practicable. W-4: Permanent impacts to W-4 were completely avoided. However, 242 SF of temporary impacts are required for construction access and the installation of perimeter controls. W-6: Permanent impacts to W-6 total 2,100 SF, and are associated with the proposed highway widening and required grading. In addition, there are 1,145 SF of temporary impacts associated with construction access, installation of perimeter controls, and a drainage outlet from a stormwater BMP.

SECTION I.VII - RIVERINE FORESTED WETLAND SYSTEMS AND SCRUB-SHRUB – MARSH COMPLEXES (Env-Wt 313.03(b)(7)) Describe how the project avoids and minimizes impacts to natural riverine forested wetland systems and scrub-shrub – marsh complexes of high ecological integrity.
The proposed project is not anticipated to result in impacts to scrub-shrub marsh complexes. Despite Pennichuck Brook being an impoundment, the adjacent forested wetlands could be considered riverine forested wetland systems. Impacts to these resources have been avoided and minimized as described in Section I.VI above. Impacts to riverine forested wetlands are located at the edges of the existing wetland complexes, adjacent to the existing roadway and previously disturbed areas.

SECTION I.VIII - DRINKING WATER SUPPLY AND GROUNDWATER AQUIFER LEVELS (Env-Wt 313.03(b)(8))

Describe how the project avoids and minimizes impacts to wetlands that would be detrimental to adjacent drinking water supply and groundwater aquifer levels.

Pennichuck Brook provides a drinking water supply source for the City of Nashua and surrounding municipalities. The water supply intake is located approximately 1.6 miles southeast of the F.E. Everett Turnpike crossing over Pennichuck Brook, and is separated by a series of three dams located downstream from the project area. Pennichuck Brook is not a Class A surface water or an Outstanding Resource Water. VHB has coordinated with Pennichuck Water Works regarding the proposed project, impacts within Pennichuck Brook, and stormwater treatment. NHDOT has also coordinated with the NHDES regarding turbidity controls. In order to protect water quality, a double turbidity curtain will be installed around the work area during construction to reduce turbidity and sediment releases. Impacts to Pennichuck Brook and the adjacent wetlands have been avoided and minimized to the maximum extent practicable. Wetland impacts are limited to the edges of existing wetlands. Larger wetland complexes that provide groundwater recharge/discharge, sediment/toxicant retention, and nutrient removal/retention functions will continue to provide these functions.

Best management practices for soil erosion and sediment control will be implemented throughout the duration of the project, in order to protect water quality. The selected contractor will also be required to prepare a Stormwater Pollution Prevention Plan (SWPPP) to further reduce water quality impacts.

The proposed project also includes the construction of four stormwater BMP areas that will treat approximately 14.8 acres of impervious pavement surface.

The proposed project is not anticipated to impact on groundwater aquifer levels.

SECTION I.IX - STREAM CHANNELS (Env-Wt 313.03(b)(9))

Describe how the project avoids and minimizes adverse impacts to stream channels and the ability of such channels to handle runoff of waters.

Pennichuck Brook is the only surface water located in the 13761A project area. Within the project area Pennichuck Brook is an impoundment formed by Bowers Dam located 0.4 mile southeast of the existing crossing location. However, based on prior discussion with NHDES, this crossing will be permitted as a Tier 3 stream crossing replacement. Impacts to Pennichuck Brook have been minimized to the maximum extent practicable through the steepening of slopes. Causeway slopes were kept at 2:1 in order to provide vegetated banks that will facilitate wildlife passage at the crossing location. In addition, widening of the existing causeways was limited to the east side of the turnpike in order to avoid impacts on the west side. The proposed project will replace the existing 87' single span bridges with a 100' single span bridge that will accommodate the proposed widening. Due to the impounded conditions, water velocities through the structure are very low. A hydraulic analysis was completed and additional details can be found in the Hydraulic Report included with this submittal. Water quality will be protected through the use of a double turbidity curtain and a defined mixing zone to monitor turbidity and sediment releases during construction.

SECTION I.X - SHORELINE STRUCTURES - CONSTRUCTION SURFACE AREA (Env-Wt 313.03(c)(1)) Describe how the project has been designed to use the minimum construction surface area over surface waters necessary to meet the stated purpose of the structures.
N/A - The proposed project does not involve the construction of shoreline structures.

SECTION I.XI - SHORELINE STRUCTURES - LEAST INTRUSIVE UPON PUBLIC TRUST (Env-Wt 313.03(c)(2)) Describe how the type of construction proposed is the least intrusive upon the public trust that will ensure safe docking on the frontage.
N/A - The proposed project does not involve the construction of shoreline structures.

SECTION I.XII - SHORELINE STRUCTURES – ABUTTING PROPERTIES (Env-Wt 313.03(c)(3)) Describe how the structures have been designed to avoid and minimize impacts on ability of abutting owners to use and enjoy their properties.
N/A - The proposed project does not involve the construction of shoreline structures.

SECTION I.XIII - SHORELINE STRUCTURES – COMMERCE AND RECREATION (Env-Wt 313.03(c)(4)) Describe how the structures have been designed to avoid and minimize impacts to the public's right to navigation, passage, and use of the resource for commerce and recreation.
N/A - The proposed project does not involve the construction of shoreline structures.

SECTION I.XIV - SHORELINE STRUCTURES – WATER QUALITY, AQUATIC VEGETATION, WILDLIFE AND FINFISH HABITAT (Env-Wt 313.03(c)(5)) Describe how the structures have been designed, located, and configured to avoid impacts to water quality, aquatic vegetation, and wildlife and finfish habitat.
N/A - The proposed project does not involve the construction of shoreline structures.

SECTION I.XV - SHORELINE STRUCTURES – VEGETATION REMOVAL, ACCESS POINTS, AND SHORELINE STABILITY (Env-Wt 313.03(c)(6)) Describe how the structures have been designed to avoid and minimize the removal of vegetation, the number of access points through wetlands or over the bank, and activities that may have an adverse effect on shoreline stability.
N/A - The proposed project does not involve the construction of shoreline structures.

PART II: FUNCTIONAL ASSESSMENT
REQUIREMENTS Ensure that project meets the requirements of Env-Wt 311.10 regarding functional assessment (Env-Wt 311.04(j); Env-Wt 311.10).
FUNCTIONAL ASSESSMENT METHOD USED: US Army Corps of Engineers New England District Highway Methodology Workbook Supplement, 1999 Edition
NAME OF CERTIFIED WETLAND SCIENTIST (FOR NON-TIDAL PROJECTS) OR QUALIFIED COASTAL PROFESSIONAL (FOR TIDAL PROJECTS) WHO COMPLETED THE ASSESSMENT: STEPHEN HOFFMANN, CWS
DATE OF ASSESSMENT: JUNE 2023
Check this box to confirm that the application includes a NARRATIVE ON FUNCTIONAL ASSESSMENT: ☒
For minor or major projects requiring a standard permit without mitigation, the applicant shall submit a wetland evaluation report that includes completed checklists and information demonstrating the RELATIVE FUNCTIONS AND VALUES OF EACH WETLAND EVALUATED. Check this box to confirm that the application includes this information, if applicable: ☐ Note: The Wetlands Functional Assessment worksheet can be used to compile the information needed to meet functional assessment requirements.

NHDES Avoidance and Minimization Checklist

AVOIDANCE AND MINIMIZATION CHECKLIST

Water Division/Land Resources Management
Wetlands Bureau

Check the Status of your Application

RSA/Rule: RSA 482-A/ Env-Wt 311.07(c)

This checklist can be used in lieu of the written narrative required by Env-Wt 311.07(a) to demonstrate compliance with requirements for Avoidance and Minimization (A/M), pursuant to RSA 482-A:1 and Env-Wt 311.07(c).

For the construction or modification of non-tidal shoreline structures over areas of surface waters without wetland vegetation, complete only Sections 1, 2, and 4 (or the applicable sections in Attachment A: Minor and Major Projects (NHDES-W-06-013).

The following definitions and abbreviations apply to this worksheet:

- "A/M BMPs" stands for Wetlands Best Management Practice Techniques for Avoidance and Minimization dated 2019, published by the New England Interstate Water Pollution Control Commission (Env-Wt 102.18).
- "Practicable" means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes (Env-Wt 103.62).

SECTION 1 - CONTACT/LOCATION INFORMATION		
APPLICANT LAST NAME, FIRST NAME, M.I.: NH Department of Transportation		
PROJECT STREET ADDRESS: F.E. Everett Turnpike		PROJECT TOWN: Nashua & Merrimack
TAX MAP/LOT NUMBER: ROW		
SECTION 2 - PRIMARY PURPOSE OF THE PROJECT		
Env-Wt 311.07(b)(1)	Indicate whether the primary purpose of the project is to construct a water-access structure or requires access through wetlands to reach a buildable lot or the buildable portion thereof.	☐ Yes ☒ No
If you answered "no" to this question, describe the purpose of the "non-access" project type you have proposed: The purpose of the proposed 13761A F.E. Everett Turnpike widening project is to improve transportation safety and efficiency by reducing traffic congestion.		

SECTION 3 - A/M PROJECT DESIGN TECHNIQUES Check the appropriate boxes below in order to demonstrate that these items have been considered in the planning of the project. Use N/A (not applicable) for each technique that is not applicable to your project.		
Env-Wt 311.07(b)(2)	For any project that proposes new permanent impacts of more than one acre or that proposes new permanent impacts to a Priority Resource Area (PRA), or both, whether any other properties reasonably available to the applicant, whether already owned or controlled by the applicant or not, could be used to achieve the project's purpose without altering the functions and values of any jurisdictional area, in particular wetlands, streams, and PRAs.	☒ Check ☐ N/A
Env-Wt 311.07(b)(3)	Whether alternative designs or techniques, such as different layouts, construction sequencing, or alternative technologies could be used to avoid impacts to jurisdictional areas or their functions and values.	☒ Check ☐ N/A
Env-Wt 311.07(b)(4) Env-Wt 311.10(c)(1) Env-Wt 311.10(c)(2)	The results of the functional assessment required by Env-Wt 311.03(b)(10) were used to select the location and design for the proposed project that has the least impact to wetland functions.	☒ Check ☐ N/A
Env-Wt 311.07(b)(4) Env-Wt 311.10(c)(3)	Where impacts to wetland functions are unavoidable, the proposed impacts are limited to the wetlands with the least valuable functions on the site while avoiding and minimizing impacts to the wetlands with the highest and most valuable functions.	☒ Check ☐ N/A
Env-Wt 313.01(c)(1) Env-Wt 313.01(c)(2) Env-Wt 313.03(b)(1)	No practicable alternative would reduce adverse impact on the area and environments under the department's jurisdiction and the project will not cause random or unnecessary destruction of wetlands.	☒ Check ☐ N/A
Env-Wt 313.01(c)(3)	The project would not cause or contribute to the significant degradation of waters of the state or the loss of any PRAs.	☒ Check ☐ N/A
Env-Wt 313.03(b)(3) Env-Wt 904.07(c)(8)	The project maintains hydrologic connectivity between adjacent wetlands or stream systems.	☒ Check ☐ N/A
Env-Wt 311.10 A/M BMPs	Buildings and/or access are positioned away from high function wetlands or surface waters to avoid impact.	☐ Check ☒ N/A
Env-Wt 311.10 A/M BMPs	The project clusters structures to avoid wetland impacts.	☐ Check ☐ N/A
Env-Wt 311.10 A/M BMPs	The placement of roads and utility corridors avoids wetlands and their associated streams.	☒ Check ☐ N/A
A/M BMPs	The width of access roads or driveways is reduced to avoid and minimize impacts. Pullouts are incorporated in the design as needed.	☐ Check ☒ N/A
A/M BMPs	The project proposes bridges or spans instead of roads/driveways/trails with culverts.	☒ Check ☐ N/A

A/M BMPs	The project is designed to minimize the number and size of crossings, and crossings cross wetlands and/or streams at the narrowest point.	☒ Check ☐ N/A
Env-Wt 500 Env-Wt 600 Env-Wt 900	Wetland and stream crossings include features that accommodate aquatic organism and wildlife passage.	☒ Check ☐ N/A
Env-Wt 900	Stream crossings are sized to address hydraulic capacity and geomorphic compatibility.	☒ Check ☐ N/A
A/M BMPs	Disturbed areas are used for crossings wherever practicable, including existing roadways, paths, or trails upgraded with new culverts or bridges.	☒ Check ☐ N/A
SECTION 4 - NON-TIDAL SHORELINE STRUCTURES		
Env-Wt 313.03(c)(1)	The non-tidal shoreline structure has been designed to use the minimum construction surface area over surfaces waters necessary to meet the stated purpose of the structure.	☐ Check ☒ N/A
Env-Wt 313.03(c)(2)	The type of construction proposed for the non-tidal shoreline structure is the least intrusive upon the public trust that will ensure safe navigation and docking on the frontage.	☐ Check ☒ N/A
Env-Wt 313.03(c)(3)	The non-tidal shoreline structure has been designed to avoid and minimize impacts on the ability of abutting owners to use and enjoy their properties.	☐ Check ☒ N/A
Env-Wt 313.03(c)(4)	The non-tidal shoreline structure has been designed to avoid and minimize impacts to the public's right to navigation, passage, and use of the resource for commerce and recreation.	☐ Check ☒ N/A
Env-Wt 313.03(c)(5)	The non-tidal shoreline structure has been designed, located, and configured to avoid impacts to water quality, aquatic vegetation, and wildlife and finfish habitat.	☐ Check ☒ N/A
Env-Wt 313.03(c)(6)	The non-tidal shoreline structure has been designed to avoid and minimize the removal of vegetation, the number of access points through wetlands or over the bank, and activities that may have an adverse effect on shoreline stability.	☐ Check ☒ N/A

NHDES Avoidance and Minimization Narrative

AVOIDANCE AND MINIMIZATION WRITTEN NARRATIVE

Water Division/Land Resources Management
Wetlands Bureau

Check the Status of your Application

RSA/ Rule: RSA 482-A/ Env-Wt 311.04(j); Env-Wt 311.07; Env-Wt 313.01(a)(1)b; Env-Wt 313.01(c)

APPLICANT'S NAME: **NH DEPARTMENT OF TRANSPORTATION** **TOWN NAME:** **NASHUA & MERRIMACK**

An applicant for a standard permit shall submit with the permit application a written narrative that explains how all impacts to functions and values of all jurisdictional areas have been avoided and minimized to the maximum extent practicable. This attachment can be used to guide the narrative (attach additional pages if needed). Alternatively, the applicant may attach a completed Avoidance and Minimization Checklist (NHDES-W-06-050) to the permit application.

SECTION 1 - WATER ACCESS STRUCTURES (Env-Wt 311.07(b)(1))
Is the primary purpose of the proposed project to construct a water access structure?

NO

SECTION 2 - BUILDABLE LOT (Env-Wt 311.07(b)(1))
Does the proposed project require access through wetlands to reach a buildable lot or portion thereof?

NO

SECTION 3 - AVAILABLE PROPERTY (Env-Wt 311.07(b)(2))*
For any project that proposes permanent impacts of more than one acre, or that proposes permanent impacts to a PRA, or both, are any other properties reasonably available to the applicant, whether already owned or controlled by the applicant or not, that could be used to achieve the project's purpose without altering the functions and values of any jurisdictional area, in particular wetlands, streams, and PRAs?

**Except as provided in any project-specific criteria and except for NH Department of Transportation projects that qualify for a categorical exclusion under the National Environmental Policy Act.*

NO - Wetland impacts, including PRAs, were avoided and minimized to the maximum extent practicable. Wetlands W-4 and W-6 are located within the FEMA mapped 100-year floodplain of Pennichuck Brook. Therefore, under the NHDES Wetland Rules, these wetlands are classified as PRAs, floodplain wetlands adjacent to a Tier 3 watercourse. In addition, in Nashua, the surface water of Pennichuck Brook and contiguous wetlands are Designated Prime Wetlands, also PRA wetland type. Due to the location of the existing F.E. Everett Turnpike (originally constructed in the 1950s and 1960s), impacts to PRA wetlands could not be completely avoided while still accomplishing the purpose and need of the proposed project. Wetland impacts are limited to the edges of existing wetland complexes and will not result in substantial impacts to the overall wetland functions and values.

SECTION 4 - ALTERNATIVES (Env-Wt 311.07(b)(3))

Could alternative designs or techniques, such as different layouts, different construction sequencing, or alternative technologies be used to avoid impacts to jurisdictional areas or their functions and values as described in the Wetlands Best Management Practice Techniques For Avoidance and Minimization?

Wetland impacts have been avoided and minimized to the maximum extent practicable. Proposed roadway slopes and required grading associated with the proposed widening were steepened wherever possible to reduce or eliminate impacts to jurisdictional resource areas. At the location of the Pennichuck Brook crossing, the proposed widening and impacts below the OHW of Pennichuck Brook were primarily limited to the east side of the F.E. Everett Turnpike. The proposed causeway slopes were maintained at a 2:1 slope so that these areas could support vegetation and facilitate terrestrial wildlife passage. Additional infrastructure including stormwater treatment areas were sited in upland areas to avoid impacts to wetlands and surface waters. Wetland impact locations are located along the edges of existing wetlands in areas that have likely been previously disturbed by prior construction of the existing transportation network. These relatively minor impacts are not anticipated to have a substantial impact on the functions and values provided by the larger wetland complexes associated with the impacted wetlands.

SECTION 5 - CONFORMANCE WITH Env-Wt 311.10(c) (Env-Wt 311.07(b)(4))**

How does the project conform to Env-Wt 311.10(c)?

***Except for projects solely limited to construction or modification of non-tidal shoreline structures only need to complete relevant sections of Attachment A*.

The existing F.E. Everett Turnpike was originally constructed in the 1950s and 1960s and was sited on its current location at that time. Based on the existing location of the Turnpike infrastructure, opportunities for relocating the proposed widening project are limited. However, as mentioned above, avoidance and minimization efforts have substantially reduced the amount of impacts. A functional assessment was completed and used to help minimize and avoid impacts to higher quality wetlands. Wetland impacts are located along the edges of existing wetlands, and the proposed project is not anticipated to result in a substantial loss of wetland functions and values.

NHDOT Natural Resource Agency Coordination Meeting Minutes

BUREAU OF ENVIRONMENT
CONFERENCE REPORT

SUBJECT: NHDOT Monthly Natural Resource Agency Coordination Meeting
DATE OF CONFERENCE: May 17, 2023
LOCATION OF CONFERENCE: Virtual meeting held via Zoom

ATTENDED BY:

NHDOT
Matt Urban
Andrew O'Sullivan
Josh Brown
Jon Evans
Mark Hemmerlein
Paul Lovely
Marc Laurin
Jon Hebert
Mike Mozer
Tim Dunn
Rhona Thomson
Arin Mills
Rebecca Martin
Corey Spetelunas
Dillan Schmidt

ACOE
Absent

USCG
Gary Croot

EPA
Absent

NHDES
Karl Benedict
Mary Ann Tilton

NHB
Ashley Litwinenko

NH Fish & Game
Mike Dionne

Federal Highway
Absent

US Fish & Wildlife
Absent

The Nature Conservancy
Absent

NH Transportation & Wildlife Workgroup
Absent

Consultants/ Public Participants
Kimberly Peace
Aaron LaChance
Edward Weingartner
Christine Perron
Stephen Hoffman
Benjamin Martin

PRESENTATIONS/ PROJECTS REVIEWED THIS MONTH: *(minutes on subsequent pages)*

Table of Contents

Nashua-Merrimack-Bedford, 13761A (Non-Fed):

Stephen Hoffmann introduced the proposed project involving the southern segment of the overall 13761 F.E. Everett Turnpike Widening project located in Nashua and Merrimack, New Hampshire. The proposed 13761A project is approximately 2.2 miles long and is located between Exit 8 and Exit 10. The proposed project involves widening of the Turnpike from two to three lanes in both the southbound and northbound directions, replacement of the existing bridges carrying the Turnpike over Pennichuck Brook, drainage improvements, and stormwater treatment BMPs. There a currently four stormwater BMPs proposed but the design is still being finalized regarding the treatment type.

The anticipated advertising date is January 30, 2024. Anticipated permitting requirements include a NHDES Standard Dredge and Fill Permit as well as a Standard Shoreland Permit. Permit applications are anticipated to be submitted to NHDES in September 2023.

Existing resources in the project area include Pennichuck Brook and adjacent forested wetlands. Additional wetlands were delineated along the project corridor but wetland and surface water impacts are limited to Pennichuck Brook and the adjacent wetland areas. Pennichuck Brook is the only surface water in the 13761A project area. The wetland and surface water delineation was completed in 2016-2017 and wetland boundaries were confirmed in 2021-2022. Pennichuck Brook also has FEMA mapped 100-year floodplains and a regulatory floodway associated. The delineated wetlands adjacent to Pennichuck Brook are located within the 100-year floodplain, and therefore, are classified as PRAs (floodplain wetlands adjacent to Tier 3 crossings). In Nashua, wetlands adjacent to Pennichuck Brook are identified as Prime Wetlands. It is assumed that Pennichuck Brook is classified as a surface water and impacts below OHW are not considered Prime Wetland impacts. Impacts to the wetland in the southwest bridge quadrant are not anticipated. Therefore, there are no Prime Wetland impacts anticipated from the proposed project. Based on prior discussions with NHDES, the Pennichuck Brook crossing is assumed to be considered a Tier 3 crossing (23.9 square mile watershed) under the NHDES Stream Crossing Rules. There is also a vernal pool east of the Turnpike near the southern end of the project. This resource area was located outside the study area of the delineation and is not anticipated to be impacted by the proposed project.

The Pennichuck Brook impoundment is owned and operated by the Pennichuck Water Works and provides a drinking water source for the City of Nashua and surrounding municipalities. VHB has completed preliminary coordination with PWW. Additional coordination with PWW regarding impacts to Pennichuck Brook and stormwater treatment will continue into final design. Water levels in Pennichuck Brook are controlled by a series of dams upstream and downstream from the project area. The supply pond and drinking water intake are located east of the project area and are isolated from the project area by two downstream dams.

The existing crossing structures were constructed in 1954 and rehabilitated in 1980 and consist of two separate NB and SB superstructures that are 87’ long. The approach roadways to the north and south are constructed on existing causeways that extend into Pennichuck Brook. The causeways are approximately 200’-250’ long, 75’ wide, and 12’ high.

The proposed structure consists of a 100’ single span bridge with a 123’ width. The proposed widening will occur on the east side of the causeway. Impacts to the west side of the causeway are anticipated to be minimal. The new bridge abutments will be constructed behind the existing abutments, and the original abutments will be removed to a minimum of one foot below grade. The design and grading for the proposed wildlife shelves are still being finalized, but it is anticipated that an approximately 2' wide wildlife shelf can be accommodated in front of both abutments in areas of proposed stone fill. The proposed shelves will tie into the vegetated 2:1 slopes along the remaining length of the causeways.

Wetland and surface water impacts are still being finalized, but the approximate impact totals are summarized below:

Palustrine Wetland Impacts / PRA (Floodplain Wetlands Adjacent to Tier 3 Stream)
3,285 SF

Surface Water Impacts (Pennichuck Brook)
21,472 SF
210 LF

Bank Impacts (Pennichuck Brook)
15,050 SF
1,153 LF

Based on the amount of impacts and types of resources present, the proposed project is anticipated to be classified as a major impact project.

Mitigation for the previous 13761D and 13761E projects was briefly discussed. The 13761A contract is anticipated to require an in-lieu fee payment in the amount of approximately $436,705.37. Mr. Hoffmann asked for clarification/confirmation from NHDES regarding whether impacts to constructed causeways would be included as bank impacts and if portions of the impacts could be considered self-mitigating with various improvements over existing conditions including incorporating wildlife shelves to improve wildlife passage, and/or a planting plan for restoring impacted banks. Approximately $240,000 of the total in-lieu fee payment are associated with the 1,153 LF of bank (causeway) impacts.

The proposed project is anticipated to result in 6,500 CY of fill in floodplains and 4,850 CY of fill in floodways. These fills are primarily associated with the expansion of the existing causeways. VHB completed a hydraulic analysis, and despite the quantities of fill, the proposed project is not anticipated to result in an increase in the base flood elevation. Water levels are controlled by the existing dams upstream and downstream from the project area. A FEMA No-Rise Certification will be included in VHB's final hydraulic report.

Existing impervious is 28.62 acres. The proposed impervious is 31.97 acres, for a net increase of 3.35 acres of impervious surfaces. The proposed treatment area is 14.80 acres. The stormwater BMP design is still being finalized, but the treatment areas are anticipated to be Wet Extended Detention Basins and/or Infiltration Basins, pending infiltration test results.

Federally listed species include the northern long eared bat. Acoustic surveys for the 13761A contract were completed in 2021 and did not detect NLEB. Informal consultation with USFWS will be completed. Mr. Hoffmann also noted that the USFWS is currently reviewing the listing of the tri-colored bat under the ESA, with final determination anticipated in September 2023. No tricolored bats were detected during the 2021 surveys and additional consultation with USFWS regarding this species will be completed as needed.

The NHB DataCheck Results Letter identified the following species: bird foot violet, clasping milkweed, long-spined sand bur, Blanding's turtle, eastern hognose snake, and northern black racer. Coordination with NHFG regarding fish and wildlife concerns is ongoing. Rare plant surveys were conducted in 2021 and three populations of bird foot violet were identified in the project area. Impacts to populations 1 and 2 can likely be avoided by removing a proposed berm. However, impacts to population 3 on the west side of the turnpike are unavoidable due to the proximity to the existing edge of pavement and propose widening. Preliminary coordination with NHB has occurred and will continue to evaluate impacts and relocation efforts. A transplanting plan for the 13761A project will be developed similar to the one for the 13761E project, and a relocation site will be determined for the plants in population 3 through coordination with VHB, MJ, NHDOT, and NHB.

<u>Agency Discussion:</u>

Karl Benedict asked if the anticipated schedule for the 13761A project (shown on the introductory slides) and the other F.E. Everett Turnpike widening project segments was accurate. Jon Evans confirmed that the schedule was up to date, but some of the later contracts could change. Mr. Benedict asked if Pennichuck Brook was a Class A surface water due to the drinking water source. Jon Evans and Mark Hemmerlein confirmed that Pennichuck Brook is not considered a Class A surface water. Mr. Benedict agreed that the existing crossing would be permitted as a Tier 3 stream crossing based on the watershed size, despite the impounded nature of the waterbody, and indicated that the permit application should address the conditions of the existing impoundment and how the proposed bridge structure meets the hydraulic requirements and geomorphic compatibility. Mr. Benedict also indicated that specifications for the wildlife shelf material should be provided along with other mitigation measures such as improvements to geomorphic compatibility, and that some of the impacts could likely be considered self-mitigating.

Mr. Hoffmann asked for clarification on whether the impacts to the constructed causeways are considered bank impacts. Mr. Benedict indicated that his initial thought was yes, the causeways are considered bank impacts. Mr. Hemmerlein indicated that a similar issue had come up on a previous NHDOT project in Bartlett, and that impacts to fully engineered slopes were not included in the mitigation package. Mr. Hoffmann provided some additional clarification and photos of the existing causeways, which consist of stone fill around the existing abutments, but are largely vegetated with shrubs, saplings, and small trees further from the bridges. Mr. Benedict said that he could look into this question further but was not prepared to make a final decision on this issue at this time.

Jon Evans added that one alternative would be to consider the wildlife shelf as mitigation for a portion of the bank impacts. Mr. Benedict suggested breaking out the linear feet of impacts by what is proposed to be self-mitigating, additional bank impacts may be considered in-kind replacement, and then determine what is still required for mitigation.

Mary-Ann Tilton brought up the protected turtle species identified in the NHB report, including Blanding's turtle. Ms. Tilton indicated that NHFG and UNH are working on an EPA grant that is evaluating the design of wildlife crossings specifically for turtles, and Tom Ballestero and Sandi Houghton are preparing a guidance document for the design of these types of structures. Ms. Tilton recommended reaching out to them for additional information.

Jon Evans, reiterated that one of the objectives of the project was to avoid impacts to the west side of the causeway, and questioned whether this would provide a benefit to turtles and other wildlife. Ms. Tilton agreed that the wildlife crossing would need to provide a benefit to wildlife species. Mr. Hoffmann explained that the design team previously discussed extending the wildlife shelves along the entire length of the causeways, however, the required grading would increase impacts to Pennichuck Brook. It was agreed that 2:1 vegetated slopes could be navigated by wildlife and that the constructed shelves would be limited to areas of riprap in order to minimize impacts to wetlands and surface waters. Ms. Tilton indicated that the UNH/NHFG study evaluated slopes for wildlife crossings and to refer to this study for additional guidance.

Ms. Tilton also indicated that there is an environmental justice community in Nashua and a future EPA grant associated with benefiting EJ communities. Ms. Tilton also asked about the floodplain/floodway mapping and what this was based on. Ms. Tilton indicated that updates in LiDAR may provide more accurate information. Mr. Hoffman indicated that the mapping was based on the latest available FEMA National Flood Hazard Layer and that the hydraulic report was prepared by VHB. Jon Evans told Ms. Tilton to reach out to him and he could provide additional information regarding the floodplain and floodway.

Christine Perron circled back to the wildlife shelf issue and reiterated that constructing a more substantial wildlife shelf along the entire causeways would result in additional impacts to surface waters, including a drinking water supply, and wanted to confirm that this trade off was acceptable from NHDES's perspective. Ms. Tilton suggested additional coordination with NHFG to determine if this crossing location is considered a high mortality area. This issue would need to be revisited once more information is available.

Mr. Benedict added that in order for impacts to be self-mitigating, it would need to be demonstrated that the wildlife/turtle crossing would be successful. Mr. Benedict reiterated breaking out impacts to existing riprap slopes versus vegetated areas for the mitigation package.

Mike Dionne had no additional comments.

Ashley Litwinenko had no additional comments, and asked for coordination to continue regarding the impacts to the bird foot violet and the transplanting plan.

Mitigation Narrative

NHDOT 13761 Nashua-Merrimack-Bedford
F.E. Everett Turnpike Widening Project
13761A – Southern Segment
Wetlands Mitigation Approach
November 2023

INTRODUCTION

The following memo outlines the proposed mitigation approach for the southern segment (13761A) of the overall NHDOT Nashua-Merrimack-Bedford, 13761, F.E. Everett Turnpike Widening Project. The project was presented and discussed at the May 17, 2023, NHDOT Natural Resource Agency Meeting, with follow up coordination between NHDOT, NHDES, McFarland-Johnson, Inc., and VHB on June 13, 2023, via a virtual call on Microsoft Teams. The proposed project involves widening an approximately 2.2-mile-long segment of the turnpike from two to three lanes in Nashua and Merrimack, New Hampshire. The proposed project also includes the replacement of the existing bridges carrying the turnpike over Pennichuck Brook, or Bowers Pond. This body of water is an impoundment formed by series of dams located downstream (east) of the project area. Based on prior coordination with NHDES the bridge replacement is being permitted as a Tier 3 stream crossing. Anticipated impacts and the proposed mitigation approach are summarized in the following sections below.

MITIGATION

WETLANDS

The proposed 13761A project is anticipated to result in a total of 2,100 square feet (SF) of permanent impacts to palustrine forested (PFO) wetlands. All of the proposed permanent PFO impacts are located in Merrimack, NH. The impacted wetlands are adjacent and contiguous to Pennichuck Brook, a Tier 3 surface water under the NHDES Stream Crossing Rules (Env-Wt 900) and the impacted areas are also located with the FEMA mapped 100-year floodplain. Therefore, the impacted wetland resources are categorized as Floodplain Wetlands on a Tier 3 Watercourse, a Priority Resource Area (PRA) type under the NHDES Wetland Rules. Mitigation is required for impacts to PRAs. A summary of the impacted resources and associated mitigation is provided in **Table 1** below. The NHDES Aquatic Resource Mitigation (ARM) Fund Payment Calculator was used to determine an in-lieu fee payment in the amount of $15,289.98 for the proposed palustrine wetlands/PRA impacts.

PRIME WETLANDS

In Nashua, Pennichuck Brook is designated as a Prime Wetland. The existing Nashua-Merrimack boundary is located along Pennichuck Brook and bisects the existing F.E. Everett Turnpike bridges, with Nashua to the south, and Merrimack to the north. The Prime Wetland designation includes the surface water itself as well as adjacent and contiguous palustrine wetland resource areas. No permanent palustrine wetland impacts are anticipated in Nashua. However, Prime Wetland impacts in Nashua include 16,665 SF of permanent impacts to the lacustrine resource area (below the ordinary high water) of Pennichuck Brook. Within the project area, Pennichuck Brook, or Bowers Pond is an impoundment with a lacustrine classification. For the purpose of mitigation and in order to be consistent with Env-Wt 800, NHDES guidance (see attached email correspondence), and the US Army Corps of Engineers federal mitigation guidelines, mitigation for the Prime Wetland impacts will be based on the 16,665 SF of lacustrine surface water impacts (see Surface Water – Lake / Pond section below). In addition, minimization measures have been incorporated into the project to reduce Prime Wetland impacts to the east side of the causeway. Additional improvements include a larger hydraulic opening at the crossing and improved terrestrial wildlife passage.

A Prime Wetlands Evaluation was completed for the City of Nashua in 1990. That evaluation identified the following functions and values for Pennichuck Brook: groundwater recharge, groundwater discharge, floodflow alteration, sediment/toxicant retention, nutrient removal, wildlife diversity, uniqueness/heritage. Proposed impacts to Pennichuck Brook are associated with existing infrastructure that was in place at the time of the 1990 functional assessment. With the proposed improvements to the bridges and the minimization measures that have been incorporated into the project, the proposed project will not result in a net loss of the functions and values of Pennichuck Brook and will not significantly alter the functions and values that were identified as part of its Prime Wetland designation.

Surface Water – Lake / Pond

The proposed project will result in a total of 22,218 SF of permanent impacts to lacustrine surface waters, including the 16,665 SF of Prime Wetland impacts in Nashua, and 5,553 SF of permanent impacts below the OHW of Pennichuck Brook in Merrimack. Since Pennichuck Brook is classified as a lacustrine resource in the project area, mitigation will be provided based on the total square footage of impacts. According to the NHDES ARM Fund Payment Calculator, the 22,218 SF of permanent lacustrine surface water impacts would result in a $161,767.97 in-lieu fee payment.

BANKS

The existing causeways are engineered, manmade fill that are a component of the existing bridge and highway structure. The causeways have become vegetated with trees since their construction in the 1950s, developing characteristics of natural banks; however, they are constructed slopes that have been previously disturbed. Therefore, mitigation for impacts along the causeway is not proposed. This approach is consistent with the precedent set by previous NHDOT projects, where mitigation is typically only required in situations where an existing structure is expanded, resulting in impacts to previously undisturbed areas. Mitigation is not typically required for impacts to constructed or previously disturbed areas. The previously disturbed/constructed banks (causeway fill slopes) will be expanded to accommodate the proposed widening by placing additional fill over the existing fill slopes. The resulting causeway will provide similar 2:1 vegetated slopes consistent with the existing conditions. The proposed causeway slopes will be top dressed with humus material and the larger voids in the propose riprap will be filled to provide a level surface that can be revegetated and will accommodate terrestrial wildlife passage. Revegetation will be accomplished through the use of a seed mix that contains herbaceous grasses and wildflowers. The final condition of the causeway slopes will be consistent with the condition of the originally constructed slopes.

SUMMARY

Table 1 provides a summary of the total impacts and mitigation for the 13761A project.

Table 1. 13761A F.E. Everett Turnpike Widening – Southern Segment Impacts & Mitigation Summary

RESOURCE TYPE	ADDITIONAL RESOURCE CATEGORY	PERMANENT IMPACTS		PROPOSED MITIGATION (ARM FUND IN-LIEU FEE PAYMENT)
		SF	LF	
Palustrine Forested Wetland	PRA - Floodplain Wetland on a Tier 3 Watercourse	2,100	N/A	$15,289.98
Prime Wetland - Palustrine Wetlands	PRA - Prime Wetland (Nashua Only)	0	N/A	$ -
Prime Wetland - Surface Water Lacustrine Surface Water	Pennichuck Brook (Nashua, NH)	16,665	N/A	$121,336.90
Lacustrine Surface Water	Pennichuck Brook (Merrimack, NH)	5,553	N/A	$40,413.07
Bank	Existing Engineered Causeways	14,928	N/A	$ -
	TOTALS	**39,246**	**N/A**	**$177,057.95**

CONCLUSION

In conclusion, the total in-lieu fee payment for the proposed wetland/PRA impacts and the lacustrine surface water/Prime Wetland impacts below the OHW of Pennichuck Brook will be $177,057.95. The lacustrine surface water impacts include Prime Wetland impacts within Pennichuck Brook located in Nashua, NH as well as impacts to Pennichuck Brook in Merrimack, NH. Mitigation for linear feet of bank impacts along the existing causeways is not proposed. However, the proposed causeways will be constructed to match the existing 2:1 slopes, and these areas will be returned to their original condition using a humus topdressing over areas of existing riprap and using a native seed mix to help revegetate this area. In addition, the project also includes the installation of a two-foot-wide terrestrial wildlife shelf in front of both abutments to help facilitate terrestrial wildlife passage at the crossing location. While this component of the project is not specifically included in the mitigation, it will result in an overall improvement to terrestrial wildlife passage at the crossing and will be consistent with the NHDES Wetland and Stream Crossing Rules.

There are currently 5 construction contracts planned to complete the overall 13761 widening project. Each contract will have a separate permit application, with impacts considered cumulatively for purposes of mitigation. To date, two construction contracts, Contract D and Contract E, have received a permit. Impacts and mitigation will continue to be tracked and summarized in subsequent permit applications. Refer to Table 2 for a summary of previously permitted impacts and mitigation for the overall 13761 project

Table 2. 13761 F.E. Everett Turnpike Widening – Wetland Impacts and Mitigation Tracking

CONTRACT	PERMIT NUMBER	PERMANENT PALUSTRINE WETLAND IMPACTS (SF)	PERMANENT PRIME WETLAND IMPACTS (SF)	PERMANENT LACUSTRINE IMPACTS (SF)	PERMANENT STREAM CHANNEL IMPACTS (LF)	PERMANENT STREAM BANK IMPACTS (LF)	MITIGATION
13761D	2021-02109	10,370	0	0	0	0	$61,696.16 (ILF)
13761E	2022-03264	10,413	0	0	120	0	$115,392.53 (ILF)
13761E[1]	2022-03264	0	0	0	0	186	$59,955.98 (*Pending ILF*)
13761A	*Pending*	2,100	16,665[2]	5,553	0	0	$177,057.95 (*Pending ILF*)
TOTAL		**22,883**	**16,665**	**5,553**	**120**	**186**	**$414,102.62**

[1] Supplemental ARM Fund payment for additional 186 LF of Bank impacts requested by NHDES November 2023

[2] 16,665 SF of permanent impacts below the OHW of Pennichuck Brook (lacustrine) in Nashua, NH

NHDES AQUATIC RESOURCE MITIGATION FUND
WETLAND PAYMENT CALCULATION
*****INSERT AMOUNTS IN YELLOW CELLS*****

1	**Convert square feet of impact to acres:**	
INSERT SQ FT OF IMPACT	Square feet of impact =	24318.00
		43560.00
	Acres of impact =	0.5583
2	**Determine acreage of wetland construction:**	
	Forested wetlands:	0.8374
	Tidal wetlands:	1.6748
	All other areas:	0.8374
3	**Wetland construction cost:**	
	Forested wetlands:	$90,771.12
	Tidal Wetlands:	$181,542.24
	All other areas:	$90,771.12
4	**Land acquisition cost (See land value table):**	
INSERT LAND VALUE FROM TABLE WHICH APPEARS TO THE LEFT. (Insert the amount do not copy and paste.)	Town land value:	67802
	Forested wetlands:	$56,777.17
	Tidal wetlands:	$113,554.34
	All other areas:	$56,777.17
5	**Construction + land costs:**	
	Forested wetland:	$147,548.29
	Tidal wetlands:	$295,096.59
	All other areas:	$147,548.29
6	**NHDES Administrative cost:**	
	Forested wetlands:	$29,509.66
	Tidal wetlands:	$59,019.32
	All other areas:	$29,509.66
************	**TOTAL ARM PAYMENT*************	
	Forested wetlands:	$177,057.95

Tidal wetlands:	$354,115.90
All other areas:	$177,057.95

NHDES AQUATIC RESOURCE MITIGATION FUND
STREAM PAYMENT CALCULATION ***INSERT AMOUNTS IN YELLOW CELLS***

INSERT LINEAR FEET OF IMPACT ON BOTH BANKS AND CHANNEL	**Right Bank**	0.00
	Left Bank	0.0000
	Channel	0.0000
	TOTAL IMPACT	0.0000
	Stream Impact Cost:	$0.00
	NHDES Administrative cost:	
		$0.00

*********** TOTAL ARM FUND STREAM PAYMENT*******

$0.00

Stephen Hoffmann

From:	Detzel, Seta <Seta.A.Detzel@des.nh.gov>
Sent:	Thursday, September 7, 2023 12:59 PM
To:	Stephen Hoffmann; Christine J. Perron; Benedict, Karl
Cc:	Nichols, Emily; OSullivan, Andrew; Evans, Jonathan; Lindsey Lefebvre; Kempke, Jessica L CIV USARMY CEMVP (USA)
Subject:	RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

Hi Stephen,

Thank you for your patience. Here is the mitigation breakdown for this project. The Corps provided concurrence with this calculation. We understand that the impact numbers are tentative. Please feel free to reach out with any additional questions.

State and Federal Mitigation required:
Impacts B+C (SF) – Lacustrine wetland fill for rip-rap below OHW
Impacts E+F (SF) – Palustrine wetland fill for rip-rap
Total Area for mitigation = 23,835 SF

*No mitigation for impacts A+D – Lacustrine bank impact for rip-rap, since this is replenishment of existing armoring on causeway (313.04(a)(3)).
*The recently updated ARM calculator is available on the Wetlands Mitigation Page: Wetlands Mitigation | NH Department of Environmental Services.

Best,

Seta Detzel, Wetlands Mitigation Specialist
Wetlands Bureau, Land Resources Management
Water Division, NH Department of Environmental Services
P.O. Box 95 Concord, NH 03302-0095
Phone: (603) 271-0727
Email: seta.a.detzel@des.nh.gov

We value your feedback. Please consider completing a 3-minute customer satisfaction survey.

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Wednesday, September 6, 2023 11:51 AM
To: Detzel, Seta <Seta.A.Detzel@des.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Benedict, Karl <Karl.D.Benedict@des.nh.gov>
Cc: Nichols, Emily <Emily.P.Nichols@des.nh.gov>; OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>
Subject: RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

---

Hi Seta,

I'm checking in on the status of the review of the mitigation approach for the 13761A project. Have you received the concurrence from the Corps that you were waiting on? Is there any additional information you need or questions you have for us?

Thanks,
Steve

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
802-862-9381

From: Stephen Hoffmann
Sent: Tuesday, August 22, 2023 2:48 PM
To: 'Detzel, Seta' <Seta.A.Detzel@des.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Benedict, Karl <Karl.D.Benedict@des.nh.gov>
Cc: Nichols, Emily <Emily.P.Nichols@des.nh.gov>; OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>
Subject: RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

Hi Seta,

Just following up again to see if you've received a response from the Corps regarding the mitigation approach for the 13761A project. There have been some unexpected delays that have impacted the anticipated permitting schedule, but I still want to stay on top of the mitigation discussion while we wait for the other final project details to get sorted out.

Thanks,
Steve

From: Detzel, Seta <Seta.A.Detzel@des.nh.gov>
Sent: Wednesday, August 2, 2023 1:23 PM
To: Stephen Hoffmann <SHoffmann@mjinc.com>; Christine J. Perron <CPerron@mjinc.com>; Benedict, Karl <Karl.D.Benedict@des.nh.gov>
Cc: Nichols, Emily <Emily.P.Nichols@des.nh.gov>; OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>
Subject: RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

Hi Steve,

Thanks for the nudge. I am just waiting on concurrence from the Corps. I'll be back in touch soon.

-Seta

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Wednesday, August 2, 2023 9:04 AM
To: Detzel, Seta <Seta.A.Detzel@des.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Benedict, Karl <Karl.D.Benedict@des.nh.gov>
Cc: Nichols, Emily <Emily.P.Nichols@des.nh.gov>; OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>
Subject: RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

Hi Seta,

I'm just checking in to see how your review of the wetland mitigation narrative and preliminary impact plans for the southern segment of the F.E. Everett Turnpike widening project (13761A) is going.

Thanks,
Steve

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
802-862-9381

From: Stephen Hoffmann
Sent: Friday, July 21, 2023 12:34 PM
To: 'Detzel, Seta' <Seta.A.Detzel@des.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Benedict, Karl <Karl.D.Benedict@des.nh.gov>
Cc: Nichols, Emily <Emily.P.Nichols@des.nh.gov>; OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>
Subject: RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

Hi Seta,

Thank you for the update. Just a heads up, I will be out next week, but Christine Perron is familiar with the project and can respond to any additional questions or comments you may have. Have a great weekend!

Thanks,
Steve

From: Detzel, Seta <Seta.A.Detzel@des.nh.gov>
Sent: Friday, July 21, 2023 12:06 PM
To: Stephen Hoffmann <SHoffmann@mjinc.com>; Christine J. Perron <CPerron@mjinc.com>; Benedict, Karl <Karl.D.Benedict@des.nh.gov>

Cc: Nichols, Emily <Emily.P.Nichols@des.nh.gov>; OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>
Subject: RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

Steve,

Thank you for the requested information. We will review and follow up with mitigation guidance soon. Please feel free to check in on the status of our review any time. Have a nice weekend.

Best,

Seta Detzel, Wetlands Mitigation Specialist (***Please note my new position & number)**
Wetlands Bureau, Land Resources Management
Water Division, NH Department of Environmental Services
P.O. Box 95 Concord, NH 03302-0095
Phone: (603) 271-0727
Email: seta.a.detzel@des.nh.gov

We value your feedback. Please consider completing a 3-minute customer satisfaction survey.

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Thursday, July 20, 2023 12:31 PM
To: Detzel, Seta <Seta.A.Detzel@des.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Benedict, Karl <Karl.D.Benedict@des.nh.gov>
Cc: Nichols, Emily <Emily.P.Nichols@des.nh.gov>; OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>
Subject: RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

---

Hi Seta,

Please find the attached plan set for the 13761A project which includes the cross sections at the causeways, impact plans sheets, and wetland classifications that you requested. Sorry for the delay, there were some minor revisions to the plans that needed to be addressed.

I also want to include the disclaimer, that these are NOT the final wetland impact plan set. The project team is still waiting on additional geotechnical investigations that could potentially change the limits of fill within the channel of Pennichuck Brook. That being said, the bank/causeway impacts should remain the same regardless, and that is the primary issue regarding the mitigation approach discussion. Please let me know if you have any questions or need any additional information. We appreciate your time and review of the proposed project.

Thanks,
Steve

McFarland Johnson
Stephen Hoffmann | Environmental Analyst
802-862-9381
Visit our website to see how MJ employee owners are innovating to improve our world.

From: Detzel, Seta <Seta.A.Detzel@des.nh.gov>
Sent: Thursday, June 22, 2023 3:52 PM
To: Christine J. Perron <CPerron@mjinc.com>; Benedict, Karl <Karl.D.Benedict@des.nh.gov>
Cc: Nichols, Emily <Emily.P.Nichols@des.nh.gov>; OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Stephen Hoffmann <SHoffmann@mjinc.com>
Subject: RE: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

Hi Christine,

Hope all is well. We reviewed the slides and mitigation narrative provided to Karl, and we are working on a response. In the meantime, we have a couple requests that will help us with confirming impact/mitigation calculations.

1. Cross-sections for the east side of the crossing that depict the pre/post fill elevations relative to the OHW and TOB.
2. An impact plan with the breakdown of permanent impacts to wetlands, bed and "banks" of the causeway.
3. The wetland classifications, if available.

Thank you.

Best,

Seta Detzel, Wetlands Mitigation Specialist (***Please note my new position & number)**
Wetlands Bureau, Land Resources Management
Water Division, NH Department of Environmental Services
P.O. Box 95 Concord, NH 03302-0095
Phone: (603) 271-0727
Email: seta.a.detzel@des.nh.gov

We value your feedback. Please consider completing a 3-minute customer satisfaction survey.

From: Christine J. Perron <CPerron@mjinc.com>
Sent: Tuesday, June 20, 2023 8:15 AM
To: Benedict, Karl <Karl.D.Benedict@des.nh.gov>
Cc: OSullivan, Andrew <Andrew.M.OSullivan@dot.nh.gov>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Stephen Hoffmann <SHoffmann@mjinc.com>
Subject: NHDOT Everett Turnpike Widening, 13761A - mitigation approach

Good morning Karl,

Thanks again for meeting with us earlier this month to discuss mitigation for the 13761A project. Based on the discussion, we've prepared the attached narrative to summarize the proposed mitigation approach. Could you please share this with the mitigation program and let us know if a follow-up meeting would be helpful?

Thank you,
Christine

McFarland Johnson

Christine J. Perron, CWS | Regional Environmental Manager
603-931-3327

Visit our website to see how MJ employee owners are innovating to improve our world.

Wetland Functions & Values

Wetland Function-Value Evaluation Form

Total area of wetland 0.06 ac + Human made? NO Is wetland part of a wildlife corridor? YES or a "habitat island"? NO

Adjacent land use Forested, Transportation Distance to nearest roadway or other development 72'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? LOW

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. W-4
Latitude 42.803883 Longitude -71.499289
Prepared by: SH Date 06/27/2023
Wetland Impact:
Type TEMPORARY Area 33 SF

Evaluation based on:
Office X Field X
Corps manual wetland delineation completed? Y x N

Function/Value	Suitability Y / N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	Y	1, 2, 5, 6, 7, 15	X	W-4 is adjacent to Pennichuck Brook impoundment, Pennichuck Brook is drinking water supply with the intake located downstream
Floodflow Alteration	Y	3, 4, 5, 8, 9 , 10, 13, 18		W-4 is a relatively narrow fringe wetland adjacent to Pennichuck Brook with limited flood storage capacity, located within FEMA 100-year floodplain
Fish and Shellfish Habitat	Y	3, 4, 5, 6, 7, 8, 10, 14, 16	X	Open water portion of Pennichuck Brook adjacent to W-4 provides habitat for a warmwater fish assemblage
Sediment/Toxicant Retention	Y	1, 2, 4, 6, 9, 10, 13, 14,16		Proximity to F.E. Everett Turnpike potential source of sediment/toxicants, wetland provides buffer around surface water
Nutrient Removal	Y	2, 3, 5, 7, 9, 10, 11		Potential for nutrient removal exists, wetland provides a buffer around Pennichuck Brook
Production Export	N	1, 6, 10		Limited production export potential
Sediment/Shoreline Stabilization	Y	2, 3, 5, 7, 10, 12, 13, 14	X	Wetland is adjacent to Pennichuck Brook and provides shoreline stabilization function
Wildlife Habitat	Y	5, 8, 11, 12, 13, 18, 19, 20, 21		Wetland provides vegetated buffer along Pennichuck Brook, potential wildlife corridor
Recreation	N	5, 6		Private property, access to Pennichuck Brook is restricted due to drinking water supply. Fishing, hunting, boating, trespassing is not permitted
Educational/Scientific Value	N	5, 12		Access is restricted due to drinking water supply, and access from the turnpike is not safe/suitable
Uniqueness/Heritage	Y	1, 2, 3, 5, 7, 11, 14, 18, 22, 27		Designated Prime Wetland, also adjacent to Pennichuck Brook which provides drinking water supply
Visual Quality/Aesthetics	Y	2, 6, 8, 12		Open water of Pennichuck Brook and adjacent wetlands provides some visual/aesthetic value as seen by motorists traveling on the turnpike
ES Endangered Species Habitat	N			No RTE species specifically assocaited with Pennichcuk Brook and associated wetlands
Other				

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland 0.99 ac + Human made? NO Is wetland part of a wildlife corridor? YES or a "habitat island"? NO

Adjacent land use Forested, Transportation, Gravel/Sand Pit Distance to nearest roadway or other development 58'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? LOW

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. W-6
Latitude 42.805602 Longitude -71.498584
Prepared by: SH Date 06/27/2023
Wetland Impact:
Type PERMANENT / TEMPORARY Area 2835 SF / 1574 SF

Evaluation based on:
Office X Field X

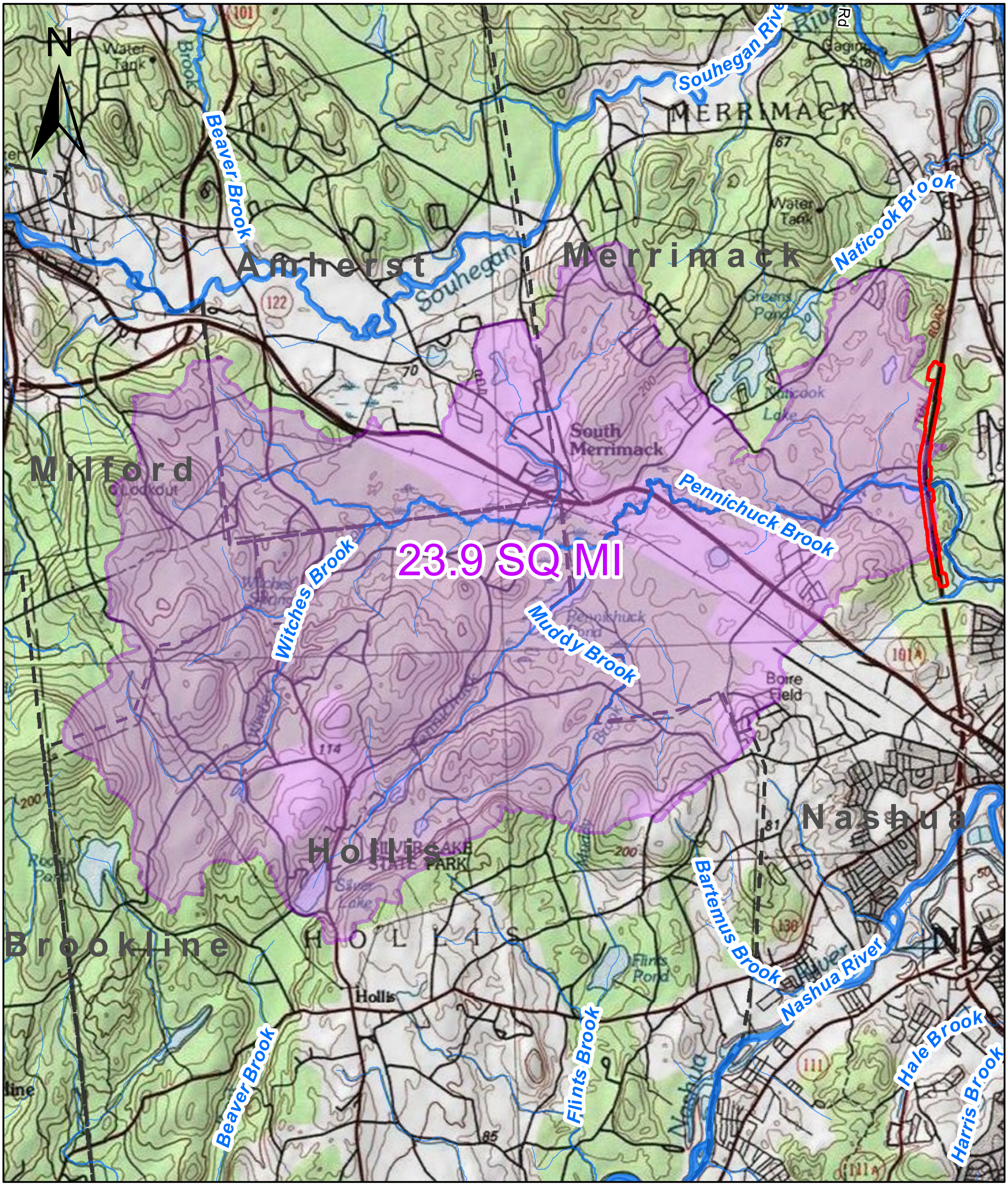
Corps manual wetland delineation completed? Y x N

Function/Value	Suitability Y / N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	Y	1, 2, 5, 6, 7, 15	X	W-6 is adjacent to Pennichuck Brook impoundment, Pennichuck Brook is drinking water supply with the intake located downstream
Floodflow Alteration	Y	3, 4, 5, 8, 9 , 10, 13, 18		W-6 is adjacent to Pennichuck Brook, located within FEMA 100-year floodplain, broad relatively flat area has potential for flood storage
Fish and Shellfish Habitat	Y	3, 4, 5, 6, 7, 8, 10, 14, 16	X	Open water portion of Pennichuck Brook adjacent to W-6 provides habitat for a warmwater fish assemblage
Sediment/Toxicant Retention	Y	1, 2, 4, 6, 9, 10, 13, 14,16		Proximity to F.E. Everett Turnpike and gravel/sand pit to the north potential source of sediment/toxicants, wetland provides buffer around surface water
Nutrient Removal	Y	2, 3, 5, 7, 9, 10, 11		Potential for nutrient removal exists, wetland provides a buffer around Pennichuck Brook
Production Export	N	1, 6, 10		Limited production export potential
Sediment/Shoreline Stabilization	Y	2, 3, 5, 7, 10, 12, 13, 14	X	Wetland is adjacent to Pennichuck Brook and provides shoreline stabilization function
Wildlife Habitat	Y	5, 8, 11, 12, 13, 18, 19, 20, 21		Wetland provides vegetated buffer along Pennichuck Brook, potential wildlife corridor
Recreation	N	5, 6		Private property, access to Pennichuck Brook is restricted due to drinking water supply. Fishing, hunting, boating, trespassing is not permitted
Educational/Scientific Value	N	5, 12		Access is restricted due to drinking water supply, and access from the turnpike is not safe/suitable
Uniqueness/Heritage	Y	1, 2, 3, 5, 7, 11, 14, 18, 22, 27		Designated Prime Wetland, also adjacent to Pennichuck Brook which provides drinking water supply
Visual Quality/Aesthetics	Y	2, 6, 8, 12		Open water of Pennichuck Brook and adjacent wetlands provides some visual/aesthetic value as seen by motorists traveling on the turnpike
ES Endangered Species Habitat	N			No RTE species specifically assocaited with Pennichcuk Brook and associated wetlands
Other				

Notes:

* Refer to backup list of numbered considerations.

Figure 2 – Watershed Map



13761A Project Area

Pennichuck Brook Watershed

Town Boundary

0 6,000 12,000

Feet

NHDOT 13761 F.E. EVERETT TURNPIKE WIDENING PROJECT
13761A - SOUTHERN SEGMENT
NASHUA-MERRIMACK, NEW HAMPSHIRE

WATERSHED MAP:
PENNICHUCK BROOK CROSSING

SCALE :	DATE :	FIGURE :
1 inch = 6,000 feet	MAY 2023	1

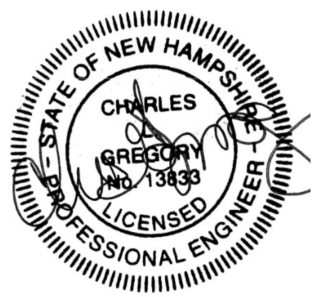
McFarland Johnson

M:\18589.00 NHDOT Southern FEET Design\Draw\GIS\13761A\Permitting Figures\Wetlands\Figure 2 - Watershed Map Pennichuck Brook Crossing 13761A.mxd

Env-Wt 904.08 Stream Crossing Rules

STANDARD DREDGE AND FILL WETLANDS PERMIT APPLICATION
NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
NASHUA-MERRIMACK-BEDFORD, 13761A
F.E. EVERETT TURNPIKE WIDENING PROJECT – SOUTHERN SEGMENT
NASHUA AND MERRIMACK, NEW HAMPSHIRE

NHDES STREAM CROSSING RULES



Env-Wt 904.09 Repair, Rehabilitation, or Replacement of Tier 3 and Tier 4 Existing Legal Crossings.

(a) The repair, rehabilitation, or replacement of tier 3 stream crossings shall be limited to existing legal crossings where the tier classification is based only on the size of the contributing watershed.

The proposed project is considered complete replacement of an existing legal crossing. Bridge No.'s 107/042 and 106/042 were originally constructed in 1954 and require complete replacement in order to accommodate the proposed widening. The proposed project involves replacing the existing substructure and superstructure as well as widening the existing causeway on the east side. At the location of the existing crossing, the Pennichuck Brook has a watershed size of approximately 23.9 square miles. Based on the size of the watershed the existing structure is a Tier 3 stream crossing. Despite the impounded condition of Pennichuck Brook in the project area, it was determined that the project would be permitted as a stream crossing based on prior coordination with NHDES.

(b) **Rehabilitation of a culvert or other closed-bottom stream crossing structure pursuant to this section may be accomplished by concrete repair, slip lining, cured-in place lining, or concrete invert lining, or any combination thereof, except that slip lining shall not occur more than once.**

Not applicable. The proposed project involves replacement of an existing bridge.

(c) **A project shall qualify under this section only if a professional engineer certifies, and provides supporting analyses to show, that:**

(1) **The existing crossing does not have a history of causing or contributing to flooding that damages the crossing or other human infrastructure or protected species habitat; and**

The existing crossing does not have a history of causing or contributing to flooding that damages the crossing or other human infrastructure or protected species habitat. Water levels in the project area are controlled by a series of dams upstream and downstream operated by the Pennichuck Water Works. A Hydraulic Report was prepared by VHB and is included with this submittal, supporting this finding.

(2) **The proposed stream crossing will:**

a. **Meet the general criteria specified in Env-Wt 904.01;**

The proposed project meets the general criteria specified in Env-Wt 904.01. The existing 87’ single span bridges will be replaced with a larger 100’ single span bridge. Due to the impounded conditions of Pennichuck Brook, water velocities through the structure are negligible. The proposed bridge will maintain sediment transport, flows, geomorphic compatibility, and is not anticipated to cause erosion, aggradation, scouring, or water quality degradation.

b. **Maintain or enhance the hydraulic capacity of the stream crossing;**

The hydraulic capacity of the existing bridge will be maintained. The project is proposing a 100’ single span bridge which will increase the hydraulic capacity of the existing 87’ single span structures. The proposed bridge abutments will be constructed behind the existing abutments. The existing abutments will be removed to a minimum depth of one foot below grade. Refer to the Hydraulic Report included with this submittal for additional details on the hydraulic capacity.

c. **Maintain or enhance the capacity of the crossing to accommodate aquatic organism passage;**

Aquatic organism passage will be maintained throughout the duration of construction and following completion of the proposed project.

d. **Maintain or enhance the connectivity of the stream reaches upstream or downstream of the crossing; and**

Stream connectivity will be maintained.

e. **Not cause or contribute to the increase in the frequency of flooding or overtopping of the banks upstream or downstream of the crossing.**

The proposed project is not anticipated to cause or contribute to an increase in the frequency of flooding or overtopping of the banks upstream or downstream from the crossing. As previously mentioned, water levels are controlled by dams located upstream and downstream from the project. A FEMA No-Rise Certification is included in the Hydraulic Report included with this submittal.

(d) Repair, rehabilitation, or replacement of a tier 4 stream crossing shall comply with Env-Wt 904.07(d)

Not applicable. At the location of the project the Pennichuck Brook is a Tier 3 stream crossing.

Stream Crossing Assessment

WETLANDS PERMIT APPLICATION
STREAM CROSSING WORKSHEET
Water Division/Land Resources Management
Wetlands Bureau

RSA/Rule RSA 482-A/ Env-Wt-900

This worksheet can be used to accompany Wetlands Permit Applications when proposing stream crossings.

SECTION 1 - TIER CLASSIFICATIONS

Determine the contributing watershed size at USGS StreamStats.

Note: Plans for tier 2 and 3 crossings shall be designed and stamped by a professional engineer who is licensed under RSA 310-A to practice in New Hampshire.

Size of contributing watershed at the crossing location: 15,320 acres

☐ **Tier 1**: A tier 1 stream crossing is a crossing located on a watercourse where the contributing watershed size is less than or equal to 200 acres.

☐ **Tier 2**: A tier 2 stream crossing is a crossing located on a watercourse where the contributing watershed size is greater than 200 acres and less than 640 acres.

☒ **Tier 3**: A tier 3 stream crossing is a crossing that meets **any** of the following criteria:

- ☒ On a watercourse where the contributing watershed is more than 640 acres.
- ☐ Within a designated river corridor unless:
  - a. The crossing would be a tier 1 stream based on contributing watershed size, or
  - b. The structure does not create a direct surface water connection to the designated river as depicted on the national hydrography dataset as found on GRANIT.
- ☒ Within a 100-year floodplain (see Section 2 below).
- ☐ In a jurisdictional area having any protected species or habitat (NHB DataCheck).
- ☒ In a prime wetland or within a duly-established 100-foot buffer, unless a waiver has been granted pursuant to RSA 482-A:11, IV(b) and Env-Wt 706. Review the Wetlands Permit Planning Tool (WPPT) for town prime wetland and prime wetland buffer maps to determine if your project is within these areas.

☐ **Tier 4**: A tier 4 stream crossing is a crossing located on a tidal watercourse.

SECTION 2 - 100-YEAR FLOODPLAIN

Use the FEMA Map Service Center to determine if the crossing is located within a 100-year floodplain. Please answer the questions below:

☐ **No**: The proposed stream crossing *is not* within the FEMA 100-year floodplain.

☒ **Yes**: The proposed project *is* within the FEMA 100-year floodplain. Zone = AE

Elevation of the 100-year floodplain at the inlet: 181 feet (FEMA El. or Modeled El.)

SECTION 3 - CALCULATING PEAK DISCHARGE

Existing 100-year peak discharge (Q) calculated in cubic feet per second (CFS): 1,150 CFS	Calculation method: FEMA FIS
Estimated bankfull discharge at the crossing location: 766 CFS	Calculation method: NH Reg. Geo. Curve

Note: If tier 1, then skip to Section 10

SECTION 4 - PREDICTED CHANNEL GEOMETRY BASED ON REGIONAL HYDRAULIC CURVES *For **tier 2**, **tier 3** and **tier 4** crossings only.*	
Bankfull Width: 57 feet	Mean Bankfull Depth: 3.0 feet
Bankfull Cross Sectional Area: 170 square feet (SF)	

SECTION 5 - CROSS SECTIONAL CHANNEL GEOMETRY: MEASUREMENTS OF THE EXISTING STREAM WITHIN A REFERENCE REACH

*For **tier 2**, **tier 3** and **tier 4** crossings only.*

Describe the reference reach location: N/A

Reference reach watershed size: N/A acres

Parameter	**Cross Section 1** Describe bed form (*e.g. pool, riffle, glide*)	**Cross Section 2** Describe bed form (*e.g. pool, riffle, glide*)	**Cross Section 3** Describe bed form (*e.g. pool, riffle, glide*)	**Range**
Bankfull Width	feet	feet	feet	feet
Bankfull Cross Sectional Area	SF	SF	SF	SF
Mean Bankfull Depth	feet	feet	feet	feet
Width to Depth Ratio				
Max Bankfull Depth	feet	feet	feet	feet
Flood Prone Width	feet	feet	feet	feet
Entrenchment Ratio				

*Use **Figure 1** below to determine the measurements of the Reference Reach Attributes*

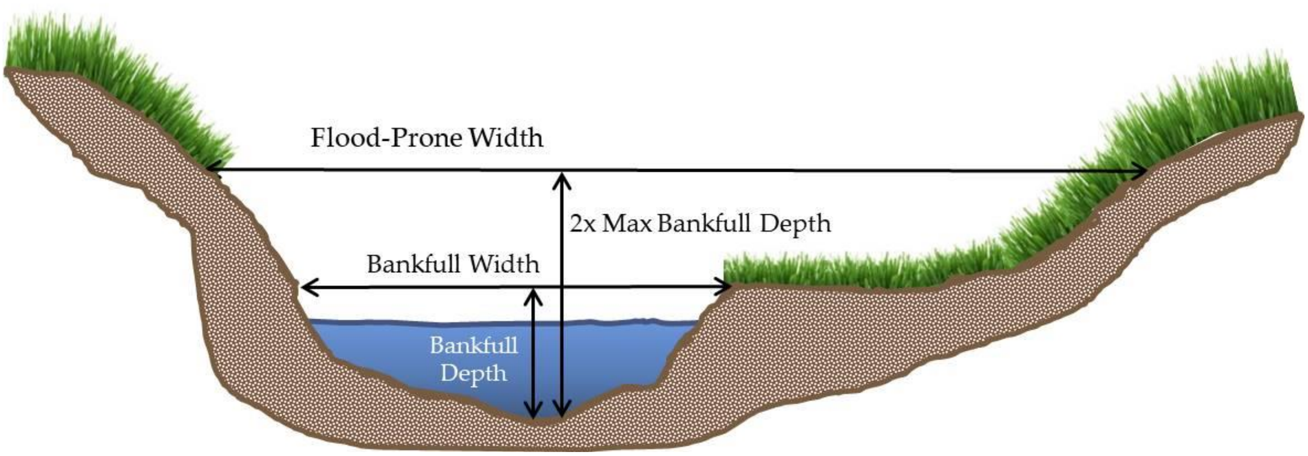


Figure 1: Determining the Reference Reach Attributes.

SECTION 6 - LONGITUDINAL PARAMETERS OF THE REFERENCE REACH AND CROSSING LOCATION

*For **tier 2**, **tier 3** and **tier 4** crossings only.*

Average Channel Slope of the Reference Reach: N/A

Average Channel Slope at the Crossing Location: N/A

SECTION 7 - PLAN VIEW GEOMETRY

Note: Sinuosity is measured a distance of at least 20 times bankfull width, or 2 meander belt widths.

*For **tier 2**, **tier 3** and **tier 4** crossings only.*

Sinuosity of the Reference Reach: N/A

Sinuosity of the Crossing Location: N/A

SECTION 8 - SUBSTRATE CLASSIFICATION BASED ON FIELD OBSERVATIONS *For **tier 2**, **tier 3** and **tier 4** crossings only.*	
% of reach that is bedrock:	%
% of reach that is boulder:	%
% of reach that is cobble:	%
% of reach that is gravel:	%
% of reach that is sand:	%
% of reach that is silt:	%
SECTION 9 - STREAM TYPE OF REFERENCE REACH *For **tier 2**, **tier 3** and **tier 4** crossings only.*	
Stream Type of Reference Reach:	N/A

*Refer to Rosgen Classification Chart (**Figure 2**) below:*

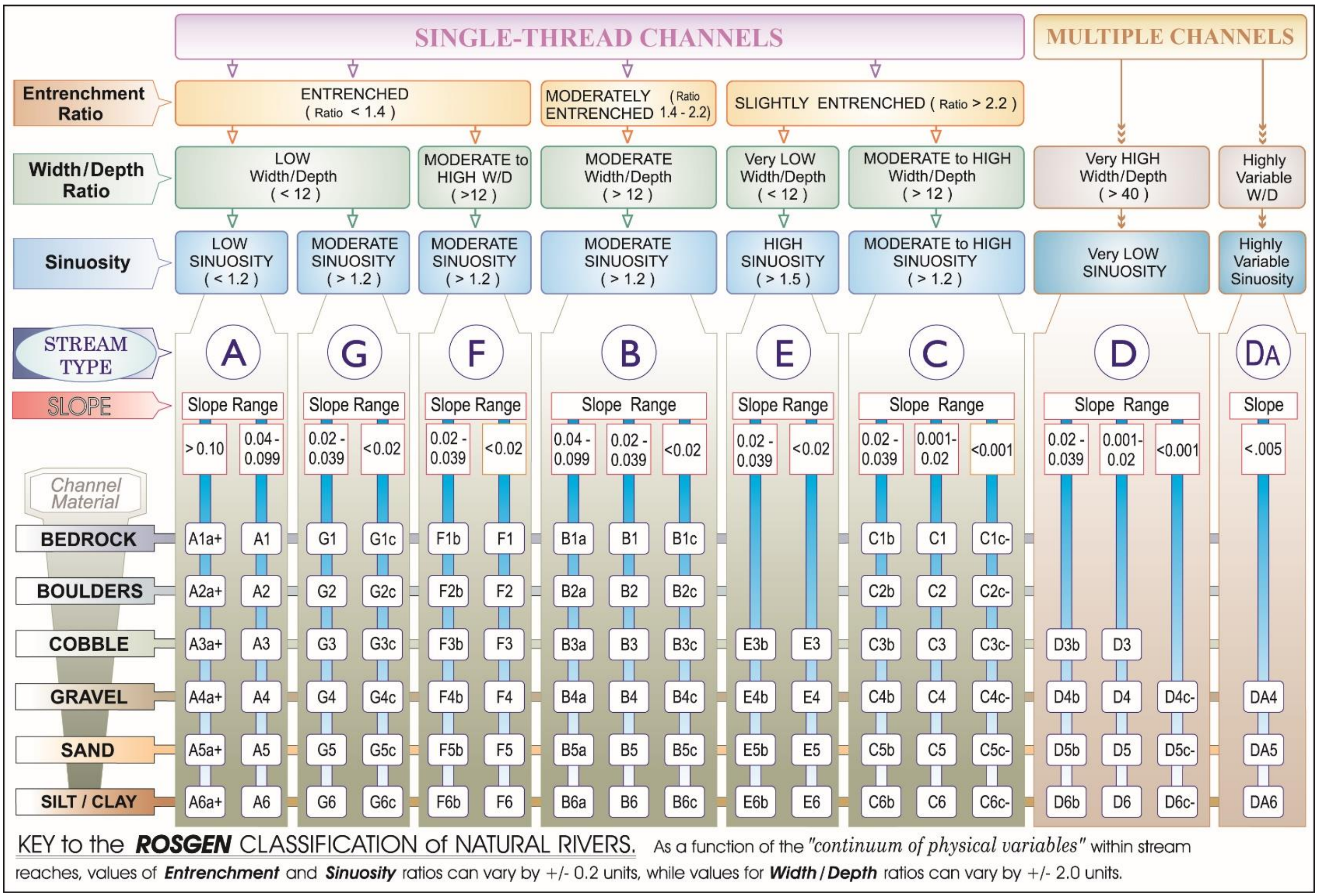


Figure 2: Reference from Applied River Morphology, Rosgen, 1996.

SECTION 10 - CROSSING STRUCTURE METRICS			
Existing Conditions	**Existing Structure Type:**	☒ Bridge span ☐ Pipe arch ☐ Open-bottom culvert ☐ Closed-bottom culvert ☐ Closed-bottom culvert with stream simulation ☒ Other: Twin Bridge Structures	
	Existing Crossing Span: *(perpendicular to flow)* 87 feet	**Culvert Diameter:** N/A feet **Inlet Elevation:** El. N/A feet	
	Existing Crossing Length: *(parallel to flow)* 36 feet	**Outlet Elevation:** El. N/A feet **Culvert Slope:** N/A	

Proposed Conditions	**Proposed Structure Type:**	**Tier 1**	**Tier 2**	**Tier 3**	**Alternative Design**
	Bridge Span	☐	☐	☒	☐
	Pipe Arch	☐	☐		☐
	Closed-bottom Culvert	☐	☐		☐
	Open-bottom Culvert	☐	☐	☐	☐
	Closed-bottom Culvert with stream simulation	☐	☐	☐	☐
	Proposed Structure Span: 100' feet *(perpendicular to flow)*	**Culvert Diameter:** N/A feet **Inlet Elevation:** El. N/A feet			
	Proposed Structure Length: 123' feet *(parallel to flow)*	**Outlet Elevation:** El. N/A feet **Culvert Slope:** N/A			
	Proposed Entrenchment Ratio:* N/A *For **Tier 2**, **Tier 3** and **Tier 4** Crossings Only. To accommodate the entrenchment ratio, floodplain drainage structures may be utilized.*				

** Note: Proposed Entrenchment Ratio must meet the minimum ratio for each stream type listed in **Figure 3**, otherwise the applicant must address the Alternative Design criteria listed in Env-Wt 904.10.*

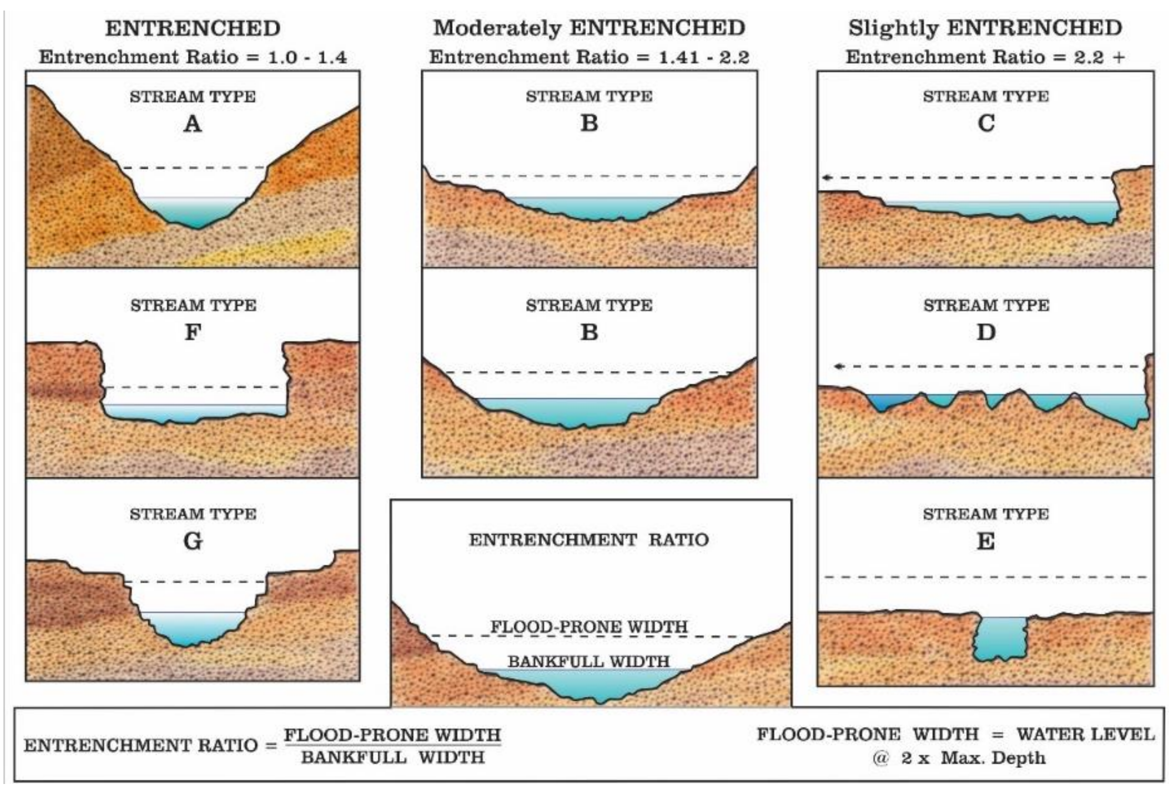


Figure 3: Reference from Applied River Morphology, Rosgen, 1996.

SECTION 11 - CROSSING STRUCTURE HYDRAULICS		
	Existing	**Proposed**
100 year flood stage elevation at inlet:	181	181
Flow velocity at outlet in feet per second (FPS):	1.5	1.4
Calculated 100 year peak discharge (Q) for the *proposed* structure in CFS:		1,150
Calculated 50 year peak discharge (Q) for the *proposed* structure in CFS:		

SECTION 12 - CROSSING STRUCTURE OPENNESS RATIO

*For **tier 2**, **tier 3** and **tier 4** crossings only.*

Crossing Structure Openness Ratio* = N/A
* Openness box culvert = (height x width)/length
Openness round culvert = (3.14 x radius^2)/length

SECTION 13 - GENERAL DESIGN CONSIDERATIONS

Env-Wt 904.01 requires all stream crossings to be designed and constructed according to the following requirements. Check each box if the project meets these general design considerations.

All stream crossings shall be designed and constructed so as to:

☒ Not be a barrier to sediment transport.

☒ Prevent the restriction of high flows and maintain existing low flows.

☒ Not obstruct or otherwise substantially disrupt the movement of aquatic life indigenous to the waterbody beyond the actual duration of construction.

☒ Not cause an increase in the frequency of flooding or overtopping of banks.

☒ Maintain or enhance geomorphic compatibility by:

a. Minimizing the potential for inlet obstruction by sediment, wood, or debris, and
b. Preserving the natural alignment of the stream channel.

☒ Preserve watercourse connectivity where it currently exists.

☒ Restore watercourse connectivity where:

a. Connectivity previously was disrupted as a result of human activity(ies), and
b. Restoration of connectivity will benefit aquatic life upstream or downstream of the crossing, or both.

☒ Not cause erosion, aggradation, or scouring upstream or downstream of the crossing.

☒ Not cause water quality degradation.

SECTION 14 - TIER-SPECIFIC DESIGN CRITERIA

Stream crossings must be designed in accordance with the tier specific design criteria listed in Part Env-Wt 904.

☒ The proposed project meets the tier specific design criteria listed in Part Env-Wt 904 and each requirement has been addressed in the plans and as part of the wetland application.

SECTION 15 - ALTERNATIVE DESIGN

NOTE: If the proposed crossing does not meet all of the general design considerations, the tier specific design criteria, or the minimum entrenchment ratio for each given stream type listed in **Figure 3**, then an alternative design plan and associated requirements must be addressed pursuant to Env-Wt 904.10.

☐ I have submitted an alternative design and addressed each requirement listed in Env-Wt 904.10.

Hydraulic Capacity Report

Ref: 52775.00
February 20, 2023
Revised: June 5, 2023

Memorandum

To: Wendy Johnson, P.E.
NHDOT Bureau of Highway Design
Bob Juliano, P.E.
NHDOT Bureau of Bridge Design
Jennifer Reczek, P.E.
Consultant Design Chief,
NHDOT Bureau of Bridge Design

Date: February 20, 2023
Revised: June 5, 2023

Project #: 52275.00

From: Annique Fleurock, P.E.
Water Resources Engineer

Re: FE Everett Turnpike – Merrimack and Nashua, NH
(State Project #13761A)
Pennichuck Brook Bridge Hydraulic Analysis

This report provides a comprehensive analysis of the existing and proposed hydrologic and hydraulic conditions of the FE Everett Turnpike over the Pennichuck Brook, completed by VHB, to support the design of the new bridge on the border of Merrimack and Nashua, NH (the Crossing) as part of the New Hampshire Department of Transportation (NHDOT) highway Slope and Drain submittal. All elevations listed in this report are referenced to the North American Vertical Datum of 1988 (NAVD88), feet, unless noted otherwise.

The existing condition modeling exercise found that water surface elevations are highly dependent upon the downstream Bowers Pond dam. The proposed hydraulic modeling found no adverse impacts to the proposed water surface elevations for the design event which aligns with expectations as the proposed hydraulic opening is larger than the existing conditions.

Project Background

The proposed FE Everett Turnpike (FEET) improvement project is intended to address traffic congestion and safety related deficiencies associated with the southern segment of FEET; this project will include roadway widening and bridge replacements. As part of the overall FEET improvement project, existing Bridges No. 106/042 and 107/042 carrying FEET northbound and southbound, respectively, will be replaced with one 123-foot (out-to-out) wide 100-foot single span bridge that will carry both northbound and southbound FEET over Pennichuck Brook (proposed bridge numbers: 108/043 and 107/043).

The National Flood Insurance Program (NFIP) Flood Insurance Rate Map (FIRM) Panel 33011C0511D (Effective Date September 25, 2009) provided in **Appendix A**) shows the Crossing to be located within the Special Flood Hazard Area (SFHA) Zone AE associated with the Pennichuck Brook, with a Base Flood Elevation (BFE) of elevation 181.3 ft (NAVD88). There is a regulatory floodway defined for Pennichuck Brook; because there is a floodway, the NFIP regulations for floodway development set forth in 44 CFR 60.3(d)(3) do apply for this project and a "No Rise" Floodway Encroachment Assessment is required and provided as part of this submission.

Pennichuck Brook flows generally west to east, from Pennichuck Pond on the Merrimack-Hollis town line, to its confluence with the Merrimack River on the Merrimack-Nashua town line. The river is the primary drinking water source for the City of Nashua and is therefore an environmentally sensitive water course. Pennichuck Brook is fed by ponds and streams between the eastern side of Birch Hill in Hollis and the west side of FEET. There are three (3) dams downstream of the FEET Pennichuck Brook crossing:

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- Supply Pond Dam (NH00123)
- Harris Pond Dam (NH00122)
- Bowers Pond Dam (NH00330)

There are also four (4) dams upstream of the FEET Pennichuck Brook crossing:

- Stump Pond Dam (NH00505)
- Holt Pond Dam (NH00327)
- Dunklee Pond Dam (NH00503)
- Silver Lake Dam (NH01056)

The crossing is located within the impoundment of Bowers Pond Dam (approximately 3,000 feet upstream of the dam) and its hydrology is impacted by the presence of dams upstream. According to the NH Dam Bureau Data Sheet (provided in **Appendix A**), the Bowers Pond Dam (NH00330) water supply dam provides permanent storage of 1,060 acre-feet with maximum flood storage of 2,040 acre-feet; the 88-acre dam impoundment extends approximately 8,500 feet upstream to the Holt Pond Dam (NH00327) and is limited to the river channel and adjacent bank areas. The Bowers Pond Dam (NH00330) is a 24.5-foot-tall by 420-foot-wide water-supply with a 52.8-foot-wide by 9-foot-tall, gated spillway. The gate is closed under normal conditions as shown by the stop logs described on the Bowers Pond Dam Plans (provided in **Appendix A**) and confirmed to remain in place during coordination with Pennichuck Water Works. The dam was built in 1884 and reconstructed in 1991. VHB has been in contact with the dam owner, Pennichuck Water Works, who most recently modeled the dam in the Spring of 2022.

Hydrology

VHB evaluated multiple sources of hydrologic data available for Pennichuck Brook:

- VHB calculated the contributing watershed of the Pennichuck Brook at the Crossing location using USGS StreamStats 4.11 hydrologic software to be 23.92 square miles, and estimated design discharge flows for multiple exceedance probabilities based on watershed data applying New Hampshire-specific hydrologic regression equations from USGS Scientific Investigations Report (SIR) 2008-5206. The 1% Annual Exceedance Probability (AEP) design flow from StreamStats is 1,650 cubic feet per second (cfs). StreamStats provides lower and upper 90% prediction intervals for each estimate indicating lower and upper prediction intervals of 899 cfs and 3,030 cfs, respectively, for the 1% AEP storm.

- The September 25, 2009 Effective Flood Insurance Study (FIS) for Hillsborough County, New Hampshire estimates flood discharges for the Pennichuck Brook associated with the 1% AEP, based on USGS regression equations from a 1974 study. The contributing watershed at the crossing location is reported at 23 square miles by FEMA. The study notes that values below Route 101A were routed through one natural storage area and four reservoirs; Holt Pond, Bowers Pond, Harris Pond, and Supply Pond, using a reservoir routing method (Viessman, 1972). Peak discharges for this portion of Pennichuck Brook were developed through the routed results. The October 2022 Preliminary FIS for Hillsborough County uses the same hydrology for Pennichuck Brook. The 1% AEP design flow from FEMA (Effective and Preliminary) is 1,150 cfs.

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- VHB contacted the New Hampshire Department of Environmental Services (NHDES) Dam Bureau to obtain backup documentation for Bowers Pond Dam. In conjunction with that data, the Dam Bureau provided VHB with the contact information of the dam owner, Pennichuck Waterworks. With client approval, VHB contacted Pennichuck Waterworks who was able to provide a 1% AEP design flow based upon a HydroCAD model. The contributing watershed at the dam location is reported at 24.3 square miles. The 1% AEP design flow calculated by the NHDES model at Bowers Pond Dam is 441 cfs.
- There is no applicable stream gage data for the Pennichuck Brook in Merrimack; the nearest gage is located approximately 2.5 miles downstream on the Pennichuck (USGS Gage 01094161); however, it was only active for 4 months in the year 2000 and has no applicable readings.

Based on the quality of available data, VHB selected the FEMA study as the most appropriate estimate for flood discharges at the Crossing location. The NHDES model estimate is the largest outlier of all available data and VHB cannot verify the accuracy of the HydroCAD model inputs. The 2008 regression equation results from StreamStats do not account for the full storage provided by the dams within the vicinity of the crossing but do account for wetland storage, so the expected actual flows would be lower than the regression estimate, which is noticeably larger than the other estimates. FEMA flows reportedly account for routing through the ponds and fall within fall within the StreamStats upper and lower 90% prediction intervals of the 2008 regression equations. The FEMA flows have been verified by the FIS review process and provide a more conservative estimate for headwater and scour than the NHDES model. As stated previously, the FEMA study lists the watershed area as 23.0 sq miles which varies slightly from the estimate by StreamStats calculation however a 4% variation is an acceptable tolerance level for an area calculation of a hydrology analysis. FEMA does not provide a map for the contributing watershed of Pennichuck Brook, and therefore it is difficult to discern the reason for this 4% area difference.

The NHDES Wetland Section designates this crossing as a Tier 3 stream crossing classification due to its watershed size and FEMA Zone AE designation.

As a NHDOT Tier 1 highway, the design flood for the Crossing is the 1% AEP, or “100-year” event as shown in the NHDOT Bridge Design Manual Section 2.7 Table 2.7.5-1. **Table 1** presents a summary of hydrology and a comparison of FEMA flows and USGS StreamStats flows; detailed hydrologic calculations are included in **Appendix A. Figure 1** (attached) shows the approximate contributing watershed of the Pennichuck Brook for the study area.

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Table 1 Hydrology: Pennichuck Brook at Pennichuck Brook Dam

	FIS *(Effective and Preliminary)*	USGS SIR 2008-5026 Regression
Watershed Area (sq miles)	**23.0**	23.9
Design Storm AEP	Peak Discharge (cfs)	
50% AEP (2-year flood)		464
10% AEP (10-year flood)	**629**	894
40% AEP (25-year flood)		1170
2% AEP (50-year flood)	**967**	1390
1% AEP (100-year flood)	**1150**	1650
0.2% AEP (500-year flood)	**1640**	2290

Source: USGS StreamStats 4.11, USGS SIR 2008-5206, 2009/2022 Hillsborough County FIS

Hydraulic Analysis Methodology

Using bathymetric survey of the Pennichuck Brook collected by VHB in December 2021, supplemented by 2019 NH USGS LiDAR digital terrain model, and 2004 Pennichuck Waterworks site plans of the Bowers Pond Dam (NH00330), VHB developed a hydraulic model of the Pennichuck Brook using the US Army Corps of Engineers (USACE) Hydraulic Engineering Center River Analysis System (HEC-RAS) software version 6.3. The model extends approximately 3,500 feet downstream and 1,200 feet upstream of the proposed crossing and includes the downstream Bowers Pond Dam (NH00330) to quantify the tailwater impacts of the dam on the hydraulics of the crossing. The model includes FIS Published Cross-Section I, upstream of the crossing and Cross Section H, downstream of Bowers Pond Dam. The geometry of the dam is modeled from the 2004 Pennichuck Waterworks site plan geometry.

Model geometry was assembled using the HEC-RAS RAS Mapper subprogram to set cross-section locations, elevations, bank stations, and reach lengths. Expansion and contraction coefficients were set to be 0.1 and 0.3, respectively, for normal cross-sections and 0.3 and 0.5 for cross-sections bounding bridge and the dam in accordance with HEC-RAS manual guidelines. Ineffective flow areas were set to reflect areas of non-active flow blocked by buildings or bridge structures. Manning's "n" values were estimated from Chow (1959) and applied to cross-section locations based on aerial imagery. The Pennichuck Brook channel is clean and straight with no significant pools, brush, or stones. Table 2 presents a summary of the roughness values applied in the HEC-RAS model:

Table 2 Manning's "n" values

Land Cover	"n" value
Pennichuck Brook Channel	0.030
Shallow Vegetated Area	0.070
Wooded Areas	0.120

Source: Chow (1959), aerial imagery

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Using the existing conditions model geometry as a base, VHB developed an additional model representing the proposed single-span bridge with an effective hydraulic opening of 97 feet (structural span of 100 feet). **Figure 2** (attached) shows the domain of the HEC-RAS model; detailed HEC-RAS model outputs are included in **Appendix B.**

Hydraulic Analysis Results

Using effective FIS peak discharges, hydraulic model results indicate the 1% AEP flood elevation at the existing FEET crossing is 181.0 feet. This elevation will be compared the results of the proposed model rather than the 181.3 feet computed by the FEMA FIS hydraulic analysis.

Hydraulic model results indicate that the proposed effective hydraulic 97-foot span bridge would result in no noticeable change in flood elevations in the Pennichuck Brook upstream (west) of the crossing compared to existing conditions. Model results also indicate that tailwater effects from the Bowers Pond Dam (NH00330) are the primary factor influencing water elevations at the crossing. The proposed structure has been designed to provide a minimum 1 foot of freeboard during the 1% AEP storm event at the lowest elevation of the bridge low chord: 182.7 feet at the left (northern) abutment face, a low chord increase in elevation of 0.6 feet due to refined bridge design and reduced girder depth completed during Preliminary Design.

The proposed structure crosses Pennichuck Brook with no proposed impacts to the 1% AEP floodplain. **Table 3** below provides a summary of model results for the design 1% AEP flood event and 0.2% AEP scour check flood event:

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Table 3 FEET – Pennichuck Brook Hydraulic Analysis Results

	Existing Conditions	Proposed Conditions
Drainage Area (sq mi)	23 [1]	
Bridge Low Chord (ft)	182.1	182.7
Bridge Waterway Opening (sf)	903	1073
1% AEP Design Flood Discharge (cfs)	1,150	1,150
1% AEP Design Flood Elevation (ft) [2]	181.0	181.0
1% AEP Design Flood Velocity (fps) [3]	1.5	1.4
1% AEP Design Flood Freeboard (ft) [4]	1.1	1.7
0.2% AEP Check Flood Discharge (cfs)	1,640	1,640
0.2% AEP Check Flood Elevation (ft) [2]	181.9	181.9
0.2% AEP Check Flood Velocity (fps) [3]	2.0	1.8

Source: VHB HEC-RAS model.
1: Reporting the FEMA watershed area based on the use of the FEMA hydrology.
2: Model River Station (RS) 3728
3: Measured through the crossing
4: Freeboard is measured as the difference between the headwater elevation and the lowest elevation of the bridge low chord.

The proposed structure crosses Pennichuck Brook with no proposed increases to the FEMA 1% AEP floodplain. **Table 4** below provides a summary of model results for the FEMA 1% AEP flood event and the Effective FEMA 1% AEP flood event. **Appendix B** includes a FEMA No-Rise Certification.

Table 4 FEET – Pennichuck Brook FEMA 1% AEP Floodplain Results

	FEMA FIS[1]	Pre-Project Conditions	Post-Project Conditions	[Post] – [Pre] Change
1% AEP Design Flood Discharge (cfs)	1,150	1,150	1,150	
		WSE at FEMA Cross Section I (Model RS 4267)		
1% AEP Design Flood Elevation (ft)	181.3	180.98	180.98	*0.00*
		WSE Two RS Upstream of Bridge (Model RS 3728)		
1% AEP Design Flood Elevation (ft)	**181.3**	**180.98**	**180.98**	***0.00***

1: FEMA FIS water surface elevations taken from the FIS floodway table (provided in NAVD88) for the Published Cross-Section I location, and estimated from the FIS flood profile for the Upstream of Bridge location

Scour Analysis

As a Tier 1 highway, the design scour and check scour events for the proposed FEET crossing are the 1% AEP and 0.2% AEP, respectively in accordance with the NHDOT Bridge Design Manual Section 2.7 Table 2.7.5-1.

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The current roadway and river alignment can be seen in USGS Maps dating back to 1968. The first depiction of FEET is shown in 1953. The USGS Maps show no change in channel alignment dating to oldest historic maps from 1905. There are no USGS historic maps available prior to the construction of the downstream dam which was built in 1884. There is no other evidence of channel migration or lateral channel instability and the channel is assumed to be laterally stable. There is no historic bathymetric data at the crossing location and no known evidence of aggradation or degradation of the channel at the crossing location.

Boring logs from subsurface explorations around the proposed bridge abutments performed in August and September of 2019 indicate alluvial fine sand deposits over organics. There is no boring data available within the channel but the streambed material is assumed to be similar to that below the roadway approaches. VHB evaluated scour for a conservative D_{50} value corresponding to fine sand (0.074 mm); the values presented below assume this as the minimum particle size for sand. The boring logs are included in **Appendix C.**

Given the downstream dam and historic stability of the river channel, long-term channel degradation and lateral channel migration are not anticipated to be an issue at this location. Scour at the bridge substructures is assumed to be a function of general scour from floodplain contraction and local scour from flows impacting abutments. VHB calculated scour depths for the 1% and 0.2% AEP events based on the methodology presented in the Hydraulic Engineering Circular (HEC) 18 published by the Federal Highway Administration (FHWA) in April 2012. All scour calculations indicated maximum abutment scour elevations below the bottom of proposed pile caps, understood to be at elevations 176.00 and 177.25, with piles extending below. This report recommends any existing riprap from the existing bridge be left in place and all disturbed areas be protected with a minimum of NHDOT Class I riprap armoring, placing larger riprap to match existing is acceptable. Additionally, NHDOT Class I Riprap (at a minimum) should also be placed based upon the extents described in **Table 6** below. VHB evaluated predicted design and check scour events based on FHWA HEC-23 methodology, confirming Class I riprap sizing is appropriate. **Table 5 and Table 6** provides a summary of scour calculations and recommended riprap protection; detailed HEC-18 scour calculations and HEC-23 riprap sizing calculations are provided in **Appendix C.**

Table 5 NH FEET – Pennichuck Brook Scour Analysis Results

	Channel	Left (North) Abutment	Right (South) Abutment
Reference bed elevation (ft)	172.5	179.0	180.3
1% AEP Design Scour Depth (ft)	2.1	10.5	11.8
1% AEP Design Scour Elevation (ft)	170.5	168.5	168.5
0.2% AEP Check Scour Depth (ft)	4.9	14.1	15.4
0.2% AEP Check Scour Elevation (ft)	167.6	164.9	164.9

Source: VHB HEC-18 calculations.

Table 6 NH FEET – Riprap Protection Extents

Location	Riprap Size D50 (inches)	Riprap Size D100 (inches)	Riprap Thickness (Feet)	Riprap Extent from Toe (feet)	Riprap Extents Upstream and Downstream (feet)
Abutments	6	12	1	19	19

Source: VHB HEC-23 calculations.

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Table 7 Hydraulic Data Table for Bridge General Plan (NHDOT NHDOT Bridge Design Manual Figure 2.7.8-1)

HYDRAULIC DATA	
Drainage Area	23 square miles
Design Flood Discharge (1% or 100-yr)	1,150 cfs
Design Flood Elevation (1% or 100-yr)	181.0 feet NAVD88
Design Flood Velocity (1% or 100-yr)	1.4 feet per second
Scour Check Discharge (0.2% or 500-yr)	1,640 cfs
Anticipated Depth of Scour (1% or 100-yr)	Channel: 2.1 feet Left Abutment: 10.5 feet Right Abutment: 11.8 feet
Anticipated Depth of Scour (0.2% or 500-yr)	Channel: 4.9 feet Left Abutment: 14.1 feet Right Abutment: 15.4 feet
Bridge Full Waterway Opening	1075 square feet

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Figures

Figure 1: Locus

Figure 2: Model Layout

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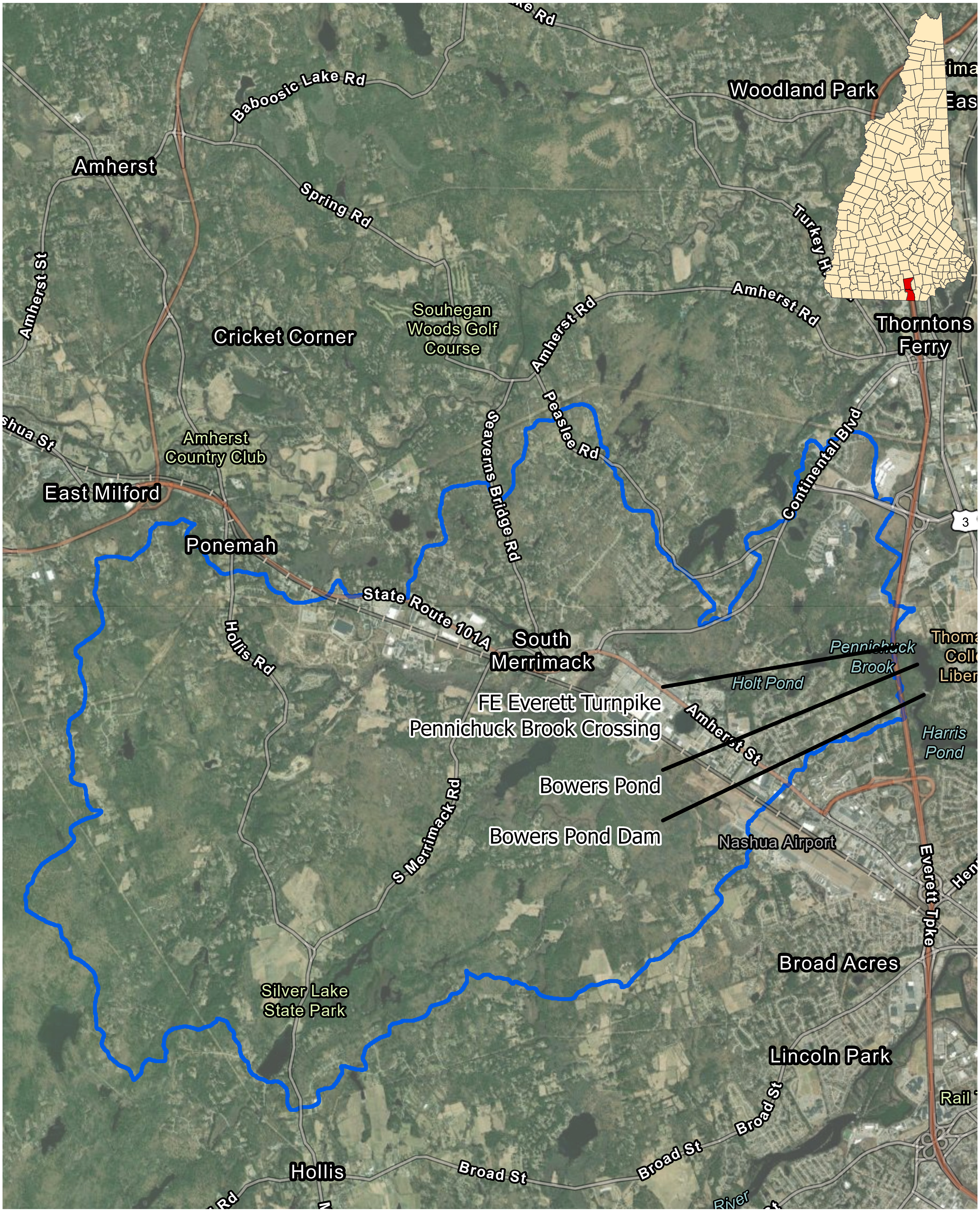
Figure 1: Locus

13761A FE Everett Turnpike | Merrimack and Nashua, NH



0 6,000 12,000 US Feet

Source: USGS Mapping Services

Legend

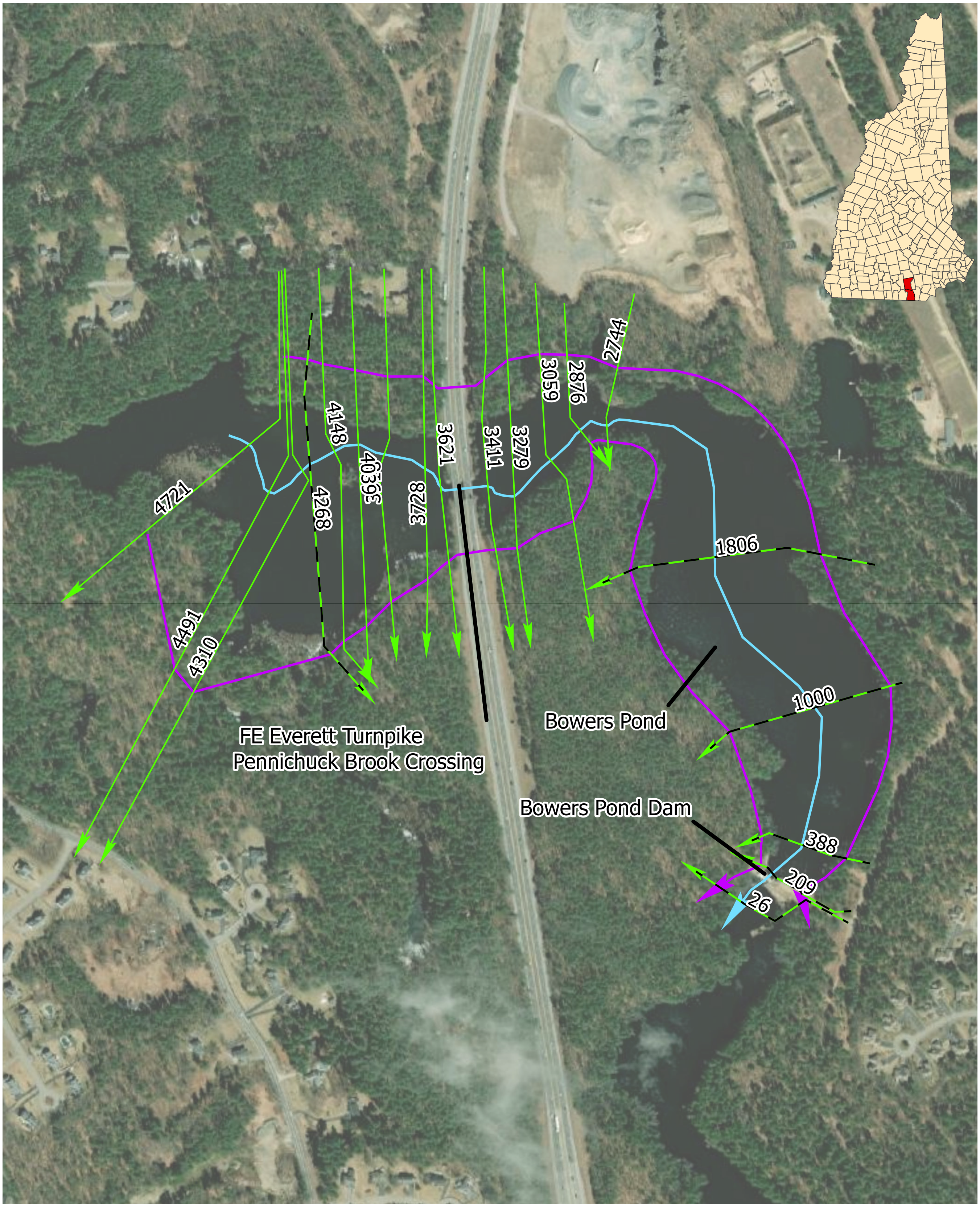
StreamStats Watershed

FEMA Hydrology used.
FEMA Watershed not available.
StreamStats Watershed shown for context.

Path: \\vhb\gis\proj\Bedford\52775.00 FEE Everett Turnpike\Project\HH\5277500_FEET_HH\5277500_FEET_HH.aprx (afleurock, 2/3/2023)

Figure 2: Model Layout

13761A FE Everett Turnpike | Merrimack and Nashua, NH



0 600 1,200 US Feet

Source: USGS Mapping Services

Legend

- River Centerline
- Flow Paths
- Project Cross Sections
- FEMA Model Cross Sections

Appendix A

NH Dam Bureau Data Sheet
Bowers Pond Dam Plans
StreamStats Output
FEMA

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NHDAMS DATA SHEET

Dam# **D165004** Haz Cl: H Name BOWERS DAM
Status ACTIVE Town: NASHUA
Haz by Rule: River: PENNICHUCK BROOK
Condition: POOR Other Name:
NATDAM # NH00330 FERC #: FERC HZCL:

Dam Owner: PENNICHUCK WATER WORKS INC Class Own P
Represent: ATTN MR DONALD WARE COO Tel#: 603-913-2330
Street: PO BOX 428 25 WALNUT STREET Cell#: 603-860-3261
Mail Town: NASHUA State: NH Zip: 03061 0428
Email: DONALD.WARE@PENNICHUCK.COM

Emer Cont MR CHRIS COUNTIE DIR WS EC Cell: 603-566-0650
EC Email: CHRIS.COUNTIE@PENNICHUCK.COM EC Tel: 603-913-2372

Alter Cont: WASTE WTR TRTMNT PLANT OPER AC Tel: 603-913-2370

Height: 24.5 ft
Length: 420 ft
Impnd: 88 acres
Perm Stor 1060 acft
Max Stor: 2040 acft
Free Board ft
Drain Area: 15580 acres
Use: WATER SUPPLY

Design Evnt yr: 2.5 X 100 YR
Des Evnt inflow: 2270 cfs
Des Evnt rtd outflow: 2269 cfs
Unop Disch w/1' frbrd: 470 cfs
Max Unop Disch: 864 cfs
Total Disch full op: cfs
Year last HH: 2018
Primary Const: EARTH/CONCRETE

Type main spill: BROADLT2
Main spill size:
Flashboards: N
Stoplogbay size: 52.8' Effective
Gate size: NA
Auxilliary Spill sz: NA
Pond drain: N
Type outlet pipe: NA

County: HILLSBOROUGH Tax ID: G-488 Year orig Permit:
Basin: MERR Deed BK/PG: Year orig Const: 1884
Latitude 42.8 Longitude -71.4941 Year last Reconst: 1991

Physical Loc: GATED ACCESS

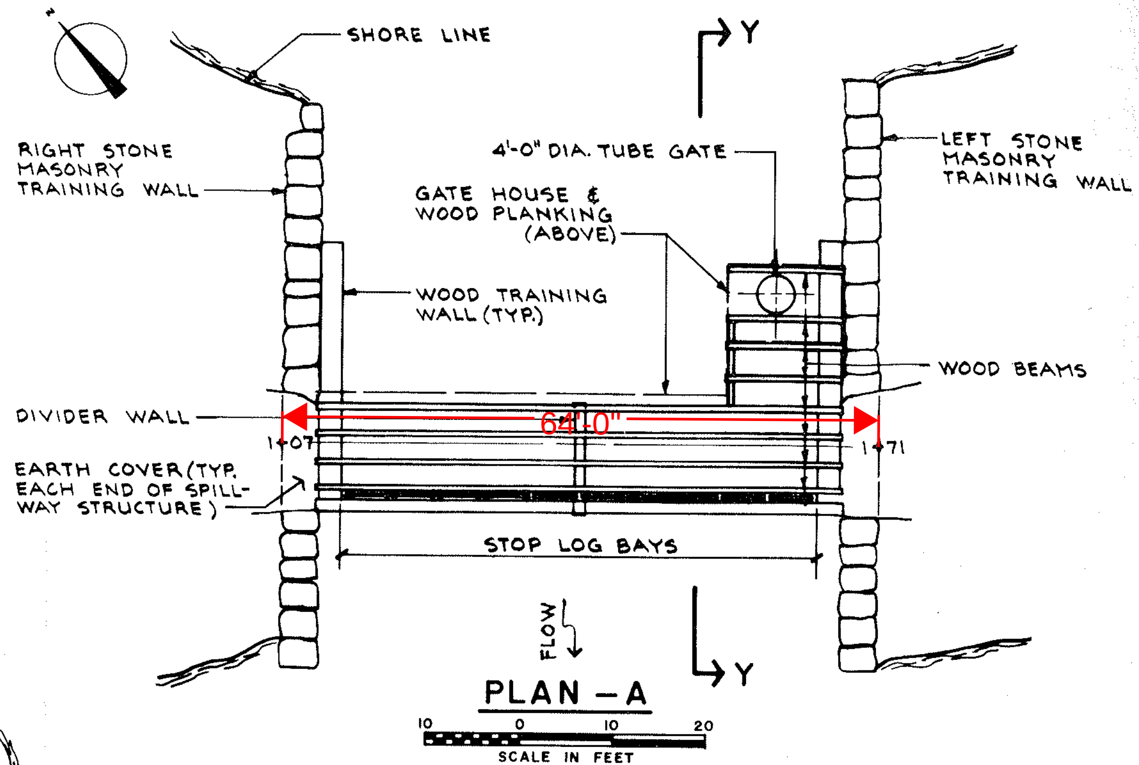
OMR Date 4/1/2019 Drawdown time: NA
Fall Drawdown N Drawdown dept NA
Drawdown comment: NA

Last Field Insp: 6/8/2020 Insp By: JDF
Next Insp YR: 2022

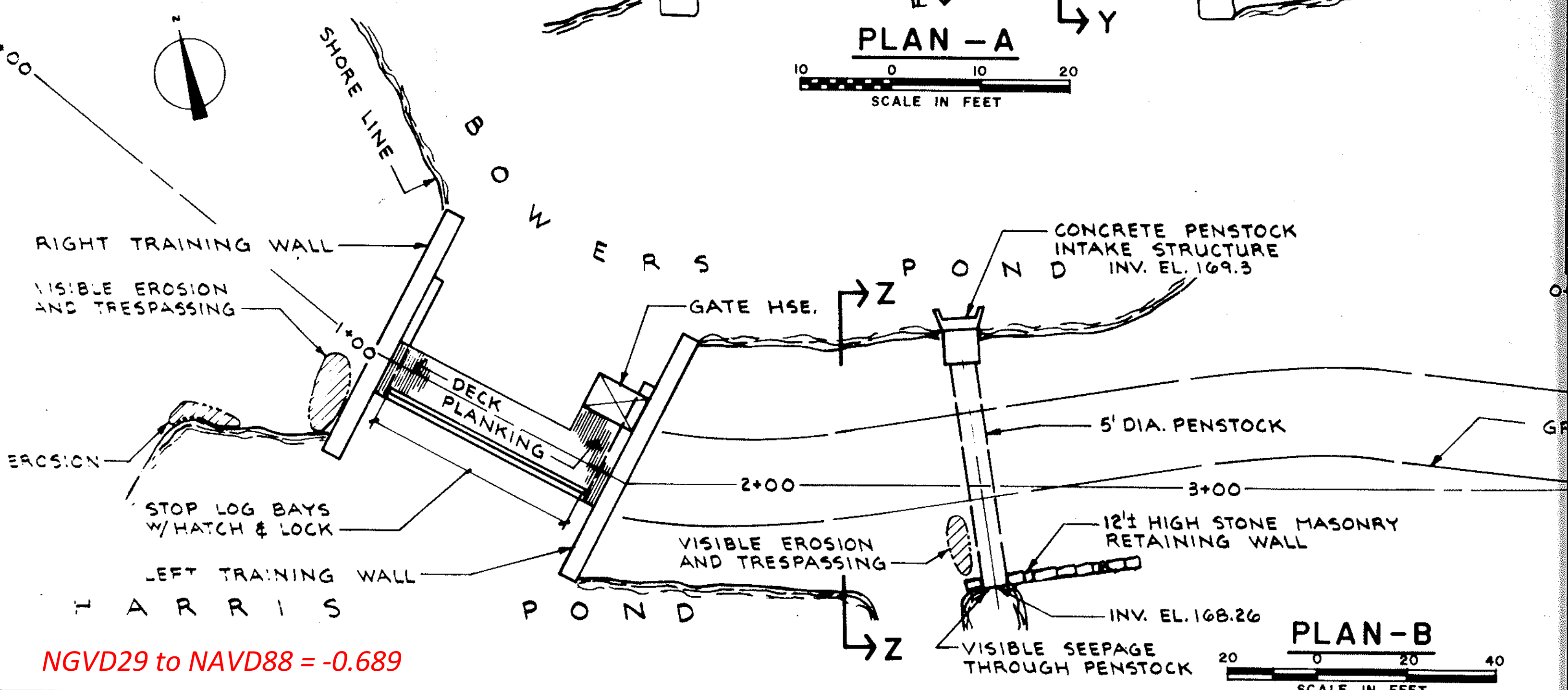
Comment: **19970101 S TO H**

2/19/2021

AN EMPTY FIELD MEANS DATA NOT YET ENTERED OR NOT YET AVAILABLE
ALL DATA SUBJECT TO CONTINUOUS CHANGE AND REVIEW

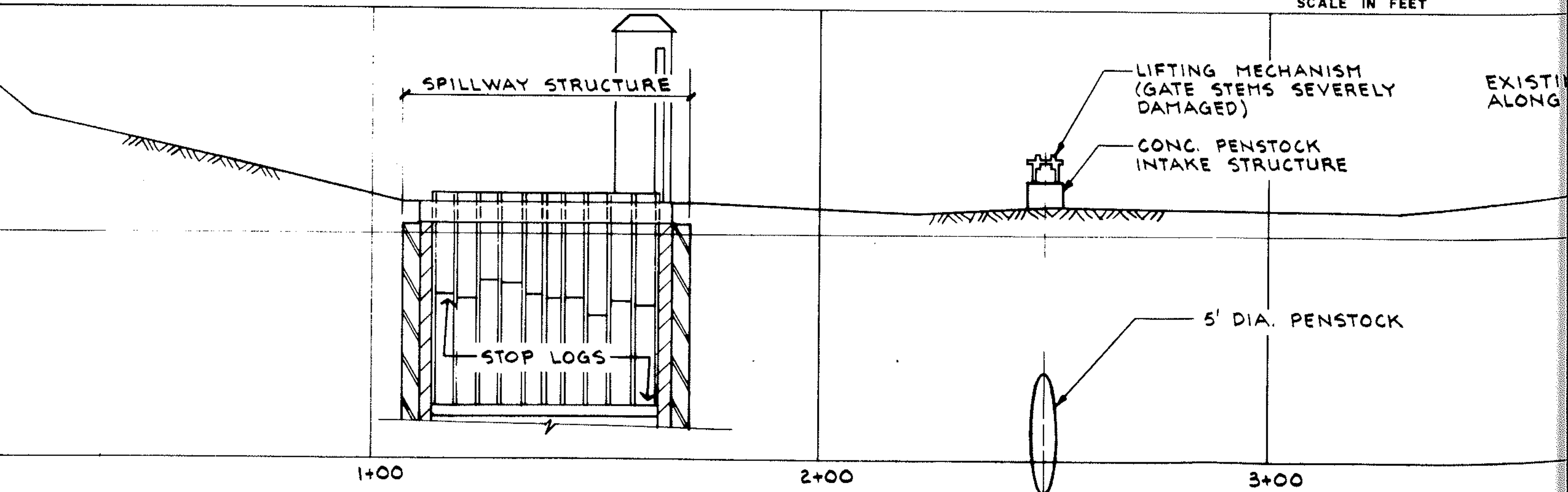


PLAN – A

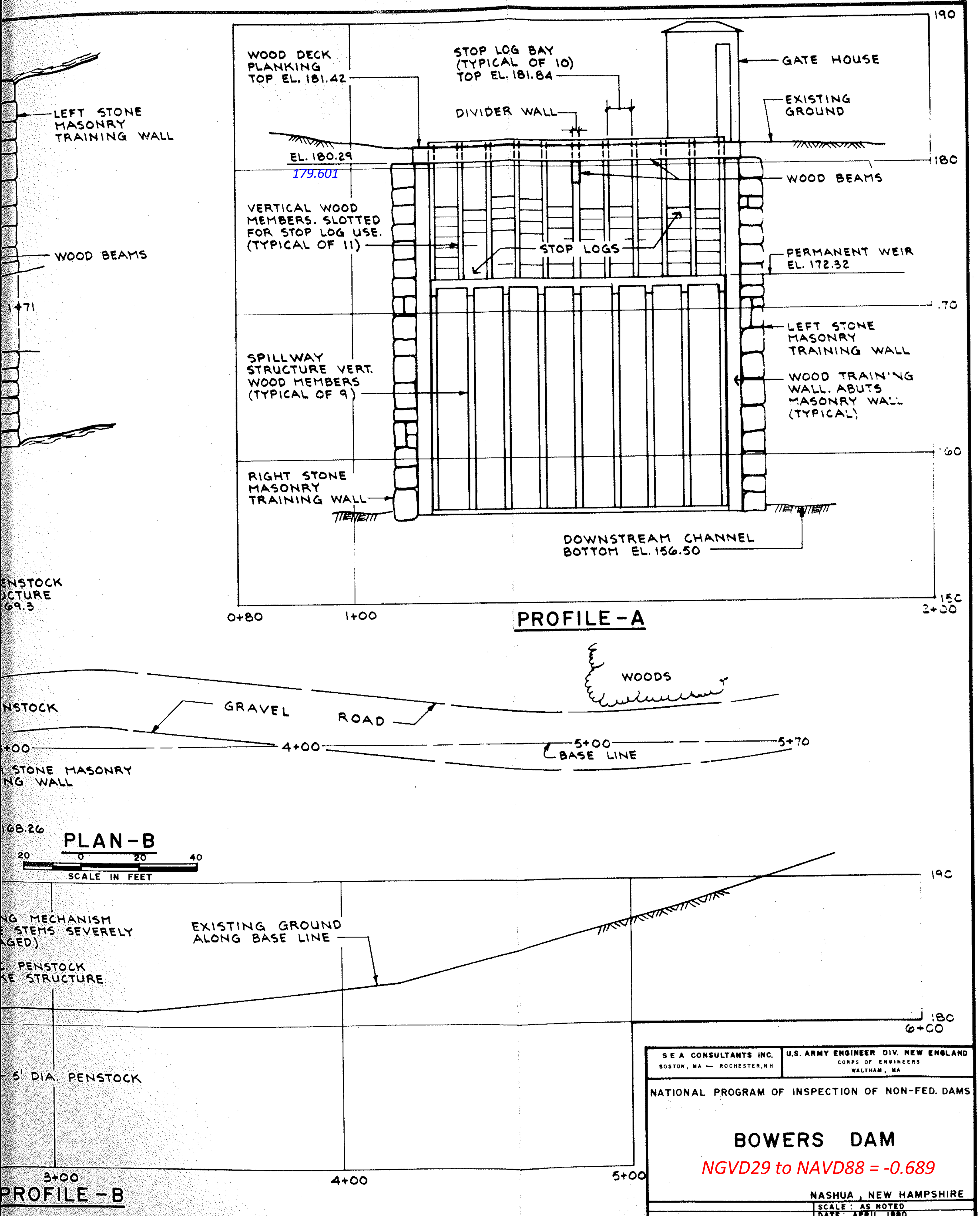


PLAN – B

NGVD29 to NAVD88 = -0.689

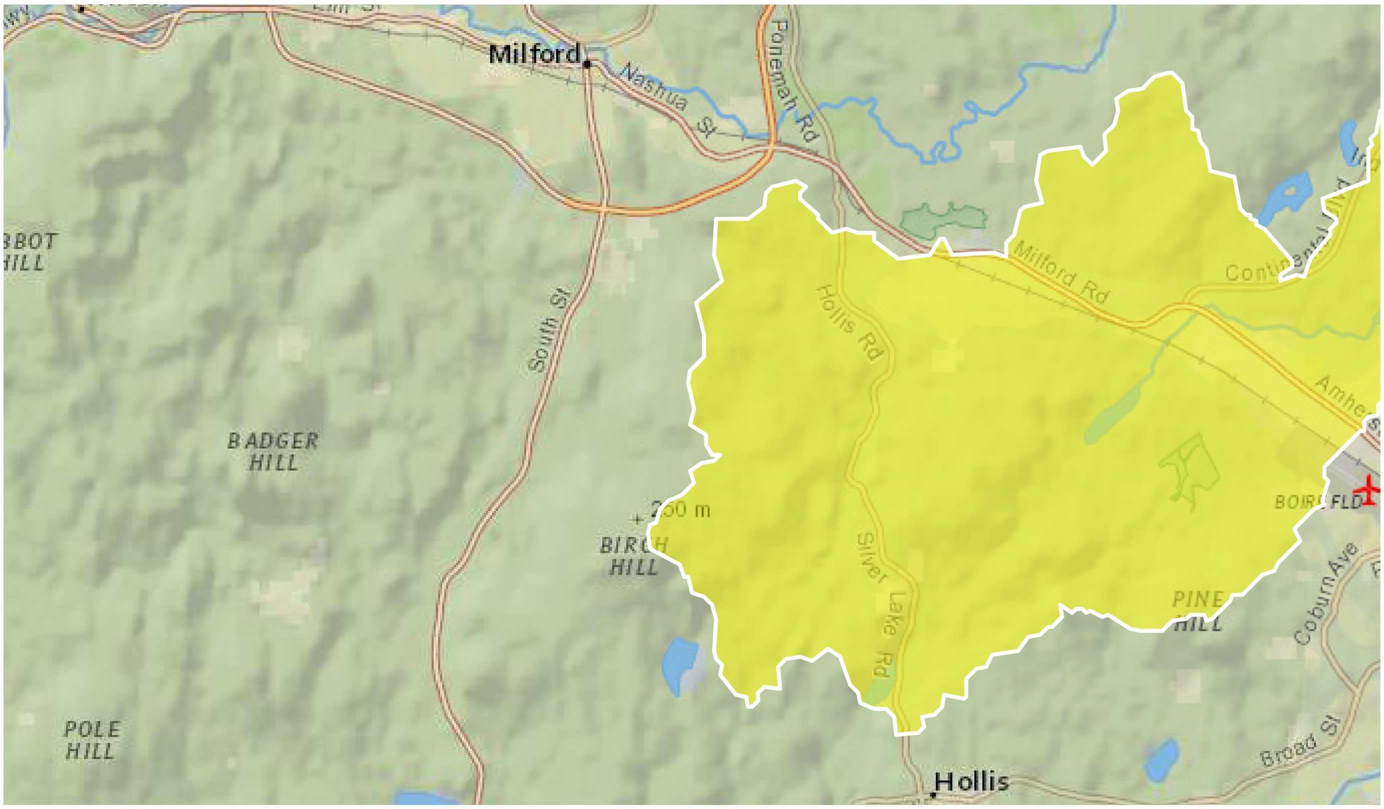


PROFILE – B


WOOD DECK PLANKING TOP EL. 181.42
STOP LOG BAY (TYPICAL OF 10) TOP EL. 181.84
GATE HOUSE
DIVIDER WALL
EXISTING GROUND
LEFT STONE MASONRY TRAINING WALL
EL. 180.29
179.601
WOOD BEAMS
VERTICAL WOOD MEMBERS, SLOTTED FOR STOP LOG USE. (TYPICAL OF 11)
STOP LOGS
PERMANENT WEIR EL. 172.32
1+71
SPILLWAY STRUCTURE VERT. WOOD MEMBERS (TYPICAL OF 9)
WOOD TRAINING WALL, ABUTS MASONRY WALL (TYPICAL)
RIGHT STONE MASONRY TRAINING WALL
DOWNSTREAM CHANNEL BOTTOM EL. 156.50
ENSTOCK UCTURE 69.3
190
180
170
160
150
0+80
1+00
2+00
PROFILE-A
WOODS
NSTOCK
GRAVEL ROAD
4+00
5+00
5+70
BASE LINE
STONE MASONRY NG WALL
168.26
PLAN-B
20 0 20 40
SCALE IN FEET
190
NG MECHANISM STEMS SEVERELY AGED)
EXISTING GROUND ALONG BASE LINE
PENSTOCK KE STRUCTURE
180
6+00
5' DIA. PENSTOCK
3+00
4+00
5+00
PROFILE-B
S E A CONSULTANTS INC. BOSTON, MA — ROCHESTER, NH
U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
BOWERS DAM
NGVD29 to NAVD88 = -0.689
NASHUA, NEW HAMPSHIRE
SCALE: AS NOTED
DATE: APRIL 1980

StreamStats Report - NH Route 101 at Pennichuck Brook (Bowers Pond), Nashua-Merrimack NH

Region ID: NH
Workspace ID: NH20210707154150271000
Clicked Point (Latitude, Longitude): 42.80467, -71.49894
Time: 2021-07-07 11:42:10 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	23.92	square miles
APRAVPRE	Mean April Precipitation	3.966	inches
WETLAND	Percentage of Wetlands	10.8816	percent
CSL10_85	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known	21	feet per mi

Parameter Code	Parameter Description	Value	Unit
TEMP	Mean Annual Temperature	46.776	degrees F
PREG_06_10	Mean precipitation at gaging station location for June to October summer period	17.3	inches
CONIF	Percentaqe of land surface covered by coniferous forest	17.3409	percent
PREBC0103	Mean annual precipitation of basin centroid for January 1 to March 15 winter period	8.43	inches
BSLDEM30M	Mean basin slope computed from 30 m DEM	5.679	percent
MIXFOR	Percentage of land area covered by mixed deciduous and coniferous forest	21.3881	percent
PREG_03_05	Mean precipitation at gaging station location for March 16 to May 31 spring period	8.9	inches
TEMP_06_10	Basinwide average temperature for June to October summer period	62.783	degrees F
ELEVMAX	Maximum basin elevation	809.32	feet
PRECIPOUT	Mean annual precip at the stream outlet (based on annual PRISM precip data in inches from 1971-2000)	42.9	inches
MINTEMP_W	Mean winter minimum air temperature over basin surface area	15.957	degrees F
SNOFALL	Mean Annual Snowfall	65.171	inches
PREBC_1112	Mean annual precipitation of basin centroid for November 1 to December 31 period	8.39	inches
PRECIPCENT	Mean Annual Precip at Basin Centroid	43.5	inches
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	1010087.6	meters
CENTROIDY	Basin centroid vertical (y) location in state plane units	106530.3	meters
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	25	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	9.38	percent
OUTLETX	Basin outlet horizontal (x) location in state plane coordinates	1029255	feet
OUTLETY	Basin outlet vertical (y) location in state plane coordinates	111075	feet

Peak-Flow Statistics Parameters [Peak Flow Statewide SIR2008 5206]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	23.92	square miles	0.7	1290
APRAVPRE	Mean April Precipitation	3.966	inches	2.79	6.23
WETLAND	Percent Wetlands	10.8816	percent	0	21.8
CSL10_85	Stream Slope 10 and 85 Method	21	feet per mi	5.43	543

Peak-Flow Statistics Flow Report [Peak Flow Statewide SIR2008 5206]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SEp	Equiv. Yrs.
50-percent AEP flood	434	ft^3/s	268	703	30.1	3.2
20-percent AEP flood	688	ft^3/s	420	1130	31.1	4.7
10-percent AEP flood	894	ft^3/s	535	1490	32.3	6.2
4-percent AEP flood	1170	ft^3/s	679	2020	34.3	8
2-percent AEP flood	1390	ft^3/s	783	2470	36.4	9
1-percent AEP flood	1650	ft^3/s	899	3030	38.6	9.8
0.2-percent AEP flood	2290	ft^3/s	1150	4550	44.1	11

Peak-Flow Statistics Citations

Olson, S.A.,2009, Estimation of flood discharges at selected recurrence intervals for streams in New Hampshire: U.S.Geological Survey Scientific Investigations Report 2008-5206, 57 p. (http://pubs.usgs.gov/sir/2008/5206/)

Low-Flow Statistics Parameters [Low Flow Statewide]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	23.92	square miles	3.26	689
TEMP	Mean Annual Temperature	46.776	degrees F	36	48.7

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
PREG_06_10	Jun to Oct Gage Precipitation	17.3	inches	16.5	23.1

Low-Flow Statistics Flow Report [Low Flow Statewide]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SE	SEp
7 Day 2 Year Low Flow	1.3	ft^3/s	0.477	2.7	55.7	55.7
7 Day 10 Year Low Flow	0.511	ft^3/s	0.123	1.3	79.4	79.4

Low-Flow Statistics Citations

Flynn, R.H. and Tasker, G.D.,2002, Development of Regression Equations to Estimate Flow Durations and Low-Flow-Frequency Statistics in New Hampshire Streams: U.S.Geological Survey Scientific Investigations Report 02-4298, 66 p. (http://pubs.water.usgs.gov/wrir02-4298)

Flow-Duration Statistics Parameters [Low Flow Statewide]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	23.92	square miles	3.26	689
PREG_06_10	Jun to Oct Gage Precipitation	17.3	inches	16.5	23.1
TEMP	Mean Annual Temperature	46.776	degrees F	36	48.7

Flow-Duration Statistics Flow Report [Low Flow Statewide]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SE	SEp
60 Percent Duration	13.2	ft^3/s	9.67	17.5	18	18
70 Percent Duration	8.27	ft^3/s	5.78	11.4	20.6	20.6
80 Percent Duration	4.65	ft^3/s	2.85	7.13	28	28
90 Percent Duration	2.24	ft^3/s	1.15	3.89	37.5	37.5
95 Percent Duration	1.34	ft^3/s	0.614	2.52	44.1	44.1

Statistic	Value	Unit	PIl	PIu	SE	SEp
98 Percent Duration	0.833	ft^3/s	0.319	1.75	54.3	54.3

Flow-Duration Statistics Citations

Flynn, R.H. and Tasker, G.D.,2002, Development of Regression Equations to Estimate Flow Durations and Low-Flow-Frequency Statistics in New Hampshire Streams: U.S.Geological Survey Scientific Investigations Report 02-4298, 66 p. (http://pubs.water.usgs.gov/wrir02-4298)

Seasonal Flow Statistics Parameters [Low Flow Statewide]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	23.92	square miles	3.26	689
CONIF	Percent Coniferous Forest	17.3409	percent	3.07	56.2
PREBC0103	Jan to Mar Basin Centroid Precip	8.43	inches	5.79	15.1
BSLDEM30M	Mean Basin Slope from 30m DEM	5.679	percent	3.19	38.1
MIXFOR	Percent Mixed Forest	21.3881	percent	6.21	46.1
PREG_03_05	Mar to May Gage Precipitation	8.9	inches	6.83	11.5
TEMP	Mean Annual Temperature	46.776	degrees F	36	48.7
TEMP_06_10	Jun to Oct Mean Basinwide Temp	62.783	degrees F	52.9	64.4
PREG_06_10	Jun to Oct Gage Precipitation	17.3	inches	16.5	23.1
ELEVMAX	Maximum Basin Elevation	809.32	feet	260	6290

Seasonal Flow Statistics Flow Report [Low Flow Statewide]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SE	SEp
Jan to Mar15 60 Percent Flow	19.6	ft^3/s	13.6	27.1	21.2	21.2
Jan to Mar15 70 Percent Flow	16.8	ft^3/s	11.8	23.1	20.7	20.7
Jan to Mar15 80 Percent Flow	14	ft^3/s	10.3	18.6	18.2	18.2

Statistic	Value	Unit	PIl	PIu	SE	SEp
Jan to Mar15 90 Percent Flow	10.7	ft^3/s	7.69	14.4	19.3	19.3
Jan to Mar15 95 Percent Flow	8.46	ft^3/s	5.93	11.6	20.7	20.7
Jan to Mar15 98 Percent Flow	6.62	ft^3/s	4.15	9.91	27.1	27.1
Jan to Mar15 7 Day 2 Year Low Flow	13.8	ft^3/s	10.3	18	17.2	17.2
Jan to Mar15 7 Day 10 Year Low Flow	8.05	ft^3/s	5.57	11.1	21.5	21.5
Mar16 to May 60 Percent Flow	43.1	ft^3/s	34.7	52.8	12.2	12.2
Mar16 to May 70 Percent Flow	34.8	ft^3/s	28.5	42	11.4	11.4
Mar16 to May 80 Percent Flow	28	ft^3/s	22.5	34.3	12.4	12.4
Mar16 to May 90 Percent Flow	21	ft^3/s	16.5	26.3	13.7	13.7
Mar16 to May 95 Percent Flow	16.2	ft^3/s	12.5	20.6	14.8	14.8
Mar16 to May 98 Percent Flow	11.8	ft^3/s	8.57	15.8	18.1	18.1
Mar16 to May 7 Day 2 Year Low Flow	17.3	ft^3/s	13.5	21.7	14.5	14.5
Mar16 to May 7 Day 10 Year Low Flow	9.73	ft^3/s	7.37	12.5	16.2	16.2
Jun to Oct 60 Percent Flow	3.19	ft^3/s	1.68	5.5	36.7	36.7
Jun to Oct 70 Percent Flow	2.28	ft^3/s	1.13	4.09	39.9	39.9
Jun to Oct 80 Percent Flow	1.68	ft^3/s	0.766	3.19	44.5	44.5
Jun to Oct 90 Percent Flow	1.02	ft^3/s	0.417	2.07	50.7	50.7
Jun to Oct 95 Percent Flow	0.71	ft^3/s	0.259	1.54	57	57
Jun to Oct 98 Percent Flow	0.525	ft^3/s	0.179	1.19	61.1	61.1
Jun to Oct 7 Day 2 Year Low Flow	1.2	ft^3/s	0.436	2.52	55.6	55.6
Jun to Oct 7 Day 10 Year Low Flow	0.465	ft^3/s	0.114	1.18	78.5	78.5
Nov to Dec 60 Percent Flow	17.4	ft^3/s	11.5	25.1	23.3	23.3
Nov to Dec 70 Percent Flow	12.8	ft^3/s	8.1	19.1	25.9	25.9
Nov to Dec 80 Percent Flow	8.96	ft^3/s	5.48	13.7	27.8	27.8
Nov to Dec 90 Percent Flow	5.57	ft^3/s	3.18	8.98	31.6	31.6
Nov to Dec 95 Percent Flow	3.68	ft^3/s	1.86	6.46	38.3	38.3
Nov to Dec 98 Percent Flow	2.3	ft^3/s	0.926	4.64	50.6	50.6
Oct to Nov 7 Day 2 Year Low Flow	9.2	ft^3/s	6.01	13.4	23.3	23.3
Oct to Nov 7 Day 10 Year Low Flow	3.3	ft^3/s	1.68	5.72	36.6	36.6

Seasonal Flow Statistics Citations

Flynn, R.H. and Tasker, G.D.,2002, Development of Regression Equations to Estimate Flow Durations and Low-Flow-Frequency Statistics in New Hampshire Streams: U.S.Geological Survey Scientific Investigations Report 02-4298, 66 p. (http://pubs.water.usgs.gov/wrir02-4298)

Application Version: 4.5.3
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

National Flood Hazard Layer FIRMette

FEMA

71°30'15"W 42°48'31"N

71°29'38"W 42°48'4"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

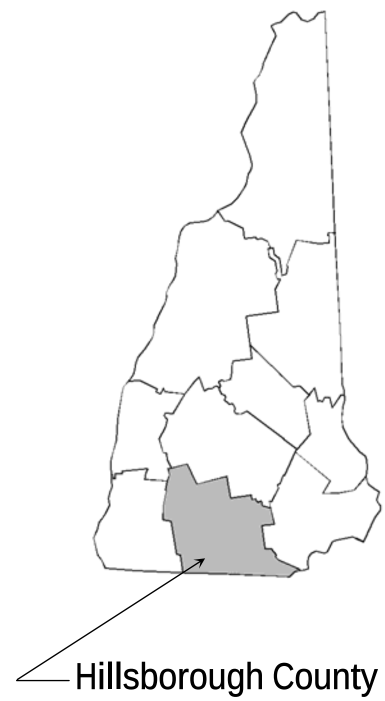
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/7/2021 at 11:45 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

FLOOD INSURANCE STUDY

VOLUME 1 OF 5

HILLSBOROUGH COUNTY, NEW HAMPSHIRE
(ALL JURISDICTIONS)



COMMUNITY NAME	COMMUNITY NUMBER
AMHERST, TOWN OF	330081
ANTRIM, TOWN OF	330082
BEDFORD, TOWN OF	330083
BENNINGTON, TOWN OF	330084
BROOKLINE, TOWN OF	330180
DEERING, TOWN OF	330085
FRANCESTOWN, TOWN OF	330086
GOFFSTOWN, TOWN OF	330087
GREENFIELD, TOWN OF	330209
GREENVILLE, TOWN OF	330088
HANCOCK, TOWN OF	330089
HILLSBOROUGH, TOWN OF	330090
HOLLIS, TOWN OF	330091
HUDSON, TOWN OF	330092
LITCHFIELD, TOWN OF	330093
LYNDEBOROUGH, TOWN OF	330218
MANCHESTER, CITY OF	330169
MASON, TOWN OF	330221
MERRIMACK, TOWN OF	330095
MILFORD, TOWN OF	330096
MONT VERNON, TOWN OF	330224
NASHUA, CITY OF	330097
NEW BOSTON, TOWN OF	330098
NEW IPSWICH, TOWN OF	330099
PELHAM, TOWN OF	330100
PETERBOROUGH, TOWN OF	330101
SHARON, TOWN OF	330192
TEMPLE, TOWN OF	335781
WEARE, TOWN OF	330235
WILTON, TOWN OF	330102
WINDSOR, TOWN OF	335780

Initial Countywide FIS Effective Date: September 25, 2009

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
33011CV001A

(Viessman, 1972). Discharges for Second Brook were modified to include the storage effects of Second Pond also using this analysis.

Discharges for Gumpas Road Brook, New Meadow Brook, Simpson Mill Brook, were determined by averaging the results of the regional equation developed by Johnson and Tasker (U.S. Department of the Interior, Geological Survey, 1974), and an area-weighted transposition with an adjusted log-Pearson Type III frequency analysis of the gages at Hop Brook (no. 01174000), Bungay Brook (no. 01112300), and East Meadow Brook (no. 01100700) in Massachusetts (U.S. Water Resources Council, 1976). The regional equations developed by Johnson and Tasker consist of parameters which include drainage area, ground slope, and average rainfall per year. Golden Brook, Gumpas Pond Brook, and Island Pod Brook were modified to include storage effects. This modification utilizes a numerical reservoir routing technique known as the Unit Hydrograph Method, which developed an inflow hydrograph (Viessman, 1972). Downstream decreases in discharge Beaver Brook No. 2 and Golden Brook result from a decrease in channel slope and an increase in overbank storage due to a wide floodplain and several large swamps. The floodwater surfaces for Gumpas Pond were determined using the above-referenced reservoir routing technique (Viessman, 1972).

Hydrology Methodology

Peak discharge values for Pennichuck Brook upstream of NH Route 101-A were calculated from regional frequency-related equations (U.S. Department of the Interior, 1974). These values were then routed through one natural storage area and four reservoirs; Holt's Pond, Bowers Pond, Harris Pond, and Supply Pond, using a reservoir routing method (Viessman, 1972). Peak discharges for the lower portions of the Pennichuck Brook were developed from the routed results. The peak discharges for Pennichuck Brook were coordinated with historical data supplied by the Pennichuck Water Works for Holt's Pod Dam and published frequency-discharge data (Hamilton Engineers Association, 1975).

Peak discharges for Bartemus Brook were based on regional discharge-frequency equations in conjunction with comparisons to USGS stream gages in basins of similar characteristics. For the Nashua River in the City of Nashua, the principal sources of information were frequency-discharge values developed for the Nashua River, USGS gaging station at Pepperell, Massachusetts (gage no. 01096500) and regional discharge-frequency equations (U.S. Department of the Interior, 1974).

Discharges for the Nissitissit River were derived by combining the results of Johnson and Tasker equations (U.S. Department of the Interior, 1974) and discharge-frequency relationships transposed from stream gage records of nearby basins with similar characteristics. Discharges for Witches Brook were derived solely from the Johnson and Tasker equations.

On Naticook Brook, the discharges at the outlets to Green Pond and Naticook Lake were calculated by the SCS inflow hydrograph method in conjunction with a numerical iteration routing method (Viessman, 1972). Below the outlet of Greens Pond, the regional equations developed by Manuel Benson were used.

For Peacock Brook, the starting water-surface elevations were taken from the Witches Brook profiles.

For Limit Brook and Second Brook, the starting water-surface elevations were taken from the Merrimack River profiles.

The starting water-surface elevations for Sherburn Mill Brook were taken from the FIS for the Town of Merrimack (FEMA, 1977).

Starting water-surface elevations for Ferguson Brook and Moose Brook were determined using slope-conveyance techniques based on field measurements. Starting water-surface elevations for Hosley Brook were developed using critical depth at the downstream cross section.

Starting water-surface elevations for Great Brook No. 1 were calculated using the slope/area method.

Countywide Analyses

Hydraulics Methodology

For the revised portions of the Merrimack River, Baboosic Brook, Gumpas Road Brook, Pennichuck Brook, Salmon Brook, Second Brook, and Souhegan River, water-surface elevations for floods of the selected recurrence intervals were computed through the use of the USACE, HEC-RAS River Analysis System (USACE, 2003). Starting water-surface elevations for the Merrimack River were calculated by an interpolation of stage-discharge curves located upstream and downstream of the Hudson town line. Starting water-surface elevations for Pennichuck Brook, Salmon Brook, Second Brook, and Souhegan River, were based on normal depth analysis. Starting water-surface elevations for Gumpas Road Brook step-backwater computations were taken from the previous FIS for the Town of Pelham just downstream of Marsh Road (FEMA, 1979). The computed water-surface elevations were then used along with the USGS topographic maps, digital raster graphs, and digital orthophoto quadrangles to determine the extent of flooding (U.S. Department of the Interior, Geological Survey, 1979, 2003). For Pennichuck Brook and Salmon Brook, the water-surface elevations determined were used along with digital photogrammetry for Nashua (City of Nashua, 1998) and Merrimack (Alan H. Swanson, Inc., 1976) to determine the extent of flooding. Normal depth was assumed for the starting water-surface elevations for Baboosic Brook and Naticook Brook step-backwater computations. The computed water-surface elevations were then used along with the Town of Merrimack contour maps, USGS Digital Orthophoto Quadrangles, and USGS Digital Raster Graphs to determine the extent of flooding (Lockwood Mapping, 1976; U.S. Department of the Interior, 1998; U.S. Department of the Interior, 2003). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. In those areas where the analysis indicated supercritical flow conditions, critical depth was assumed for the flood elevation due to the inherent instability of supercritical flow. For Second Brook, the water-surface elevations determined were used along with digital photogrammetry (Town of Hudson, 2000) to determine the extent of flooding. For the Merrimack River, the water-surface elevations determined were used

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
OTTER LAKE BROOK					
At confluence with Otter Brook	3.9	130	140	150	170
OX BROOK					
At Armory Road	2.8	215	440	535	885
PARKHURST BROOK					
At confluence with Joe English Brook	1.7	150	450	560	910
At Schoolhouse Road	0.9	90	270	340	600
PEACOCK BROOK					
At confluence with Witches Brook	2.2	215	444	503	830
At State Highway 122	1.9	208	433	485	825
PENNICHUCK BROOK					
At confluence of Merrimack River	25.76	821	1,300	1,550	2,240
Supply Pond Dam	25.45	769	1,200	1,430	2,070
Harris Pond Dam	24.92	696	1,070	1,270	1,820
Bower Pond Dam	23.00	629	967	1,150	1,640
Holts Pond Dam	19.95	539	830	984	1,410
Upstream of Holts Pond Dam	18.83	532	826	982	1,410
Confluence with Witches Brook	5.29	185	307	369	558
PISCATAQUOG RIVER					
At Goffstown USGS Gage #01091500	138.0	5,300	9,700	12,500	21,000
At confluence with Bog Brook	129.7	4,500	7,500	9,400	13,500
At the Riverdale Dam	69.0	*	*	2,200	*
At the outlet of Everett Lake and USGS gage No. 01090800	63.1	*	*	2,200	*
At the inlet to Everett Lake	41.0	*	*	3,860	*
Upstream from the confluence of Center Brook	34.2	*	*	3,380	*
At the outlet of Weare Reservoir	27.5	*	*	2,880	*

Design Discharges

*Data not available

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Parkhurst Brook								
A	0.180[1]	55	129	3.5	245.7	243.4[4]	243.6	0.3
B	0.700[1]	35	114	4.0	253.0	253.0	253.8	0.8
Peacock Brook								
A	3,332[2]	70	224	2.2	202.6	202.6	203.5	0.9
B	5,364[2]	95	252	2.0	207.4	207.4	208.2	0.8
C	6,653[2]	35	118	4.2	211.5	211.5	212.3	0.8
Pennichuck Brook								
A	153[3]	40	144	10.8	114.7	93.4[5]	93.4	0.0
B	2,418[3]	42	150	10.3	114.7	100.4[5]	100.7	0.3
C	3,543[3]	60	423	3.4	114.7	114.3[5]	114.3	0.0
D	4,229[3]	66	385	3.7	115.6	115.6	115.6	0.0
E	7,630[3]	320	5,909	0.2	170.9	170.9	170.9	0.0
F	9,963[3]	710	9,590	0.1	171.0	171.0	171.0	0.0
G	10,903[3]	150	1,864	0.6	171.0	171.0	171.0	0.0
H	12,181[3]	168	1,700	0.7	171.1	171.1	171.1	0.0
I	16,394[3]	980	14,854	0.1	181.3	181.3	181.3	0.0
J	17,640[3]	124	1,361	0.7	181.3	181.3	181.3	0.0
K	20,191[3]	274	1,900	0.5	181.4	181.4	181.5	0.1
L	22,794[3]	232	1,450	0.7	185.8	185.8	185.8	0.0
M	27,921[3]	90	395	0.9	186.0	186.0	186.0	0.0
N	34,426[3]	30	145	2.5	187.8	187.8	188.0	0.2

Floodway Table

[1]Miles above confluence with Joe English Brook
[2]Feet above confluence with Witches Brook
[3]Feet above confluence with Merrimack River
[4]Elevation computed without consideration of backwater effects of Joe English Brook
[5]Elevation computed without consideration of backwater effects from the Merrimack River

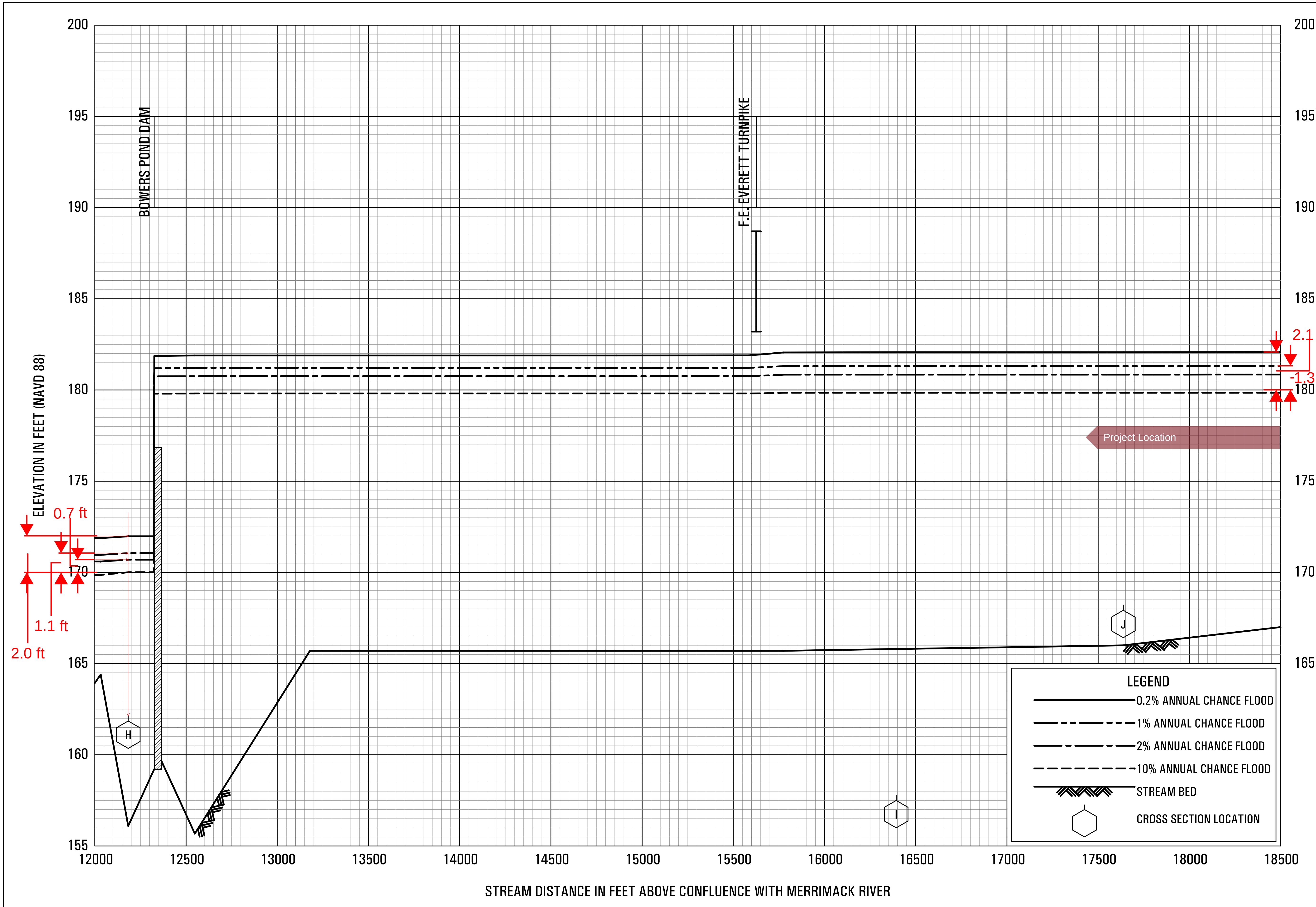
TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

HILLSBOROUGH COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

PARKHURST BROOK – PEACOCK BROOK - PENNICHUCK BROOK



FLOOD PROFILES

PENNICHUCK BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HILLSBOROUGH COUNTY, NH

(ALL JURISDICTIONS)

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 2 OF 8

HILLSBOROUGH COUNTY, NEW HAMPSHIRE

(ALL JURISIDICTIONS)

COMMUNITY NAME	NUMBER	COMMUNITY NAME	NUMBER
AMHERST, TOWN OF	330081	MILFORD, TOWN OF	330096
ANTRIM, TOWN OF	330082	MONT VERNON, TOWN OF	330224
BEDFORD, TOWN OF	330083	NASHUA, CITY OF	330097
BENNINGTON, TOWN OF	330084	NEW BOSTON, TOWN OF	330098
BROOKLINE, TOWN OF	330180	NEW IPSWICH, TOWN OF	330099
DEERING, TOWN OF	330085	PELHAM, TOWN OF	330100
FRANCESTOWN, TOWN OF	330086	PETERBOROUGH, TOWN OF	330101
GOFFSTOWN, TOWN OF	330087	SHARON, TOWN OF	330192
GREENFIELD, TOWN OF	330209	TEMPLE, TOWN OF	335781
GREENVILLE, TOWN OF	330088	WEARE, TOWN OF	330235
HANCOCK, TOWN OF	330089	WILTON, TOWN OF	330102
HILLSBOROUGH, TOWN OF	330090	WINDSOR, TOWN OF	335780
HOLLIS, TOWN OF	330091		
HUDSON, TOWN OF	330092		
LITCHFIELD, TOWN OF	330093		
LYNDEBOROUGH, TOWN OF	330218		
MANCHESTER, CITY OF	330169		
MASON, TOWN OF	330221		
MERRIMACK, TOWN OF	330095		

REVISED: PRELIMINARY 10/12/2022

FLOOD INSURANCE STUDY NUMBER
33011CV002C
Version Number 2.6.3.6

FEMA

Table 12: Summary of Hydrologic and Hydraulic Analyses

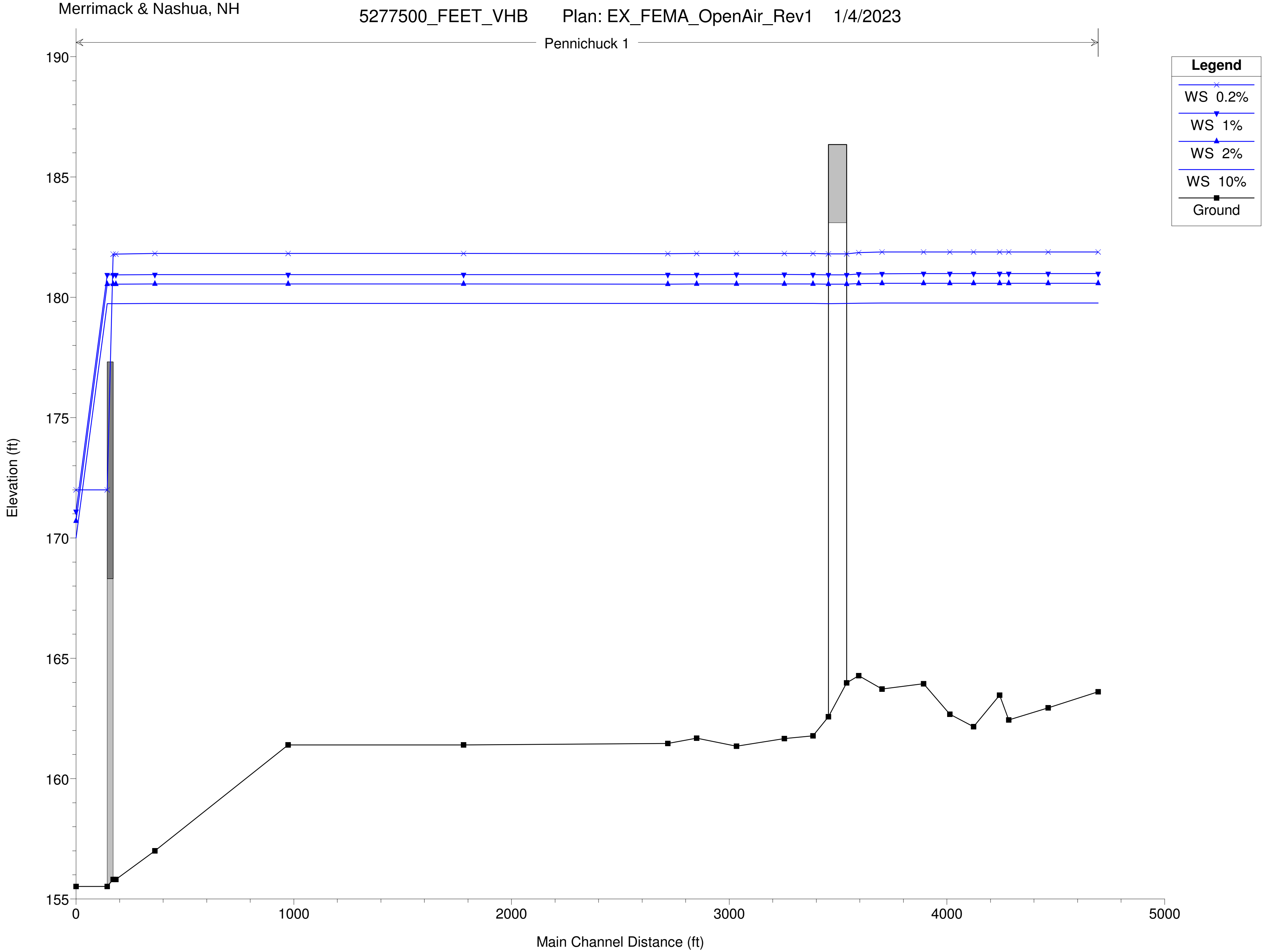
Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Peacock Brook 2 Tributary C	Confluence with Peacock Brook 2	Point of one square mile of drainage area	Regression equations (Olson 2009)	HEC-RAS 5.0 (USACE 2016)	6/4/2019	A	See special considerations for Baboosic Brook Tributary B.
Peacock Brook 2 Tributary D	Confluence with Peacock Brook 2	Point of one square mile of drainage area	Regression equations (Olson 2009)	HEC-RAS 5.0 (USACE 2016)	6/4/2019	A	See special considerations for Baboosic Brook Tributary B.
Peaslee Meadow Brook	Confluence with Piscataquog River	Point of one square mile of drainage area	Regression equations (Olson 2009)	HEC-RAS 5.0 (USACE 2016)	6/4/2019	A	See special considerations for Baboosic Brook Tributary B.
Peaslee Meadow Brook Tributary A	Confluence with Peaslee Meadow Brook	Point of one square mile of drainage area	Regression equations (Olson 2009)	HEC-RAS 5.0 (USACE 2016)	6/4/2019	A	See special considerations for Baboosic Brook Tributary B.
Peaslee Meadow Brook Tributary B	Confluence with Peaslee Meadow Brook	Point of one square mile of drainage area	Regression equations (Olson 2009)	HEC-RAS 5.0 (USACE 2016)	6/4/2019	A	See special considerations for Baboosic Brook Tributary B.
Pennichuck Brook	Confluence with Merrimack River	Pennichuck Pond	Regression equations (LeBlanc 1978)	HEC-RAS (USACE 1997)	12/1/2003	AE w/ floodway	Discharges were from regional regression equations (LeBlanc 1978). Routing through Hollis Pond was attempted but found to have little effect on flows. Overbank portions of cross-sections were from topographic maps and field surveys. Underwater portions and structures were from field surveys. Starting water-surface elevations were from normal depth. Roughness factors were from engineering judgment and field observations.
Pennichuck Brook Tributary C	Confluence with Pennichuck Brook	Point of one square mile of drainage area	Regression equations (Olson 2009)	HEC-RAS 5.0 (USACE 2016)	6/4/2019	A	See special considerations for Baboosic Brook Tributary B.
Pennichuck Brook Tributary D	Confluence with Pennichuck Brook	Point of one square mile of drainage area	Regression equations (Olson 2009)	HEC-RAS 5.0 (USACE 2016)	6/4/2019	A	See special considerations for Baboosic Brook Tributary B.
Pennichuck Brook Tributary E	Confluence with Pennichuck Brook	Point of one square mile of drainage area	Regression equations (Olson 2009)	HEC-RAS 5.0 (USACE 2016)	6/4/2019	A	See special considerations for Baboosic Brook Tributary B.

Appendix B

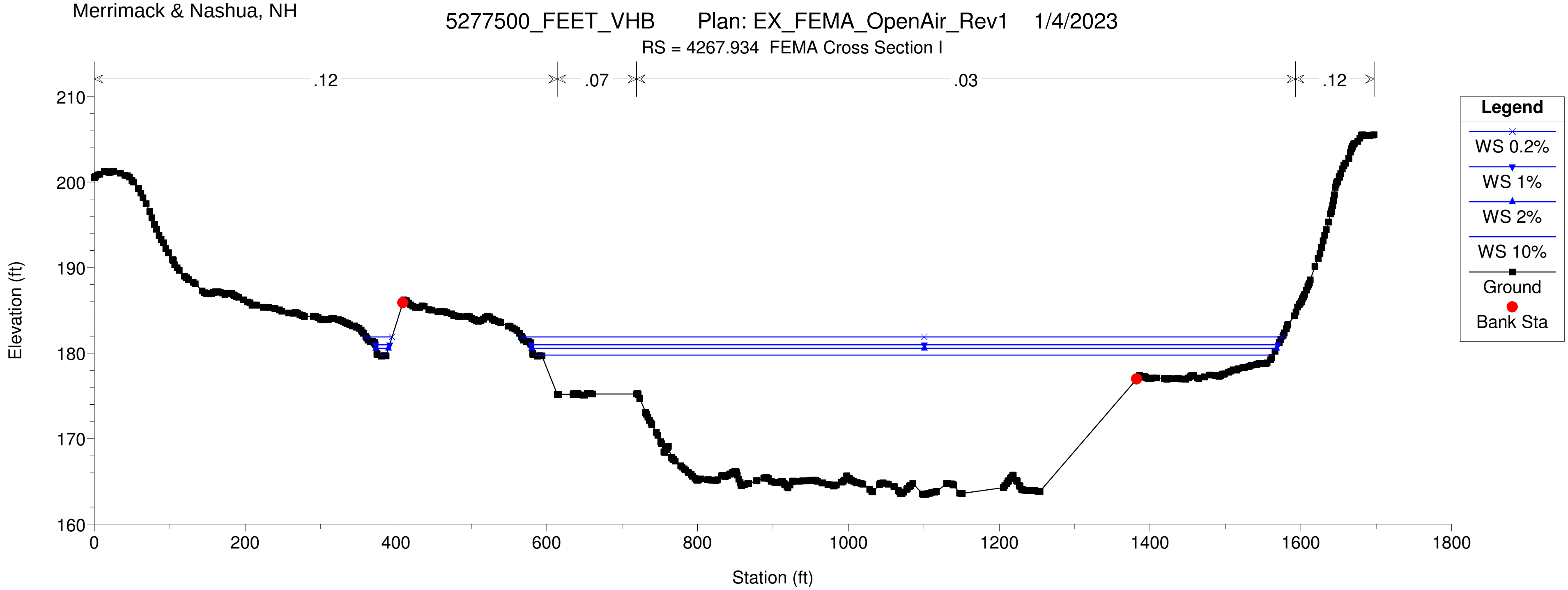
HEC-RAS Hydraulic Model Results
FEMA No-Rise Certification

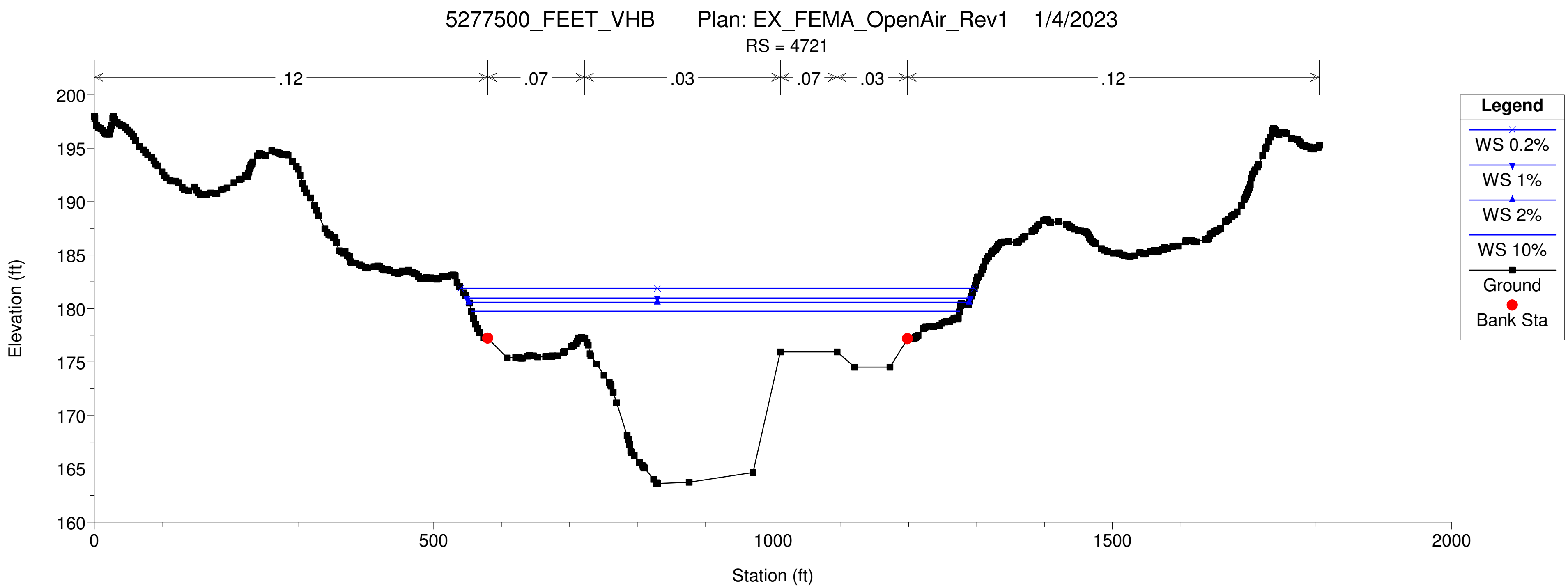
2 Bedford Farms Drive
Suite 200
Bedford, NH 03110-6532
P 603.391.3900

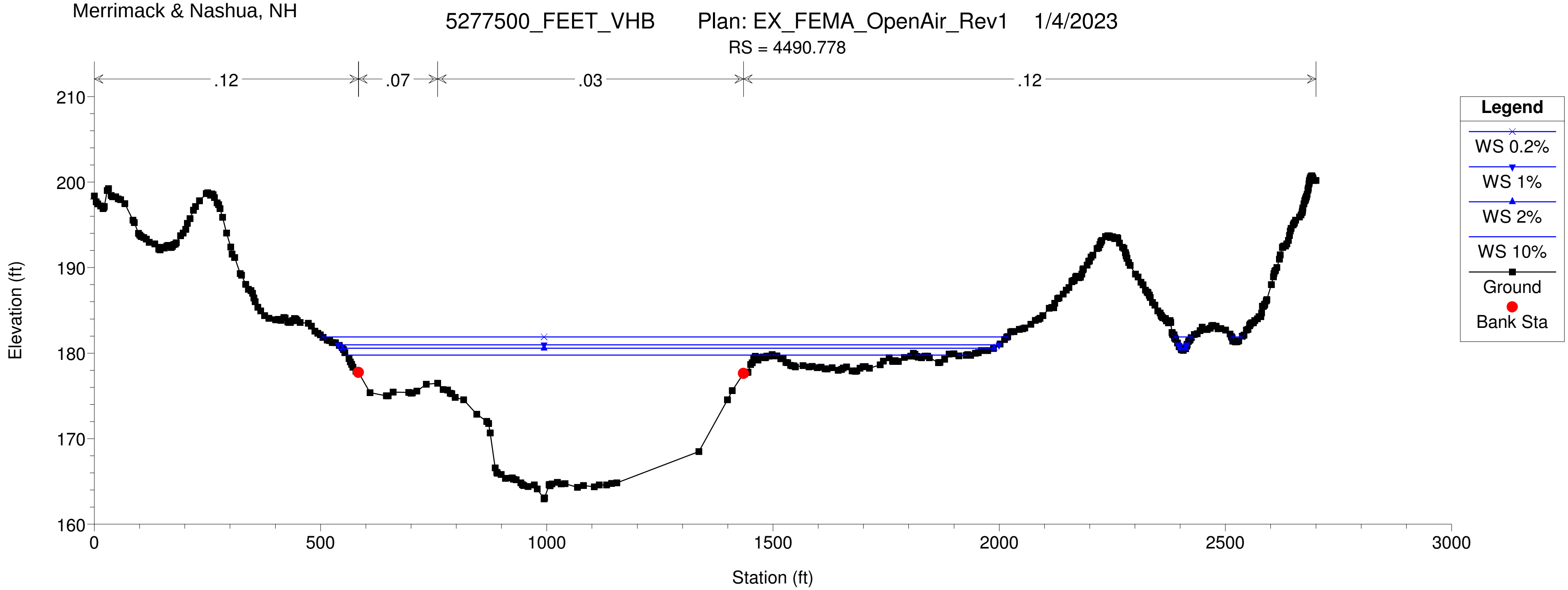
13761A FEET: Pennichuck Brook
Merrimack & Nashua, NH



13761A FEET: Pennichuck Brook
Merrimack & Nashua, NH



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RS = 4490.778
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.07
.03
.12
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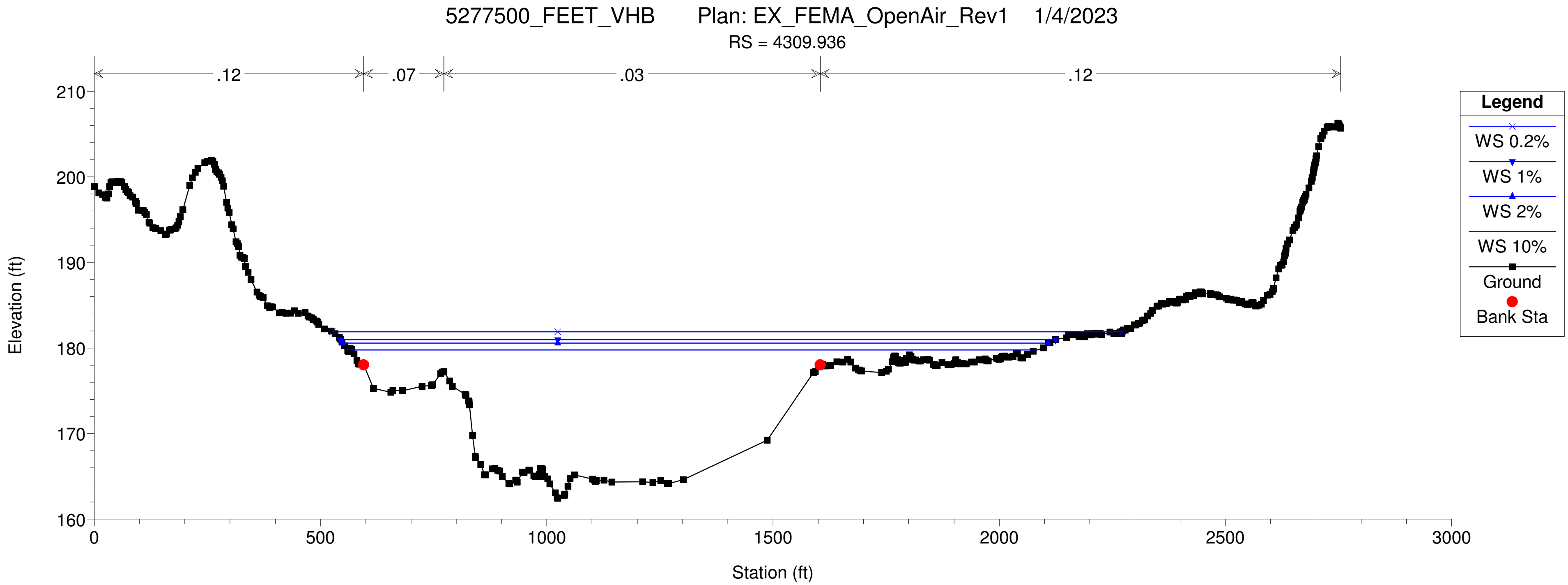
Station (ft)
210
200
190
180
170
160
0
500
1000
1500
2000
2500
3000
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta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RS = 4309.936
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.03
.12
Elevation (ft)
Station (ft)
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200
190
180
170
160
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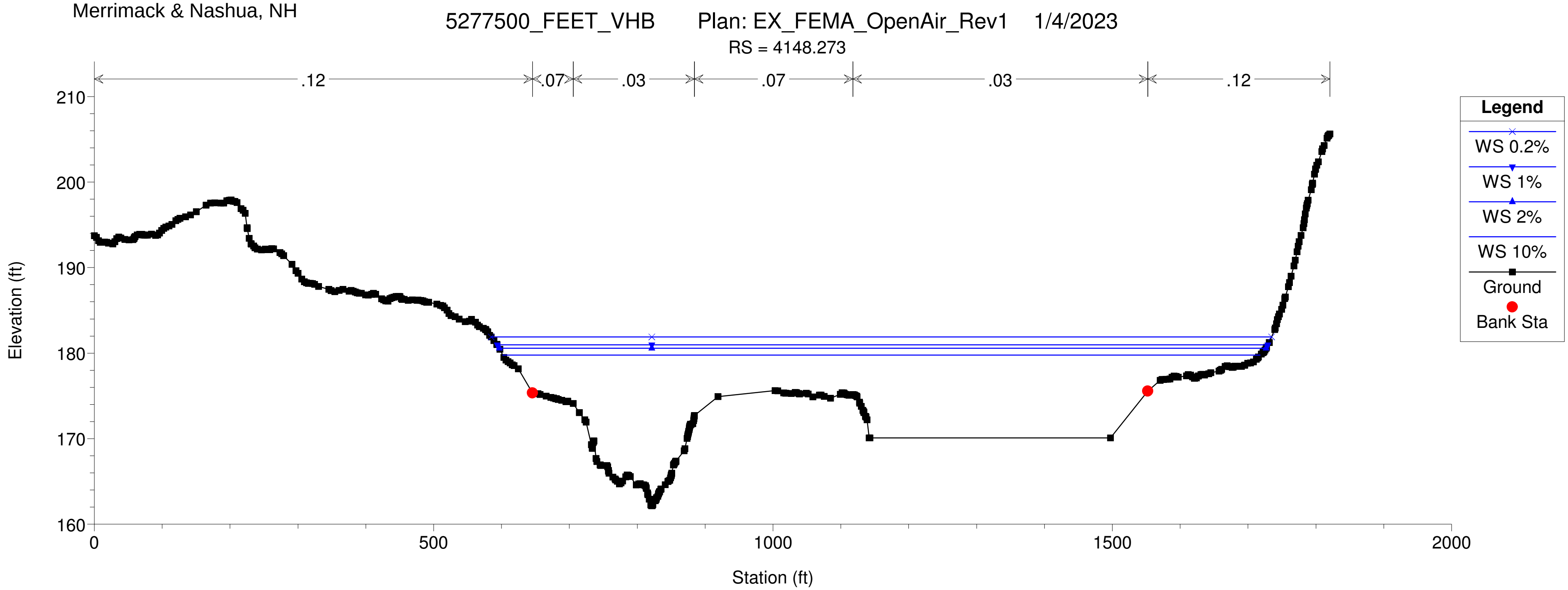
1000
1500
2000
2500
3000
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta


5277500_FEET_VHB Plan: EX_FEMA_OpenAir_Rev1 1/4/2023
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.03
.07
.03
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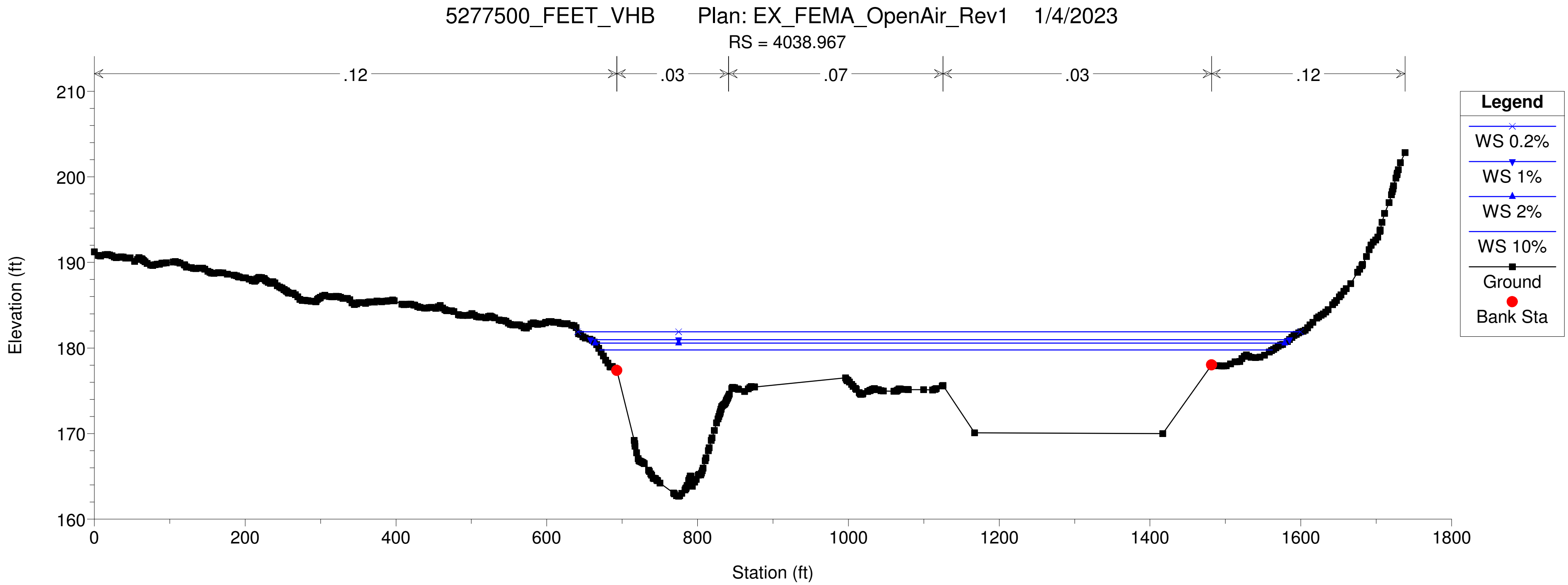
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta


5277500_FEET_VHB Plan: EX_FEMA_OpenAir_Rev1 1/4/2023
RS = 4038.967
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.07
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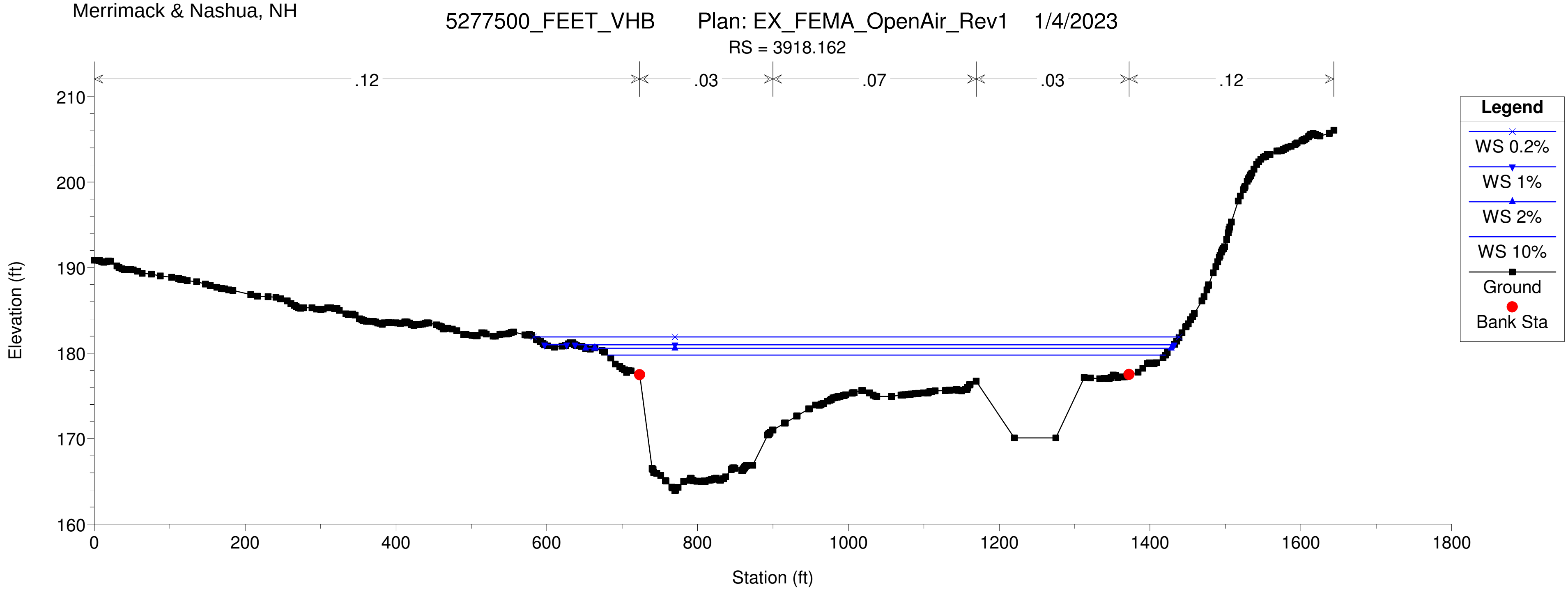
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta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RS = 3918.162
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.07
.03
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Legend
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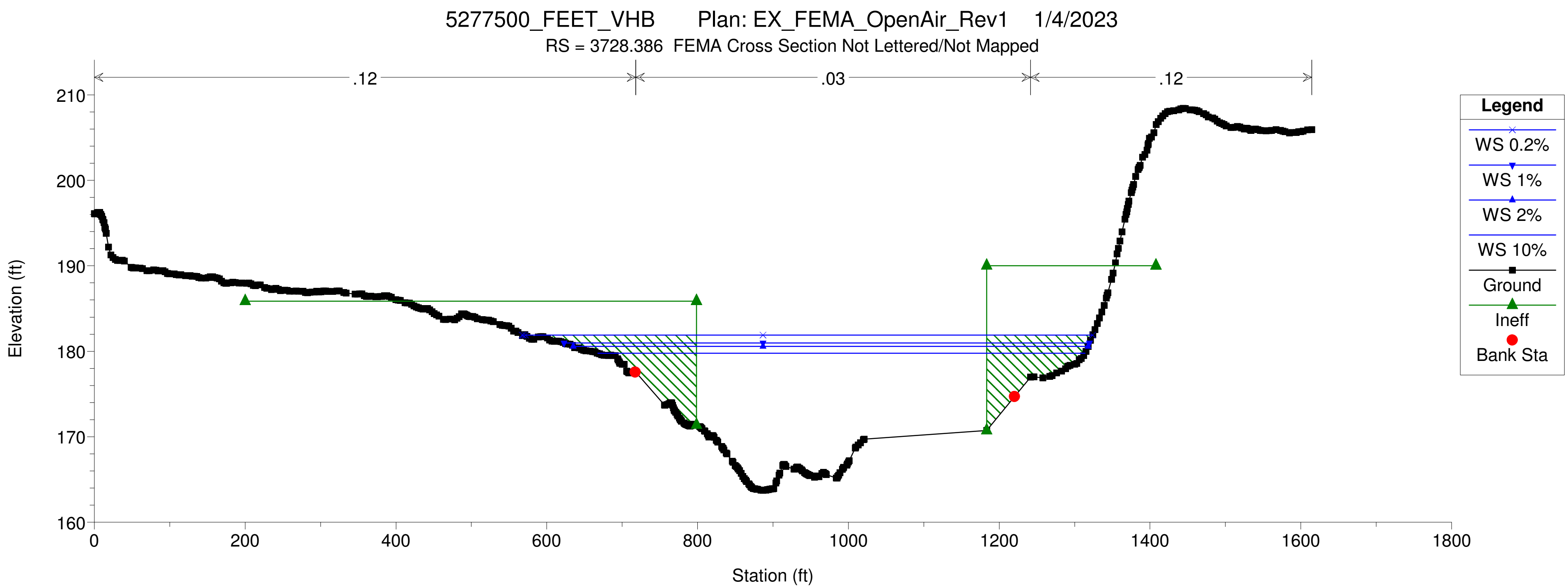
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Elevation (ft)
Station (ft)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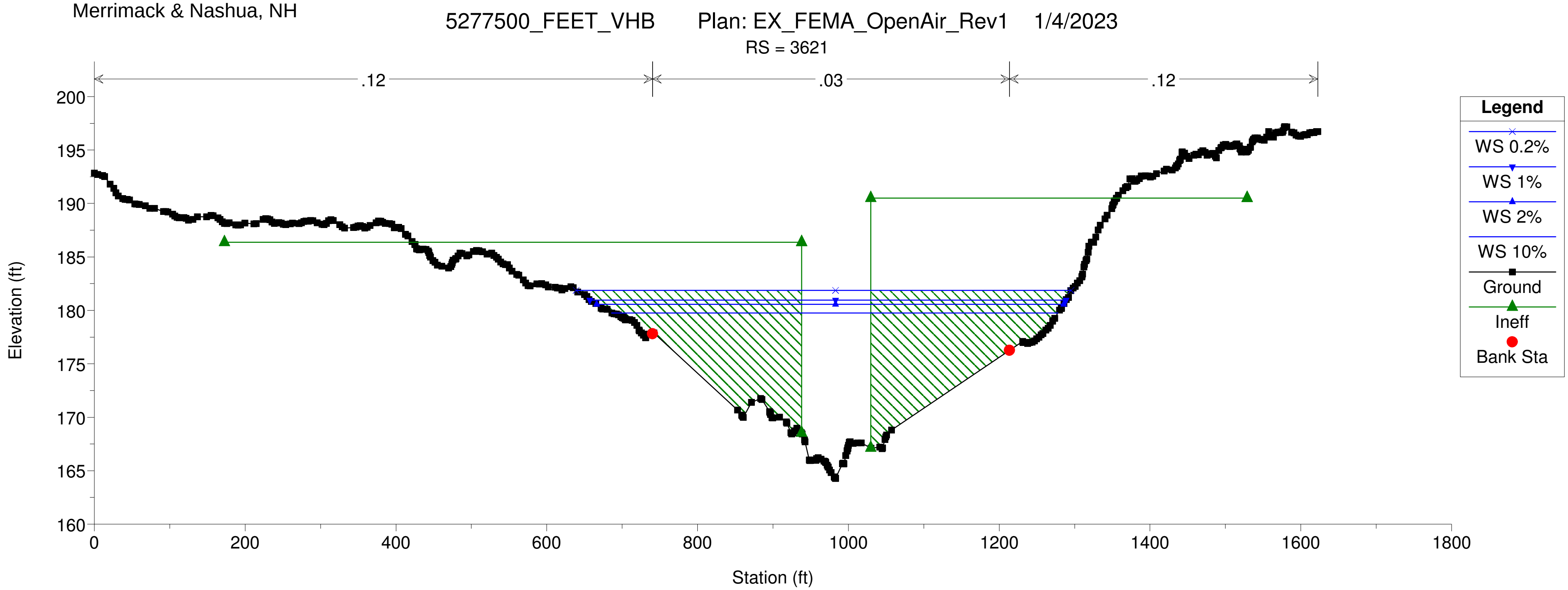
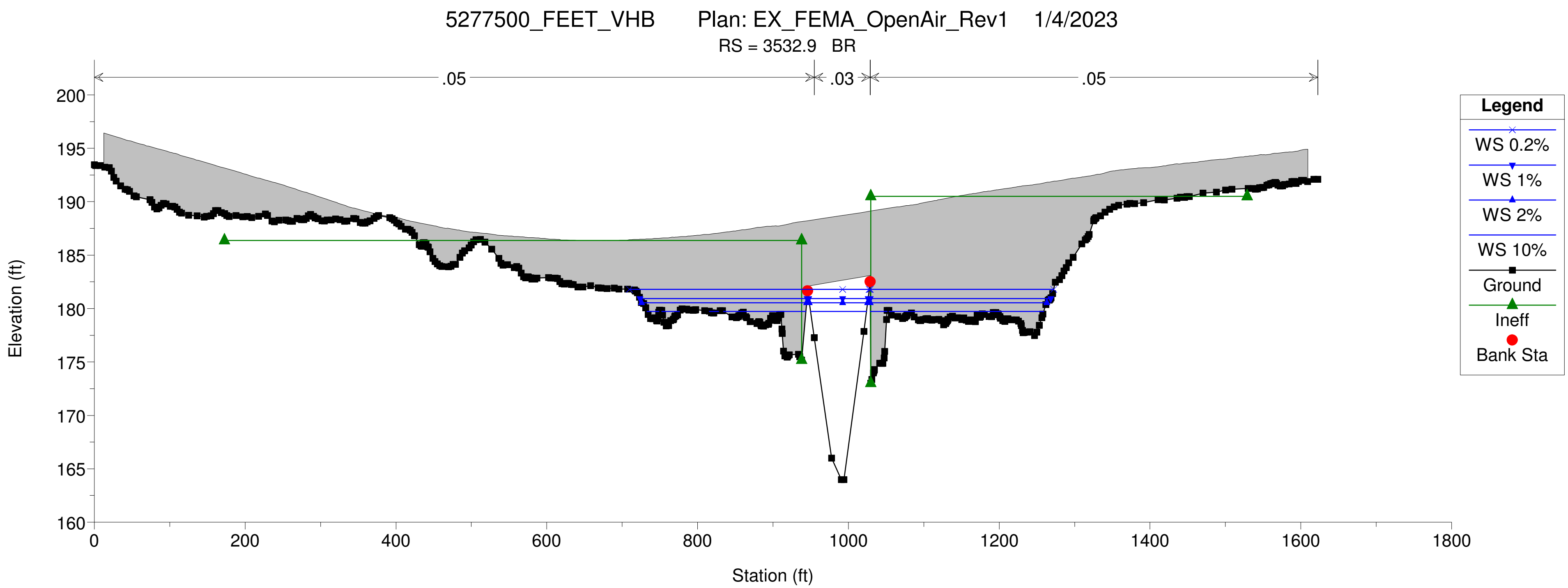
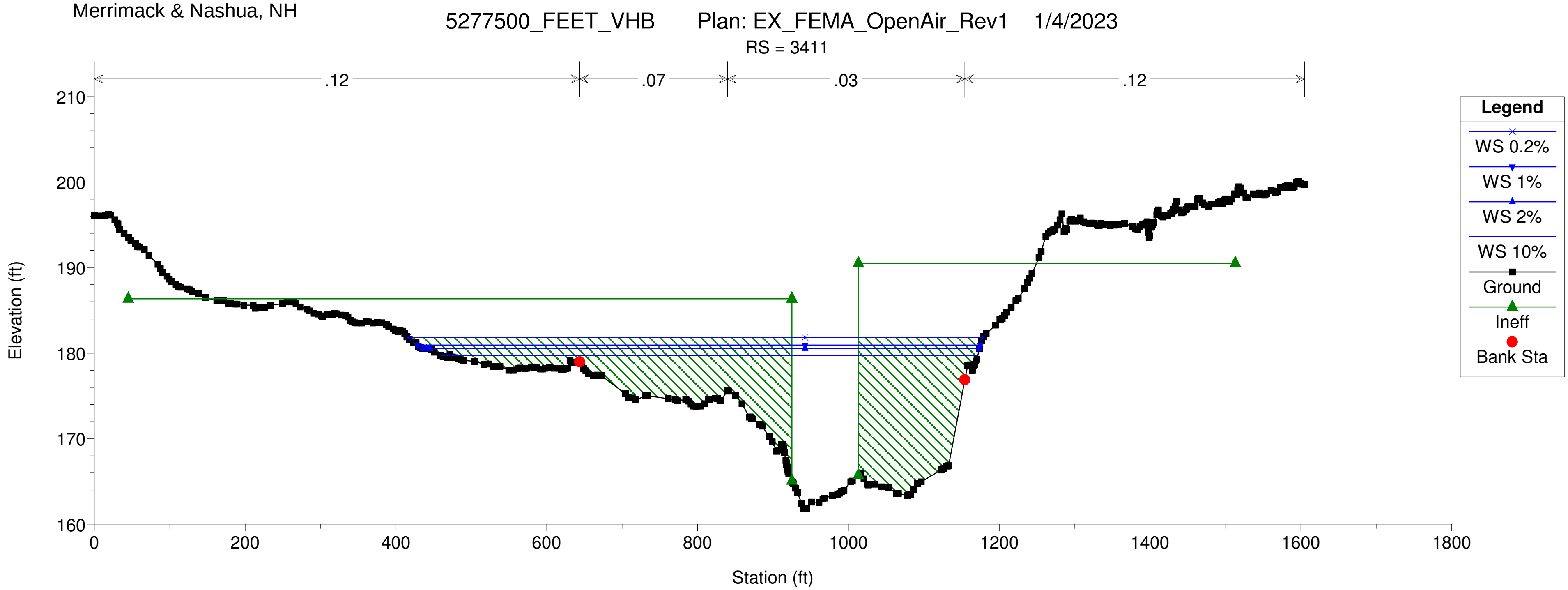
.12
.03
.12
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

13761A FEET: Pennichuck Brook
Merrimack & Nashua, NH



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.03
.12
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Station (ft)
Legend
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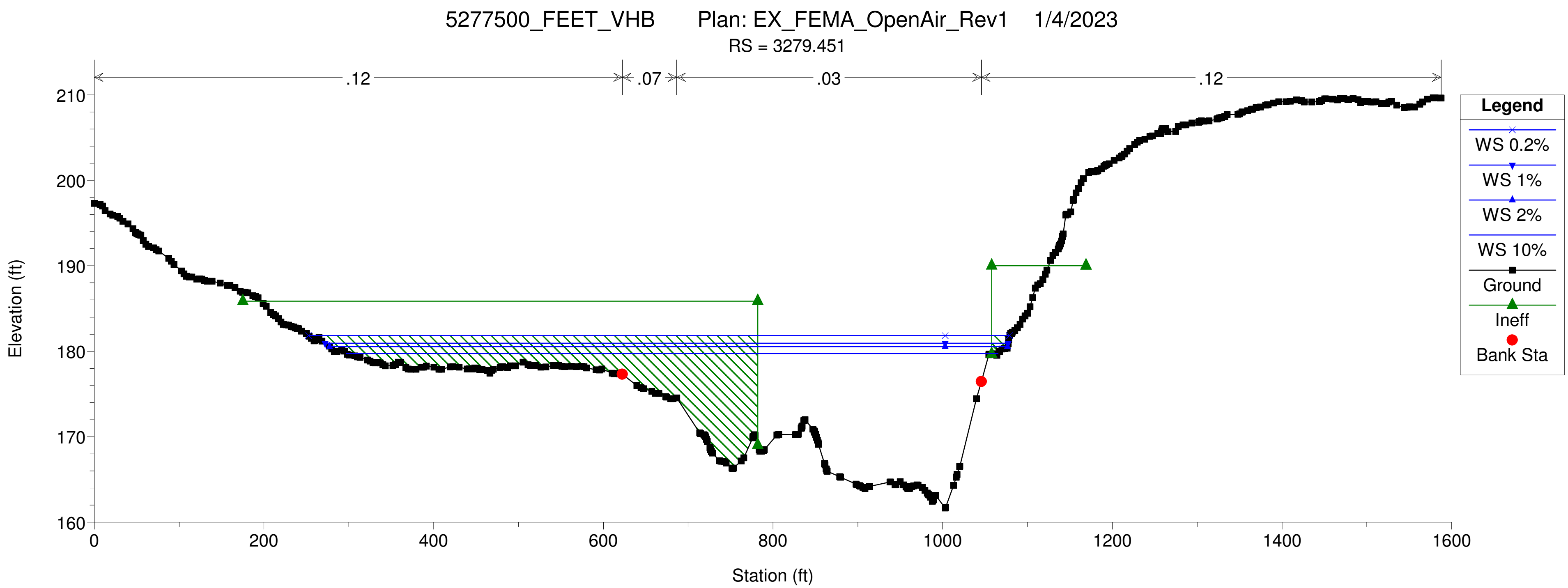
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta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RS = 3279.451
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.07
.03
.12
Elevation (ft)
Station (ft)
Legend
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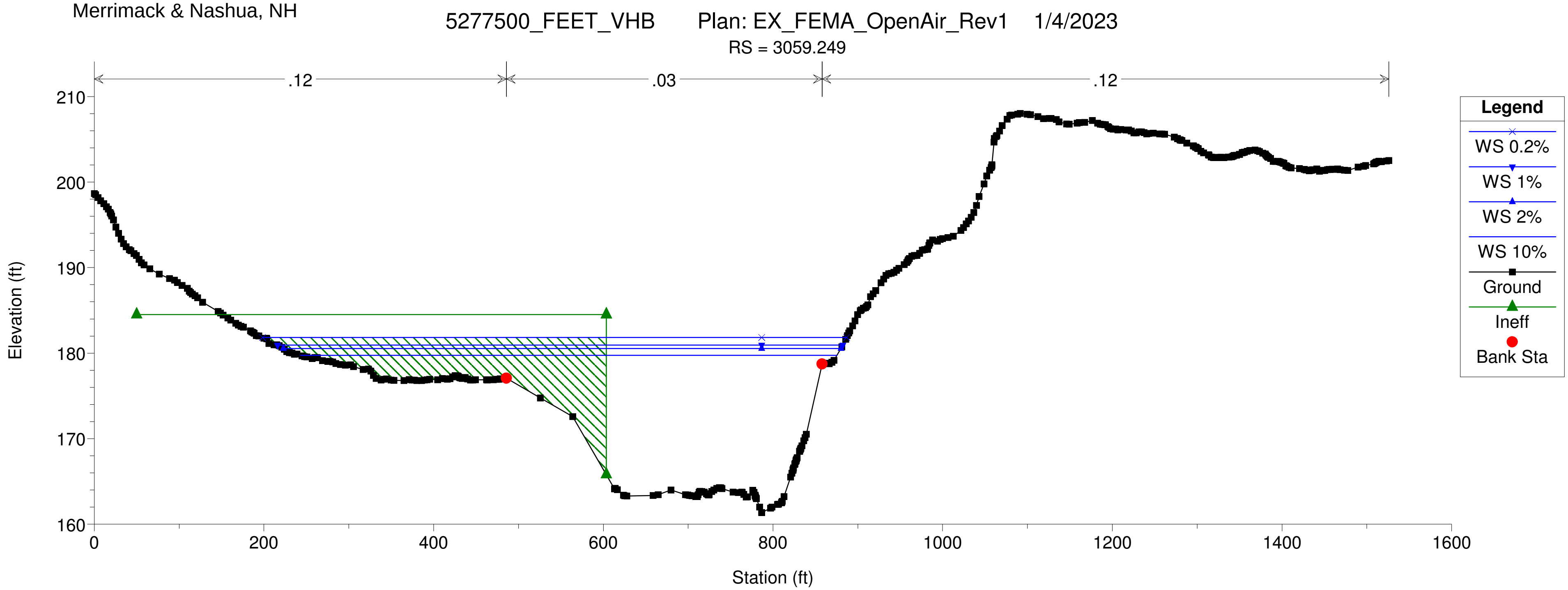
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta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RS = 3059.249
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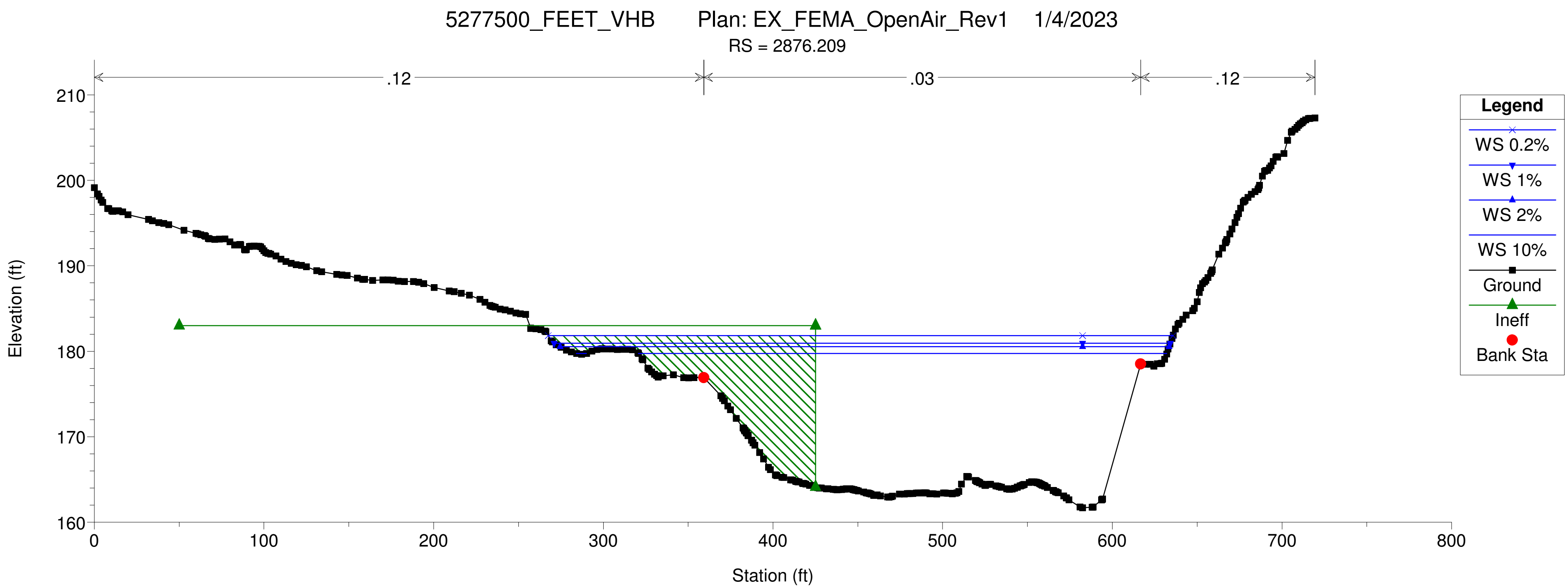
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta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RS = 2876.209
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.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta

5277500_FEET_VHB Plan: EX_FEMA_OpenAir_Rev1 1/4/2023
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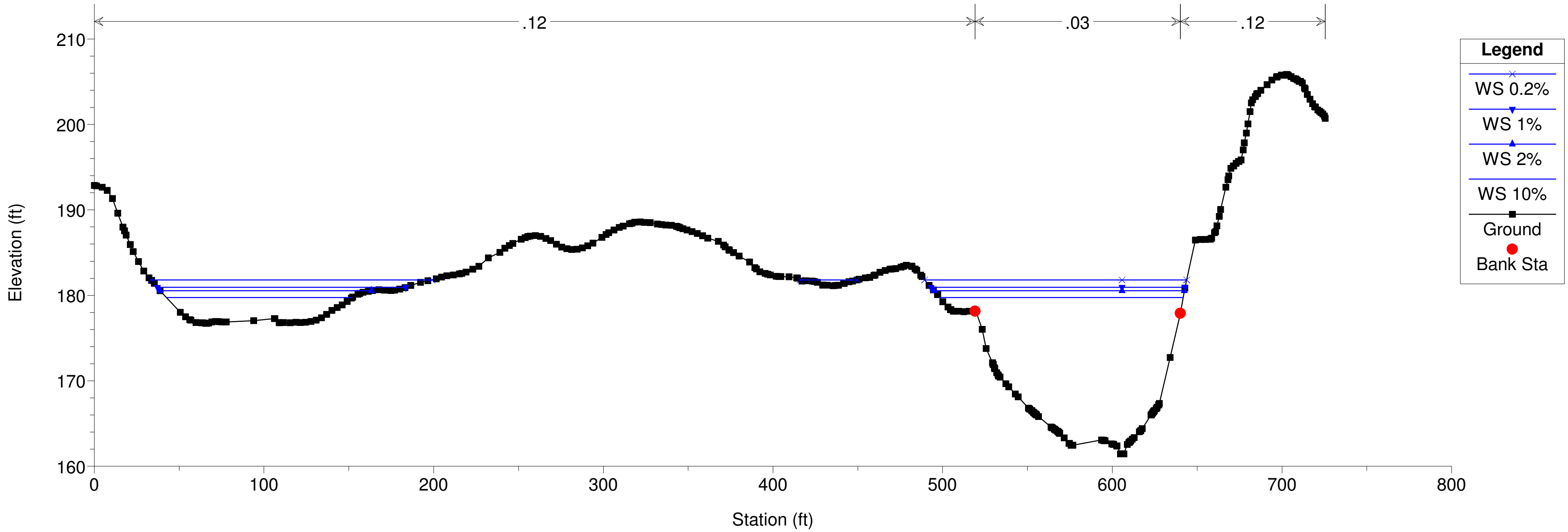

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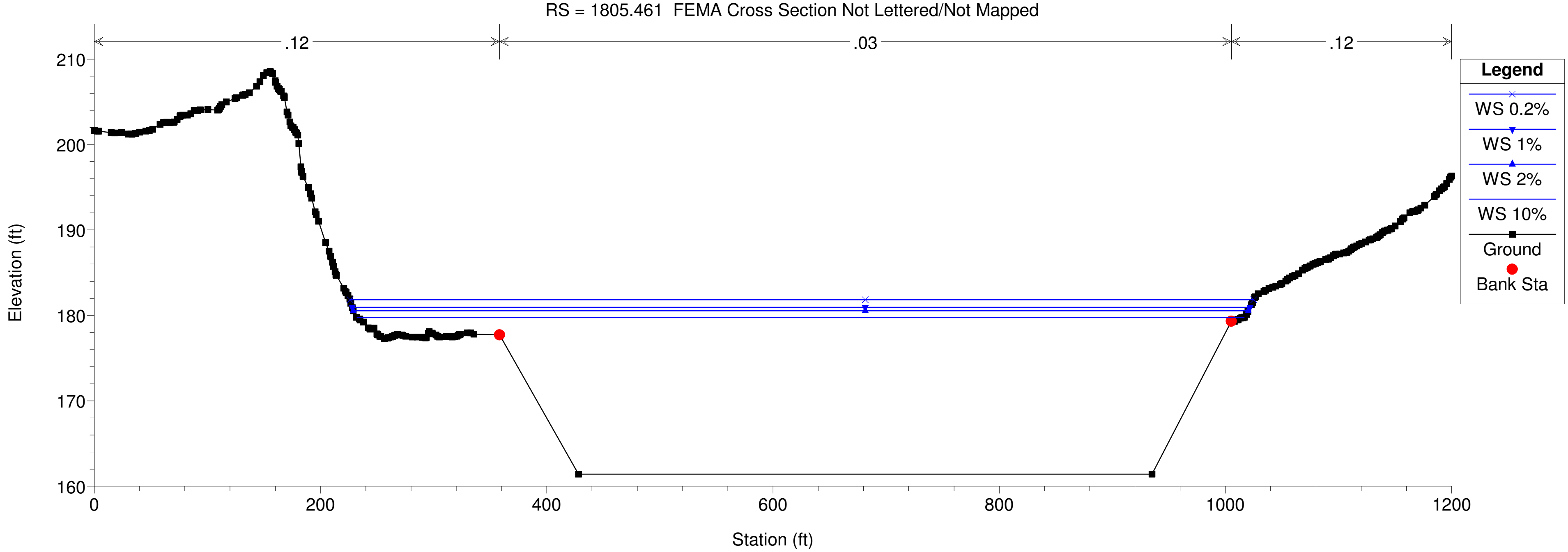
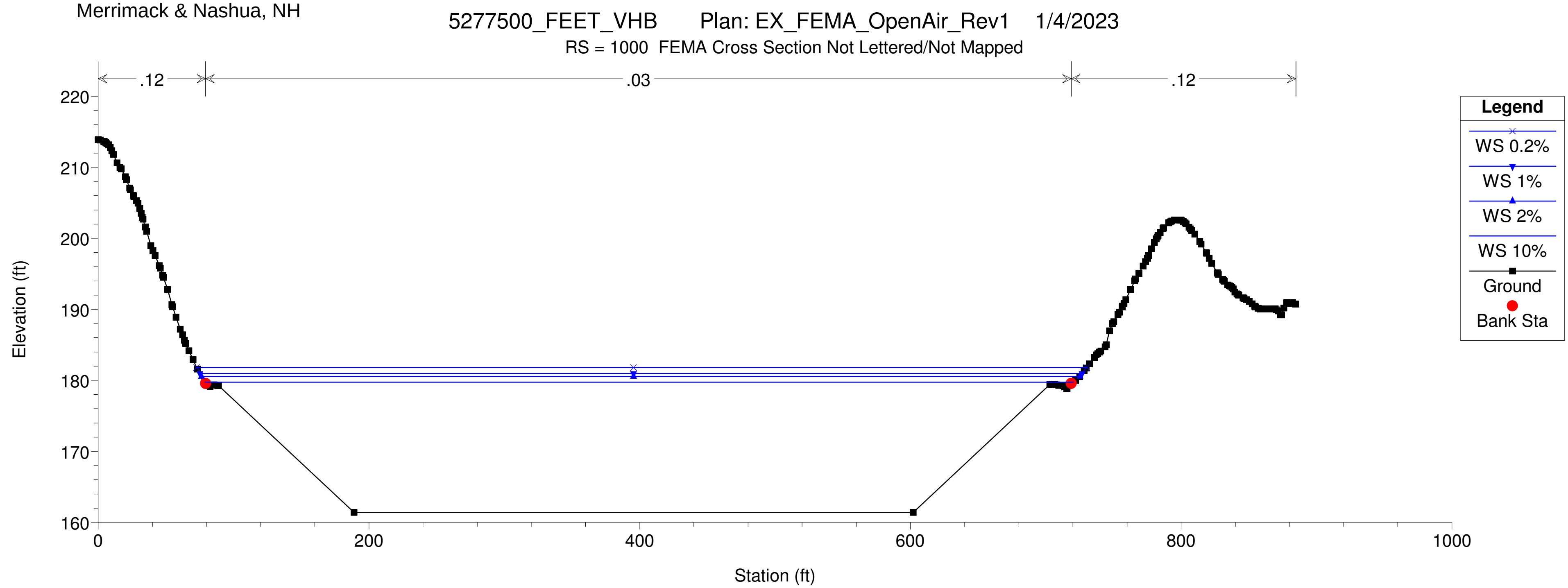
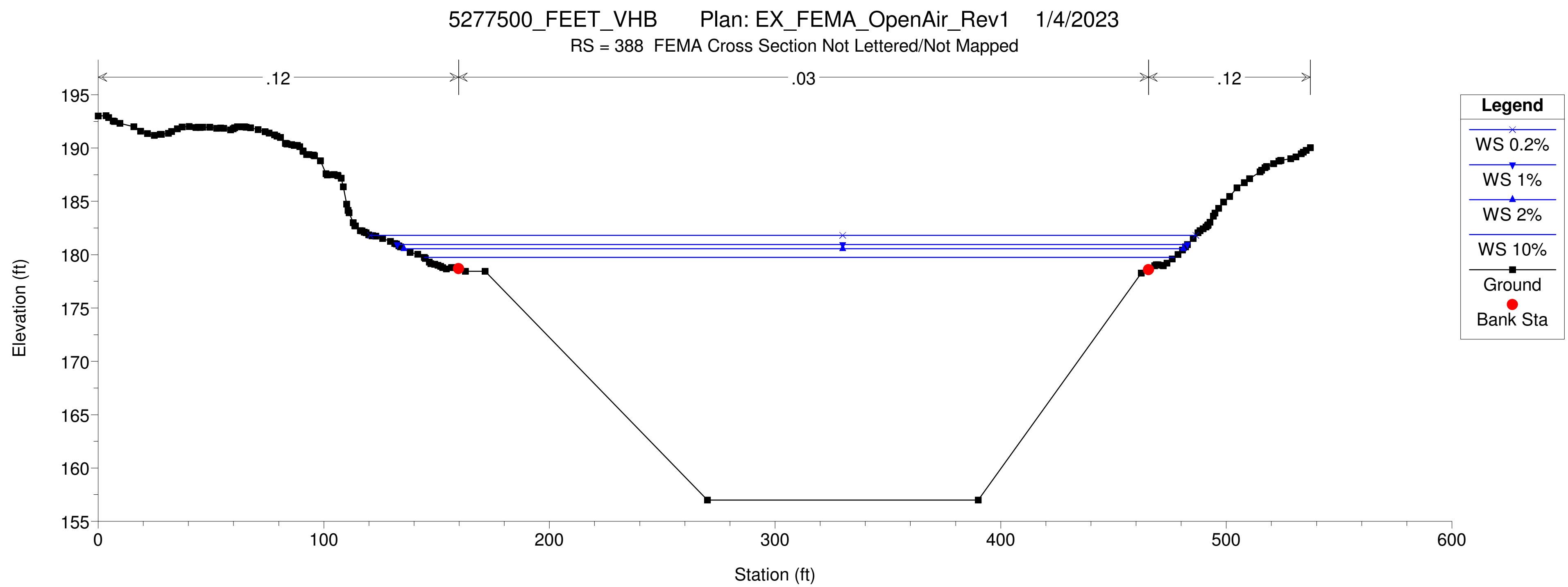



5277500_FEET_VHB Plan: EX_FEMA_OpenAir_Rev1 1/4/2023
RS = 1000 FEMA Cross Section Not Lettered/Not Mapped
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta


5277500_FEET_VHB Plan: EX_FEMA_OpenAir_Rev1 1/4/2023
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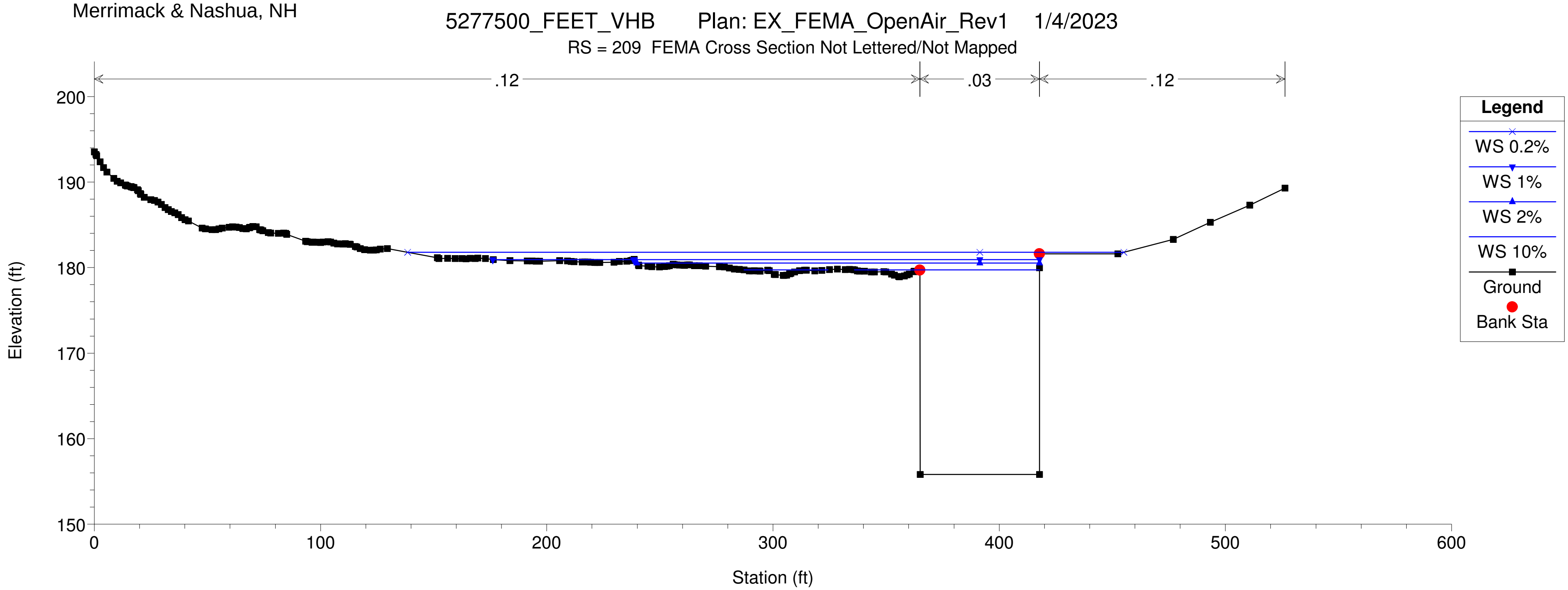
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta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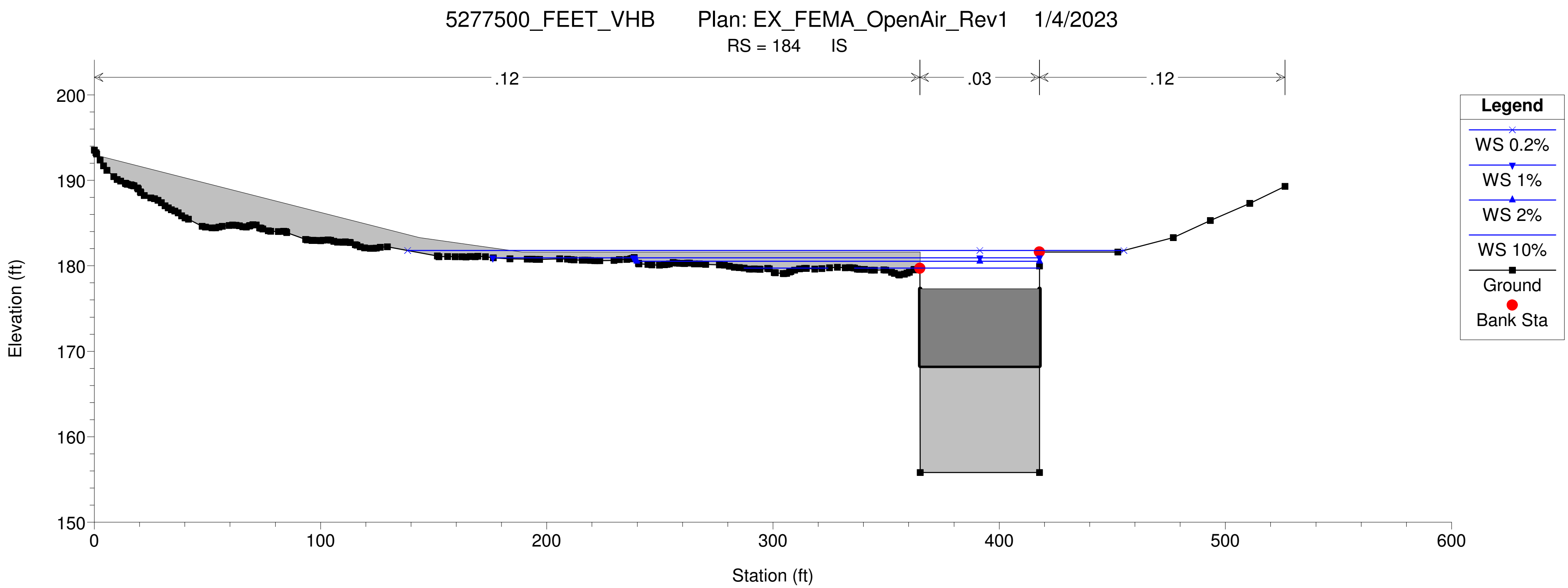
RS = 209 FEMA Cross Section Not Lettered/Not Mapped
.12
.03
.12
Elevation (ft)
Station (ft)
0
100
200
300
400
500
600
150
160
170
180
190
200
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta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.03
.12
Elevation (ft)
Station (ft)
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100
200
300
400
500
600
150
160
170
180
190
200
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta

5277500_FEET_VHB Plan: EX_FEMA_OpenAir_Rev1 1/4/2023

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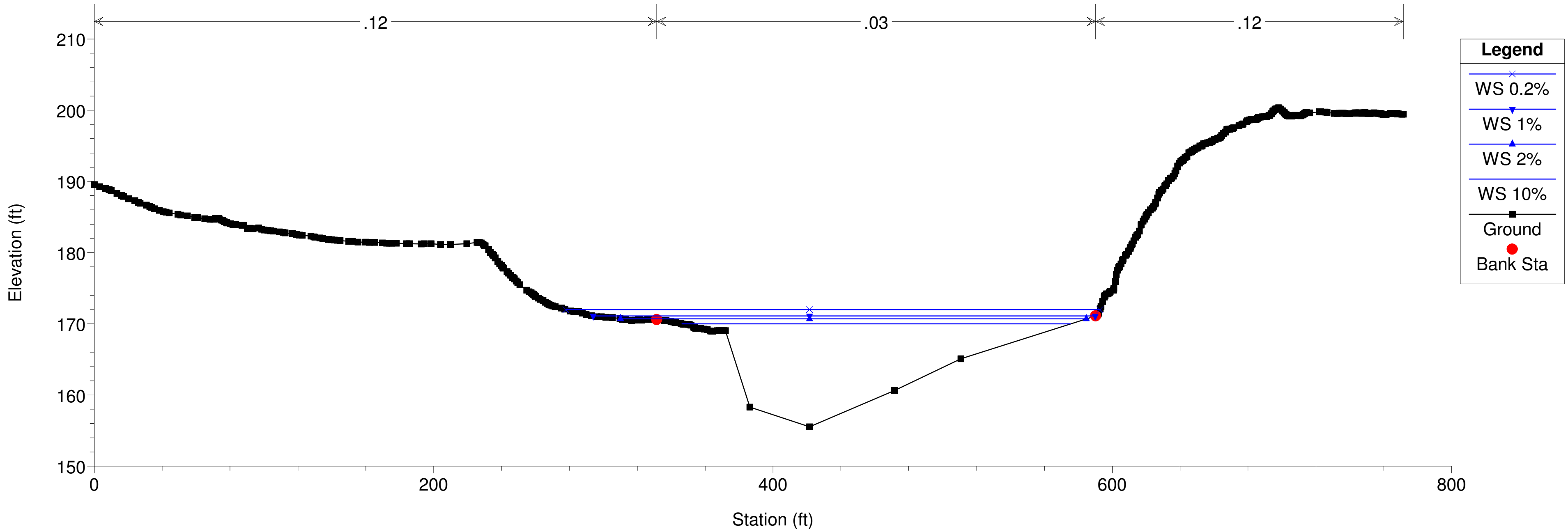


Appendix B - HecRAS Existing Standard Table

13761A FEET: Pennichuck Brook | Merrimack & Nashua, NH

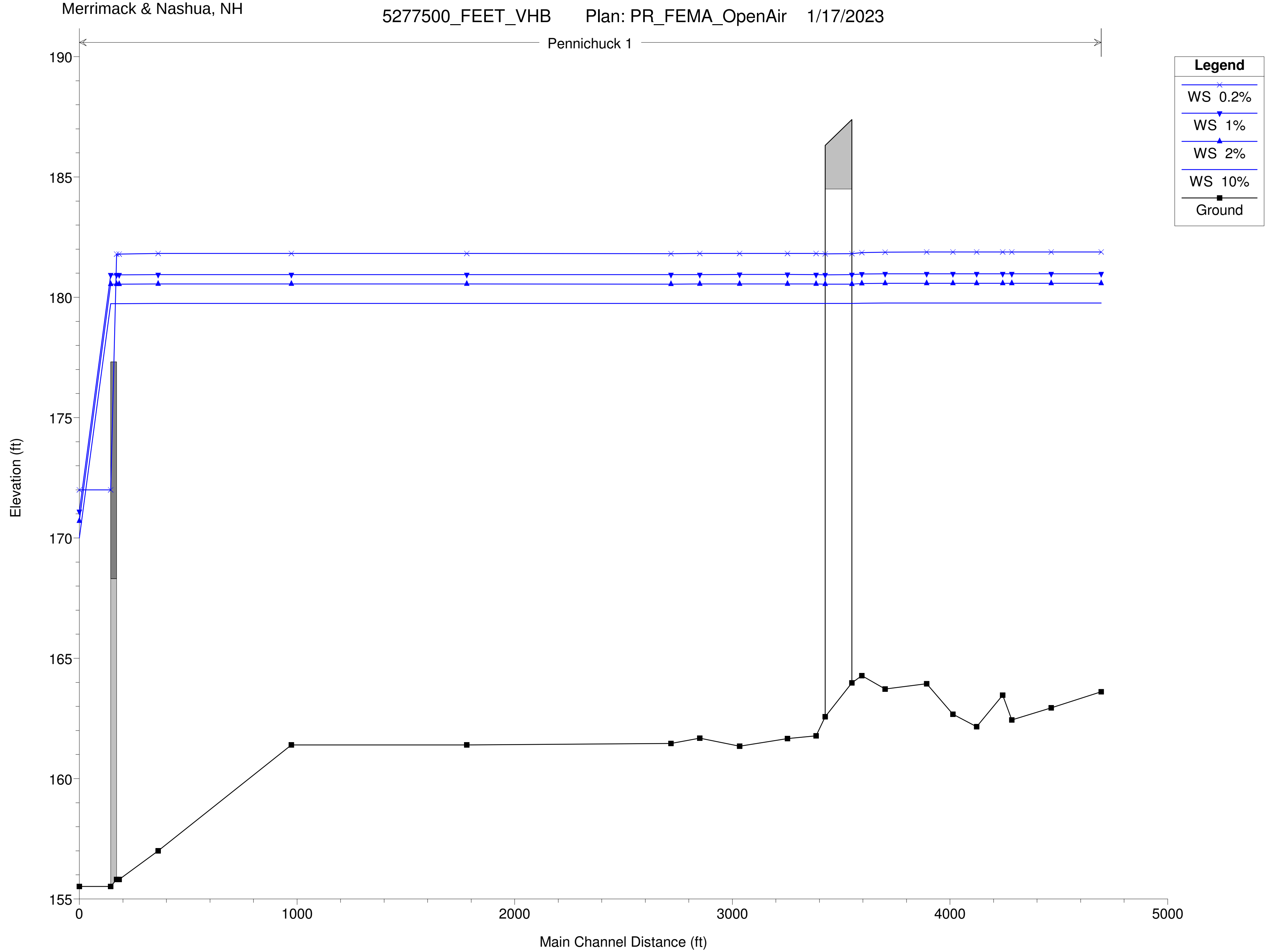
HEC-RAS Plan: EX_Rev1 River: Pennichuck Reach: 1

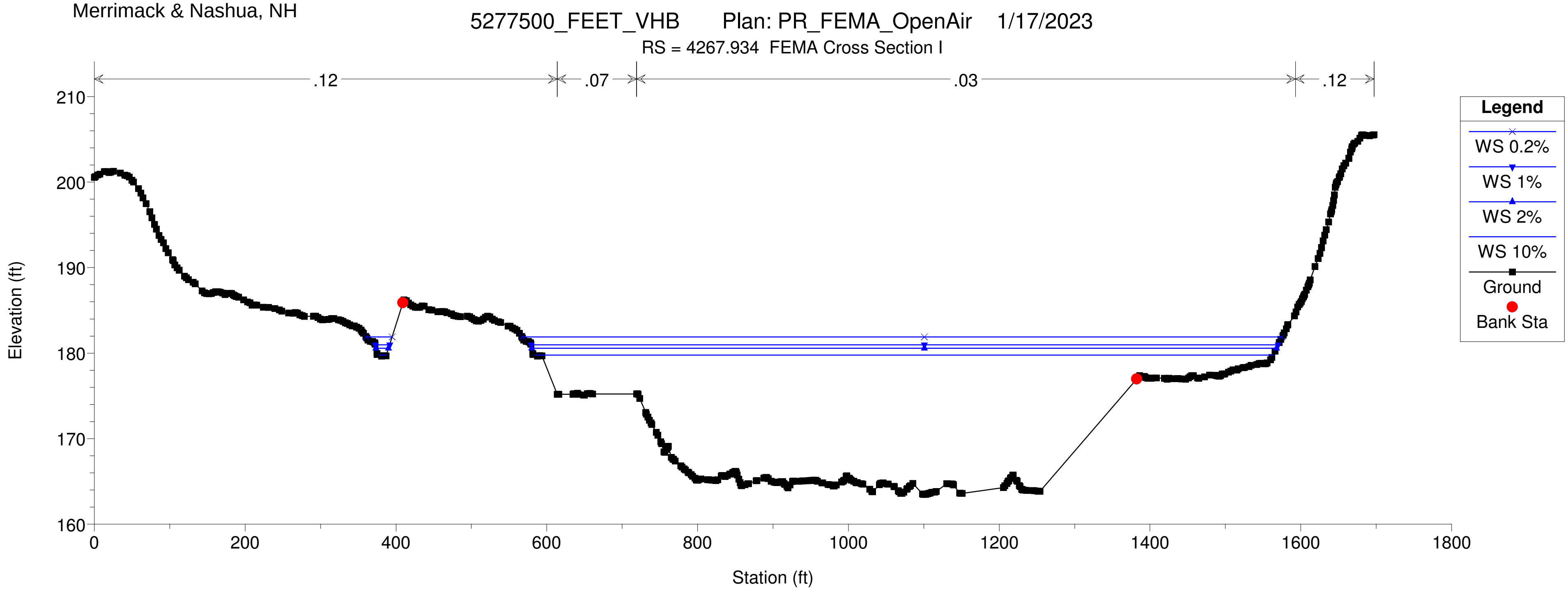
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4721	10%	629.00	163.61	179.76		179.76	0.000000	0.13	5167.44	719.59	0.01
1	4721	2%	967.00	163.61	180.58		180.58	0.000001	0.17	5763.01	736.90	0.01
1	4721	1%	1150.00	163.61	180.98		180.98	0.000001	0.20	6059.57	742.42	0.01
1	4721	0.2%	1640.00	163.61	181.89		181.89	0.000001	0.26	6737.49	756.95	0.01
1	4490.778	10%	629.00	162.94	179.76		179.76	0.000000	0.07	9013.27	1337.22	0.00
1	4490.778	2%	967.00	162.94	180.58		180.58	0.000000	0.10	10168.20	1452.07	0.01
1	4490.778	1%	1150.00	162.94	180.98		180.98	0.000000	0.12	10755.92	1479.20	0.01
1	4490.778	0.2%	1640.00	162.94	181.89		181.89	0.000000	0.16	12136.25	1573.91	0.01
1	4309.936	10%	629.00	162.44	179.76		179.76	0.000000	0.06	11861.75	1518.54	0.00
1	4309.936	2%	967.00	162.44	180.58		180.58	0.000000	0.08	13131.09	1559.59	0.00
1	4309.936	1%	1150.00	162.44	180.98		180.98	0.000000	0.09	13761.11	1579.66	0.00
1	4309.936	0.2%	1640.00	162.44	181.89		181.89	0.000000	0.12	15249.21	1745.63	0.01
1	4267.934	10%	629.00	163.47	179.76		179.76	0.000000	0.07	9842.82	988.10	0.00
1	4267.934	2%	967.00	163.47	180.58		180.58	0.000000	0.09	10663.71	1004.53	0.00
1	4267.934	1%	1150.00	163.47	180.98		180.98	0.000000	0.11	11067.54	1009.78	0.01
1	4267.934	0.2%	1640.00	163.47	181.89		181.89	0.000000	0.14	11996.00	1042.52	0.01
1	4148.273	10%	629.00	162.16	179.76		179.76	0.000000	0.08	8081.23	1115.71	0.00
1	4148.273	2%	967.00	162.16	180.58		180.58	0.000000	0.11	9004.49	1129.94	0.01
1	4148.273	1%	1150.00	162.16	180.98		180.98	0.000000	0.13	9458.73	1135.84	0.01
1	4148.273	0.2%	1640.00	162.16	181.89		181.89	0.000001	0.17	10492.82	1149.88	0.01
1	4038.967	10%	629.00	162.68	179.76		179.76	0.000000	0.10	6254.01	891.97	0.01
1	4038.967	2%	967.00	162.68	180.58		180.58	0.000000	0.14	6995.75	914.67	0.01
1	4038.967	1%	1150.00	162.68	180.98		180.98	0.000001	0.16	7364.76	926.53	0.01
1	4038.967	0.2%	1640.00	162.68	181.89		181.89	0.000001	0.21	8218.44	958.50	0.01
1	3918.162	10%	629.00	163.94	179.76		179.76	0.000000	0.13	5052.82	739.61	0.01
1	3918.162	2%	967.00	163.94	180.58		180.58	0.000001	0.18	5669.40	775.61	0.01
1	3918.162	1%	1150.00	163.94	180.98		180.98	0.000001	0.20	5989.26	823.80	0.01
1	3918.162	0.2%	1640.00	163.94	181.89		181.89	0.000002	0.26	6752.28	856.50	0.01
1	3728.386	10%	629.00	163.72	179.76		179.76	0.000000	0.14	4479.48	645.89	0.01
1	3728.386	2%	967.00	163.72	180.58		180.58	0.000001	0.20	4795.77	683.00	0.01
1	3728.386	1%	1150.00	163.72	180.98		180.98	0.000001	0.23	4950.04	696.77	0.01
1	3728.386	0.2%	1640.00	163.72	181.89		181.89	0.000001	0.31	5298.01	753.88	0.01
1	3621	10%	629.00	164.28	179.75	167.27	179.76	0.000003	0.51	1221.72	591.77	0.02
1	3621	2%	967.00	164.28	180.57	167.89	180.58	0.000007	0.75	1296.46	619.27	0.03
1	3621	1%	1150.00	164.28	180.97	168.09	180.98	0.000009	0.86	1332.84	631.65	0.04
1	3621	0.2%	1640.00	164.28	181.86	168.56	181.88	0.000014	1.16	1414.59	656.07	0.05
1	3532.9		Bridge									
1	3411	10%	629.00	161.78	179.74		179.75	0.000002	0.44	1439.68	711.12	0.02
1	3411	2%	967.00	161.78	180.55		180.56	0.000004	0.64	1511.02	734.14	0.03
1	3411	1%	1150.00	161.78	180.94		180.95	0.000005	0.74	1545.65	746.48	0.03
1	3411	0.2%	1640.00	161.78	181.82		181.84	0.000009	1.01	1623.15	763.58	0.04
1	3279.451	10%	629.00	161.66	179.75		179.75	0.000000	0.18	3461.90	768.11	0.01
1	3279.451	2%	967.00	161.66	180.55		180.56	0.000001	0.26	3684.94	799.21	0.01
1	3279.451	1%	1150.00	161.66	180.95		180.95	0.000001	0.31	3793.28	805.34	0.01
1	3279.451	0.2%	1640.00	161.66	181.83		181.83	0.000002	0.41	4035.97	826.40	0.02
1	3059.249	10%	629.00	161.35	179.75		179.75	0.000000	0.16	3860.32	632.54	0.01
1	3059.249	2%	967.00	161.35	180.55		180.56	0.000001	0.24	4082.07	657.59	0.01
1	3059.249	1%	1150.00	161.35	180.95		180.95	0.000001	0.28	4191.19	666.49	0.01
1	3059.249	0.2%	1640.00	161.35	181.83		181.83	0.000001	0.37	4438.43	688.38	0.02
1	2876.209	10%	629.00	161.68	179.75		179.75	0.000001	0.21	2954.43	317.36	0.01
1	2876.209	2%	967.00	161.68	180.55		180.55	0.000001	0.31	3122.14	359.01	0.01
1	2876.209	1%	1150.00	161.68	180.95		180.95	0.000001	0.36	3204.02	363.15	0.02
1	2876.209	0.2%	1640.00	161.68	181.82		181.83	0.000002	0.49	3388.35	368.22	0.02
1	2744.186	10%	629.00	161.46	179.74		179.75	0.000002	0.39	1877.37	252.74	0.02
1	2744.186	2%	967.00	161.46	180.55		180.55	0.000004	0.56	2087.58	272.12	0.03
1	2744.186	1%	1150.00	161.46	180.94		180.95	0.000005	0.65	2200.54	296.18	0.03
1	2744.186	0.2%	1640.00	161.46	181.82		181.83	0.000009	0.86	2481.23	353.49	0.04
1	1805.461	10%	629.00	161.40	179.74		179.75	0.000000	0.06	10917.65	783.78	0.00
1	1805.461	2%	967.00	161.40	180.55		180.55	0.000000	0.09	11554.00	791.38	0.00
1	1805.461	1%	1150.00	161.40	180.94		180.94	0.000000	0.10	11864.84	793.77	0.00
1	1805.461	0.2%	1640.00	161.40	181.82		181.82	0.000000	0.14	12564.13	798.93	0.01

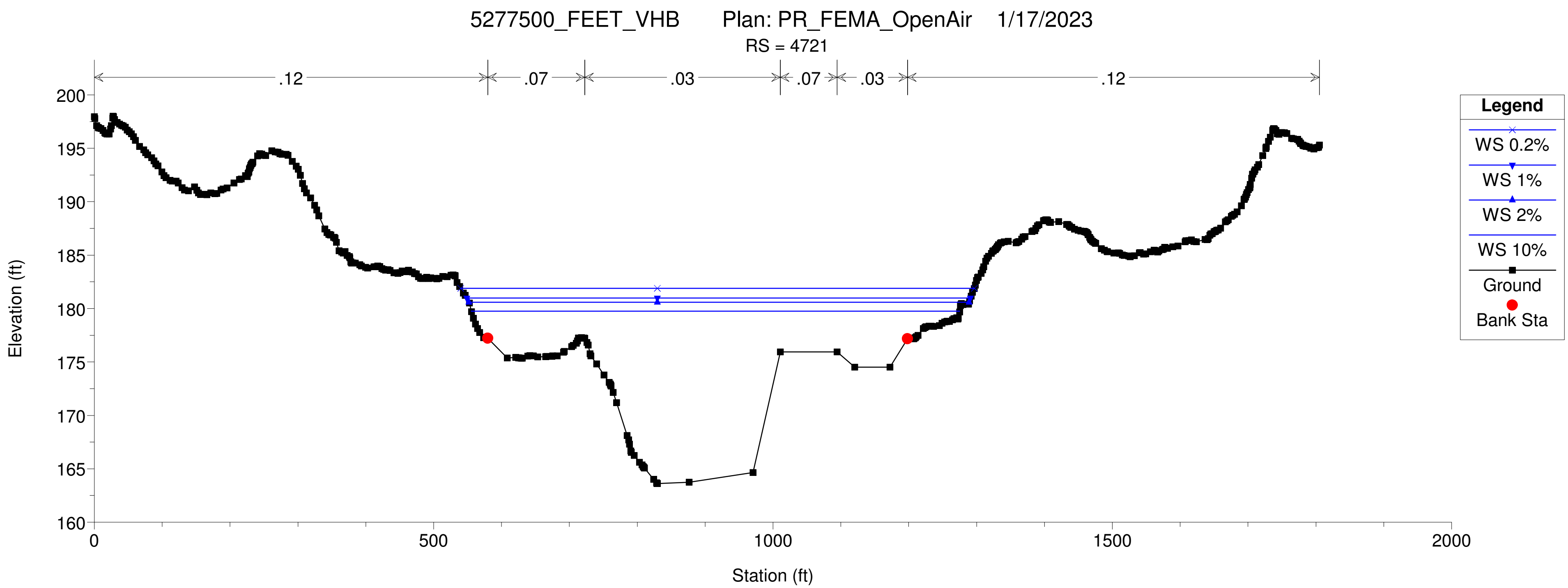
HEC-RAS Plan: EX_Rev1 River: Pennichuck Reach: 1 (Continued)

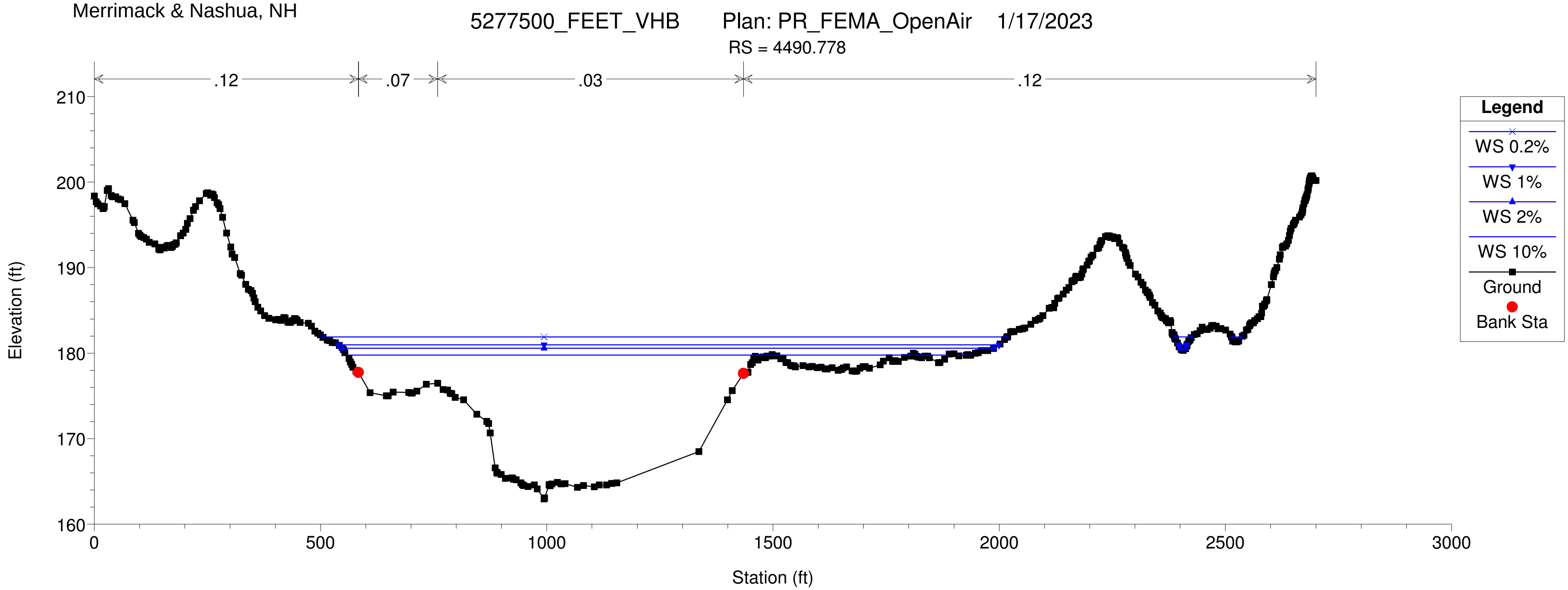
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	1000	10%	629.00	161.40	179.74		179.75	0.000000	0.07	9473.46	641.49	0.00
1	1000	2%	967.00	161.40	180.55		180.55	0.000000	0.10	9994.57	648.90	0.00
1	1000	1%	1150.00	161.40	180.94		180.94	0.000000	0.11	10249.55	651.61	0.00
1	1000	0.2%	1640.00	161.40	181.82		181.82	0.000000	0.15	10824.33	657.65	0.01
1	388	10%	629.00	157.00	179.74		179.74	0.000000	0.13	4828.22	332.34	0.01
1	388	2%	967.00	157.00	180.55		180.55	0.000000	0.19	5102.02	345.59	0.01
1	388	1%	1150.00	157.00	180.94		180.94	0.000000	0.22	5238.42	350.11	0.01
1	388	0.2%	1640.00	157.00	181.82		181.82	0.000001	0.30	5551.70	365.89	0.01
1	209	10%	629.00	155.81	179.74	157.45	179.74	0.000003	0.50	1280.94	118.91	0.02
1	209	2%	967.00	155.81	180.54	157.99	180.55	0.000007	0.74	1404.20	177.98	0.03
1	209	1%	1150.00	155.81	180.93	158.25	180.94	0.000010	0.86	1485.13	241.19	0.03
1	209	0.2%	1640.00	155.81	181.80	158.91	181.82	0.000018	1.18	1723.14	316.54	0.04
1	184		Inl Struct									
1	26	10%	629.00	155.52	170.00	158.38	170.00	0.000005	0.39	1602.80	229.03	0.03
1	26	2%	967.00	155.52	170.70	158.89	170.70	0.000009	0.55	1774.41	274.50	0.04
1	26	1%	1150.00	155.52	171.10	159.13	171.11	0.000011	0.61	1888.31	295.89	0.04
1	26	0.2%	1640.00	155.52	172.00	159.71	172.01	0.000015	0.78	2163.32	314.84	0.05

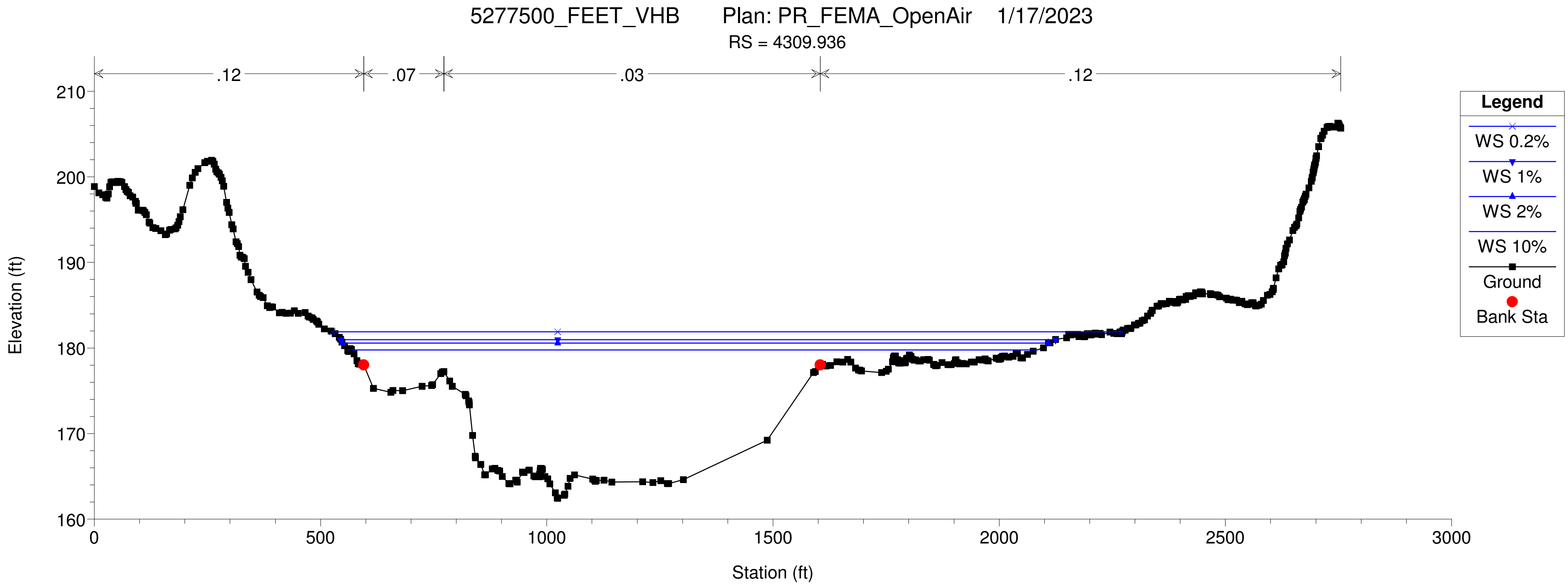
13761A FEET: Pennichuck Brook
Merrimack & Nashua, NH

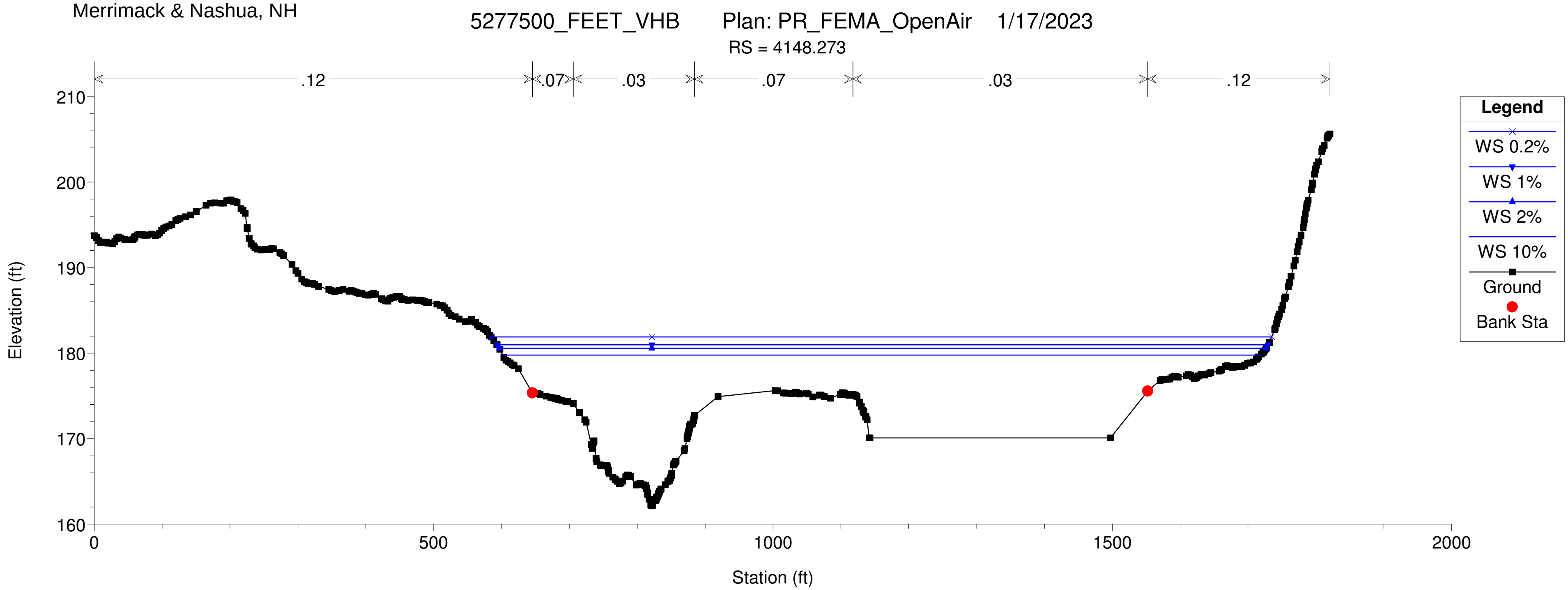


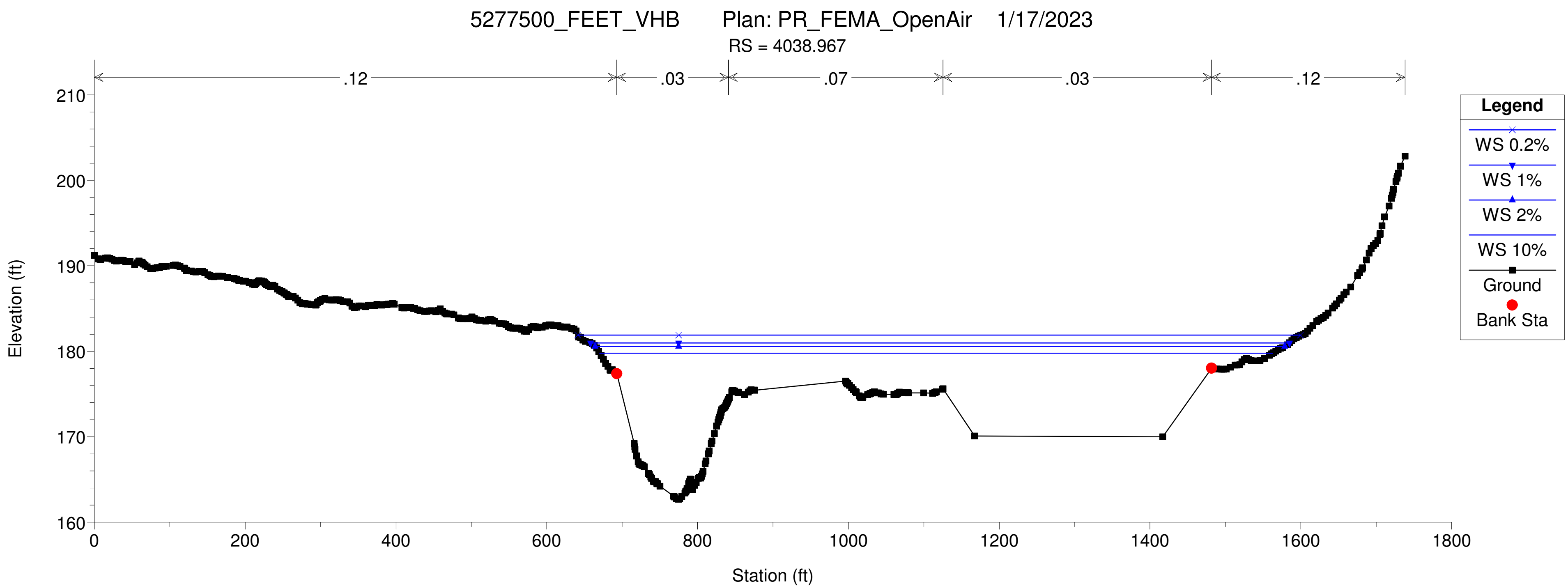

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 4267.934 FEMA Cross Section I
.12
.07
.03
.12
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Elevation (ft)
Station (ft)
160
170
180
190
200
210
0
200
400
600
800
1000
1200
1400
1600
1800

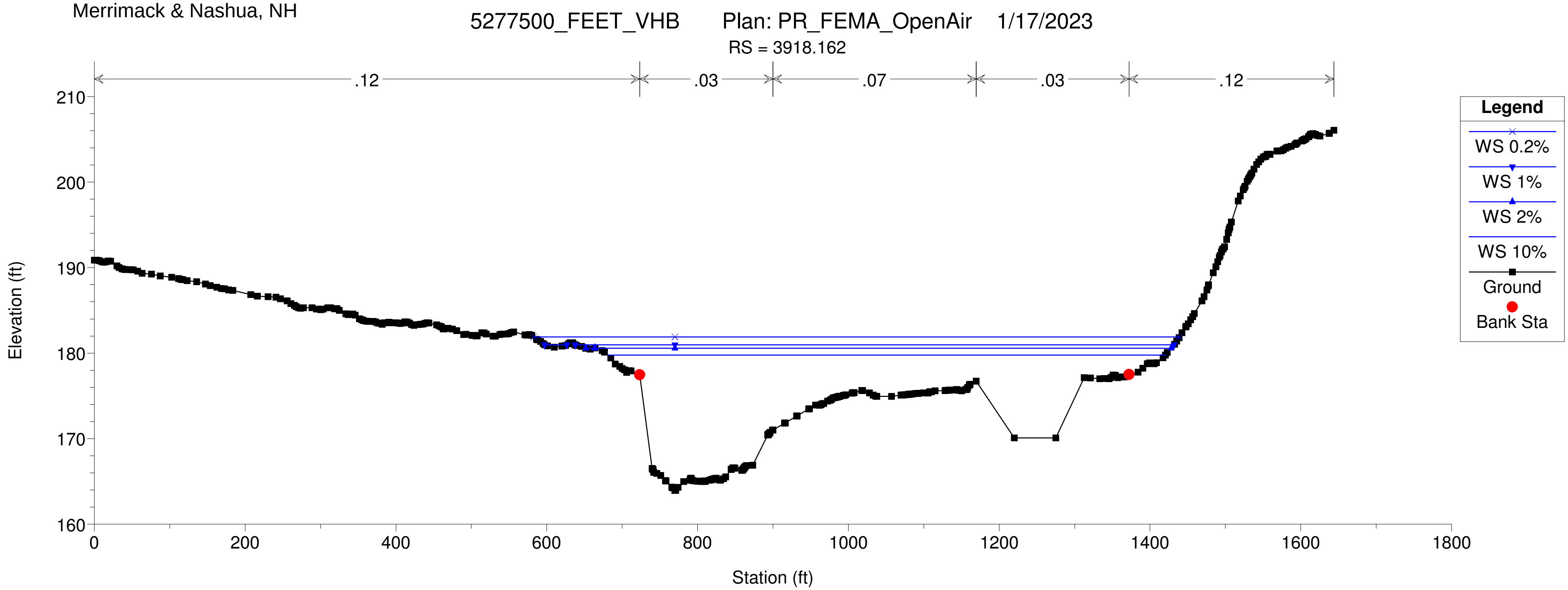

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 4721
.12
.07
.03
.07
.03
.12
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Elevation (ft)
Station (ft)
160
165
170
175
180
185
190
195
200
0
500
1000
1500
2000


5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 4490.778
.12
.07
.03
.12
Elevation (ft)
210
200
190
180
170
160
0
500
1000
1500
2000
2500
3000
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta


5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 4309.936
.12
.07
.03
.12
Elevation (ft)
210
200
190
180
170
160
0
500
1000
1500
2000
2500
3000
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta


5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 4148.273
.12
.07
.03
.07
.03
.12
Elevation (ft)
210
200
190
180
170
160
0
500
1000
1500
2000
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta


5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 4038.967
.12
.03
.07
.03
.12
Elevation (ft)
210
200
190
180
170
160
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta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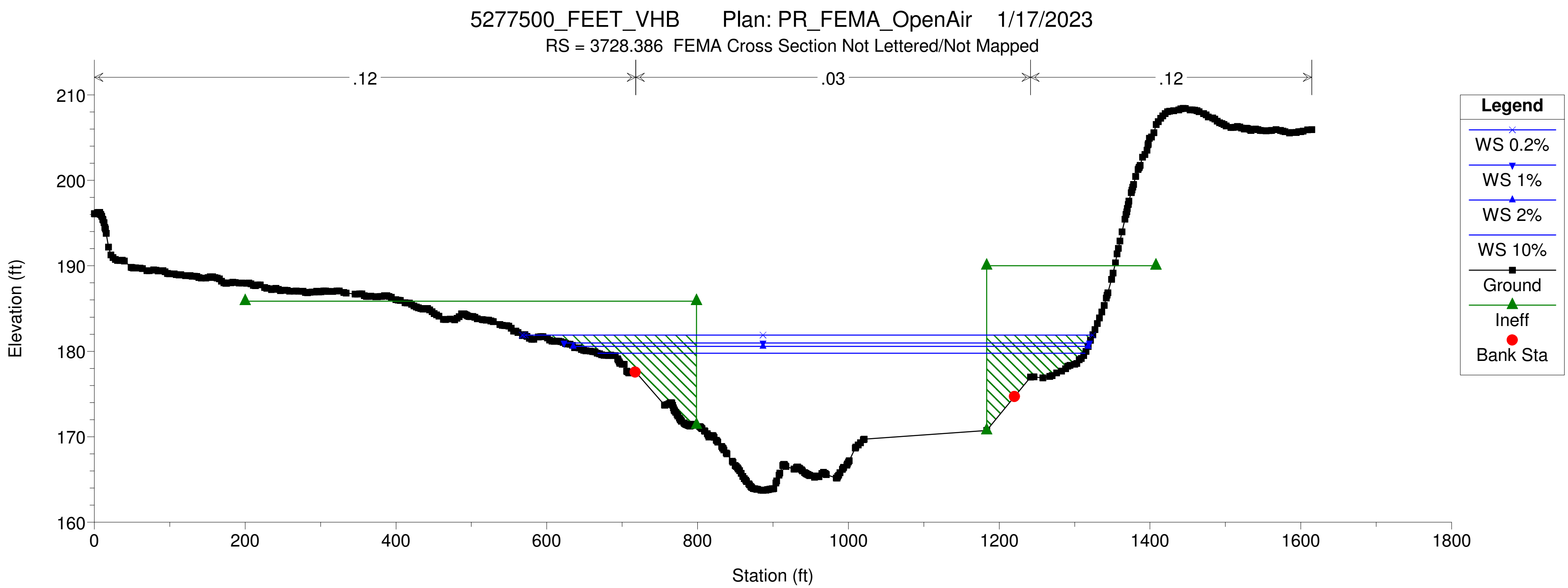
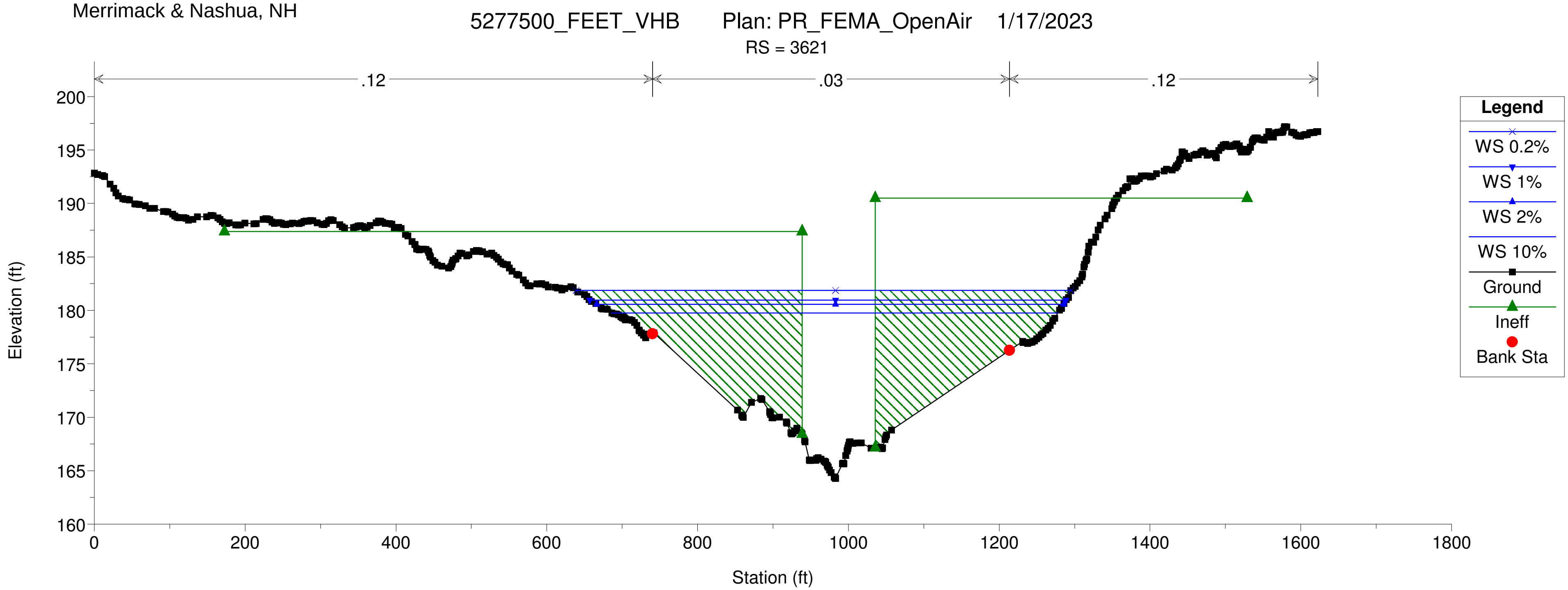
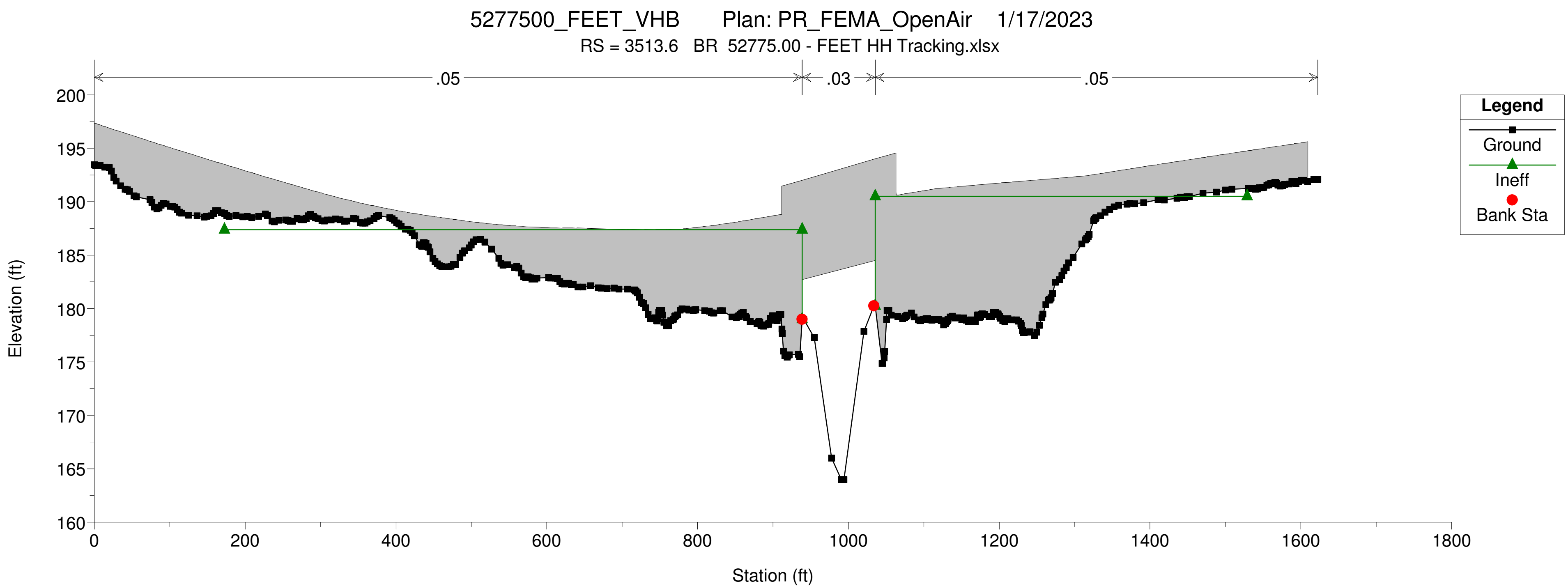
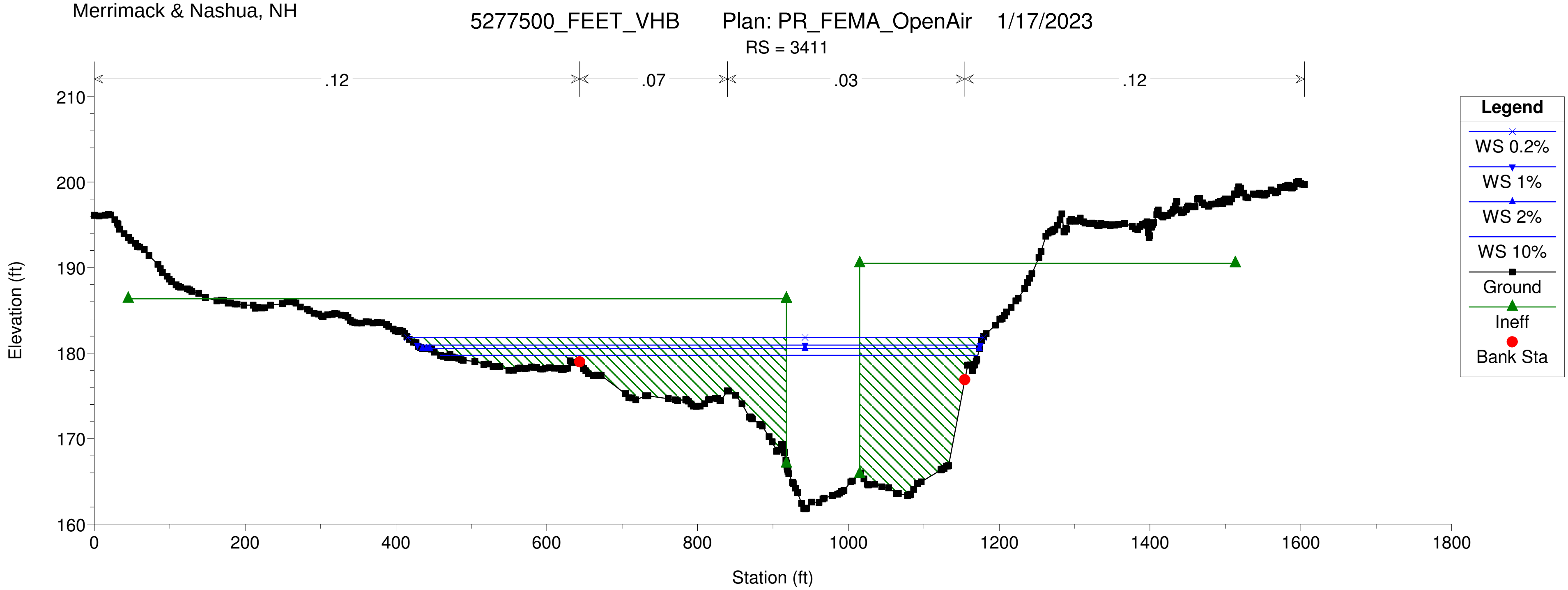
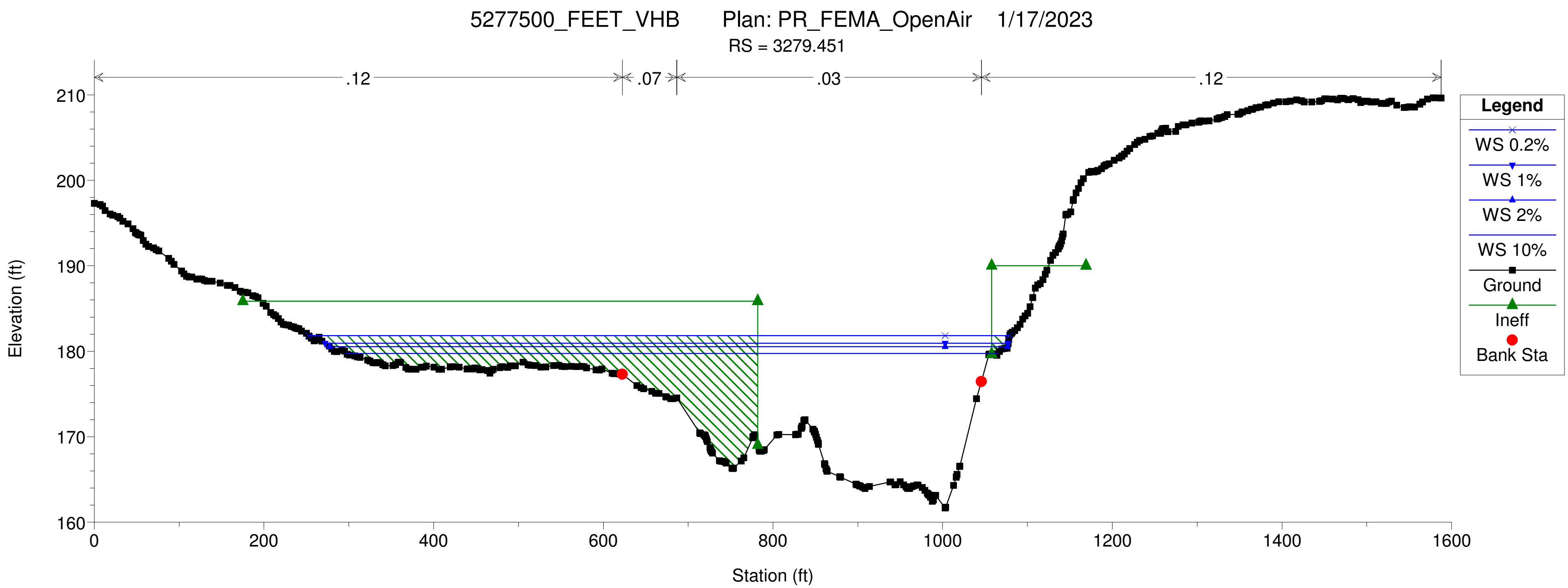
RS = 3918.162
.12
.03
.07
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta

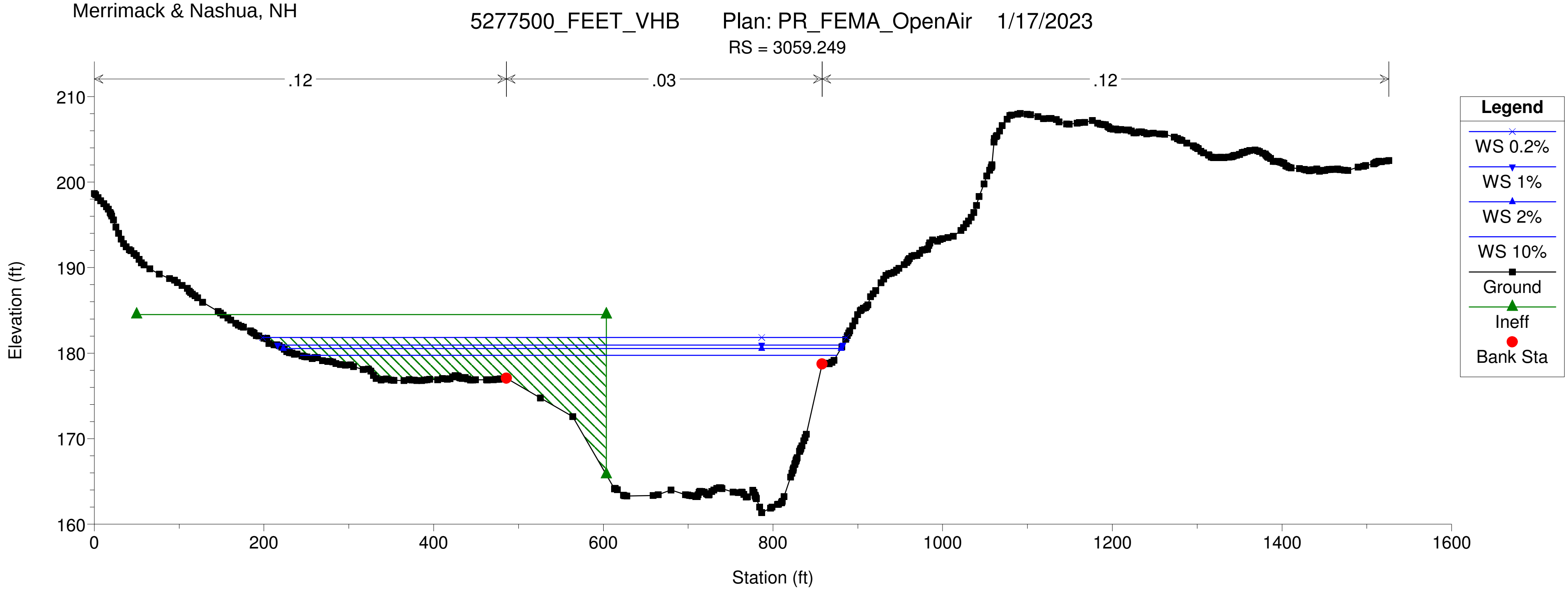

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 3728.386 FEMA Cross Section Not Lettered/Not Mapped
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta

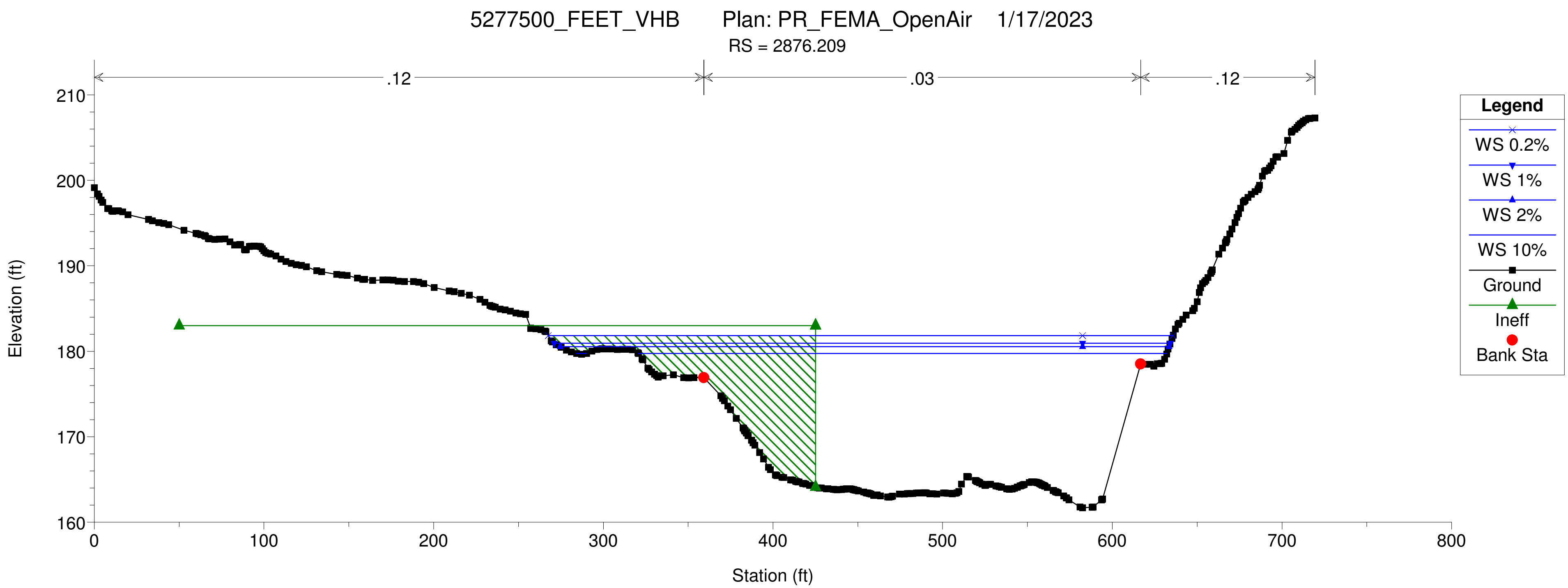

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 3621
.12
.03
.12
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

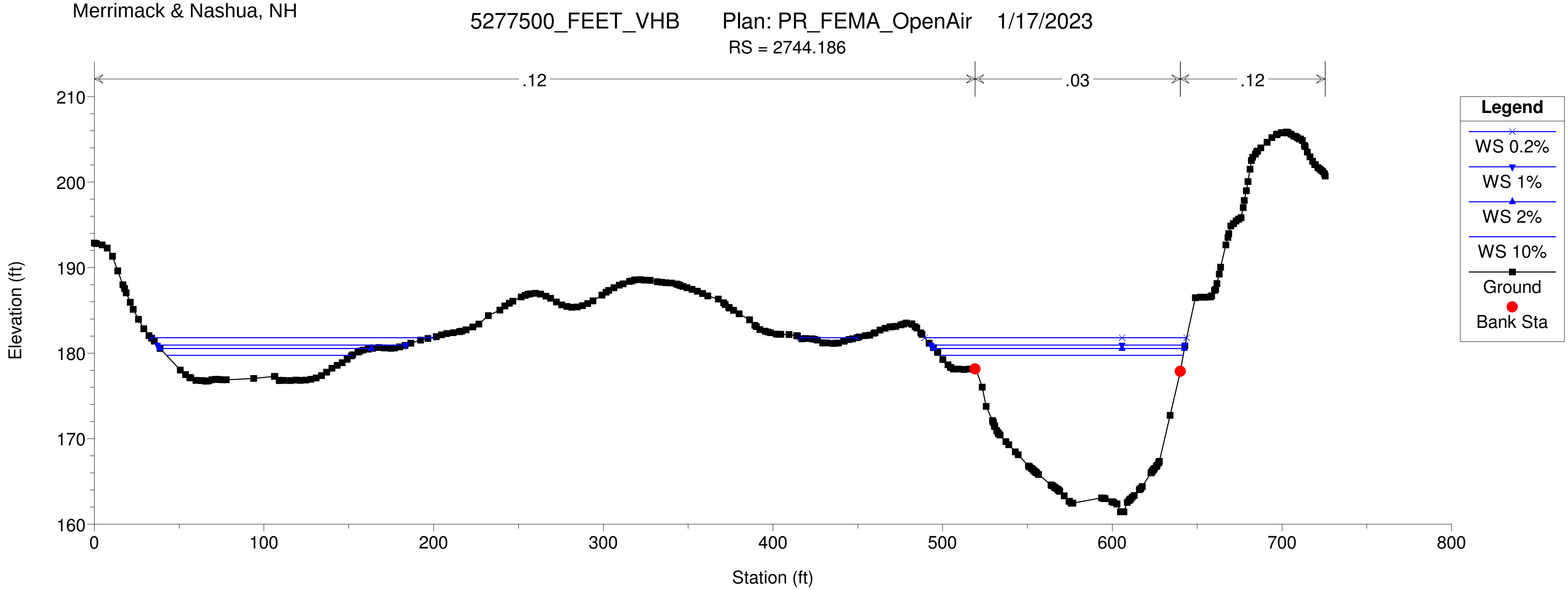

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 3513.6 BR 52775.00 - FEET HH Tracking.xlsx
.05
.03
.05
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

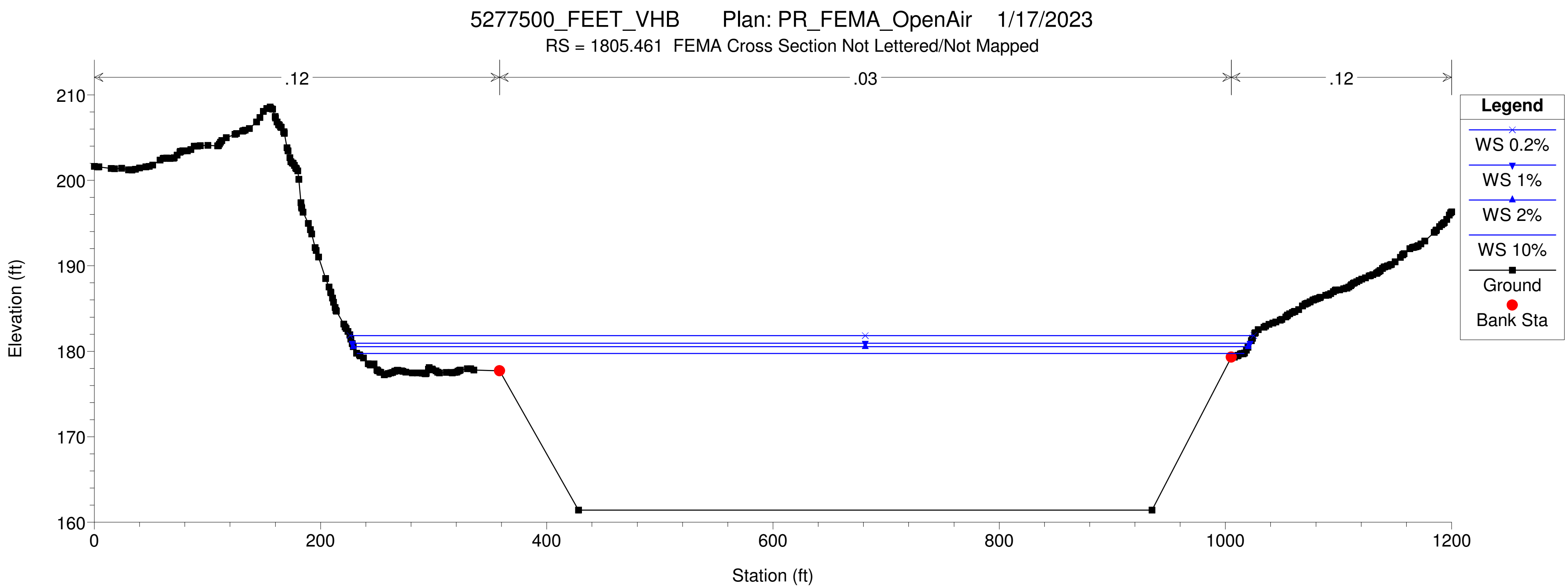

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 3411
.12
.07
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta

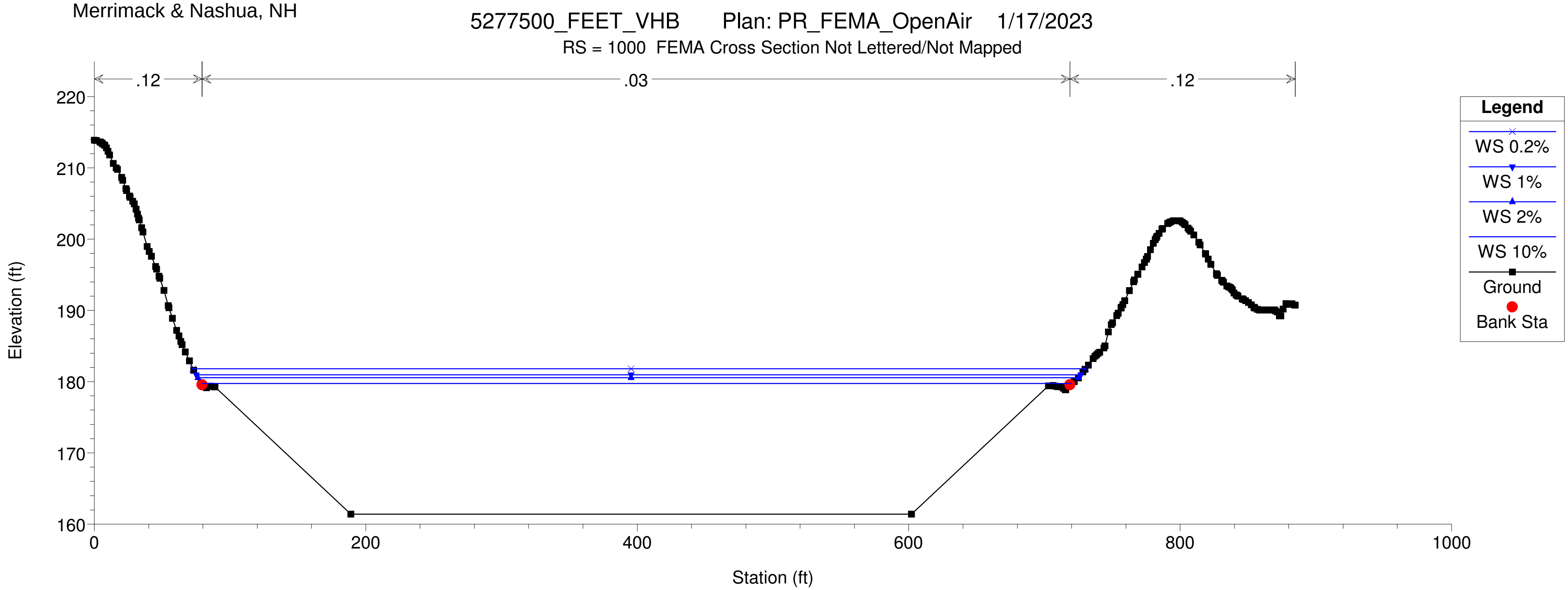

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 3279.451
.12
.07
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta

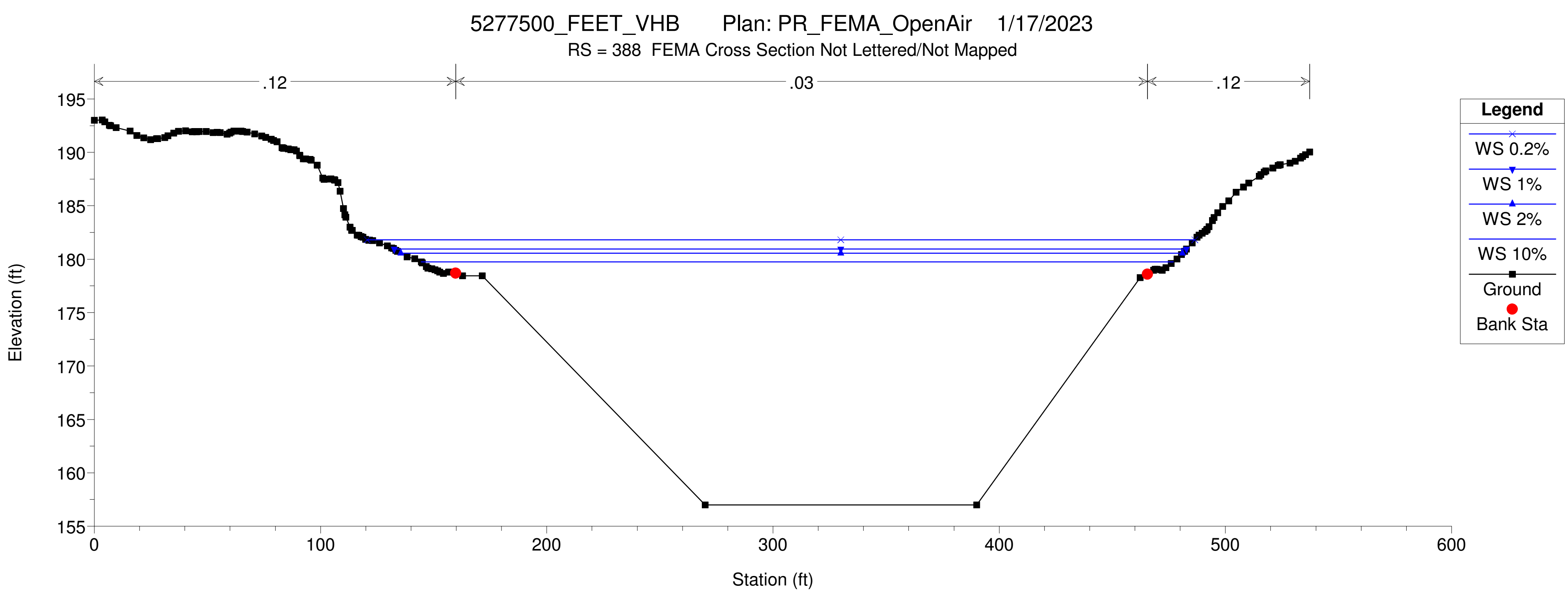

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 3059.249
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta

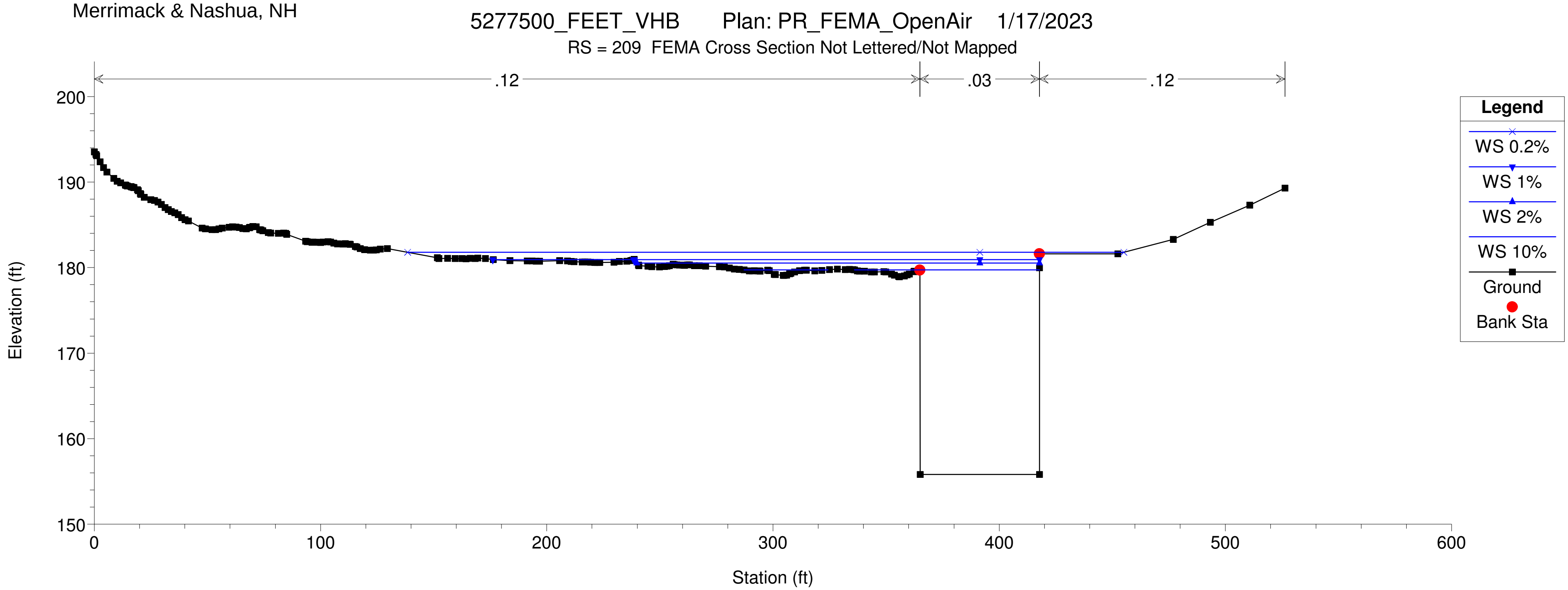

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 2876.209
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta

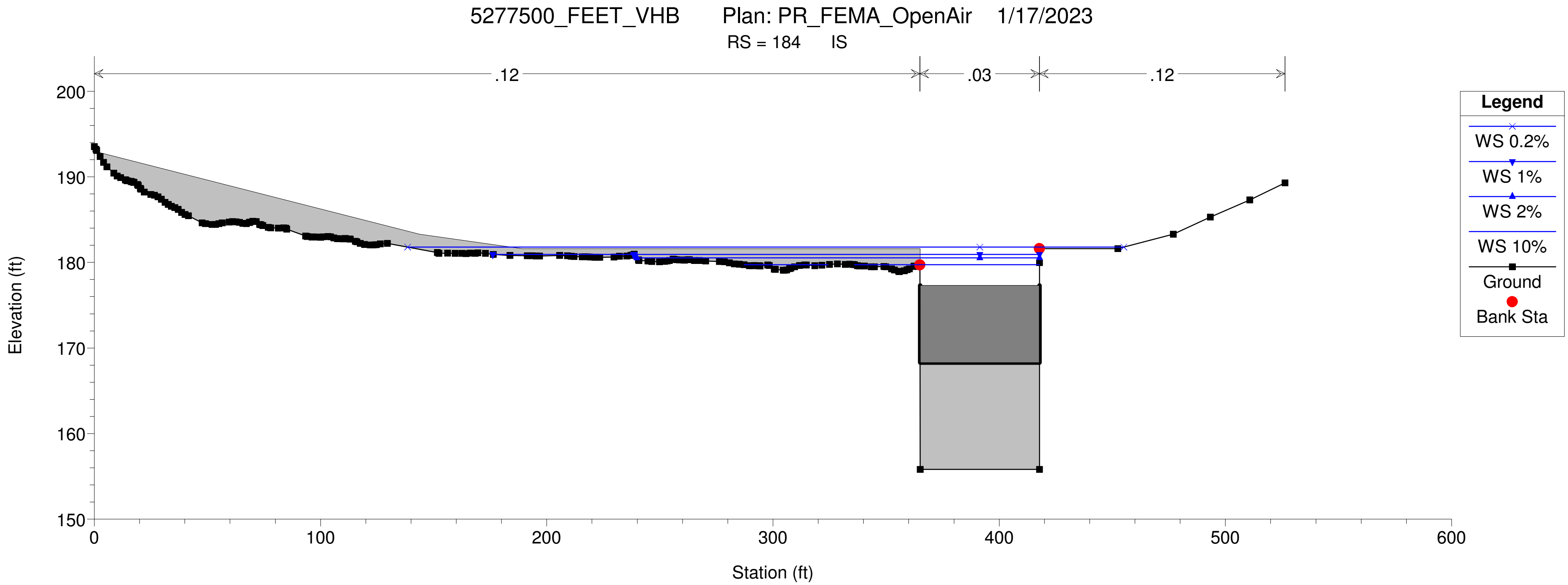

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 2744.186
.12
.03
.12
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Elevation (ft)
Station (ft)
210
200
190
180
170
160
0
100
200
300
400
500
600
700
800


5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 1805.461 FEMA Cross Section Not Lettered/Not Mapped
.12
.03
.12
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Elevation (ft)
Station (ft)
210
200
190
180
170
160
0
200
400
600
800
1000
1200


5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 1000 FEMA Cross Section Not Lettered/Not Mapped
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta

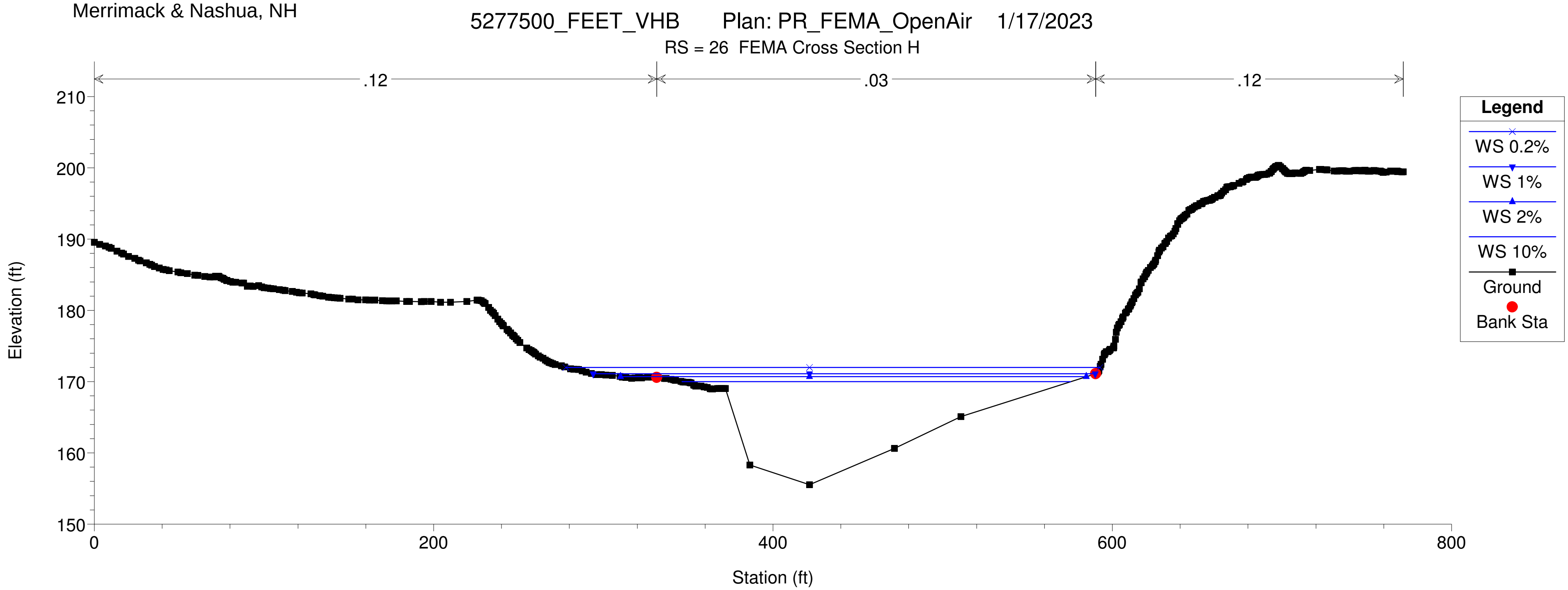

5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 388 FEMA Cross Section Not Lettered/Not Mapped
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta


5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 209 FEMA Cross Section Not Lettered/Not Mapped
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta


5277500_FEET_VHB Plan: PR_FEMA_OpenAir 1/17/2023
RS = 184 IS
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta

Appendix B - HecRAS Proposed Cross Sections

13761A FEET: Pennichuck Brook
Merrimack & Nashua, NH



Appendix B - HecRAS Proposed Standard Table

13761A FEET: Pennichuck Brook | Merrimack & Nashua, NH

HEC-RAS Plan: PR_OpenAir River: Pennichuck Reach: 1

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)	
1	4721	10%	629.00	163.61	179.76		179.76	0.000000	0.13	5167.33	719.59	0.01
1	4721	2%	967.00	163.61	180.58		180.58	0.000001	0.17	5761.91	736.87	0.01
1	4721	1%	1150.00	163.61	180.98		180.98	0.000001	0.20	6057.58	742.38	0.01
1	4721	0.2%	1640.00	163.61	181.88		181.88	0.000001	0.26	6732.54	756.86	0.01
1	4490.778	10%	629.00	162.94	179.76		179.76	0.000000	0.07	9013.06	1337.17	0.00
1	4490.778	2%	967.00	162.94	180.58		180.58	0.000000	0.10	10166.03	1451.98	0.01
1	4490.778	1%	1150.00	162.94	180.98		180.98	0.000000	0.12	10751.97	1479.01	0.01
1	4490.778	0.2%	1640.00	162.94	181.88		181.88	0.000000	0.16	12125.95	1573.24	0.01
1	4309.936	10%	629.00	162.44	179.76		179.76	0.000000	0.06	11861.51	1518.52	0.00
1	4309.936	2%	967.00	162.44	180.58		180.58	0.000000	0.08	13128.76	1559.54	0.00
1	4309.936	1%	1150.00	162.44	180.98		180.98	0.000000	0.09	13756.89	1579.55	0.00
1	4309.936	0.2%	1640.00	162.44	181.88		181.88	0.000000	0.12	15237.79	1745.40	0.01
1	4267.934	10%	629.00	163.47	179.76		179.76	0.000000	0.07	9842.67	988.09	0.00
1	4267.934	2%	967.00	163.47	180.58		180.58	0.000000	0.09	10662.21	1004.51	0.00
1	4267.934	1%	1150.00	163.47	180.98		180.98	0.000000	0.11	11064.84	1009.74	0.01
1	4267.934	0.2%	1640.00	163.47	181.88		181.88	0.000000	0.14	11989.18	1042.35	0.01
1	4148.273	10%	629.00	162.16	179.76		179.76	0.000000	0.08	8081.06	1115.70	0.00
1	4148.273	2%	967.00	162.16	180.58		180.58	0.000000	0.11	9002.80	1129.92	0.01
1	4148.273	1%	1150.00	162.16	180.98		180.98	0.000000	0.13	9455.70	1135.80	0.01
1	4148.273	0.2%	1640.00	162.16	181.88		181.88	0.000001	0.17	10485.29	1149.79	0.01
1	4038.967	10%	629.00	162.68	179.76		179.76	0.000000	0.10	6253.88	891.96	0.01
1	4038.967	2%	967.00	162.68	180.58		180.58	0.000000	0.14	6994.38	914.63	0.01
1	4038.967	1%	1150.00	162.68	180.98		180.98	0.000001	0.16	7362.28	926.43	0.01
1	4038.967	0.2%	1640.00	162.68	181.88		181.88	0.000001	0.21	8212.17	958.31	0.01
1	3918.162	10%	629.00	163.94	179.76		179.76	0.000000	0.13	5052.71	739.61	0.01
1	3918.162	2%	967.00	163.94	180.58		180.58	0.000001	0.18	5668.24	775.40	0.01
1	3918.162	1%	1150.00	163.94	180.98		180.98	0.000001	0.20	5987.08	823.60	0.01
1	3918.162	0.2%	1640.00	163.94	181.88		181.88	0.000002	0.26	6746.67	856.36	0.01
1	3728.386	10%	629.00	163.72	179.76		179.76	0.000000	0.14	4479.42	645.89	0.01
1	3728.386	2%	967.00	163.72	180.58		180.58	0.000001	0.20	4795.19	682.98	0.01
1	3728.386	1%	1150.00	163.72	180.98		180.98	0.000001	0.23	4949.02	696.70	0.01
1	3728.386	0.2%	1640.00	163.72	181.88		181.88	0.000001	0.31	5295.49	753.51	0.01
1	3621	10%	629.00	164.28	179.75	167.32	179.76	0.000003	0.49	1291.04	591.78	0.02
1	3621	2%	967.00	164.28	180.57	167.87	180.58	0.000006	0.71	1370.13	619.26	0.03
1	3621	1%	1150.00	164.28	180.97	168.06	180.98	0.000008	0.82	1408.57	631.62	0.04
1	3621	0.2%	1640.00	164.28	181.86	168.51	181.87	0.000013	1.10	1494.89	655.97	0.05
1	3513.6		Bridge									
1	3411	10%	629.00	161.78	179.74		179.75	0.000002	0.40	1560.41	711.12	0.02
1	3411	2%	967.00	161.78	180.55		180.56	0.000003	0.59	1638.80	734.27	0.03
1	3411	1%	1150.00	161.78	180.94		180.95	0.000004	0.69	1676.86	746.48	0.03
1	3411	0.2%	1640.00	161.78	181.82		181.83	0.000007	0.93	1762.04	763.60	0.04
1	3279.451	10%	629.00	161.66	179.75		179.75	0.000000	0.18	3461.90	768.11	0.01
1	3279.451	2%	967.00	161.66	180.55		180.56	0.000001	0.26	3684.94	799.21	0.01
1	3279.451	1%	1150.00	161.66	180.95		180.95	0.000001	0.31	3793.28	805.34	0.01
1	3279.451	0.2%	1640.00	161.66	181.83		181.83	0.000002	0.41	4035.97	826.40	0.02
1	3059.249	10%	629.00	161.35	179.75		179.75	0.000000	0.16	3860.32	632.54	0.01
1	3059.249	2%	967.00	161.35	180.55		180.56	0.000001	0.24	4082.07	657.59	0.01
1	3059.249	1%	1150.00	161.35	180.95		180.95	0.000001	0.28	4191.19	666.49	0.01
1	3059.249	0.2%	1640.00	161.35	181.83		181.83	0.000001	0.37	4438.43	688.38	0.02
1	2876.209	10%	629.00	161.68	179.75		179.75	0.000001	0.21	2954.43	317.36	0.01
1	2876.209	2%	967.00	161.68	180.55		180.55	0.000001	0.31	3122.14	359.01	0.01
1	2876.209	1%	1150.00	161.68	180.95		180.95	0.000001	0.36	3204.02	363.15	0.02
1	2876.209	0.2%	1640.00	161.68	181.82		181.83	0.000002	0.49	3388.35	368.22	0.02
1	2744.186	10%	629.00	161.46	179.74		179.75	0.000002	0.39	1877.37	252.74	0.02
1	2744.186	2%	967.00	161.46	180.55		180.55	0.000004	0.56	2087.58	272.12	0.03
1	2744.186	1%	1150.00	161.46	180.94		180.95	0.000005	0.65	2200.54	296.18	0.03
1	2744.186	0.2%	1640.00	161.46	181.82		181.83	0.000009	0.86	2481.23	353.49	0.04
1	1805.461	10%	629.00	161.40	179.74		179.75	0.000000	0.06	10917.65	783.78	0.00
1	1805.461	2%	967.00	161.40	180.55		180.55	0.000000	0.09	11554.00	791.38	0.00
1	1805.461	1%	1150.00	161.40	180.94		180.94	0.000000	0.10	11864.84	793.77	0.00
1	1805.461	0.2%	1640.00	161.40	181.82		181.82	0.000000	0.14	12564.13	798.93	0.01

HEC-RAS Plan: PR_OpenAir River: Pennichuck Reach: 1 (Continued)

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)	
1	1000	10%	629.00	161.40	179.74		179.75	0.000000	0.07	9473.46	641.49	0.00
1	1000	2%	967.00	161.40	180.55		180.55	0.000000	0.10	9994.57	648.90	0.00
1	1000	1%	1150.00	161.40	180.94		180.94	0.000000	0.11	10249.55	651.61	0.00
1	1000	0.2%	1640.00	161.40	181.82		181.82	0.000000	0.15	10824.33	657.65	0.01
1	388	10%	629.00	157.00	179.74		179.74	0.000000	0.13	4828.22	332.34	0.01
1	388	2%	967.00	157.00	180.55		180.55	0.000000	0.19	5102.02	345.59	0.01
1	388	1%	1150.00	157.00	180.94		180.94	0.000000	0.22	5238.42	350.11	0.01
1	388	0.2%	1640.00	157.00	181.82		181.82	0.000001	0.30	5551.70	365.89	0.01
1	209	10%	629.00	155.81	179.74	157.45	179.74	0.000003	0.50	1280.94	118.91	0.02
1	209	2%	967.00	155.81	180.54	157.99	180.55	0.000007	0.74	1404.20	177.98	0.03
1	209	1%	1150.00	155.81	180.93	158.25	180.94	0.000010	0.86	1485.13	241.19	0.03
1	209	0.2%	1640.00	155.81	181.80	158.91	181.82	0.000018	1.18	1723.14	316.54	0.04
1	184		Inl Struct									
1	26	10%	629.00	155.52	170.00	158.38	170.00	0.000005	0.39	1602.80	229.03	0.03
1	26	2%	967.00	155.52	170.70	158.89	170.70	0.000009	0.55	1774.41	274.50	0.04
1	26	1%	1150.00	155.52	171.10	159.13	171.11	0.000011	0.61	1888.31	295.89	0.04
1	26	0.2%	1640.00	155.52	172.00	159.71	172.01	0.000015	0.78	2163.32	314.84	0.05

FLOODWAY "NO-RISE / NO-IMPACT" CERTIFICATION

This document is to certify that I am duly qualified engineer licensed to practice in the State of

New Hampshire (State). It is to further certify that the attached technical data supports

the fact that proposed **FE Everett Turnpike Project** (Name of Development) will not impact the base flood

elevations, floodway elevations, and floodway widths on **Pennichuck Brook** (Name of Stream) at published

cross sections in the Flood Insurance Study for, **Hillsborough County** (Name of community), dated **9/25/2009** (Date)

and will not impact the base flood elevations, floodway elevations, and floodway widths at the unpublished cross-sections in the area of the proposed development.

Feb 20, 2023

STATE OF NEW HAMPSHIRE
ANNIQUE HELEN FLEUROCK No. 16725
LICENSED
PROFESSIONAL ENGINEER

SEAL, SIGNATURE AND DATE

Annique Fleurock, PE
Name

Water Resources Engineer
Title

2 Bedford Farms Drive, Suite 200

Bedford, NH 03110
Address

FOR COMMUNITY USE ONLY:		
Community Approval		
☐ Approved	☐ Disapproved	
Community Official's Name	Community Official's Signature	Title

FEMA, MT
DTD.09/2004

Memorandum

Appendix C

Geotechnical Data
HEC-18 Scour Calculations
HEC-23 Rip Rap Sizing

2 Bedford Farms Drive
Suite 200
Bedford, NH 03110-6532
P 603.391.3900

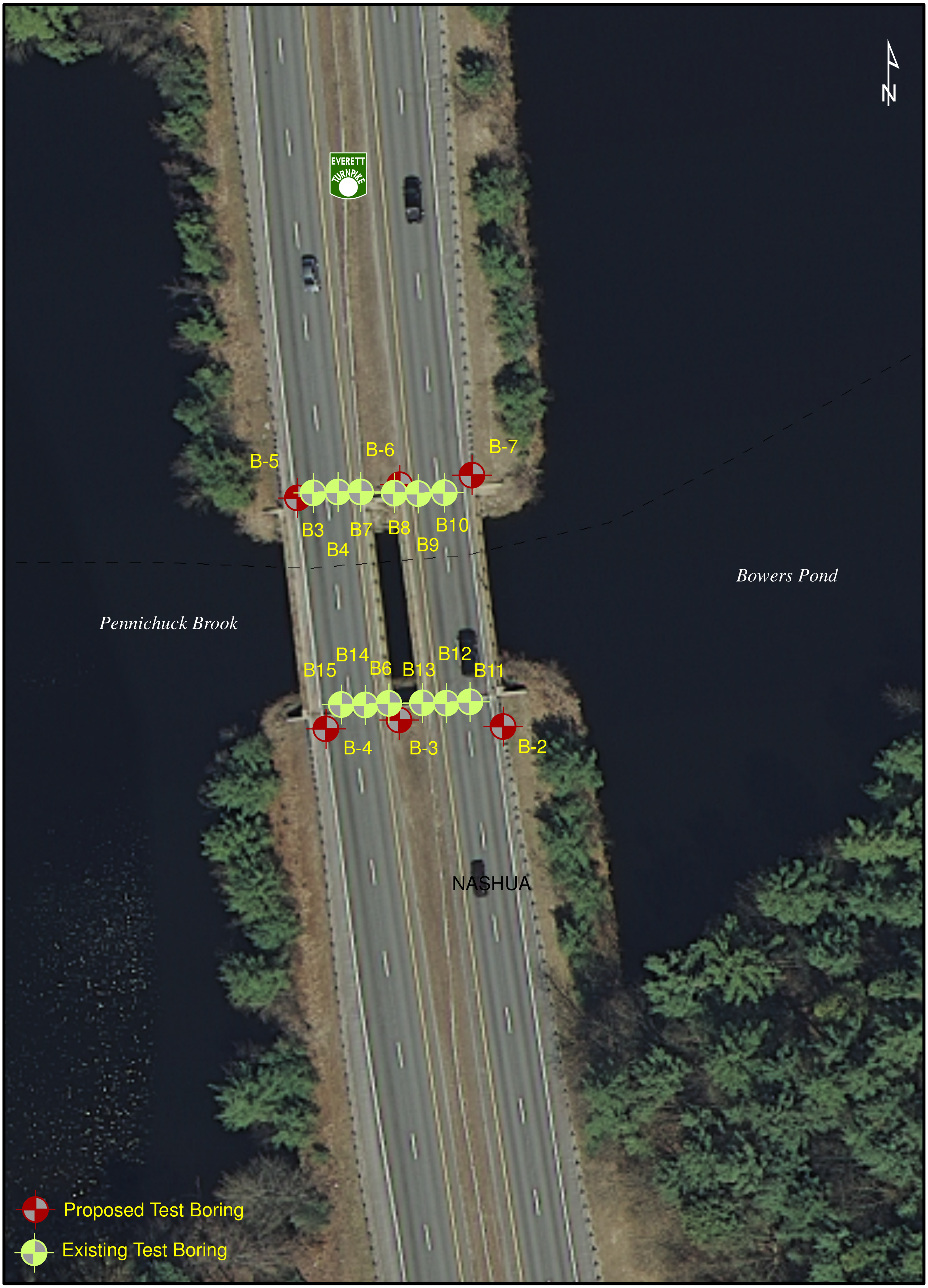


FIGURE 2 - BORING LOCATION PLAN
FEET Over PENNICHUCK BROOK
Nashua-Merrimack-Bedford 13761

Feet 0 100 200

TEST BORING REPORT

STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION

PROJECT NAME **NASHUA-MERRIMACK-BEDFORD 13761** BRIDGE NO. N/A
DESCRIPTION Replace B1 - FEET over Pennichuck Brook

BORING NO.	**B02**
SHEET NO.	1 OF 3
STA.	OFF.
BASELINE	FEET NB CL
ELEVATION (ft)	189.0
START/END	8/29/19 / 9/4/19
DRILLER	J. Woodward (NHDOT)
INSPECTOR	Doug Rogers
CLASSIFIER	DRR
EAST/NORTH (ft)	1029330/111009

GROUNDWATER

DATE	TIME	DEPTH (ft)	ELEV. (ft)	BOTTOM OF CASING	BOTTOM OF HOLE
8/29/19	12:35 pm	13.1	175.9	20.0	21.7
9/3/19	8:15 am	12.9	176.1	24.0	25.7

EQUIPMENT	SAMPLER	CASING	CORE
TYPE:	S	NW	NX
SIZE I.D. (in):	1.375	3	1.875
HAMMER WT. (lb):	140	DRILL RIG	
HAMMER FALL (in):	30	CME 45-C Track rig	
HAMMER TYPE:	Automatic		

DEPTH (ft)	STRATUM CHANGE DEPTH (ft)	STRATUM CHANGE ELEVATION (ft)	BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) [%]	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS
0	0.4	188.6	WOH 3 6 8	S1	1.0 [50]	0.0 - 2.0	Dark brown-dark greyish brown, fine sandy SILT, trace coarse-medium sand, occasional fiber -TOPSOIL- Loose, yellowish brown coarse-fine sandy GRAVEL, trace of silt
			5 7 7 10	S2	1.2 [60]	2.0 - 4.0	Medium dense, yellowish brown w/ traces of dark yellowish brown, gravelly COARSE-FINE SAND, trace silt
5			17 13 10 8	S3	0.2 [10]	4.0 - 6.0	Medium dense, similar to S2
			7 7 6 7	S4	1.0 [50]	6.0 - 8.0	Medium dense, yellowish brown w/ traces of greyish brown, MEDIUM-FINE SAND, some coarse sand, some-little gravel, little-trace silt -FILL-
			7 6 5 6	S5	0.8 [40]	8.0 - 10.0	Medium dense, yellowish brown and greyish brown, MEDIUM-FINE SAND, little gravel, little coarse sand, trace to little silt
10			7 6 7 11	S6	1.0 [50]	10.0 - 12.0	Medium dense, yellowish brown to greyish brown, MEDIUM-FINE SAND, trace gravel, trace coarse sand, trace silt
			11 13 8 7	S7	0.9 [45]	12.0 - 14.0	Medium dense, dark yellowish brown and greyish brown, COARSE-FINE SAND, some gravel to "gravelly", little silt
15	14.6	174.4	7 4 5 5	S8	0.9 [45]	14.0 - 16.0	Yellowish brown and greyish brown, MEDIUM-FINE SAND, little fine gravel, little coarse sand, trace silt Dark yellowish brown, gravelly COARSE-FINE SAND, little-trace silt
			4 4 2 1	S9	0.5 [25]	16.0 - 18.0	Loose, greyish brown and yellowish brown, gravelly COARSE-FINE SAND
			3 2 2 2	S10	0.8 [40]	18.0 - 20.0	Very loose, greyish brown-grey, FINE SAND, little medium sand, trace gravel, trace coarse sand -ALLUVIUM-
20			3 2 2 2	S11	0.6 [30]	20.0 - 22.0	Very loose, brownish grey-grey, FINE SAND, little medium sand, trace fine gravel, trace coarse sand, trace silt
			2 1 2 1	S12	0.7 [35]	22.0 - 24.0	Very loose, grey to greyish brown, MEDIUM-FINE SAND, little-trace coarse sand, trace fine gravel, slight trace of silt
25	24.7	164.3	2 2 3 2	S13	0.7 [35]	24.0 - 26.0	Grey to brownish grey, MEDIUM-FINE SAND, little-trace fine gravel, little-trace coarse sand, little-trace silt Note: black, partially decayed wood fragments in end of spoon tip
			2 2 3 5	S14	1.1 [55]	26.0 - 28.0	Medium stiff, very dark greyish brown and dark grey to black, SILT, little organic, slight trace of fine sand -ORGANIC SWAMP DEPOSIT-
			3 2			28.0	

Description Continues on Next Page

Sampler	Identification
S	Standard Split Spoon
SL	Large Spoon (O.D.= 3 in)
T	Thin Wall Tube
U	Undisturbed Piston
O	Open End Rod
A	Auger Flight
C	Core Barrel
NR	Not Recorded

COHESIVE SOILS

Blows/foot (N)	Consistency
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Very Stiff
> 30	Hard

NON-COHESIVE SOILS

Blows/foot (N)	Apparent Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

WOR - Weight of Rod
WOH - Weight of Hammer

Soil Descriptions	Proportion
Capitalized Soil Name	Major Component
Lower Case Adjective	35% - 50%
Some	20% - 35%
Little	10% - 20%
Trace	1% - 10%

ENGLISH

TEST BORING REPORT

STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION

New Hampshire DOT

PROJECT NAME **NASHUA-MERRIMACK-BEDFORD 13761** BRIDGE NO. N/A
DESCRIPTION Replace B1 - FEET over Pennichuck Brook

BORING NO. **B02**
SHEET NO. 2 OF 3
STA. ______ OFF. ______
BASELINE FEET NB CL
ELEVATION (ft) 189.0

DEPTH (ft)	STRATUM CHANGE (ft) DEPTH	STRATUM CHANGE (ft) ELEVATION	BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) [%]	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS
			3 5	S15	1.2 [60]	30.0	Loose, very dark greyish brown, SILT and fine sandy SILT, little to trace organic w/ frequent layers of greyish brown fine sand, some-little silt
30	30.7	158.3	4 6 8 9	S16	1.2 [60]	30.0 - 32.0	Similar to S15
							Grey, silty FINE SAND to fine sandy SILT
							-GLACIAL LACUSTRINE-
35	36.0	153.0	WOH 3 3 6	S17	1.2 [60]	35.0 - 37.0	Grey, SILT, slight trace of fine sand, w/ occasional thin dark grey clayey silt layer
							Grey, silty MEDIUM-FINE SAND, some gravel, some coarse sand
40			19 11 9 4	S18	0.2 [10]	40.0 - 42.0	Medium dense, grey, GRAVEL, some coarse-medium sand
			6 6 5 7	S19	0.6 [30]	42.0 - 44.0	Medium dense, grey, gravelly COARSE-MEDIUM SAND, trace coarse sand
45			7 8 6 6	S20	0.5 [25]	45.0 - 47.0	Medium dense, grey, medium-fine sandy GRAVEL, some-little coarse sand, trace of silt
							-GLACIAL OUTWASH-
50			10 8 10 12	S21	0.6 [30]	50.0 - 52.0	Medium dense, grey, coarse-fine sandy GRAVEL, trace to some silt
55			10 9 8 9	S22	0.5 [25]	55.0 - 57.0	Medium dense, grey, gravelly MEDIUM-FINE SAND, some-little coarse sand, little-trace silt Note: 3/4" stone wedged in end of spoon tip
60			15 18 14 24	S23	0.7 [35]	60.0 - 62.0	Dense, grey, coarse-fine sandy GRAVEL, little silt
							Advanced hole to 65'; 3" drill casing becoming very difficult to drive from approximately 64.3'
	64.3	124.7					-APPROXIMATE BEDROCK SURFACE-
65			47	S24	0.4 [80]	65.0 - 65.5	Dark grey, severely-very severely weathered, angular ROCK FRAGMENTS w/ traces of brownish grey silt

TEST BORING REPORT

STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION

PROJECT NAME **NASHUA-MERRIMACK-BEDFORD 13761** BRIDGE NO. N/A
DESCRIPTION Replace B1 - FEET over Pennichuck Brook

BORING NO. **B02**

STA. ______ OFF. ______
BASELINE FEET NB CL
ELEVATION (ft) 189.0

DEPTH (ft)	STRATUM CHANGE (ft) DEPTH	STRATUM CHANGE (ft) ELEVATION	BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) [%]	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS	STRATUM SYMBOL
			25/0					
70				C1	4.8 [100]	66.0 - 70.8	Hard, moderately to slightly weathered, moderately to extremely fractured, dark grey-grey, fine-grained, QUARTZ-MICA SCHIST. Occasionally to frequently interbedded w/ MICACEOUS QUARTZITE. Joints/fractures are shallow to steeply dipping. Foliation is moderate to steep and moderately well-defined for the first 3' of the run. Total, sudden drilling fluid loss from approximately 66.8' and for the remainder of the boring. RQD: 1.6 / 4.8 = 33%	
75				C2	5.0 [100]	70.8 - 75.8	Hard, very slightly weathered, moderately to slightly fractured, dark grey-grey, fine-grained, MICACEOUS QUARTZITE. Isolated schistose zones throughout the run. Joints/fractures are shallow to moderately dipping. RQD: 3.4 / 5.0 = 68%	
							Bottom of Exploration @ 75.8 ft (El. 113.2)	
80								
85								
90								
95								
100								

TEST BORING REPORT

STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION

New Hampshire DOT

BORING NO.	B07
SHEET NO.	1 OF 2
STA.	OFF.
BASELINE	FEET NB CL
ELEVATION (ft)	186.4
START/END	9/6/19 / 9/11/19
DRILLER	J. Woodward (NHDOT)
INSPECTOR	Doug Rogers
CLASSIFIER	DRR
EAST/NORTH (ft)	1029315/111154

PROJECT NAME **NASHUA-MERRIMACK-BEDFORD 13761** BRIDGE NO. N/A

DESCRIPTION Replace B1 - FEET over Pennichuck Brook

GROUNDWATER

DATE	TIME	DEPTH (ft)	ELEV. (ft)	BOTTOM OF CASING	BOTTOM OF HOLE
9/9/19	8:30 am				

EQUIPMENT

	SAMPLER	CASING	CORE
TYPE:	S	NW	NX
SIZE I.D. (in):	1.375	3	1.875
HAMMER WT. (lb):	140	DRILL RIG	
HAMMER FALL (in):	30	CME 45-C Track rig	
HAMMER TYPE:	Automatic		

DEPTH (ft)	STRATUM CHANGE (ft) DEPTH	STRATUM CHANGE (ft) ELEVATION	BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) [%]	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS
0	0.4	186.0	WOH 3 4 8	S1	1.0 [50]	0.0 - 2.0	Dark brown-dark greyish brown, loamy TOPSOIL Loose, yellowish brown, gravelly COARSE-MEDIUM SAND, trace silt
			5 4 3 3	S2	0.8 [40]	2.0 - 4.0	Loose, dark yellowish brown-yellowish brown, COARSE-MEDIUM SAND, trace fine gravel, trace fine sand, slight trace of silt
5			11 11 7 8	S3	0.9 [45]	4.0 - 6.0	Medium dense, greyish brown and yellowish brown, COARSE-MEDIUM SAND, little fine sand, little-trace silt, over dark yellowish brown, MEDIUM-FINE SAND, some gravel to "gravelly", little coarse sand, little silt
			30/0.2				S4, 6' - 6.2', no recovery. Advanced hole w/ 3" roller bit through boulder (6.2-6.9'), cobble (7.0-7.3') to 8.0'
			8 9 7 23	S5	0.4 [20]	8.0 - 10.0	Medium dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt -FILL-
10			13 12 10 6	S6	0.6 [30]	10.0 - 12.0	Medium dense, yellowish brown and greyish brown, coarse-fine sandy GRAVEL, little-trace silt
			12 9 8 3	S7	0.2 [10]	12.0 - 14.0	Medium dense, grey-light grey, GRAVEL, trace coarse-medium sand
15			7 6 4 3	S8	0.5 [25]	14.0 - 16.0	Loose, yellowish brown, gravelly COARSE-FINE SAND, little-trace silt
			4 4 5 4	S9	0.5 [25]	16.0 - 18.0	Loose, greyish brown and yellowish brown, COARSE-FINE SAND, some gravel, trace to little silt
			5 11 6 3	S10	0.6 [30]	18.0 - 20.0	Medium dense, yellowish brown, gravelly COARSE-FINE SAND, little-trace silt Note: washwater color change to dark brown at 19.5' Dark brown-dark greyish brown, FINE SAND, some silt to "silty", trace coarse-medium sand
20	20.3	166.1	6 4 6 7	S11	0.7 [35]	20.0 - 22.0	Loose, greyish brown, MEDIUM-FINE SAND, some coarse sand, some-little silt -ALLUVIUM-
	22.6	163.8	8 6 8 8	S12	1.1 [55]	22.0 - 24.0	Greyish brown, MEDIUM-FINE SAND, little-trace coarse sand, trace silt Brownish grey to grey, FINE SAND, some silt
25			4 4 5 2	S13	1.3 [65]	24.0 - 26.0	Loose, grey, FINE SAND, some silt to "silty" -GLACIAL LACUSTRINE-
			4 3 3 5	S14	1.0 [50]	26.0 - 28.0	Loose, greyish brown, silty FINE SAND and fine sandy SILT, occasional very thin layer of dark grey silt, little clay
			4 5			28.0	Grey, FINE SAND, trace medium sand, occasional pocket of fine sandy silt

Sampler	Identification
S	Standard Split Spoon
SL	Large Spoon (O.D.= 3 in)
T	Thin Wall Tube
U	Undisturbed Piston
O	Open End Rod
A	Auger Flight
C	Core Barrel
NR	Not Recorded

COHESIVE SOILS

Blows/foot (N)	Consistency
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Very Stiff
> 30	Hard

NON-COHESIVE SOILS

Blows/foot (N)	Apparent Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

WOR - Weight of Rod
WOH - Weight of Hammer

Soil Descriptions	Proportion
Capitalized Soil Name	Major Component
Lower Case Adjective	35% - 50%
Some	20% - 35%
Little	10% - 20%
Trace	1% - 10%

ENGLISH

TEST BORING REPORT

STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION

New Hampshire DOT

PROJECT NAME **NASHUA-MERRIMACK-BEDFORD 13761** BRIDGE NO. N/A
DESCRIPTION Replace B1 - FEET over Pennichuck Brook

BORING NO. **B07**
SHEET NO. 2 OF 2
STA. ____ OFF. ____
BASELINE FEET NB CL
ELEVATION (ft) 186.4

DEPTH (ft)	STRATUM CHANGE (ft) DEPTH	STRATUM CHANGE (ft) ELEVATION	BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) [%]	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS
	29.0	157.4	4 4	S15	1.4 [70]	30.0	Dark yellowish brown to yellowish brown, MEDIUM-FINE to FINE SAND
30			4 5 6 5	S16	1.3 [65]	30.0 - 32.0	Medium dense, greyish brown w/ traces of yellowish brown, FINE SAND, trace medium sand, trace silt
			4 5 5 3	S17	1.4 [70]	33.0 - 35.0	Loose, yellowish brown, FINE SAND, little to trace silt
35			4 3 5 13	S18	1.2 [60]	35.0 - 37.0	Loose, yellowish brown, FINE SAND, trace gravel, trace silt
			6 5 10 9	S19	0.7 [35]	38.0 - 40.0	Medium dense, yellowish brown and dark yellowish brown, gravelly MEDIUM-FINE SAND, little coarse sand, trace silt
40			10 6 7 7	S20	0.8 [40]	40.0 - 42.0	Medium dense, dark yellowish brown, COARSE-FINE SAND, some gravel to "gravelly", little-trace silt
							-GLACIAL OUTWASH-
45			14 9 25/0.3	S21	0.7 [54]	45.0 - 46.3	Dark yellowish brown, gravelly COARSE-FINE SAND, little silt
				C1	3.6 [72]	46.5 - 51.5	Advanced hole w/ Nx Wireline through boulder (46.5-49.5'), small cobble and little coarse gravel to 51.5'; sudden drop of drill head noted near 49.5' along with rapid color changes in the washwater; at approximately 51.0' there was a total loss of drilling fluid Drill casing drive shoe replaced w/ spin shoe diamond to further advance the boring
50							
			23 8 12 10	S22	0.3 [15]	51.5 - 53.5	Medium dense, grey-dark grey, GRAVEL, little coarse-medium sand, trace fine sand
55	54.9	131.5					-APPROXIMATE BEDROCK SURFACE-
			20 36 40 40	S23	0.9 [45]	55.0 - 57.0	Dark grey to grey and brownish grey, very severely weathered, angular ROCK FRAGMENTS, little-trace silt (as a result of the weathering process)
							Advanced to 58.0' w/ roller bit; cutting slow and steady
60				C2	4.7 [96]	58.0 - 62.9	Hard, very slightly to moderately weathered, sound to moderately fractured, dark grey-grey, fine-grained, MICACEOUS QUARTZITE. Occasionally to frequently interbedded w/ QUARTZ-MICA SCHIST. Zone of severe weathering and extreme fracturing from approximately 61.8' to end of run. Joints/fractures are shallow to moderately dipping. Most are discolored, few are silt-coated. RQD: 2.7 / 4.9 = 55%
							Bottom of Exploration @ 62.9 ft (El. 123.5)
65							

https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=31847.wba

Table 3–1 Particle gradation scales for earth materials

inches	U.S. Standard Sieve No.	mm	Unified Soil Classification System [1]	AASHTO [2]	AGU [3]	USDA [4]	Udden-Wentworth [5]
		4026					
		2048	boulders		boulders		
		1024				boulders	boulders
		512		boulders			
12		300					
10		256	cobbles		cobbles		
6		128				cobbles	cobbles
3		75					
		64					
		32	coarse gravel	coarse gravel			
1		25.4			coarse gravel		
0.75		19					
		16					pebble gravel
0.5		12.7	fine gravel	fine gravel	medium gravel	gravel	
0.375		9.5					
		8					
0.25		6.35			fine gravel		
	4	4.76					
		4	coarse sand				granule
	10	2		coarse sand			
		1			coarse sand	coarse sand	coarse sand
		0.5	medium sand				
	40	0.425			medium sand	medium sand	medium sand
		0.25	fine sand	fine sand			
		0.125			fine sand	fine sand	fine sand
	200	0.074			very fine sand	very fine sand	very fine sand
		0.0625					
		0.05					
		0.031		silt			
		0.0156			silt		silt
		0.0078	silt or clay			silt	
		0.005					
		0.0039		clay			
		0.001			clay	clay	clay
				colloids			

1/ Unified Soil Classification System, ASTM D2487
2/ AASHTO, American Association of State Highway and Transportation Officers (AASHTO 1998)
3/ AGU, American Geophysical Union (Lane 1947)
4/ USDA textural classification system (USDA 1951)
5/ Udden-Wentworth classification system (Udden 1914; Wentworth 1922)

Scour Computations Worksheet

INPUTS AND ASSUMPTIONS	Project:	FE Everett Turnpike	Project #	52775.00
	Location:	Merrimack and Nashua, NH	Sheet	Inputs and Assumptions
	Calculated by:	AHF	Date:	1/17/2023
	Checked by:	DWC	Date:	2/17/2023
	Title:	Appendix C: Scour Calculations Pennichuck Brook Bridge State Project #13761A		

Notes:

Light-yellow cells in italics are required inputs
Clear cells are automatically calculated

Basis of Design: Calculations based on methodology outlined in HEC-18 5th Edition (FHWA-HIF-12-003, 2012)

NHDOT Bridge Design Manual v2.0, Chapter 2

Scour Design Discharge = Q100, Check Discharge = Q500 per NHDOT Bridge Design Manual Section 2.7.6

Data Sources:

Proposed bridge dimensions:
\\vhb\gbl\proj\Bedford\52775.00 FEE Everett Turnpike\tech\Bridge\HH\Proposed_13761A - NMB - Bridge 106-042 & 107-042 FEET over Pennichuck Brook - Preliminary Plans.pdf

Topographic data: Bathymetric survey collected by VHB in Dec 2021, supplemented by 2019 NH USGS LiDAR digital terrain model, and 2004 Pennichuck Waterworks site plans of the Bowers Pond Dam

Design Discharge hydrology: FEMA Flows
\\vhb\gbl\proj\Bedford\52775.00 FEE Everett Turnpike\tech\Bridge\HH\52775.00 - FEET HH Tracking.xlsx

HEC-RAS hydraulic model file: \\vhb\gis\proj\Bedford\52775.00 FEE Everett Turnpike\Techdoc\HECRAS\

HEC-RAS hydraulic model EX plan "EX_FEMA_OpenAir_Rev1": \\vhb\gis\proj\Bedford\52775.00 FEE Everett Turnpike\Techdoc\HECRAS\5277500_FEET_VHB.p06

HEC-RAS hydraulic model PR plan "PR_FEMA_OpenAir": \\vhb\gis\proj\Bedford\52775.00 FEE Everett Turnpike\Techdoc\HECRAS\5277500_FEET_VHB.p05

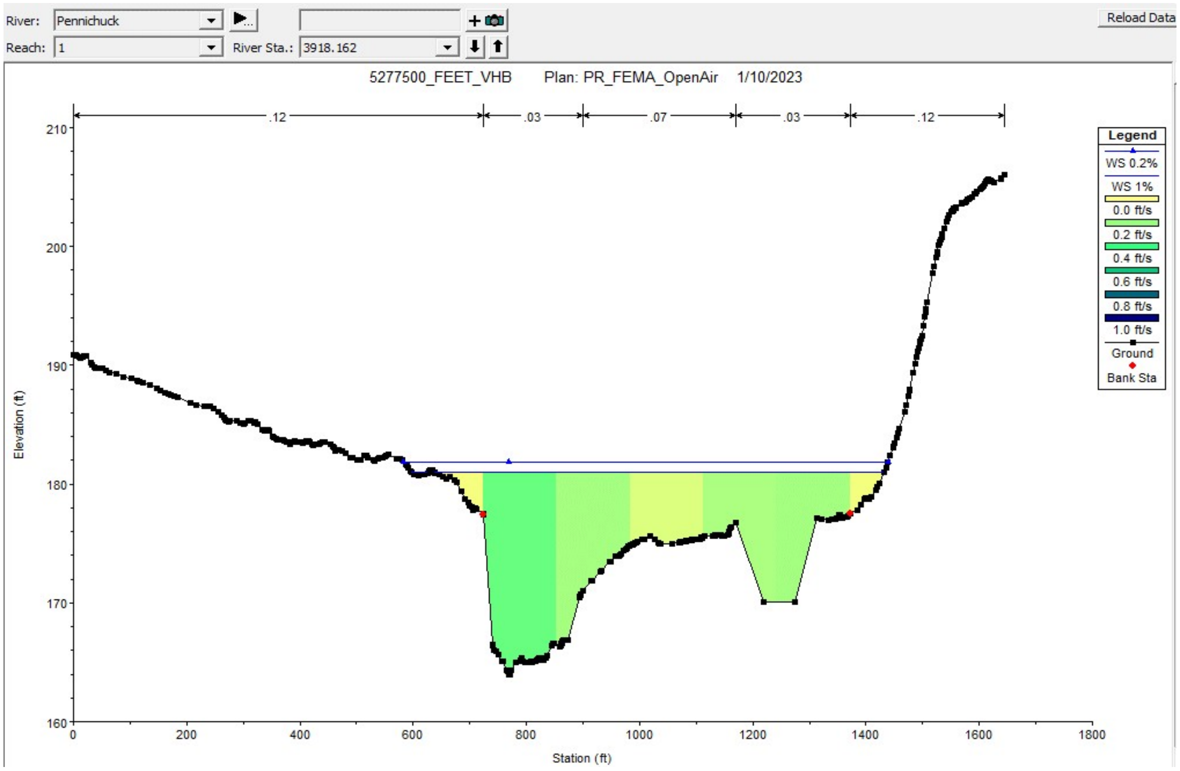
Steady-State Model - HEC-RAS variables for Q100 and Q500 flood profiles

Average Bed Particle Sizes from: \\vhb\gbl\proj\Bedford\52775.00 FEE Everett Turnpike\tech\Bridge\HH\Borings - 011620 feet bridge 1 over bowers pond.pdf

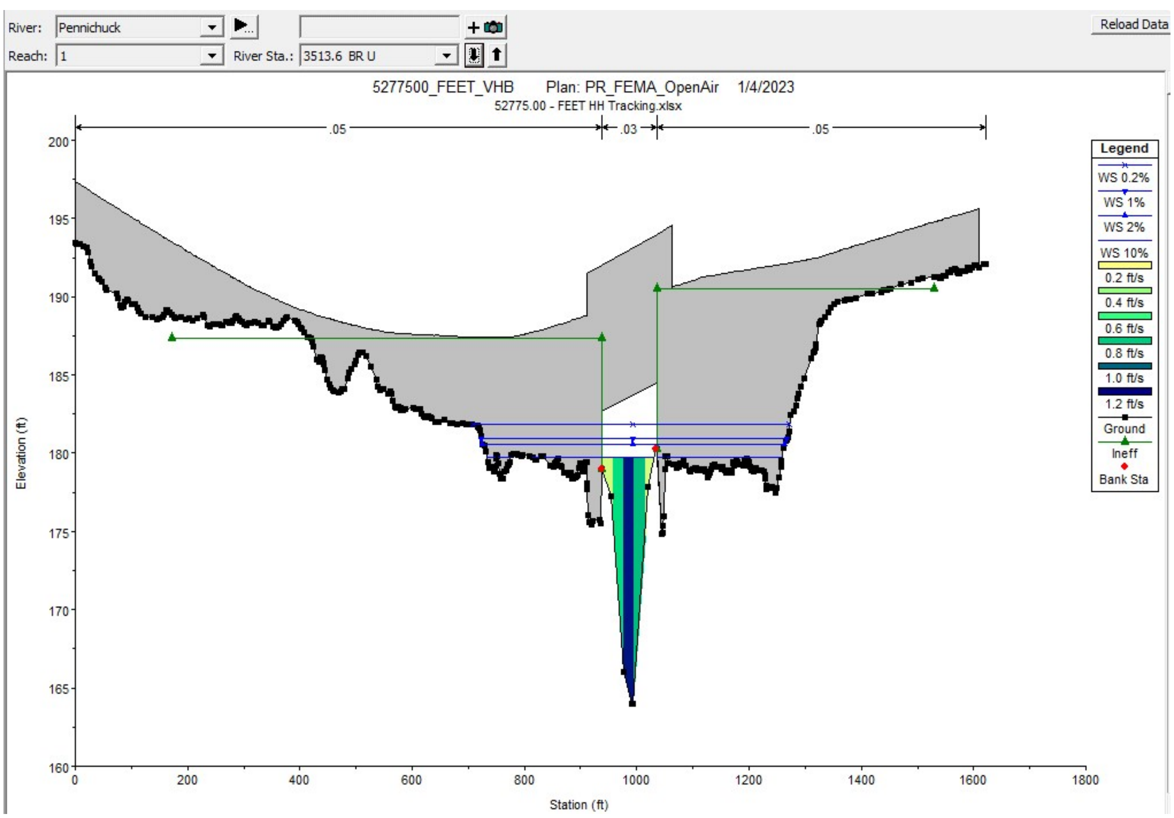
1. HEC-RAS Model Plan View:

2. HEC-RAS Model Cross-Sections:

Approach Section 3918



Contracted/Bridge Section 5332 Up



Scour Computations Worksheet

RESULTS SUMMARY				
	Project:	FE Everett Turnpike	Project #	52775.00
	Location:	Merrimack and Nashua, NH	Sheet	Results Summary
	Calculated by:	AHF	Date:	1/17/2023
	Checked by:	DWC	Date:	2/17/2023
	Title:	Appendix C: Scour Calculations Pennichuck Brook Bridge State Project #13761A		

1. Summary of Scour Calculations

100-Year	500-Year	Scour Conditions
Clear-Water	Clear-Water	Contraction Scour: Live Bed or Clear Water
Free Flow	Free Flow	Contraction Scour: Pressure Flow or Free Flow
Yes	Yes	Abutment Scour: Left Abutment Impacted by Flow?
Yes	Yes	Abutment Scour: Right Abutment Impacted by Flow?

Left Abutment:

Storm Event	$y_{s\text{-}cont}$ (ft)	$y_{s\text{-}total}$ (ft)	El_{scour} (ft)	El_{bed} (ft)	El_{ftg} (ft)
100-Year	2.07	**10.54**	**168.46**	179.00	176.00
500-Year	4.91	**14.12**	**164.88**	179.00	176.00

Right Abutment:

Storm Event	$y_{s\text{-}cont}$ (ft)	$y_{s\text{-}total}$ (ft)	El_{scour} (ft)	El_{bed} (ft)	El_{ftg} (ft)
100-Year	2.07	**11.79**	**168.46**	180.25	177.25
500-Year	4.91	**15.37**	**164.88**	180.25	177.25

Notes:

1. $y_{s\text{-}cont}$ = General scour depth due to contraction scour

2. $y_{s\text{-}total}$ = Total scour depth combining local and general scour (NCHRP 24-20)

4. El_{scour} = Elevation of streambed from calculated scour at the face of abutment

5. El_{bed} = Average elevation of bed across bridge prior to scour (ft)

6. El_{ftg} = Bottom elevation of substructure footing or pile cap

Scour Computations Worksheet

CONTRACTION SCOUR				
	Project:	FE Everett Turnpike	Project #	52775.00
	Location:	Merrimack and Nashua, NH	Sheet	Contraction Scour
	Calculated by:	AHF	Date:	1/17/2023
	Checked by:	DWC	Date:	2/17/2023
	Title:	Appendix C: Scour Calculations Pennichuck Brook Bridge State Project #13761A		

Notes: All hydraulic inputs are taken from the Existing HEC-RAS model.
Only input values in Section 1; all other cells are automatically populated from inputs.
Light-yellow cells in italics are required inputs
Clear cells are automatically calculated
Light-green cells in italics are required inputs (from inputs page)
Light-blue cells are intermediate calculated values
Light-orange cells in bold are scour calculation results

1. Provide HEC-RAS Model Result Inputs:

Variable	Value	Notes
K_u (Eqn. 6.1) =	11.17	Bed material transport critical velocity constant
D_{50} =	0.0002	Average particle size in channel bed approach section (ft)
K_u (Eqn. 6.4) =	0.0077	Clear water contraction scour constant
$D_{50\ bridge}$ =	0.0002	Average particle size in channel bed contracted section (ft)
K_u (Eqn. 6.12) =	0.57	Open Bottom Culvert Scour Coefficient (no wingwalls)
D_m =	0.0003	Diameter of smallest nontransportable partical in contracted section, 1.25* $D_{50\ (ft)}$
g =	32.2	Acceleration due to gravity (ft/sec^2)
W_{br} =	97	Width of bridge opening (ft)
El_{lc} =	182.7	Average elevation of bridge low chord at upstream fascia (ft)
El_{hc} =	197	Average elevation of bridge high chord at upstream fascia (ft)
El_{bed} =	172.5	Average elevation of channel bed at upstream fascia
T =	14.3	Bridge superstructure thickness (ft)
h_b =	10.2	Vertical size of bridge opening prior to scour, El_{lc}-El_{bed} (ft)

Approach Section Location: HEC-RAS Model Station 3918

Storm Event	Q_1 (cfs)	V_1 (ft/s)	y_1 (ft)	W_1 (ft)	S_1 (ft/ft)	WSE_1 (ft)
100-Year	1150	0.20	8.82	648.90	0.000001	180.98
500-Year	1640	0.26	9.72	648.90	0.000002	181.88

Contracted/Bridge Section: HEC-RAS Model Station 3513 BR U

Storm Event	Q_2 (cfs)	V_2 (ft/s)	y_0 (ft)	W_2 (ft)	WSE_2 (ft)
100-Year	1150	1.41	8.40	97.00	180.94
500-Year	1640	1.82	9.28	97.00	181.81

Notes:
1. Q_1 is flow in the channel at approach section (HEC-RAS Variable "Q Channel")
2. V_1 is average channel velocity at approach section (HEC-RAS Variable "Vel Chnl")
3. y_1 is channel hydraulic depth at approach section (HEC-RAS Variable "Hydr Depth C")
4. W_1 is width of channel at approach section (HEC-RAS Variable "Top W Chnl")

5. S_1 is the energy grade line slope at approach section (HEC-RAS Variable "E.G. Slope")

6. WSE_1 is the water surface elevation in the approach section (HEC-RAS Variable "W.S. Elev")

7. Q_2 is flow through the bridge opening (HEC-RAS Variable "Q Bridge" from bridge output table)

8. V_2 is average channel velocity through the contracted section (HEC-RAS Variable "Vel Chnl")

9. y_0 is average hydraulic depth through the bridge opening (HEC-RAS Variable "Hydr Depth" from bridge output table)

10. W_2 is the width of channel through the bridge opening (HEC-RAS Variable "Top W Chnl")

2. Determine Live-Bed or Clear-Water Scour

A. Calculate Critical Velocity (V_c)

$$V_c = K_u\, y^{1/6}\, D^{1/3} \qquad (6.1)$$

K_u =	11.17	*critical velocity constant (from inputs page)*
D =	0.0007	*Particle size for V_c, assume = D_{50} of channel streambed at approach section.*

Storm Event	y (ft)	V_c (ft/s)
100-Year	8.82	1.40
500-Year	9.72	1.42

Notes:

1. $y = y_1$, average channel depth at approach section (from HEC-RAS inputs)

2. V_c = critical transport velocity for bed material

B. Compare V_c to Average Velocity in Main Channel

Storm Event	V_1 (ft/s)	V_c (ft/s)	Live Bed or Clear Water
100-Year	0.20	1.40	Clear-Water
500-Year	0.26	1.42	Clear-Water

Notes:

1. V_1 = average channel velocity at approach section (from inputs page)

2. If V_c > V; Clear-Water condition exists; else Live Bed Condition

2: Calculate Contraction Scour (Case 2: Clear-Water Scour)

$$y_2 = \left[\frac{K_u Q^2}{D_m^{2/3}\, W^2}\right]^{3/7} \qquad (6.4)$$

$$y_s = y_2 - y_o = \text{(average contraction scour depth)} \qquad (6.5)$$

K_u =	0.0077	Clear water contraction scour constant (from inputs page)
D_m =	0.0003	Smallest nonstransportable particle in bed material (1.25 * D_{50})

Storm Event	Q_2 (ft^3/s)	W_2 (ft)	y_2 (ft)
100-Year	1150.00	97.00	10.47
500-Year	1640.00	97.00	14.19

Notes:

1. Q_2 is flow through the bridge opening (from HEC-RAS inputs)

2. W_2 is the width of channel through the bridge opening (from HEC-RAS inputs)

Scour Computations Worksheet

ABUTMENT SCOUR				
Project:	FE Everett Turnpike	Project #	52775.00
Location:	Merrimack and Nashua, NH	Sheet	Abutment Scour
Calculated by:	AHF	Date:	1/17/2023
Checked by:	DWC	Date:	2/17/2023
Title:	Appendix C: Scour Calculations Pennichuck Brook Bridge State Project #13761A		

Notes: All hydraulic inputs are taken from the Existing HEC-RAS model.
Only input values in Section 1; all other cells are automatically populated from inputs.
Light-yellow cells in italics are required inputs
Clear cells are automatically calculated
Light-green cells in italics are required inputs (from inputs page)
Light-blue cells are intermediate calculated values
Light-orange cells in bold are scour calculation results

1. Provide HEC-RAS Model Result Inputs:

W_{br} =	97	Width of the bridge opening (ft)
K_1 =	0.55	Abutment shape coefficient (Table 8.1)
$\Theta_{lt\ abut}$ =	90	Abutment skew angle (degrees)
$\Theta_{rt\ abut}$ =	90	Abutment skew angle (degrees)
$K_{2\text{-}lt\ abut}$ =	1.00	Abutment skew coefficient for left abutment, $(\Theta_{lt\ abut}/90)^{0.13}$
$K_{2\text{-}rt\ abut}$ =	1.00	Abutment skew coefficient for right abutment, $(\Theta_{rt\ abut}/90)^{0.13}$
El_{bed_lt} =	*179.00*	Minimum bed elevation at face of Left abutment (ft)
El_{bed_rt} =	*180.25*	Minimum bed elevation at face of Right abutment (ft)
El_{ftg_lt} =	*176.00*	Bottom of Left abutment footing elevation (ft)
El_{ftg_rt} =	*177.25*	Bottom of Right abutment footing elevation (ft)
$Sta_{cl\text{-}appr}$ =	1047.85	Station of channel centerline, approach section (HEC-RAS Variable "Center Station") (ft)
$Sta_{cl\text{-}contr}$ =	987.2	Station of channel centerline, contracted section (HEC-RAS Variable "Center Station") (ft)
$Sta_{lt\text{-}abut}$ =	938.70	Station of left abutment in contracted section (ft)
$Sta_{rt\text{-}abut}$ =	1035.70	Station of right abutment in contracted section (ft)
$Sta_{lt\text{-}bank}$ =	940.70	Station of left bank of channel, contracted section (HEC-RAS Variable "Ch Sta L")
$Sta_{rt\text{-}bank}$ =	1033.70	Station of right bank of channel, contracted section (HEC-RAS Variable "Ch Sta R")
$Sta_{lt\text{-}abut\text{-}proj}$ =	999.35	Station of left abutment projected to approach section (ft)
$Sta_{rt\text{-}abut\text{-}proj}$ =	1096.35	Station of right abutment projected to approach section (ft)

Left Abutment Approach Section Flow Distribution — 3918

Storm Event	$Sta_{lt\text{-}ws}$ (ft)	Impact?	L (ft)	Q_e (cfs)	A_e (sf)	L' (ft)	Q_{lob} (cfs)	$W_{ob\text{-}lt}$ (ft)	Q_{total} (cfs)
100-Year	597.02	YES	294.25	801.65	3424.53	0.00	0	115.1	1150
500-Year	582.65	YES	279.88	1109.92	3791.33	0.00	0	140.75	1640

Right Abutment Approach Section Flow Distribution — 3918

Storm Event	$Sta_{rt\text{-}ws}$ (ft)	Impact?	L (ft)	Q_e (cfs)	A_e (sf)	L' (ft)	Q_{rob} (cfs)	$W_{ob\text{-}rt}$ (ft)
100-Year	1431.90	YES	189.38	153.60	986.23	0.00	0	59.6
500-Year	1439.01	YES	326.27	458.70	2197.03	76.07	0	66.71

Contracted Section Flow Distribution

					3513 BR U		
Storm Event	**A_{lob} (sf)**	**A_{chnl} (sf)**	**A_{rob} (sf)**	**y_{lob} (ft)**	**y_{chnl} (ft)**	**y_{rob} (ft)**	**WSE_0 (ft)**
100-Year	3.88	809.9	1.38	1.94	8.40	0.69	180.94
500-Year	5.62	891.0	3.12	2.81	9.28	1.56	181.81

Notes:

1. Sta $_{lt\text{-}ws}$ and Sta $_{rt\text{-}ws}$ are the left and right limits of flow (HEC-RAS Variables "Sta W.S. Lft" and "Sta W.S. Rgt") (ft)

2. L is the length of flow blocked by the projected abutment, Sta $_{ws}$ - Sta $_{abut}$ (ft)

3. Q $_{e}$ is the volume of flow obstructed by each abutment, between Sta $_{ws}$ and Sta $_{abut}$ (cfs)

4. A $_{e}$ is the area of flow obstructed by each abutment, between Sta $_{ws}$ and Sta $_{abut}$ (sf)

5. L' is the length of active flow blocked, corresponding to the area closest to the channel conveying 2/3 of total obstructed flow, calculated from the HEC-RAS flow distribution tables for the approach section below

6. Q $_{lob}$ and Q $_{rob}$ area the volume of flow in the left and right overbanks, respectively, through the contracted section (HEC-RAS Variables "Q Left" and Q Right")

7. A $_{lob}$, A $_{chnl}$, and A $_{rob}$ are the areas of flow in the left overbank, channel, and right overbank, respectively, through the contracted section (HEC-RAS Variables "Area Left", "Area Channel", and "Area Right")

8. y $_{0\text{-}lob}$,y $_{0\text{-}chnl}$, and y $_{0\text{-}rob}$ are the depth of flow in the left overbank, channel, and right overbank, respectively, through the contracted section (HEC-RAS Variables "Hydr Depth L", "Hydr Depth C", and "Hydr Depth R")

9. Q $_{total}$ = total flow in the approach section, including overbanks (HEC-RAS Variable "Q")

10. W $_{ob\text{-}lt}$ and W $_{ob\text{-}rt}$ = width of left and right overbank flows, respectively, in the approach section (HEC-RAS Variables "Top W left " and "Top W Right)

2. Calculate Abutment Scour - NCHRP 24-20 Approach

Check for Pressure Flow (From Contraction Scour Calculations):

Storm Event	WSE (ft)	Ellc (ft)	Pressure Flow or Free Flow
100-Year	180.98	182.7	Free Flow
500-Year	181.88	197	Free Flow

Note: NCHRP 24-20 Approach is not valid for pressure flow scenarios.

A. Determine scour condition for each abutment:

Case (a): Abutment embankment obstructs > 75% of floodplain
Case (b): Abutment embankment obstructs < 75% of floodplain
Case (c): Embankment breaches - evaluate as pier scour

Figure to use to determine value of α:

Case (a), spill-through abutments:	8.9
Case (a), wingwall abutments	8.10
Case (b), spill-through abutments:	8.11
Case (b), wingwall abutments:	8.12
Abutment is located in channel:	8.10

Left Abutment:

Storm Event	L (ft)	W_{ob-lt} (ft)	L/W (%)	Abut.in channel?	Figure to use:
100-Year	294.25	115.10	256%	YES	**8.11**
500-Year	279.88	140.75	199%	YES	**8.11**

Right Abutment:

Storm Event	L (ft)	W_{ob-rt} (ft)	L/W (%)	Abut.in channel?	Figure to use:
100-Year	189.38	59.60	318%	YES	**8.11**
500-Year	326.27	66.71	489%	YES	**8.11**

Notes:
1. L is the length of flow in the approach section obstructed by the projected abutment
2. W_{ob-lt} and W_{ob-rt} = width of left and right overbank flows, respectively, in the approach section

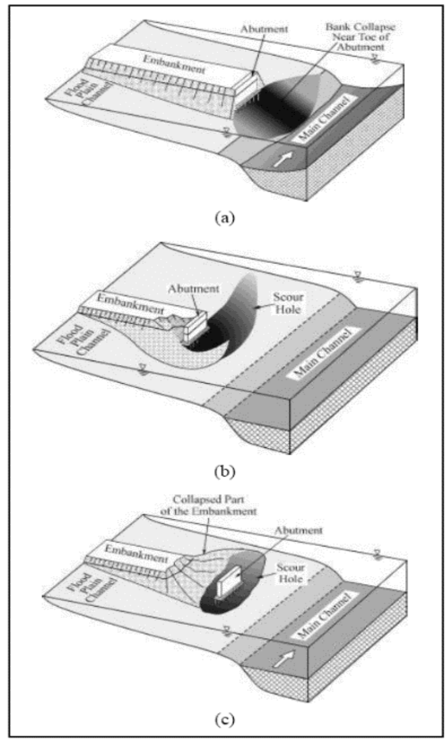


Figure 8.7. Abutment scour conditions (NCHRP 2010b).

B. Determine Set-back ratio (SBR) for each abutment/embankment:

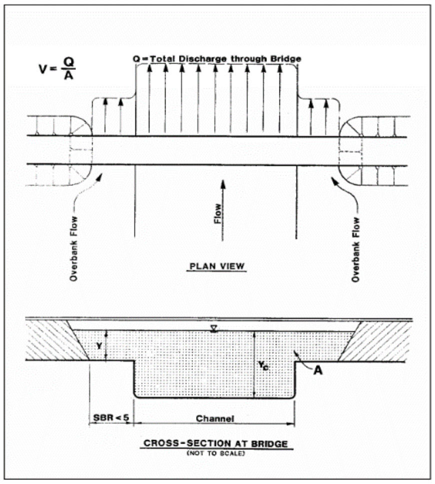


Figure 8.14. Velocity for SBR<5.

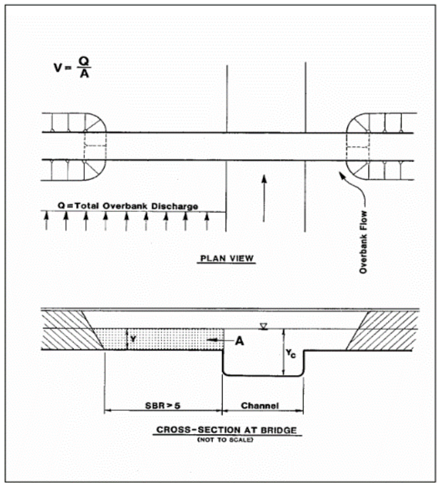


Figure 8.15. Velocity for SBR>5.

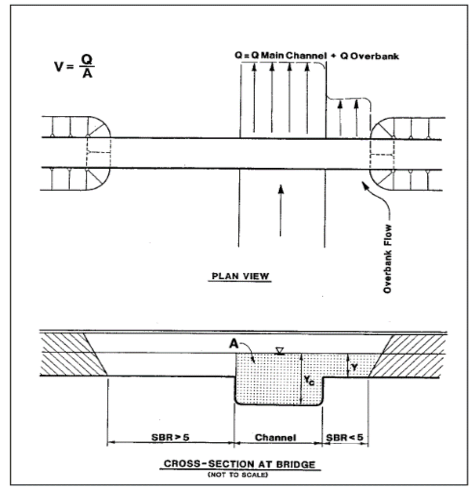


Figure 8.16. Velocity for SBR>5 and SBR<5.

SBR = Set-back length/average channel flow depth

Storm Event	$Sta_{lt\text{-}abut}$ =	$Sta_{lt\text{-}bank}$ =	$Sta_{rt\text{-}bank}$ =	$Sta_{rt\text{-}abut}$ =	y_1 (ft)	SBR_{lt}	SBR_{rt}	Figure
100-Year	938.70	940.7	1033.7	1035.7	8.82	0.23	0.23	8.14
500-Year	938.70	940.7	1033.7	1035.7	9.72	0.21	0.21	8.14

Notes:

1. $Sta_{lt\text{-}abut}$ and $Sta_{rt\text{-}abut}$ are the station of left and right abutments, respectively, in the contracted section (ft)

2. $Sta_{lt\text{-}bank}$ and $Sta_{rt\text{-}bank}$ are the station of left and right banks, respectively, in the contracted section (ft)

3. y_1 = the average depth of flow in the approach section channel (from contraction scour inputs) (ft)

4. SBR_{lt} and SBR_{rt} are the calculated right and left setback ratios, respectively, from Figures 8.14-8.16

B. Determine unit discharge values q_1 and q_{2c}

Abutment in Channel?

Left Abut. =	YES	Abutment in channel if $Sta_{lt\text{-}abut} > Sta_{lt\text{-}bank}$
Right Abut. =	YES	Abutment in channel if $Sta_{rt\text{-}abut} < Sta_{rt\text{-}bank}$

Approach Section unit discharge:

Storm Event	Q_1 (cfs)	W_1 (ft)	q_1 (ft^2/s)
100-Year	1150	834.88	1.38
500-Year	1640	856.36	1.92

Contracted Section unit discharge:

Left Abutment:

Storm Event	Q_2 (cfs)	A_2 (sf)	V (fps)	y_{chan} (ft)	y_{lob} (ft)	q_{2c} (ft^2/s)
100-Year	1150.00	815.12	1.41	8.4	1.94	11.85
500-Year	1640.00	899.78	1.82	9.28	2.81	16.91

Right Abutment:

Storm Event	Q_2 (cfs)	A_2 (sf)	V (fps)	y_{chan} (ft)	y_{rob} (ft)	q_{2c} (ft^2/s)
100-Year	1150.00	815.12	1.41	8.4	0.69	11.85
500-Year	1640.00	899.78	1.82	9.28	1.56	16.91

Notes:

1. $Q_1 = Q_{total}$, total flow in the approach section including abutments and overbanks

2. $W_1 = W_{total}$, total width of flow in the approach section ($Sta_{rt\text{-}ws}$ - $Sta_{lt\text{-}ws}$)

3. q_1 = upstream unit discharge, Q_1/W_1

4. Q_2 = contracted section total flow, overbank flow, or overbank+channel flow, dependent on SBR (HEC-18 Page 8.16)

5. A_2 = contracted section total area, overbank flow, or overbank+channel area, dependent on SBR (HEC-18 Page 8.16)

6. V = Q/A, average velocity through contracted section (HEC-RAS Figures 8.14-8.16)

7. y_{lob}, y_{chan}, and y_{-rob} are depth of flow in the contracted left overbank, channel, and right overbank, respectively

*8. q_{2c} = estimated contracted section unit discharge, V*y, dependent on SBR (HEC-18 Page 8.16)*

C. Determine flow depth including contraction scour, y_c

Storm Event	L/W (Left)	L/W (Right)
100-Year	256%	318%
500-Year	199%	489%

Scour Condition (a), L/W > 75% (Live-Bed):

$$y_c = y_1 \left(\frac{q_{2c}}{q_1} \right)^{6/7} \quad (8.5)$$

<u>**Scour Condition (b), L/W < 75% (Clear-Water):**</u>

Forcing the use of Equation 8.6 due to the effects of the downstream dam and the lake-like condition which maintains a Clear-Water condition

$$y_c = \left(\frac{q_{2f}}{K_u D_{50}^{1/3}} \right)^{6/7} \quad (8.6)$$

K_u =	11.17	Bed material transport critical velocity constant (from contraction scour calculations)
D_{50} =	0.0002	Average particle size in channel bed contracted section from contraction scour inputs (ft)

Storm Event	y_1 (ft)	q_1 (cfs)	q_2 (cfs)	$y_{c\text{-}lt}$ (ft)	$y_{c\text{-}rt}$ (ft)
100-Year	8.82	1.38	11.85	11.35	11.35
500-Year	9.72	1.92	16.91	15.39	15.39

Notes:

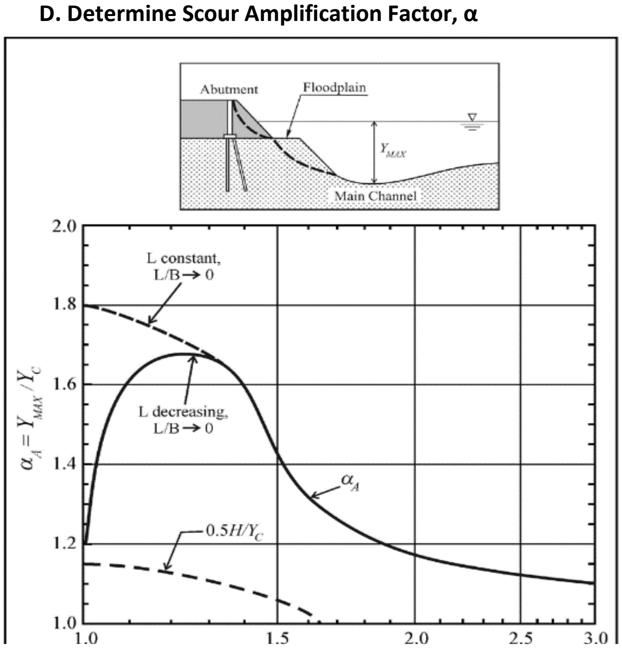
1. y_1 = the average depth of flow in the approach section channel (from contraction scour inputs)

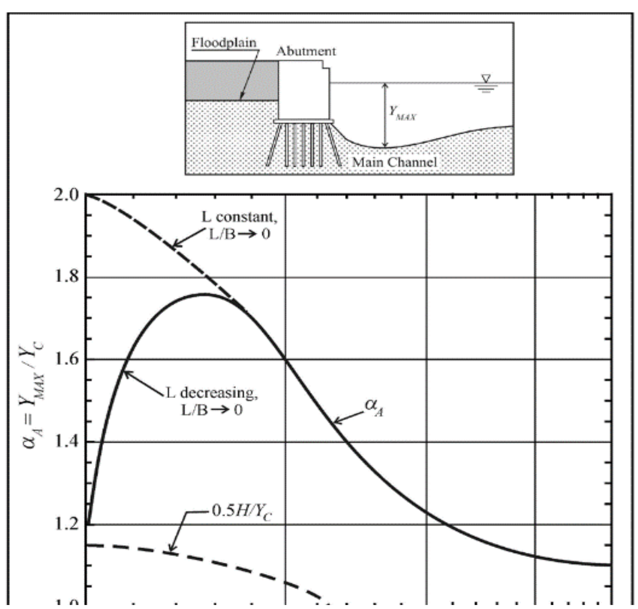
2. q_1 = upstream unit discharge, Q/W

3. q_2 = q_{2c} or q_{2f}, unit discharge in the constricted opening calculated above

4. $y_{c\text{-}lt}$ and $y_{c\text{-}rt}$ = flow depth including contraction scour for left and right abutments, respectively (equation 8.5 for L/W > 75%, equation 8.6 for L/W <75%)

D. Determine Scour Amplification Factor, α





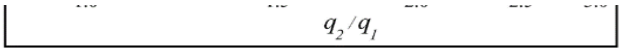


Figure 8.9. Scour amplification factor for spill-through abutments and live-bed conditions (NCHRP 2010b).

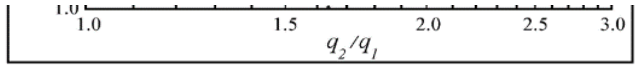


Figure 8.10. Scour amplification factor for wingwall abutments and live-bed conditions

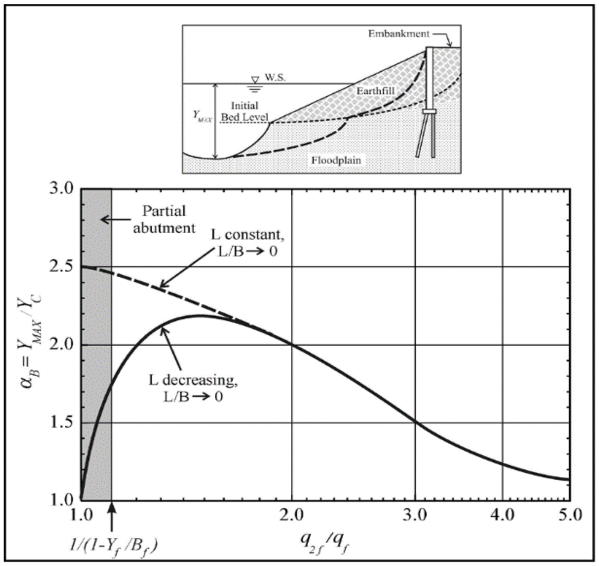


Figure 8.11. Scour amplification factor for spill-through abutments and clear-water conditions (NCHRP 2010b).

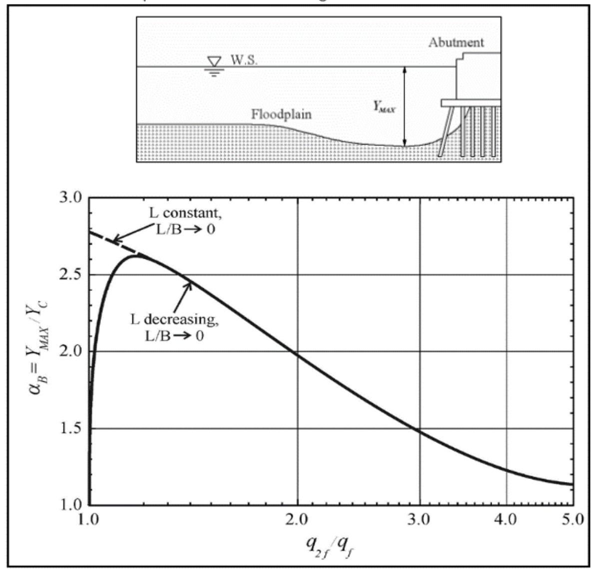


Figure 8.12. Scour amplification factor for wingwall abutments and clear-water conditions (NCHRP 2010b).

Left Abutment:

Storm Event	Use Figure	q_1 (cfs)	q_2 (cfs)	q_2/q_1	α
100-Year	8.1	1.38	11.85	8.60	1.10
500-Year	8.11	1.92	16.91	8.83	1.10

Right Abutment:

Storm Event	Use Figure	q_1 (cfs)	q_2 (cfs)	q_2/q_1	α
100-Year	8.11	1.38	11.85	8.60	1.10
500-Year	8.11	1.92	16.91	8.83	1.10

Notes:

1. Figure to use determined above for appropriate scour condition

2. q_1 = upstream unit discharge, Q/W

3. $q_2 = q_{2c}$ or q_{2f}, unit discharge in the constricted opening calculated above

4. α = scour amplification factor from Figures 8.9-8.12

D. Calculate maximum combined contraction and abutment scour, y_{max} hec

$$y_{max} = \alpha_A \, y_c \text{ or } y_{max} = \alpha_B \, y_c \tag{8.3}$$

Left Abutment:

Storm Event	y_c (ft)	α	y_{max} (ft)	El_{bed_Lt}	y_0 (ft)	y_s (ft)	El_{scour} (ft)
100-Year	11.35	1.10	**12.48**	179.00	1.94	**10.54**	**168.46**
500-Year	15.39	1.10	**16.93**	179.00	2.81	**14.12**	**164.88**

Right Abutment:

Storm Event	y_c (ft)	α	y_{max} (ft)	El_{bed_rt}	y_0 (ft)	y_s (ft)	El_{scour} (ft)
100-Year	11.35	1.10	**12.48**	180.25	0.69	**11.79**	**168.46**
500-Year	15.39	1.10	**16.93**	180.25	1.56	**15.37**	**164.88**

Notes:

1. y_c = flow depth including contraction scour

2. α = scour amplification factor from Figures 8.9-8.12

3. y_{max} = flow depth including contraction scour and scour amplification factor from local abutment scour

4. y_0 = flow depth at the face of the abutment prior to scour

5. y_s = calculated total contraction plus abutment scour depth (ft)

Riprap Sizing Worksheet

RESULTS	Project:	FE Everett Turnpike	Project #	52775.00
	Location:	Merrimack and Nashua, NH	Sheet	HEC 23 Rip Rap Calculation
	Calculated by:	AHF	Date:	1/17/2023
	Checked by:	DWC	Date:	2/17/2023
	Title:	Riprap Sizing at Abutments		

Notes:

1) Calculations based on methodology outlined in HEC-23 3rd Edition (FHWA-NHI-09-112, 2009), Design Guide 14
2) Scour Countermeasure Design Check Storm = 0.2%

A) Determine Set-Back Ratio (SBR)

Setback Length	2	ft
Avg. Chan. Flow Depth	9.28	ft
SBR	0.215517241	

SBR < 5: V based on entire contracted area through bridge

The set-back length is the distance from the near edge of the main channel to the toe of abutment.

B) Determine Riprap Size At Abutments (Eq. 14.1 or 14.2)

For Fr <=0.80:

$$D_{50} = y \frac{K}{(S_s - 1)} \left[\frac{V^2}{gy}\right] \qquad \text{(Eq 14.1)}$$

Q	1640	Flow Through Bridge Opening (cfs)
A	899.83	Contracted Area thru Bridge (sf)
V	1.82	Characteristic Average Velocity in Contracted Section (ft/s)
S_g	2.65	Specific Gravity of Rip Rap
g	32.2	Gravitational Acceleration
y	9.28	Average Flow Depth in Contracted Section
K	1.02	Vertical Wall Abutment
Fr	0.11	Froude Number
D_{50}	0.06	median stone diameter, ft
D_{50}	0.77	median stone diameter, inches
Recommended D_{50}	**6**	median stone diameter, inches
NHDOT Riprap Class	**I**	

C) Determine Recommended Riprap Extents

Flow Depth	9.28	ft	
Scour Design WSE	181.88	ft	
Extent from Toe	19	ft	*DG14.3 4.a*
Extent Downstream	19	ft	*DG14.3 4.a*
Extent Up-Slope	2	ft	*DG14.3 4.b*
Up-Slope Elev	183.9	ft	
Recommended D_{50}	0.5	ft	
Riprap Thickness	1.0	ft	*DG14.3 4.c*

NHB DataCheck Results Letter

Memo

NH Natural Heritage Bureau
NHB DataCheck Results Letter

Please note: portions of this document are confidential.
Maps and NHB record pages are confidential and should be redacted from public documents.

To: Stephen Hoffmann
53 Regional Drive
Concord, NH 03301

From: NHB Review, NH Natural Heritage Bureau
Date: 2/24/2023 (valid until 02/24/2024)
Re: Review by NH Natural Heritage Bureau
Permits: NHDES - Shoreland Standard Permit, NHDES - Wetland Standard Dredge & Fill - Major, USACE - General Permit, USEPA - Stormwater Pollution Prevention

NHB ID: **NHB23-0523** Town: Nashua Location: F.E. Everett Turnpike

Description: The NHDOT 13761A project includes the southernmost segment of the overall 13761 F.E. Everett Widening Project. The 13761A project begins in Nashua, just north of Exit 8 and the Tinker Road overpass, and continues north for approximately two miles, just south of Exit 10. Previous NHB reviews that included the southern segment included, NHB21-1748, NHB18-0238, and NHB16-2791. The proposed project involves widening the F.E. Everett Turnpike from two lanes to three lanes in both the northbound and southbound directions and associated roadway improvements including, replacement of the existing bridges carrying the Turnpike over Pennichuck Brook/Bowers Pond, drainage improvements, and construction of stormwater treatment BMPs.

cc: NHFG Review

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments **NHB: Please provide NHB with representative photos during the growing season of any proposed impact areas and proposed plans.**
F&G: Please refer to NHFG consultation requirements below.

Plant species	State[1]	Federal	Notes
bird-foot violet (*Viola pedata var. pedata*)	T	--	
clasping milkweed (*Asclepias amplexicaulis*)*	T	--	This species grows in sandplains and disturbed openings, and is sensitive to disturbances that eliminate its habitat.
long-spined sandbur (*Cenchrus longispinus*)*	E	--	This species grows in sandplains and disturbed openings, and is sensitive to disturbances that eliminate its habitat.

Memo

NH Natural Heritage Bureau
NHB DataCheck Results Letter

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Vertebrate species	State[1]	Federal	Notes
Blanding's Turtle (*Emydoidea blandingii*)	E	--	Contact the NH Fish & Game Dept (see below).
Eastern Hognose Snake (*Heterodon platirhinos*)	E	--	Contact the NH Fish & Game Dept (see below).
Northern Black Racer (*Coluber constrictor constrictor*)	T	--	Contact the NH Fish & Game Dept (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

For all animal reviews, refer to 'IMPORTANT: NHFG Consultation' section below.

Disclaimer: A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

IMPORTANT: NHFG Consultation

If this NHB Datacheck letter DOES NOT include ANY wildlife species records, then, based on the information submitted, no further consultation with the NH Fish and Game Department pursuant to Fis 1004 is required.

If this NHB Datacheck letter includes a record for a threatened (T) or endangered (E) wildlife species, consultation with the New Hampshire Fish and Game Department under Fis 1004 may be required. To review the Fis 1000 rules (effective February 3, 2022), please go to https://wildlife.state.nh.us/wildlife/environmental-review.html. All requests for consultation and submittals should be sent via email to NHFGreview@wildlife.nh.gov or can be sent by mail, and **must include the NHB Datacheck results letter number and "Fis 1004 consultation request" in the subject line.**

If the NHB DataCheck response letter does not include a threatened or endangered wildlife species but includes other wildlife species (e.g., Species of Special Concern), consultation under Fis 1004 is not required; however, some species are protected under other state laws or rules, so coordination with NH Fish & Game is highly recommended or may be required for certain permits. While some permitting processes are exempt from required consultation under Fis 1004 (e.g., *statutory permit by notification, permit by rule, permit by notification, routine roadway registration, docking structure registration, or conditional authorization by rule)*, coordination with NH Fish & Game may still be required under the rules governing those specific permitting processes, and it is recommended you contact the applicable permitting agency. For projects not requiring consultation under Fis 1004, but where additional coordination with NH Fish and Game is requested, please email: Kim Tuttle *kim.tuttle@wildlife.nh.gov* with a copy to NHFGreview@wildlife.nh.gov, and include the NHB Datacheck results letter number and "review request" in the email subject line.

Memo

NH Natural Heritage Bureau
NHB DataCheck Results Letter

Please note: portions of this document are confidential.
Maps and NHB record pages are confidential and should be redacted from public documents.

Contact NH Fish & Game at (603) 271-0467 with questions.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

NHB Coordination

Stephen Hoffmann

From: DNCR: NHB Review <nhbreview@dncr.nh.gov>
Sent: Wednesday, September 27, 2023 2:55 PM
To: Stephen Hoffmann
Cc: Evans, Jonathan; Christine J. Perron; Claire Hilsinger
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

Steve,

I really appreciate you providing that information – it was something that came up when I was discussing this project with other NHB staff members who have experience with providing recommendations on this project. Jon, thank you for your response also, that clarifies the selection of sites. I was initially concerned about the distance from the existing location, but that is not as big of a problem as I originally thought with proper preparation.

If it is possible to transplant the Population 3 from the western side to the eastern side with Populations 1 and 2 that would be the preferred transplanting location as likely they are similar genetically. In addition to the site having existing occurrences which ensures suitable habitat, having the occurrences in the same location could aid in limiting accidental take during work activities or in the future. However, it is understandable if logistically this may not be possible moving the BFV from the west side to the east side.

If the other proposed location 2,200ft south of the existing Population 3 is a more viable option, NHB is agreeable with this location. It does appear to be suitable habitat and similar to the existing location in aspect, soil type, etc as you have mentioned.

<u>A few notes for the transplanting plan to be drafted</u>:

- With either of these two locations being a decent distance away it will be vital to have the transplant location prepped and ready ahead of time prior to excavating any of the BFV's in Population 3 to prevent the roots drying out/ stress to the plants.
- Potentially utilize some sort of flat bed equipment to scoop the BFV for transport and placement in the new location.
- If the more southern location on the west side is selected, the slope is more significant and stabilization after transplanting would be recommended.
  - Use of coir logs, pack soil more tightly, water carefully and slowly, spread hay etc.

I appreciate your time, and hard work on this process!

Best,

Ashley Litwinenko
Environmental Reviewer
Natural Heritage Bureau (NHB)
Division of Forests & Lands - DNCR
172 Pembroke Rd., Concord, NH 03301
Phone: 603-271-2834
[Datacheck Tool]
[NHB Botany Information]

IMPORTANT INFORMATION BELOW

Ashley Litwinenko - Natural Heritage Bureau's Environmental Reviewer, will be on an **extended absence beginning in early November until February 2024.**
During that time, follow-up on Environmental Review related emails **may be delayed up to 2 weeks.**
NHB DataCheck Letters will continue to be distributed, and NHB DataCheck Tool assistance will continue to be available.
For time sensitive recommendations from NHB, please email NHBReview@dncr.nh.gov prior to early November.

Thank you for your understanding.

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Wednesday, September 27, 2023 1:47 PM
To: DNCR: NHB Review <nhbreview@dncr.nh.gov>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

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Hi Ashley,

The possibility of transplanting Population 3 (west side) to the east side between Populations 1 and 2 was discussed, and I believe we talked about this on a call we had earlier this spring. However, NHDOT brought up concerns about consolidating the three populations into a single area, on one side of the turnpike, possibly reducing natural dispersal potential. Another reason was the logistics of relocating the population from the west side to the east side. For these reasons, a potential transplant site was selected on the west side of the turnpike. Jon, please chime in if there's anything additional that I am missing.

Would it be NHB's preference to transplant Population 3 to the east side between Populations 1 and 2, over the potential transplant site that was identified on the west side? It appears both sites contain suitable habitat, but I can see how the presence of the existing populations on the east side strengthens the case for habitat suitability at that location. Please let me know if NHB has a preference over either potential transplant site.

Thanks,
Steve

McFarland Johnson
Stephen Hoffmann | Environmental Analyst
802-862-9381
Visit our website to see how MJ employee owners are innovating to improve our world.

From: DNCR: NHB Review <nhbreview@dncr.nh.gov>
Sent: Tuesday, September 26, 2023 11:15 AM
To: Stephen Hoffmann <SHoffmann@mjinc.com>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

Hi Stephen,

I was just able to meet with other NHB staff about this project and review the potential transplant location and the information provided. Thank you very much for providing such detailed information on the existing vs. proposed BFV location.

I looked through all my notes and couldn't locate any information relative to this question, so I apologize if you have provided it, and this is repetitive..

Have you considered the possibility of transplanting this western BFV occurrence to the east side where the two populations that are able to be avoided by work activities (populations 1&2)? If you have, is there any reason that this existing eastern location is not being proposed as a transplant location for Population 3(~71 western plants)?

Best,

Ashley Litwinenko
Environmental Reviewer
Natural Heritage Bureau (NHB)
Division of Forests & Lands - DNCR
172 Pembroke Rd., Concord, NH 03301
Phone: 603-271-2834
Datacheck Tool
NHB Botany Information

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For time sensitive recommendations from NHB, please email NHBReview@dncr.nh.gov prior to early November.

Thank you for your understanding.

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Tuesday, September 26, 2023 10:42 AM
To: DNCR: NHB Review <nhbreview@dncr.nh.gov>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

Hi Ashley,

Thank you for the update. Please don't hesitate to reach out if you have any additional questions or concerns, or if you need any additional information to facilitate your review/decision.

Thanks,
Steve

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
802-862-9381
Visit our website to see how MJ employee owners are innovating to improve our world.

From: DNCR: NHB Review <nhbreview@dncr.nh.gov>
Sent: Thursday, September 21, 2023 8:37 AM
To: Stephen Hoffmann <SHoffmann@mjinc.com>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: FW: 13761A F.E. Everett Tnpk Rare Plants

Hi Stephen,

Thank you very much for sending over this detailed summary of finding related to the proposed transplanting location.

I have a meeting scheduled to discuss this with other NHB staff early next week, and should be able to have a response back to you by the end of next week. I wanted to reach out to inform you of this delay in response, so you didn't think this email was not received.

I appreciate your patience on this, and for providing such a thorough explanation which will be helpful in my review of the suggested transplant location.

Best,

Ashley Litwinenko
Environmental Reviewer
Natural Heritage Bureau (NHB)
Division of Forests & Lands - DNCR
172 Pembroke Rd., Concord, NH 03301
Phone: 603-271-2834
Datacheck Tool
NHB Botany Information

IMPORTANT INFORMATION BELOW

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NHB DataCheck Letters will continue to be distributed, and NHB DataCheck Tool assistance will continue to be available.
For time sensitive recommendations from NHB, please email NHBReview@dncr.nh.gov prior to early November.

Thank you for your understanding.

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Monday, September 18, 2023 5:41 PM
To: Litwinenko, Ashley <Ashley.M.Litwinenko@dncr.nh.gov>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger

<CHilsinger@mjinc.com>
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Hi Ashley,

I was able to visit the proposed relocation site last week, and I'm happy to report that the potential relocation site appears to contain suitable habitat for bird foot violet (BFV). The habitat found in the proposed relocation site is is very similar to the habitat of the existing BFV population approximately 2,200' to the north.

The soils were very similar in texture, color, depth, moisture, etc. Soils in the existing population area consisted of well-drained loamy sand to a depth of approximately 9" where gravel/stone was encountered, restricting further excavation with the auger. Soils in the potential relocation site were also a well-drained loamy sand, with gravel/rock encountered at a depth of approximately 10". Pictures of the soils are included in the attached PDF.

The vegetation community was also very similar between the two sites. Both sites contain relatively sparse herbaceous cover, with areas of exposed sandy soils. The attached PDF contains photos of the two sites, and as you can see, they look very similar. The grass at the proposed relocation site was a bit taller, but it was comprised mostly of sparse patches of little bluestem. I revised the potential relocation site limits based on my field review to exclude areas that contained denser grasses. The smaller rectangle on the snip below was the original potential relocation site, and the larger polygon is the area that I identified in the field that contained higher quality, suitable habitat for BFV. The change in vegetation is visible in some of the photos.

Existing Population Vegetation:

Poa sp.
Schizachyrium scoparium
Potentilla canadensis
Viola pedata
Froelichia gracilis
Vaccinium angustifolium

Proposed Relocation Site Vegetation:

Schizachyrium scoparium
Achillea millefolium

Hpericum sp.
Digitaria sanguinalis
Pseudognaphalium obtusifolium

Please let me know if you have any additional questions or concerns, or if you concur with our findings and the proposed relocation site, we can start preparing the Transplant Plan for the 13761A project.

Thanks,
Steve

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
802-862-9381
Visit our website to see how MJ employee owners are innovating to improve our world.

From: Stephen Hoffmann
Sent: Wednesday, September 13, 2023 12:17 PM
To: 'Litwinenko, Ashley' <Ashley.M.Litwinenko@dncr.nh.gov>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

Hi Ashley,

Please see my responses to your questions below. I can provide additional details after I review the proposed site in the field. Let me know if you have any additional questions or concerns at this time.

Thanks,
Steve

From: Litwinenko, Ashley <Ashley.M.Litwinenko@dncr.nh.gov>
Sent: Wednesday, August 23, 2023 8:17 AM
To: Stephen Hoffmann <SHoffmann@mjinc.com>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

Hi Steve,

Thank you for providing the most recent version of the impact plans for this proposed project, and a potential transplant location for the western population. It's great to hear that the two populations located on the east side of the Turnpike have been avoided.

Questions:

- What is the current distance from the edge of pavement to the western population?
  The existing population is approximately 16'-20' from the edge of existing pavement.

- What would be the distance from the edge of pavement to the proposed transplanting location for the western population?

  The existing distance of 16'-20' can likely be maintained.
- As this proposed site is quite a distance from the existing population (2,200ft), has this location been assessed for similar soils, aspect, slope, and other growing conditions?

  A desktop review has been completed for the proposed site, but a field review has not been completed at this time. I hope to visit the site later this week or early next week and can provide you with additional information once I complete this review. According to NRCS Web Soil Survey mapping, both locations are underlain by loamy sands, so I would anticipate soils to be similar.

  NRCS Soil Map Units:
  Existing Population - Windsor loamy sand, 0 to 3 percent slopes
  Transplant Location - Hinckley loamy sand, 15 to 35 percent slopes

  The proposed transplant site is on the west side of the turnpike and eastward facing similar to the existing population. As you can see on the topo provided on the snip of the plans in my original email, the terrain slopes down slightly from the edge of pavement before sloping back up to the west.

I am a bit concerned about the distance from the existing population location, as the previous (so far successful) transplanting for Contract E was only 85ft away with very similar soil, slope, and other growing conditions to the initial location. I understand the difficulty in finding a suitable location on the western side of turnpike due to the proposed widening, berms, staging areas, and the limits of disturbance. However, NHB wants to utilize the experience gained from Contract E's transplanting protocols to ensure this transplanting is as successful as possible.

Thank you,

Ashley Litwinenko
Environmental Reviewer
Natural Heritage Bureau (NHB)
Division of Forests & Lands - DNCR
172 Pembroke Rd., Concord, NH 03301
Phone: 603-271-2834
Datacheck Tool
NHB Botany Information

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Tuesday, August 22, 2023 4:06 PM
To: Litwinenko, Ashley <Ashley.M.Litwinenko@dncr.nh.gov>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

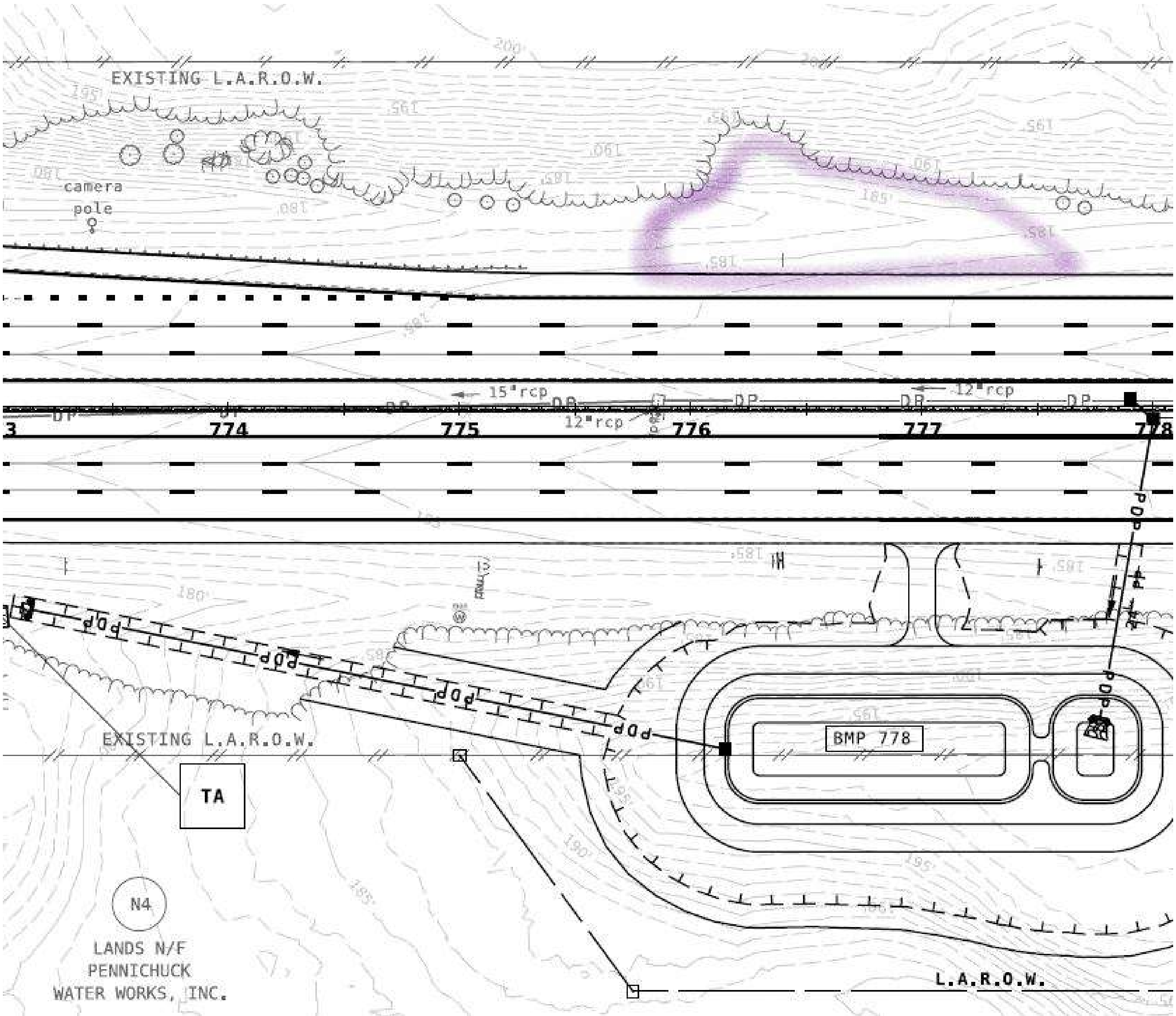
Good Afternoon Ashley,

I am reaching regarding the potential transplant location for the impacted bird foot violet population on the west side of the F.E. Everett Turnpike located within the 13761A project limits in Nashua, NH. I've attached the most recent version of the impact plans for the proposed project. The bird foot violet populations are depicted on Sheet 7 (Existing Conditions) and Sheet 20 (Wetland Impact Plan). As you can see on Sheet 20, the impacts to the two populations on the east side of the Turnpike have been avoided. You may also notice that the polygon shapes have changed slightly. The limits of the existing populations were re-delineated in the field on May 31, 2023. The existing population is approximately 355 SF in size with approximately 71 individual plants.

We have worked with the design team and NHDOT to identify a potential relocation site on the west side of the Turnpike. The potential relocation site is located between STA 776 – 778 and is depicted on the snip of the plans and image below. Work at this location is limited to pavement reconstruction within the existing roadway footprint only. It was challenging to find a suitable location on the western side of turnpike due to the proposed widening, berms, staging areas, the limits of disturbance, and also in a location that wouldn't require additional tree clearing solely for the purpose of transplanting. The area identified below is near the southern end of the project, approximately 2,200 feet south of the existing population. Please review the plans and the snips below at your earliest convenience and let us know if you have any questions or concerns regarding the proposed transplant site.

Once a transplant site is agreed upon, we can begin preparing the transplanting plan.

Thanks,
Steve



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LANDS N/F
PENNICHUCK
WATER WORKS, INC.
L.A.R.O.W.

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
802-862-9381

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From: Litwinenko, Ashley <Ashley.M.Litwinenko@dncr.nh.gov>
Sent: Monday, April 24, 2023 9:30 AM
To: Stephen Hoffmann <SHoffmann@mjinc.com>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: RE: 13761A F.E. Everett Tnpk Rare Plants

Hi Stephen,

It was great to meet with you all virtually this past Friday. I really appreciate your time discussing the upcoming transplant within 13761E, and the future work under 13761A.

Thank you very much for providing the preliminary plans for contract A, and the images depicting measurements from the three bird foot violet populations and the edge of pavement.

I look forward to continuing to work with you all for these upcoming NHDOT projects.

Best,

Ashley Litwinenko
Environmental Reviewer
Natural Heritage Bureau (NHB)
Division of Forests & Lands - DNCR
172 Pembroke Rd., Concord, NH 03301
Phone: 603-271-2834
Datacheck Tool
NHB Botany information

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Friday, April 21, 2023 2:03 PM
To: Litwinenko, Ashley <Ashley.M.Litwinenko@dncr.nh.gov>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Claire Hilsinger <CHilsinger@mjinc.com>
Subject: 13761A F.E. Everett Tnpk Rare Plants

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

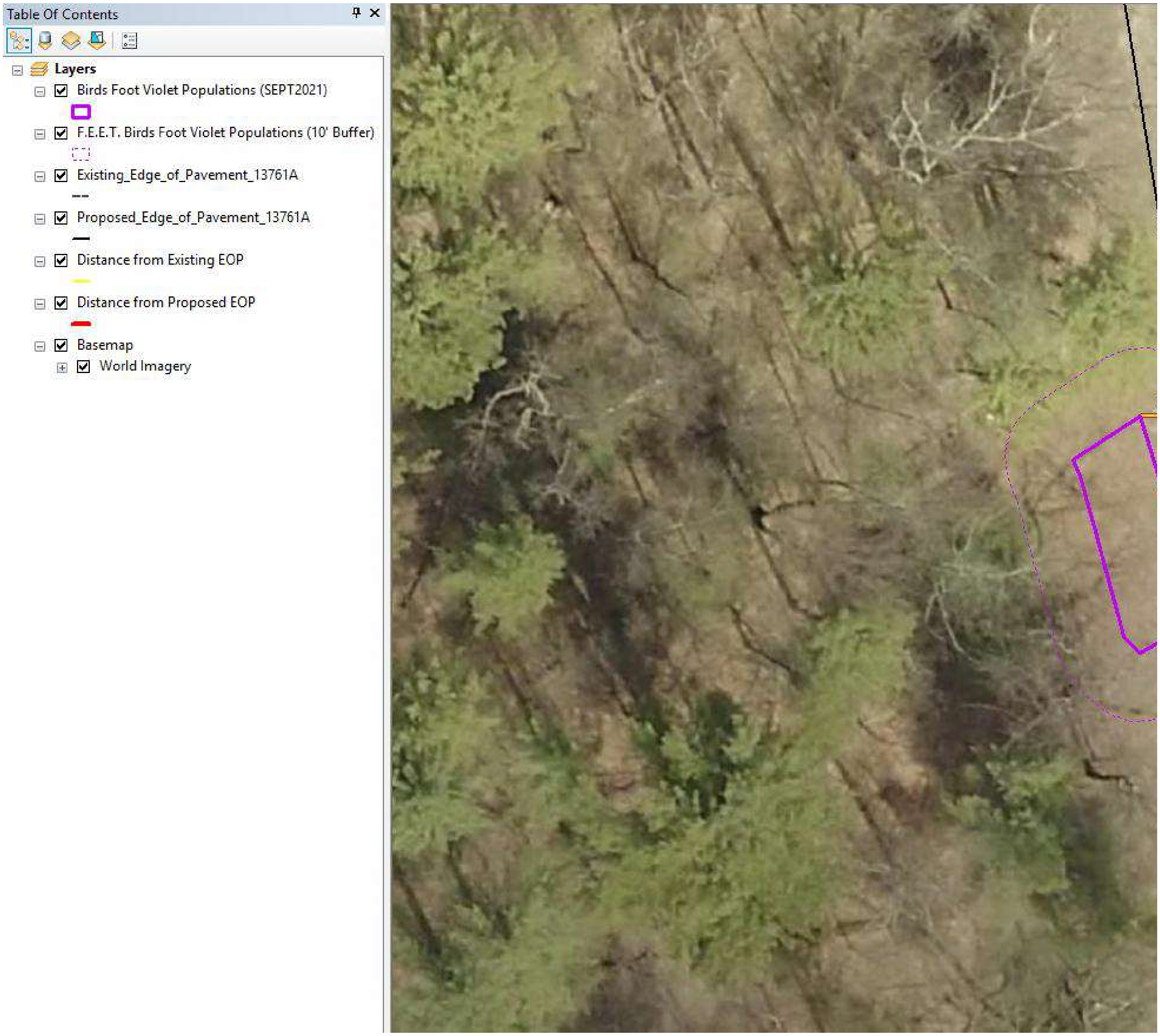
Hi Ashley,

Thanks for taking the time to meet with us regarding the 13761A project, it was nice to meet you (virtually). The snips of the three populations in the A contract are included below, with the approximate distances (in feet) from the existing and proposed edges of pavement. I've also attached the preliminary slope and drain plan sheet with the rare plants depicted. As we mentioned on the call these plans are currently being reviewed and we are hoping to eliminate the berm and impacts to the bird foot violet populations on the east side of the turnpike. We can provide updated plans once they are available.

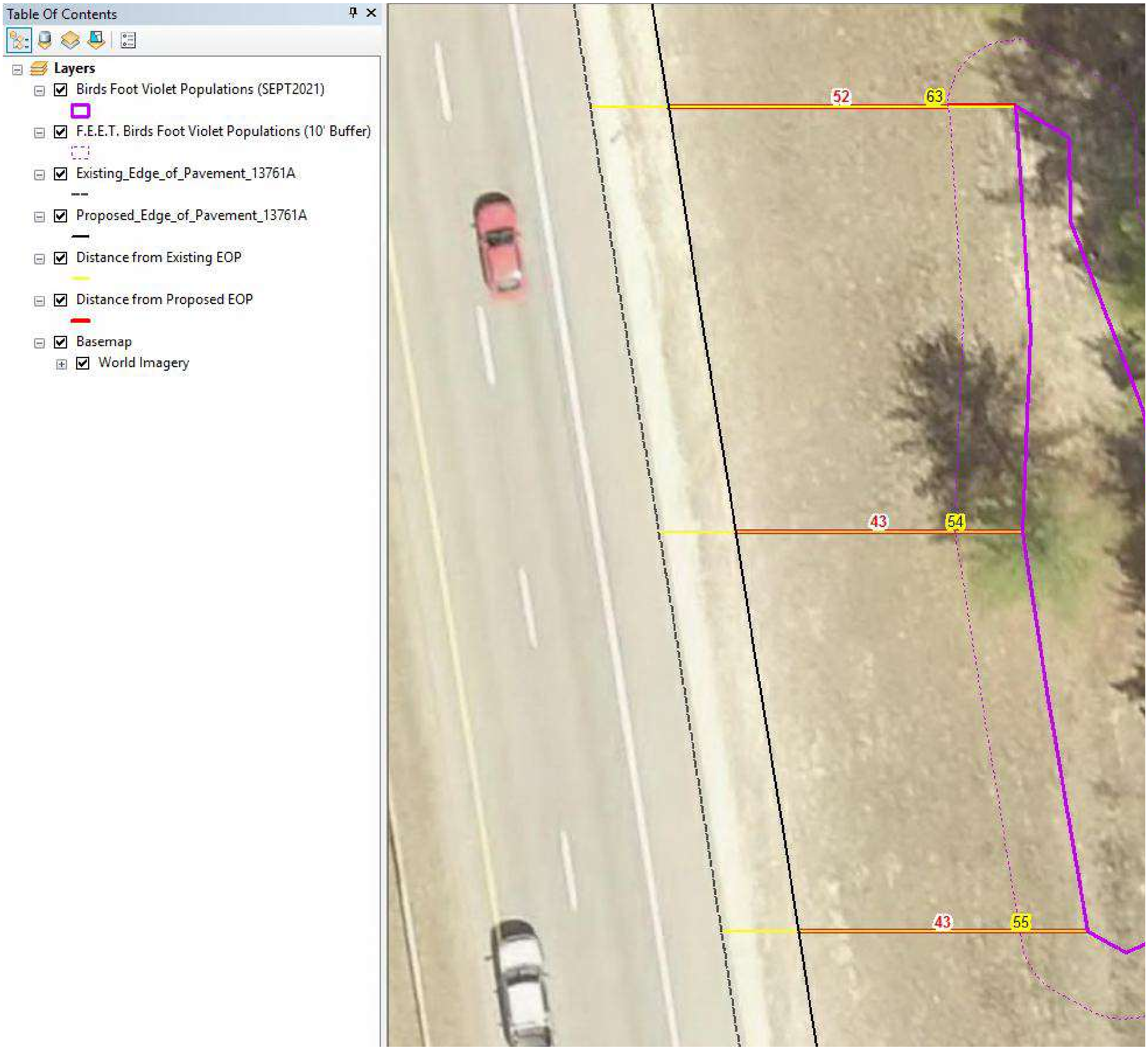
Also, please note, I just realized that the rare plant polygons on the plans are actually the 10' buffer around the limits of the populations that were GPS'd in the field using a submeter accurate GPS unit. The actual population limits and the 10' buffers are depicted on the snips below. Please let us know if you have any questions.

Thanks,
Steve

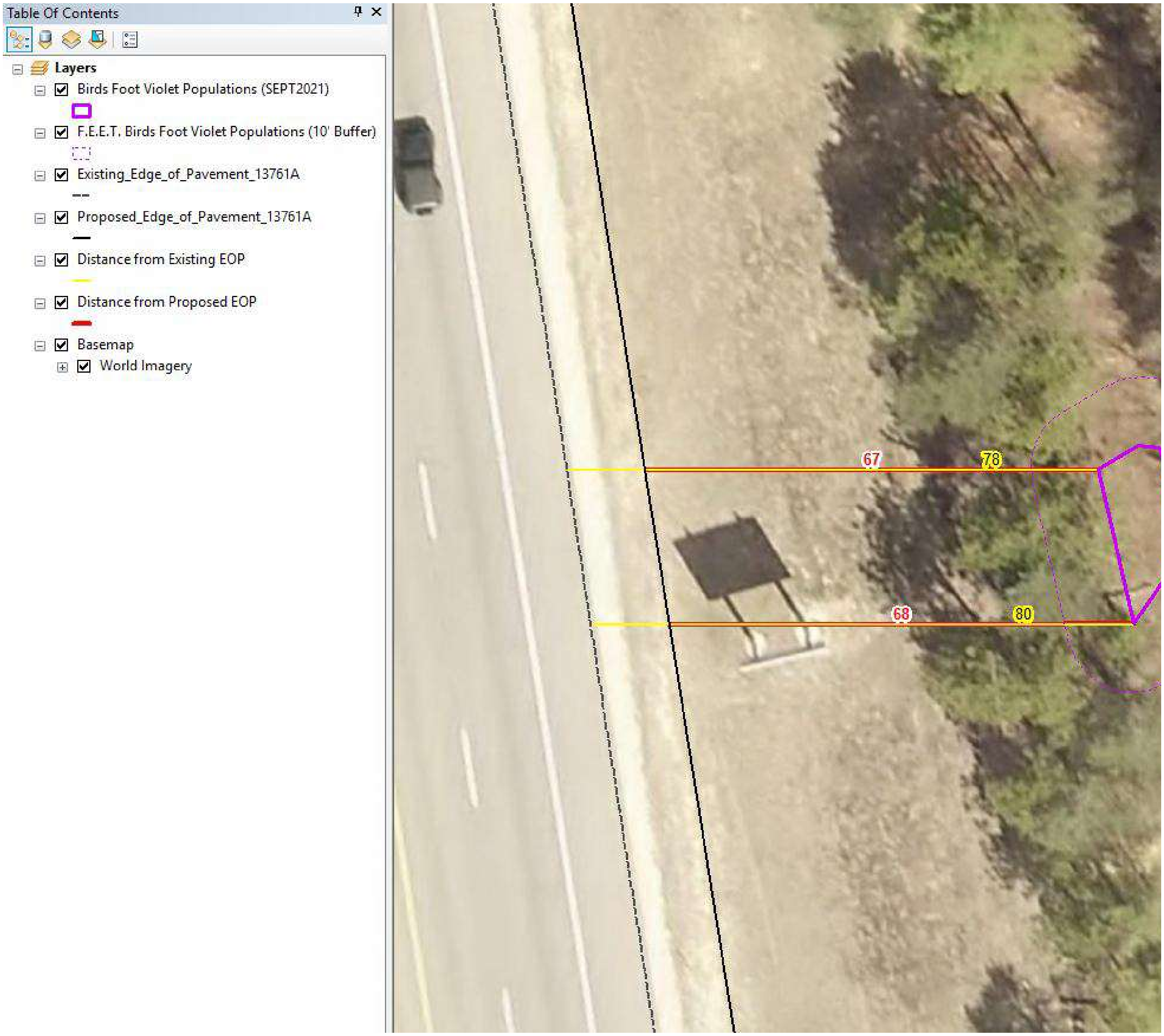
POPULATION #3 (West side of F.E. Everett Turnpike) - Approximately 71 plants



POPULATION #1 (East side of F.E. Everett Turnpike) - Approximately 585 plants



POPULATION #2 (East side of F.E. Everett Turnpike) - Approximately 32 plants



McFarland Johnson

Stephen Hoffmann | Environmental Analyst

802-862-9381

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NH Fish & Game Correspondence

Stephen Hoffmann

From: Tuttle, Kim <Kim.A.Tuttle@wildlife.nh.gov>
Sent: Tuesday, July 6, 2021 2:11 PM
To: Stephen Hoffmann
Subject: RE: NHB review: NHB21-1748

Hello Steve,

If protected mussel species aren't listed on the NHB for this phase of the project, then no mussel survey is required.

Thanks,

Kim Tuttle
Wildlife Biologist
NH Fish and Game
11 Hazen Drive
Concord, NH 03301
603-271-6544

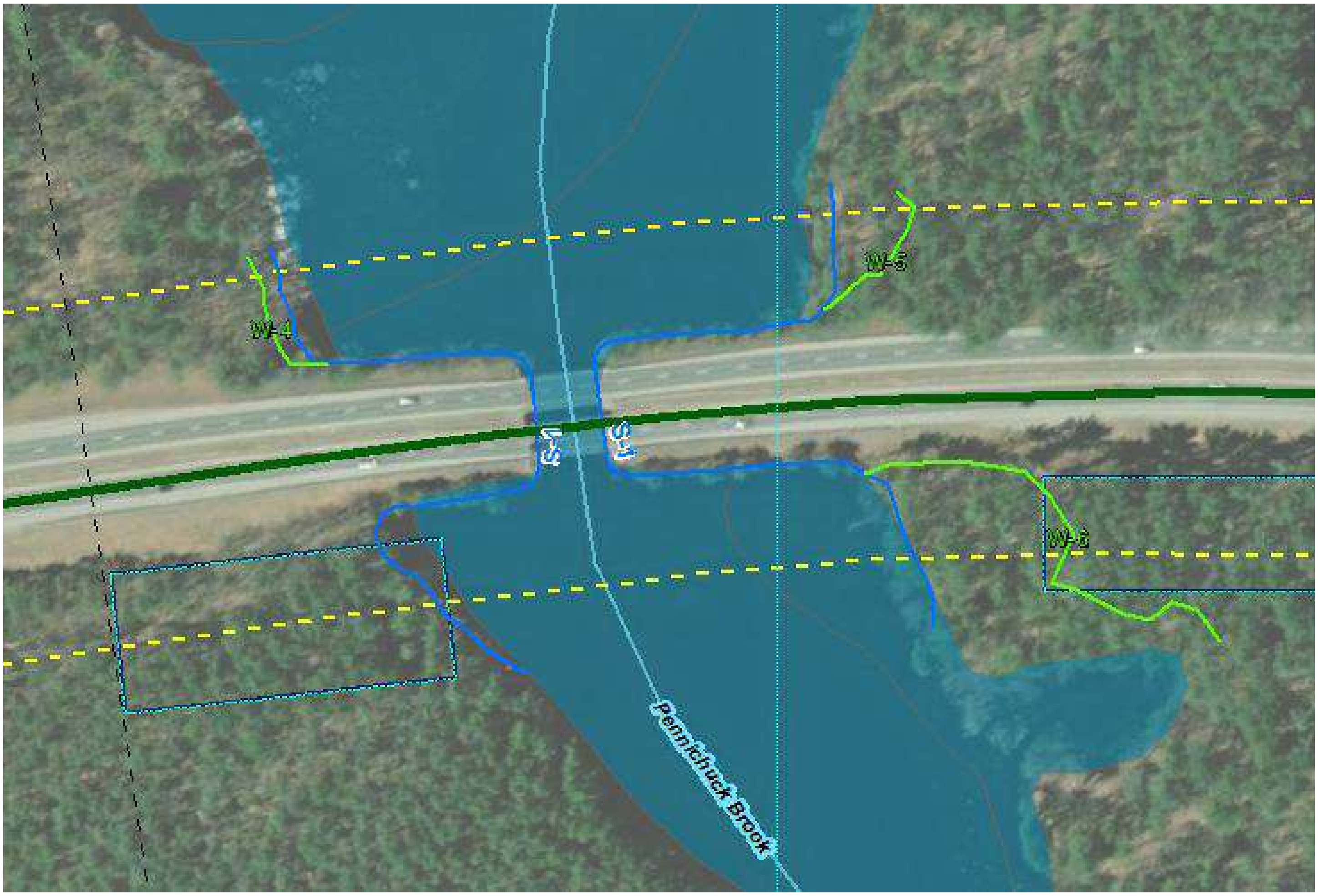
From: Stephen Hoffmann <shoffmann@mjinc.com>
Sent: Tuesday, July 6, 2021 12:43 PM
To: Tuttle, Kim <Kim.A.Tuttle@wildlife.nh.gov>
Cc: DNCR: NHB Review <nhbreview@dncr.nh.gov>; Christine J. Perron <CPerron@mjinc.com>
Subject: RE: NHB review: NHB21-1748

Hi Kim,

Have you or anyone else at NHFG had an opportunity to review the proposed project area for the potential presence of state listed mussels and/or the need for mussel surveys in any of the surface waters found in the project area? In order to keep the project on schedule, we hope to coordinate and complete any required surveys this summer. The two locations below are a priority based on the current project schedule. I've also reattached photos of the existing surface water resources and overall map of the project and surface water locations. Could you please provide guidance/recommendations on whether mussel surveys are required?

Thanks,
Steve

1.) Pennichuck Brook (Bower's Pond Impoundment)



2.) Baboosic Brook (S-7)
Unnamed Intermittent Tributary of Baboosic Brook (S-6)
Unnamed Intermittent Tributary to the Unnamed Intermittent Tributary of Baboosic Brook (S-5)

From: Stephen Hoffmann
Sent: Wednesday, June 23, 2021 9:59 AM
To: 'Tuttle, Kim' <Kim.A.Tuttle@wildlife.nh.gov>
Cc: 'DNCR: NHB Review' <nhbreview@dncr.nh.gov>; Christine J. Perron <CPerron@mjinc.com>
Subject: RE: NHB review: NHB21-1748

Good Morning Kim,

I am following up on my email from a few weeks ago regarding the potential need for mussel surveys in tributaries of the Merrimack River located within the NHDOT F.E. Everett Turnpike widening project in Nashua and Merrimack, NH. Please let me know if you have any questions or if you require any additional information to make this determination.

Thanks,
Steve

From: Stephen Hoffmann
Sent: Tuesday, June 8, 2021 8:29 AM

To: 'Tuttle, Kim' <Kim.A.Tuttle@wildlife.nh.gov>
Cc: DNCR: NHB Review <nhbreview@dncr.nh.gov>; Christine J. Perron <CPerron@mjinc.com>
Subject: RE: NHB review: NHB21-1748

Hi Kim,

I am reaching out regarding the subject NHB DataCheck Results Letter for the NHDOT F.E. Everett Turnpike widening project. The current review (NHB21-1748) is for the southern and middle segments of the overall 13761 project. You were involved in the coordination for the northern segment of the project last fall.

My first question is whether NHFG recommends or requires mussel surveys in any of the surface waters that are anticipated to be impacted by the proposed project? No mussel species were identified in the latest NHB Results Letter. However, in previous NHB reviews that included the northern segment, the project was identified as being located within an area flagged for possible impacts to the state-listed brook floater mussel (Merrimack River and tributaries). In preliminary project coordination, NHFG recommended surveying streams with suitable mussel habitat prior to construction so any rare mussels can be relocated. I have prepared the attached table summarizing the surface waters located within the southern and middle segments and the proposed work. Exact impact areas have not been determined at this time, but the majority of impacts to surface waters are associated with bridge and culvert replacements. I've also included a PDF with photographs of these areas as well as a figure showing the overall project and surface water locations to assist with your review/assessment. Please let me know if you have any questions or require any additional information. Again, the goal of this early coordination is to determine whether any mussel surveys will be required prior to construction.

Please let me know if you have any additional concerns or recommendations regarding any of the other species listed on the NHB Results Letter.

Thanks,
Steve

From: DNCR: NHB Review <nhbreview@dncr.nh.gov>
Sent: Friday, June 4, 2021 3:47 PM
To: Stephen Hoffmann <shoffmann@mjinc.com>
Cc: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Subject: NHB review: NHB21-1748

Attached, please find the review we have completed. If your review memo includes potential impacts to plants or natural communities please contact me for further information. If your project had potential impacts to wildlife, please contact NH Fish and Game at the phone number listed on the review.

Best,
Jessica

Jessica Bouchard
Environmental Reviewer / Ecological Information Specialist

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301
603-271-2834

Stephen Hoffmann

From: Newton, Kevin <Kevin.M.Newton@wildlife.nh.gov>
Sent: Friday, June 2, 2023 10:26 AM
To: Stephen Hoffmann
Cc: Winters, Melissa; FGC: NHFG review; Christine J. Perron; Evans, Jonathan; Martin, Rebecca
Subject: RE: Turtle Design Guidance NHB23-0523

Hi Steve,

Thanks for your questions. Some responses below:

1. The Pennichuck brook crossing is not identified by the NHFG Nongame and Endangered Species program as a hotspot for road mortalities for rare wildlife. However, the crossing may be a more important element for more common wildlife species, as animals tend to use river edges as travel corridors throughout the landscape.
2. Blanding's turtles predominately use wetland habitats with permanent shallow water and emergent vegetation such as marshes, swamps, bogs, and ponds. They will use vernal pools extensively in spring and will utilize upland areas during nesting season. They may use slow rivers and streams as mechanisms for dispersal between wetlands. Based on our records and the fragmentation of habitat in the area, improvements to terrestrial wildlife passage associated with the bridge replacement will likely have minimal positive impacts for Blanding's turtle. Rare snakes and amphibians may use crossings if designed correctly (allow for open light and designed to encourage use; e.g. funneling them through an area or tied to specific and preferred habitat features). However, at this location, small mammals would probably stand to benefit the most from the proposed improvements.
3. Vegetated 2:1 slopes would be navigable for turtles (and other species). Surface and vegetation should represent natural surroundings. Rip rap, if used, should not be large or angular and finer materials such as seeded soil, should be used to fill any voids.
4. Other comments for this project would include standard F & G recommendations:
    a. All manufactured erosion and sediment control products, with the exception of turf reinforcement mats, utilized for, but not limited to, slope protection, runoff diversion, slope interruption, perimeter control, inlet protection, check dams, and sediment traps shall not contain plastic, or multifilament or monofilament polypropylene netting or mesh with an opening size of greater than 1/8 inches.
    b. All observations of threatened or endangered species on the project site shall be reported to the NHFG nongame and endangered wildlife environmental review program by phone at 603-271-2461 and by email at NHFGreview@wildlife.nh.gov, with the email subject line containing the NHB DataCheck tool results letter assigned number, the project name, and the term Wildlife Species Observation.
    c. Photographs of the observed species and nearby elements of habitat or areas of land disturbance shall be provided to NHFG in digital format at the above email address for verification, as feasible.
    d. In the event a threatened or endangered species is observed on the project site during the term of the permit, the species shall not be disturbed, handled, or harmed in any way prior to consultation with NHFG and implementation of corrective actions recommended by NHFG.
    e. Site operators shall be allowed to relocate wildlife encountered if discovered within the active work zone if in direct harm from project activities. Wildlife shall be relocated in close proximity to the capture location but outside of the work zone and in the direction the individual was heading. NHFG shall be contacted immediately if this action occurs.
    f. NHFG, including its employees and authorized agents, shall have access to the property during the term of the permit.

Thanks, and let me know if you have any additional questions.

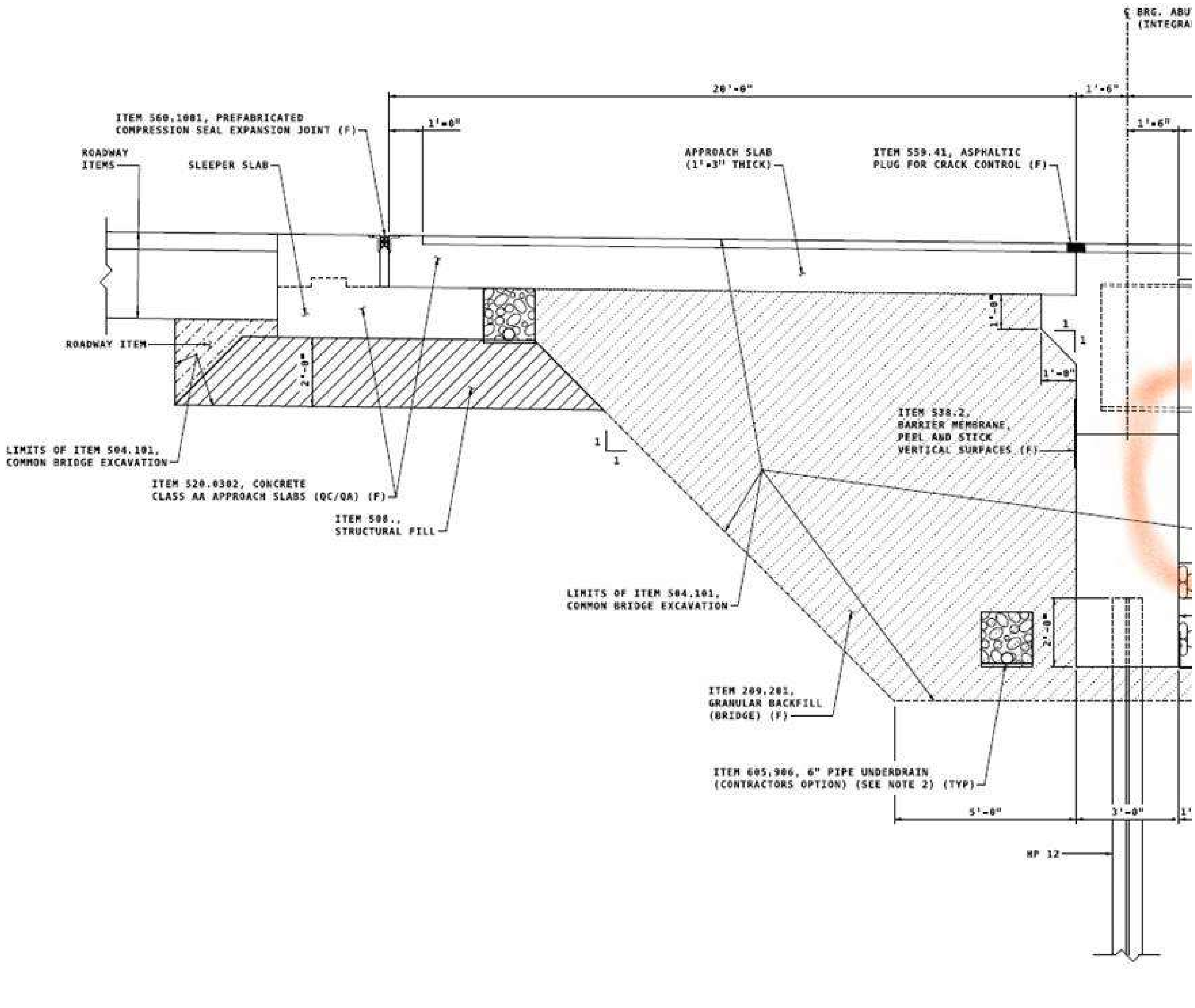
Kevin Newton
Wildlife Biologist
NH Fish and Game Department
Wildlife Division
11 Hazen Drive, Concord NH 03301
Phone: 603-271- 5860

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Tuesday, May 30, 2023 2:52 PM
To: Newton, Kevin <Kevin.M.Newton@wildlife.nh.gov>
Cc: Winters, Melissa <Melissa.J.Winters@wildlife.nh.gov>; FGC: NHFG review <NHFGreview@wildlife.nh.gov>; Christine J. Perron <CPerron@mjinc.com>; Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Martin, Rebecca <Rebecca.A.Martin@dot.nh.gov>
Subject: RE: Turtle Design Guidance NHB23-0523

Hi Kevin,

Thank you for the additional information. The question regarding the NHFG/UNH research on turtle passage design came up at the NHDOT Natural Resource Agency Meeting on Wednesday May 17, specifically for the Pennichuck Brook crossing located within the 13761A F.E. Everett Turnpike project you referenced below. Mary Ann Tilton with NHDES recommended that we reach out to Sandi and Tom for input regarding specific details of the crossing such as side slopes of the causeways, surface materials, etc. in order to demonstrate the effectiveness of the proposed crossing and improvements over the existing conditions.

The design and details of the wildlife shelves are still being finalized, but we are currently anticipating an approximately two-foot-wide shelf in front of both abutments with approximately three feet of clearance under the proposed bridge structure (see snip below with this area circled). The wildlife shelves would be limited to areas of proposed riprap and would tie in to the vegetated 2:1 slopes along the existing causeways. We briefly evaluated extending the shelves along the entire length of the causeways but this would result in additional wetland and surface water impacts, and while not ideal, we assumed that most species can navigate the vegetated 2:1 slopes (see attached photos). The surface of the wildlife shelves will be a uniform, fine material, that fills the larger voids in the proposed riprap required for scour protection. As you can see in the attached photos, the potential for wildlife crossing currently exists, however, the rocky, uneven material in front of the existing abutments is not the most conducive for smaller reptile and amphibian passage.



TYPICAL ABUTMENT

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SCALE: ½" = 1'-0"

As a result of the discussion at the meeting it was determined that additional coordination with NHFG would be needed prior to finalizing design and permitting.

1) Is the Pennichuck Brook crossing a known hotspot for road mortalities (reptiles, amphibians, or other wildlife species)?

2) What species would NHFG anticipate using this crossing/benefitting the most from improvements to terrestrial wildlife passage?
   - I think you partially answered this below, "minimal benefits to T&E species" and "benefits to other common wildlife such as raccoons, fox, and small mammals"
   - NHDES seemed very concerned about the Blanding's turtle hit on the NHB datacheck. However, upon further review, this occurrence is located approximately 1.8 miles NW of the Pennichuck Brook crossing, in the vicinity of Green's Pond. Is Blanding's turtle a concern at the F.E. Everett Turnpike over Pennichuck Brook Crossing location?

- Additional wildlife species identified by NHB included northern black racer (I believe this population is considered extirpated/impacted by the Merrimack outlet development) and eastern hognose snake.

3) Does NHFG concur with the proposed design described above?
   - Shelves limited to areas of riprap;
   - Vegetated 2:1 slopes are passable for most species;
   - 2’ wide x 3’ high shelves on both sides;
   - Tread will be finer materials to fill larger voids in riprap.

4) Any additional RTE species or other fish and wildlife concerns?

Thanks,
Steve

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
802-862-9381

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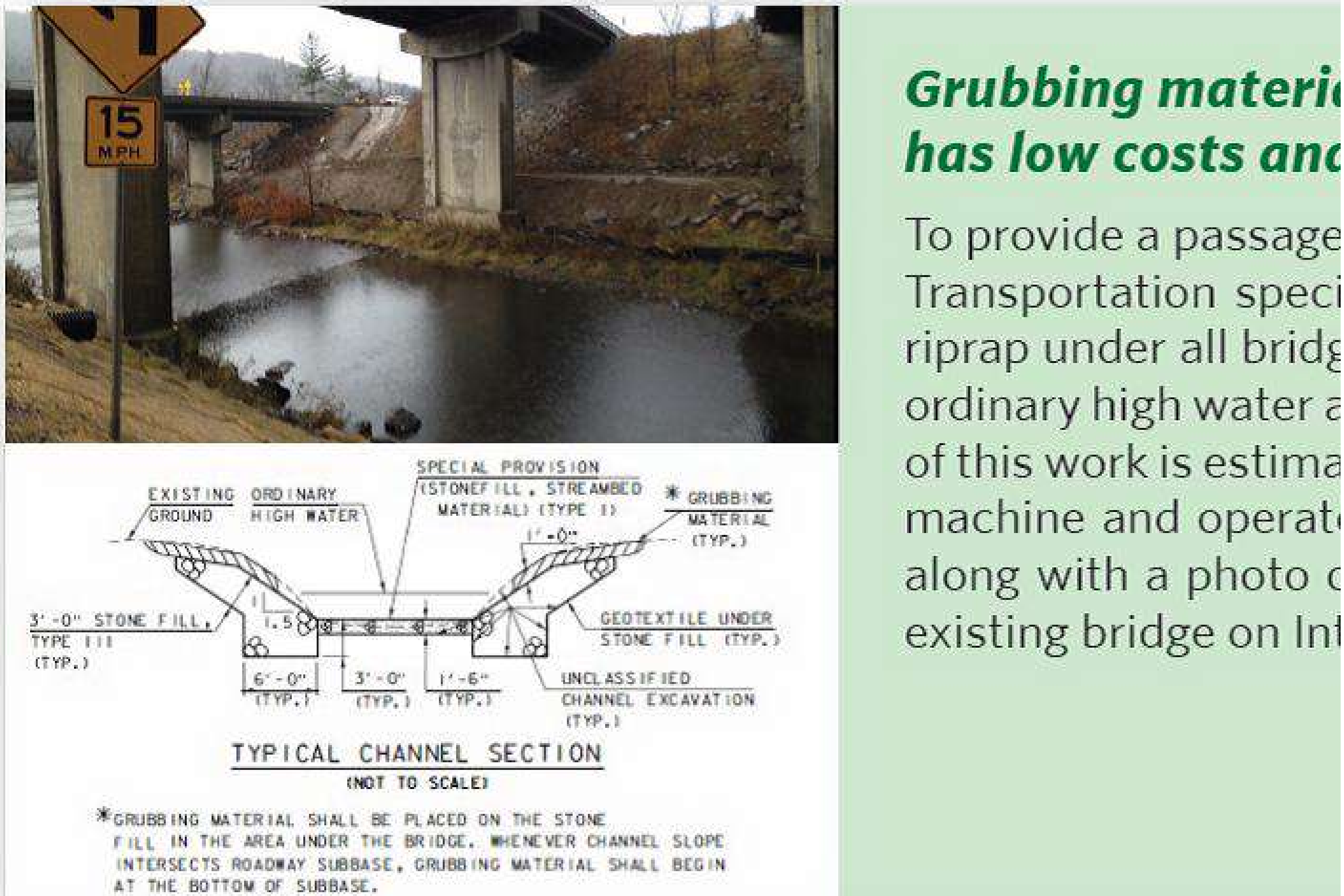
From: Newton, Kevin <Kevin.M.Newton@wildlife.nh.gov>
Sent: Friday, May 19, 2023 10:34 AM
To: Stephen Hoffmann <SHoffmann@mjinc.com>
Cc: Winters, Melissa <Melissa.J.Winters@wildlife.nh.gov>; FGC: NHFG review <NHFGreview@wildlife.nh.gov>
Subject: RE: Turtle Design Guidance NHB23-0523

Hi Steve,

In general, NHFG Nongame program recommends matching proposed crossings to the existing stream/river as closely as possible as to mimic natural conditions. In the case of larger bridges, inclusion of dry wildlife passage can provide opportunities for turtles (and other wildlife) to safely cross over land and avoid trying to cross over the highway.

A good example of this is the Minnesota/Vermont transportation guidance. It is a relatively low cost but efficient standard.



Of course, different projects have different parameter and constrains. But in general, providing some level of dry wildlife passage should be a net benefit for wildlife.

In the case of the NHDOT13761A FE Everett Turnpike project (NHB23-0523), incorporating dry wildlife passage under the bridge may result in some minimal benefits to T&E species and would most likely benefit other common wildlife such as raccoons, fox, and small mammals.

Kevin

Kevin Newton
Wildlife Biologist
NH Fish and Game Department
Wildlife Division
11 Hazen Drive, Concord NH 03301
Phone: 603-271- 5860

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Wednesday, May 17, 2023 2:14 PM
To: Houghton, Sandra <Sandra.D.Houghton@wildlife.nh.gov>; 'Tom.Ballestero@unh.edu' <Tom.Ballestero@unh.edu>; Newton, Kevin <Kevin.M.Newton@wildlife.nh.gov>

Cc: Christine J. Perron <CPerron@mjinc.com>
Subject: RE: Turtle Design Guidance

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Thank you Sandi, I will coordinate with Kevin directly.

Thanks,
Steve

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
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From: Houghton, Sandra <Sandra.D.Houghton@wildlife.nh.gov>
Sent: Wednesday, May 17, 2023 12:23 PM
To: Stephen Hoffmann <SHoffmann@mjinc.com>; 'Tom.Ballestero@unh.edu' <Tom.Ballestero@unh.edu>; Newton, Kevin <Kevin.M.Newton@wildlife.nh.gov>
Cc: Christine J. Perron <CPerron@mjinc.com>
Subject: RE: Turtle Design Guidance

Hello Stephen,

Thank you for reaching out. I've copied Kevin Newton here as he works on all NHDOT proposed projects for Nongame environmental review and can reply.

Thank you,
Sandi

Sandra Houghton
Wildlife Diversity Biologist
Nongame and Endangered Wildlife Program
NH Fish and Game Department

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Wednesday, May 17, 2023 11:17 AM
To: 'Tom.Ballestero@unh.edu' <Tom.Ballestero@unh.edu>; Houghton, Sandra <Sandra.D.Houghton@wildlife.nh.gov>

Cc: Christine J. Perron <CPerron@mjinc.com>
Subject: Turtle Design Guidance

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Good Morning Sandi and Tom,

Mary Ann Tilton with NHDES recommended that I reach out to you regarding the design of wildlife crossings, specifically wildlife shelves associated with a bridge replacement project. Mary Ann mentioned that you are currently working on an EPA grant looking at turtle crossings and preparing a guidance document for the design of turtle crossings. It sounded like you are still working on finalizing this document, but if you are able to provide any additional information at that this time that we could use to aid in our design it would be greatly appreciated.

Thanks,
Steve

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
802-862-9381

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Stephen Hoffmann

From:	Magee, John <john.a.magee@wildlife.nh.gov>
Sent:	Monday, June 12, 2023 11:52 AM
To:	Stephen Hoffmann
Cc:	Evans, Jonathan; Martin, Rebecca; Christine J. Perron; Dionne, Michael
Subject:	RE: 13761A NHDOT F.E. Everett Turnpike - Pennichuck Brook Crossing

Hi Steve, you are correct about the fish relative to this project. I do not have additional concerns. I have cc'd Mike Dionne on this email.

John

John Magee (he/him/his)
M.S., Certified Fisheries Professional
Fisheries Habitat Research and Management Programs Coordinator
New Hampshire Fish and Game Department
11 Hazen Drive, Concord, NH 03301
Phone 603-271-2744
Fax 603-271-5829

From: Stephen Hoffmann <SHoffmann@mjinc.com>
Sent: Monday, June 12, 2023 11:03 AM
To: Magee, John <john.a.magee@wildlife.nh.gov>
Cc: Evans, Jonathan <Jonathan.A.Evans@dot.nh.gov>; Martin, Rebecca <Rebecca.A.Martin@dot.nh.gov>; Christine J. Perron <CPerron@mjinc.com>
Subject: 13761A NHDOT F.E. Everett Turnpike - Pennichuck Brook Crossing

---

Hi John,

I am reaching out regarding the subject NHDOT project involving the widening of a section of the F.E. Everett Turnpike in Nashua and Merrimack, New Hampshire. This is the southernmost segment of the overall widening project and involves the replacement of the existing bridges spanning Pennichuck Brook (aka Bowers Pond). I've attached a USGS location map depicting the project location.

Pennichuck Brook has a series of four dams along its length including one (Holt Pond Dam) located upstream or west of the Turnpike, and a series of three (Bowers Dam, Harris Pond Dam, and Supply Pond Dam) located downstream or east of the Turnpike. I am assuming that aquatic organism/fish passage from downstream (i.e., the Merrimack River) is impeded by these three dams.

No rare, threatened, or endangered species were identified by NHB that are specifically associated with Pennichuck Brook (see attached DataCheck Results Letter). According to the NHDES WPPT and the 2020 NH WAP mapping, Pennichuck Brook is not identified as a cold water fishery or predicted cold water fishery, eastern brook trout water, or a water containing threatened, endangered species or species of conservation concern.

The project is moving into the final design/permitting phase, and I just wanted to confirm with you that there are no additional concerns regarding fisheries. Thank you for your time and consideration of this request. Let me know if you have any questions or need any additional information.

Thanks,
Steve

McFarland Johnson

Stephen Hoffmann | Environmental Analyst
802-862-9381

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USFWS Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: September 28, 2023
Project Code: 2023-0097754
Project Name: 13761A - NHDOT F.E. Everett Turnpike Widening Project

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:

Updated 4/12/2023 - Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.

About Official Species Lists

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. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

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 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. 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 by returning to an existing project's page in IPaC.

Endangered Species Act Project Review

Please visit the "**New England Field Office Endangered Species Project Review and Consultation**" website for step-by-step instructions on how to consider effects on listed species and prepare and submit a project review package if necessary:

https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review

NOTE Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

Northern Long-eared Bat - (**Updated 4/12/2023**) The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule went into effect on March 31, 2023. You may utilize the **Northern Long-eared Bat Rangewide Determination Key** available in IPaC. More information about this Determination Key and the Interim Consultation Framework are available on the northern long-eared bat species page:

https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis

For projects that previously utilized the 4(d) Determination Key, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective. If your project was not completed by March 31, 2023, and may result in incidental take of NLEB, please reach out to our office at newengland@fws.gov to see if reinitiation is necessary.

Additional Info About Section 7 of the Act
Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines 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 Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. 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/service/section-7-consultations

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) 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. Please contact NEFO if you would like more information.

Candidate species that appear on the enclosed species list have no current protections under the ESA. The species' occurrence on an official species list does not convey a requirement to consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

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

https://www.fws.gov/library/collections/bald-and-golden-eagle-management

Please feel free to contact us at **newengland@fws.gov** with your **Project Code** in the subject line if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat.

Attachment(s): Official Species List

Attachment(s):

- Official Species List

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:

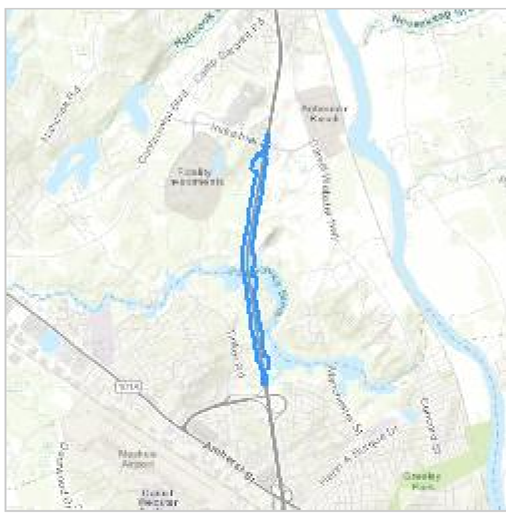
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

PROJECT SUMMARY

Project Code: 2023-0097754
Project Name: 13761A - NHDOT F.E. Everett Turnpike Widening Project
Project Type: Road/Hwy - Maintenance/Modification
Project Description: The 13761A contract includes the southern segment of the overall NHDOT 13761 Nashua-Merrimack-Bedford F.E. Everett Turnpike Widening Project. The southern segment is located in Nashua and Merrimack, Hillsborough County, New Hampshire. The proposed project involves highway widening from two to three lanes through the addition of a NB and SB travel lane. The project also includes the replacement of the existing bridges that carry the Turnpike over the Pennichuck Brook impoundment. Additional components of the project include drainage upgrades and improvements, including the construction of four stormwater treatment areas. Based on the 2019 Environmental Study, approximately 11.2 acres of tree clearing will be required to accommodate the proposed widening and stormwater treatment areas. The project is anticipated to start construction in 2024.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.80675785,-71.49883666033429,14z



Counties: Hillsborough County, New Hampshire

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
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

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.

IPAC USER CONTACT INFORMATION

Agency: McFarland-Johnson, Inc.
Name: Stephen Hoffmann
Address: 426 Industrial Ave, Suite 164
City: Williston
State: VT
Zip: 05495
Email shoffmann@mjinc.com
Phone: 8028629381

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

Northern Long-Eared Bat Effect Determination Letter

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

William Cass, P.E.
Commissioner

Andre Briere
Deputy Commissioner

U.S. Fish and Wildlife Service New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301

October 3, 2023

Re: Request for Informal Consultation, New Hampshire Department of Transportation Project: Nashua, Merrimack, Bedford (F.E. Everett Turnpike) 13761A, Northern Long Eared Bat, Project Code: 2023-0097754

Dear Dr. Mayer,

The New Hampshire Department of Transportation (NHDOT) is submitting the following request to initiate informal consultation for the Northern Long Eared Bat (NLEB) for the Nashua, Merrimack, and Bedford (F.E. Everett Turnpike) 13761A Project. NHDOT is a designated non-federal representative of the US Army Corps of Engineers (Army Corps) for informal Northern Long Eared Bat consultation. This is a request for review pursuant to Section 7 of the Endangered Species Act for the NHDOT's and Army Corps' project to widen the F.E. Everett Turnpike in Nashua and Merrimack.

The Information for Planning and Consultation (IPaC) tool was utilized to generate an Official Species List for the 13761A project area. The Official Species list includes the Northern Long Eared Bat (NLEB) and the project includes proposed impacts outside of the existing roadway and will require tree clearing. Informal consultation is requested for the action area identified in IPaC for USFWS Project Code: 2023-0097754. The proposed NHDOT 13761A project is part of the larger Nashua-Merrimack-Bedford 13761 project that involves widening three segments of the existing two-lane portions of the F.E. Everett Turnpike in Nashua, Merrimack, and Bedford, New Hampshire. The purpose of the F.E. Everett Turnpike Widening Project is to improve transportation efficiency and reduce safety problems associated with turnpike congestion in Nashua, Merrimack, and Bedford for all users of the turnpike.

The 13761 project has been divided into five separate construction contracts. The 13761A contract is located in the City of Nashua and Town of Merrimack, beginning immediately north of the Tinker Road overpass at Exit 8 in Nashua, and continuing north for approximately 2.2 miles, ending approximately 400 feet north of the Industrial Drive overpass at Exist 10 in Merrimack.

The 13761A project proposes to widen the turnpike from two to three lanes in each direction through the addition of a northbound and southbound travel lane. The project includes the replacement of the existing bridges 107/042 (NB) and 106/042 (SB) carrying the F.E. Everett Turnpike over Pennichuck Brook. The project also includes stormwater and drainage improvements to meet MS4 and AOT requirements.

Much of the project area is characterized by an urban and suburban landscape that is heavily fragmented by state and local roads and commercial and residential development. Areas of forested, unfragmented habitat exist adjacent to Pennichuck Brook in the middle of the project area. Adjacent residential development is primarily located in Nashua in the southern part of the project area, while commercial and industrial development adjacent to the F.E. Everett Turnpike is located primarily in the northern portion of the project area in Merrimack. The dominant forest type in the project area is oak-pine, with wetter areas dominated by red maple. The majority of the wetlands in the vicinity of the project consist of palustrine forested wetlands associated with Pennichuck Brook. Surface waters located within the 13761A project area include Pennichuck Brook, which is a tributary of the Merrimack River. Within the project area Pennichuck Brook is an impoundment also referred to as Bowers Pond, and water levels are controlled by a series of dams located downstream or east of the project area. Construction of the project will require clearing approximately 11.2 acres of forested habitat along the 2.2-mile project corridor.

The project is anticipated to advertise on January 30, 2024, which puts the start of construction in the Spring 2024 timeframe. The first construction phase will be widening for traffic control so tree clearing would need to begin early in construction, likely during the summer season.

A preliminary acoustic survey was carried out for the overall 13761 project between July 30, 2018 and August 20, 2018 to inform the larger project's environmental review. The survey generally followed most of the protocols outlined in the USFWS Range-Wide Indiana Bat Summer Survey Guidelines (April 2018); however, based on prior coordination with the USFWS, the acoustic survey was completed only in areas of higher quality habitat within the project area rather than deploying one detector per kilometer of forested habitat. The intent of limiting the survey to the highest quality habitat was to gather information to inform the environmental review of the project, and to afterwards conduct follow-up surveys prior to construction. As part of the 2018 survey, there were two detector sites located within the current limits of 13761A. Two acoustic files were manually identified as northern long-eared bat (NLEB) and four files were manually identified as tricolored bat (TCB) at one detector site.

A follow-up acoustic survey for the 13761A project was conducted between July 21 through July 28, 2021. Four detectors were deployed for a total of seven nights, three of which experienced unsuitable weather conditions as defined by the USFWS Range-Wide Indiana Bat & Northern Long Eared Bat Summer Survey Guidelines (Survey Guidelines). Based on an analysis of the data collected during all seven nights, no acoustic files were manually identified as NLEB or TCB at any detector site. Since the most recent survey did not identify the presence of NLEB or TCB, these species are assumed not to be present in the 13761A project area and no further summer surveys are recommended by the Survey Guidelines.

An inspection of both bridges (107/042 and 106/042) was completed on May 23, 2023, for evidence of use by bats and the Bridge/Structure Bat Assessment Form was completed. No evidence of bats (visual, audible, odor, staining, or guano) was observed.

Since neither NLEB nor TCB were detected during the acoustic survey, it seems unlikely that NLEB or TCB would be present within the project area during the active season when tree clearing is proposed. Therefore, the project would be not likely to cause adverse effects on the NLEB. The NHDOT would implement the following measures to further minimize and avoid effects to NLEB:

- The project would only clear the trees necessary to achieve project objectives and would mark all trees prior to clearing; and
- The contractor would report any dead or sick bats.

We respectfully request your concurrence with a may affect, not likely to adversely affect determination for the NLEB. We expect that if the TCB is listed pursuant to the Endangered Species Act, a may affect, not likely to adversely affect determination will likely be appropriate for TCB as well.

For additional information, please contact Rebecca Martin at (603) 271-6781 or Rebecca.a.martin@dot.nh.gov.

Sincerely,

Rebecca Martin
Digitally signed by Rebecca Martin
DN: C=US, E=rebecca.a.martin@dot.nh.gov, CN=Rebecca Martin
Date: 2023.10.03 10:50:50-04'00'

Rebecca Martin
NHDOT BOE Plant and Wildlife Program Manager

Enclosures

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: September 28, 2023
Project Code: 2023-0097754
Project Name: 13761A - NHDOT F.E. Everett Turnpike Widening Project

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:

Updated 4/12/2023 - Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.

About Official Species Lists

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. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

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 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. 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 by returning to an existing project's page in IPaC.

Endangered Species Act Project Review

Please visit the "**New England Field Office Endangered Species Project Review and Consultation**" website for step-by-step instructions on how to consider effects on listed species and prepare and submit a project review package if necessary:

https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review

NOTE Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

Northern Long-eared Bat - (**Updated 4/12/2023**) The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule went into effect on March 31, 2023. You may utilize the **Northern Long-eared Bat Rangewide Determination Key** available in IPaC. More information about this Determination Key and the Interim Consultation Framework are available on the northern long-eared bat species page:

https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis

For projects that previously utilized the 4(d) Determination Key, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective. If your project was not completed by March 31, 2023, and may result in incidental take of NLEB, please reach out to our office at newengland@fws.gov to see if reinitiation is necessary.

Additional Info About Section 7 of the Act
Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines 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 Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. 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/service/section-7-consultations

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) 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. Please contact NEFO if you would like more information.

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Migratory Birds

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- Official Species List

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Concord, NH 03301-5094
(603) 223-2541

PROJECT SUMMARY

Project Code: 2023-0097754
Project Name: 13761A - NHDOT F.E. Everett Turnpike Widening Project
Project Type: Road/Hwy - Maintenance/Modification
Project Description: The 13761A contract includes the southern segment of the overall NHDOT 13761 Nashua-Merrimack-Bedford F.E. Everett Turnpike Widening Project. The southern segment is located in Nashua and Merrimack, Hillsborough County, New Hampshire. The proposed project involves highway widening from two to three lanes through the addition of a NB and SB travel lane. The project also includes the replacement of the existing bridges that carry the Turnpike over the Pennichuck Brook impoundment. Additional components of the project include drainage upgrades and improvements, including the construction of four stormwater treatment areas. Based on the 2019 Environmental Study, approximately 11.2 acres of tree clearing will be required to accommodate the proposed widening and stormwater treatment areas. The project is anticipated to start construction in 2024.

Project Location:

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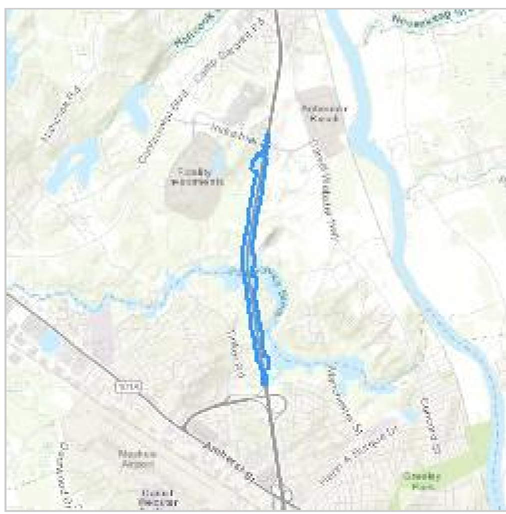

Counties: Hillsborough County, New Hampshire

ENDANGERED SPECIES ACT SPECIES

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

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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.

---

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
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

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.

IPAC USER CONTACT INFORMATION

Agency: McFarland-Johnson, Inc.
Name: Stephen Hoffmann
Address: 426 Industrial Ave, Suite 164
City: Williston
State: VT
Zip: 05495
Email shoffmann@mjinc.com
Phone: 8028629381

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

Acoustic Site Info

LAT (decimal degree)	LONG (decimal degree)	Positional Accuracy	Month	Day	Year	Start Time (military)	End Time (military)	Project Name	Site
42.8	-71.5	GPS with 3'-20' ac	7	21	2021	20:17	5:28	Southern FEET	A-1
42.8	-71.5	GPS with 3'-20' ac	7	22	2021	20:17	5:28	Southern FEET	A-1
42.8	-71.5	GPS with 3'-20' ac	7	23	2021	20:17	5:28	Southern FEET	A-1
42.8	-71.5	GPS with 3'-20' ac	7	24	2021	20:17	5:28	Southern FEET	A-1
42.8	-71.5	GPS with 3'-20' ac	7	25	2021	20:17	5:28	Southern FEET	A-1
42.8	-71.5	GPS with 3'-20' ac	7	26	2021	20:17	5:28	Southern FEET	A-1
42.8	-71.5	GPS with 3'-20' ac	7	27	2021	20:17	5:28	Southern FEET	A-1
42.8	-71.49	GPS with 3'-20' ac	7	21	2021	20:17	5:28	Southern FEET	A-2
42.8	-71.49	GPS with 3'-20' ac	7	22	2021	20:17	5:28	Southern FEET	A-2
42.8	-71.49	GPS with 3'-20' ac	7	23	2021	20:17	5:28	Southern FEET	A-2
42.8	-71.49	GPS with 3'-20' ac	7	24	2021	20:17	5:28	Southern FEET	A-2
42.8	-71.49	GPS with 3'-20' ac	7	25	2021	20:17	5:28	Southern FEET	A-2
42.8	-71.49	GPS with 3'-20' ac	7	26	2021	20:17	5:28	Southern FEET	A-2
42.8	-71.49	GPS with 3'-20' ac	7	27	2021	20:17	5:28	Southern FEET	A-2
42.82	-71.5	GPS with 3'-20' ac	7	21	2021	20:17	5:28	Southern FEET	A-3
42.82	-71.5	GPS with 3'-20' ac	7	22	2021	20:17	5:28	Southern FEET	A-3
42.82	-71.5	GPS with 3'-20' ac	7	23	2021	20:17	5:28	Southern FEET	A-3
42.82	-71.5	GPS with 3'-20' ac	7	24	2021	20:17	5:28	Southern FEET	A-3
42.82	-71.5	GPS with 3'-20' ac	7	25	2021	20:17	5:28	Southern FEET	A-3
42.82	-71.5	GPS with 3'-20' ac	7	26	2021	20:17	5:28	Southern FEET	A-3
42.82	-71.5	GPS with 3'-20' ac	7	27	2021	20:17	5:28	Southern FEET	A-3
42.82	-71.49	GPS with 3'-20' ac	7	21	2021	20:17	5:28	Southern FEET	A-4
42.82	-71.49	GPS with 3'-20' ac	7	22	2021	20:17	5:28	Southern FEET	A-4
42.82	-71.49	GPS with 3'-20' ac	7	23	2021	20:17	5:28	Southern FEET	A-4
42.82	-71.49	GPS with 3'-20' ac	7	24	2021	20:17	5:28	Southern FEET	A-4
42.82	-71.49	GPS with 3'-20' ac	7	25	2021	20:17	5:28	Southern FEET	A-4
42.82	-71.49	GPS with 3'-20' ac	7	26	2021	20:17	5:28	Southern FEET	A-4
42.82	-71.49	GPS with 3'-20' ac	7	27	2021	20:17	5:28	Southern FEET	A-4

Acoustic Site Info

State	County	Survey Type	Detector Brand	Detector Model	Microphone Brand & Model
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
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New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
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New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1
New_Hamp	Hillsborough	Summer - Acoustic	Wildlife Acoustics	Song Meter SM3BAT	Wildlife Acoustics SMM-U1

Directional, Omnidirectional, or Hemispherical Microphone	Weatherproofing type	Microphone Height (m)	Horizontal Orientation of Directional Microphone (1-360 degrees)	Vertical Orientation of Directional Microphone (approx. degrees)
Omnidirectional	None	3.66	263	0 (parallel with ground)
Omnidirectional	None	3.66	263	0 (parallel with ground)
Omnidirectional	None	3.66	263	0 (parallel with ground)
Omnidirectional	None	3.66	263	0 (parallel with ground)
Omnidirectional	None	3.66	263	0 (parallel with ground)
Omnidirectional	None	3.66	263	0 (parallel with ground)
Omnidirectional	None	3.66	263	0 (parallel with ground)
Omnidirectional	None	3.66	95	0 (parallel with ground)
Omnidirectional	None	3.66	95	0 (parallel with ground)
Omnidirectional	None	3.66	95	0 (parallel with ground)
Omnidirectional	None	3.66	95	0 (parallel with ground)
Omnidirectional	None	3.66	95	0 (parallel with ground)
Omnidirectional	None	3.66	95	0 (parallel with ground)
Omnidirectional	None	3.66	95	0 (parallel with ground)
Omnidirectional	None	3.66	270	0 (parallel with ground)
Omnidirectional	None	3.66	270	0 (parallel with ground)
Omnidirectional	None	3.66	270	0 (parallel with ground)
Omnidirectional	None	3.66	270	0 (parallel with ground)
Omnidirectional	None	3.66	270	0 (parallel with ground)
Omnidirectional	None	3.66	270	0 (parallel with ground)
Omnidirectional	None	3.66	270	0 (parallel with ground)
Omnidirectional	None	3.66	300	0 (parallel with ground)
Omnidirectional	None	3.66	300	0 (parallel with ground)
Omnidirectional	None	3.66	300	0 (parallel with ground)
Omnidirectional	None	3.66	300	0 (parallel with ground)
Omnidirectional	None	3.66	300	0 (parallel with ground)
Omnidirectional	None	3.66	300	0 (parallel with ground)
Omnidirectional	None	3.66	300	0 (parallel with ground)

Sensitivity Setting	**Audio Division** (if applicable)	**Data Division** (if applicable)	**Were calls collected in Full Spectrum or Zero Crossing?**	**Habitat Type or Feature being Surveyed**
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Upland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest
			Full spectrum	Bottomland forest

Name of Person who Selected Acoustic Site	Name of Person who Deployed Detector	Email Address of Primary Surveyor
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com
Stephen Hoffman	Stephen Hoffman	shoffmann@mjinc.com

Acoustic Survey Results

Species	Number of calls ID'ed for that species	Bat ID Software Program Used	Software Version Used	If calls were converted from Full Spectrum to Zero Cross, what program was used?	Maximum Likelihood Estimation (MLE) *P*-value	Number of Calls Confirmed through Qualitative ID (if conducted)	Name of Individual who Conducted Qualitative ID (if conducted)	Site ID (use drop-down menu)
Eptesicus fuscus	167	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/21/2021
Myotis lucifugus	2	Kaleidoscope	5.2.1		0.0185567			NHDOT Southern FEET site A-1 m 7/21/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.1236614			NHDOT Southern FEET site A-1 m 7/22/2021
Lasiurus borealis	22	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/22/2021
Myotis lucifugus	4	Kaleidoscope	5.2.1		0.0185567			NHDOT Southern FEET site A-1 m 7/22/2021
Eptesicus fuscus	14	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/23/2021
Lasiurus borealis	23	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/23/2021
Lasiurus cinereus	1	Kaleidoscope	5.2.1		0.9172115			NHDOT Southern FEET site A-1 m 7/23/2021
Myotis lucifugus	1	Kaleidoscope	5.2.1		1			NHDOT Southern FEET site A-1 m 7/23/2021
Eptesicus fuscus	90	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/24/2021
Lasiurus borealis	45	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/24/2021
Lasiurus cinereus	1	Kaleidoscope	5.2.1		1			NHDOT Southern FEET site A-1 m 7/24/2021
Eptesicus fuscus	57	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/25/2021
Lasiurus borealis	11	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/25/2021
Lasiurus cinereus	3	Kaleidoscope	5.2.1		0.968343			NHDOT Southern FEET site A-1 m 7/25/2021
Myotis lucifugus	3	Kaleidoscope	5.2.1		0.5596074			NHDOT Southern FEET site A-1 m 7/25/2021
Eptesicus fuscus	21	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/26/2021
Lasiurus borealis	13	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/26/2021
Myotis lucifugus	2	Kaleidoscope	5.2.1		0.9703614			NHDOT Southern FEET site A-1 m 7/26/2021
Eptesicus fuscus	15	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-1 m 7/27/2021
Myotis lucifugus	1	Kaleidoscope	5.2.1		0.1200161			NHDOT Southern FEET site A-1 m 7/27/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.5434382			NHDOT Southern FEET site A-2 m 7/21/2021
Lasiurus cinereus	2	Kaleidoscope	5.2.1		0.0273257			NHDOT Southern FEET site A-2 m 7/21/2021
Lasionycteris noctivagans	1	Kaleidoscope	5.2.1		0.8837502			NHDOT Southern FEET site A-2 m 7/21/2021
Eptesicus fuscus	4	Kaleidoscope	5.2.1		0.00906			NHDOT Southern FEET site A-2 m 7/22/2021
Lasiurus cinereus	2	Kaleidoscope	5.2.1		0.1117266			NHDOT Southern FEET site A-2 m 7/22/2021
Lasionycteris noctivagans	2	Kaleidoscope	5.2.1		0.6564246			NHDOT Southern FEET site A-2 m 7/22/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.2530162			NHDOT Southern FEET site A-2 m 7/23/2021
Lasiurus cinereus	1	Kaleidoscope	5.2.1		0.1652346			NHDOT Southern FEET site A-2 m 7/23/2021
Eptesicus fuscus	2	Kaleidoscope	5.2.1		0.1931052			NHDOT Southern FEET site A-2 m 7/24/2021
Lasiurus cinereus	4	Kaleidoscope	5.2.1		0.0002832			NHDOT Southern FEET site A-2 m 7/24/2021
Lasionycteris noctivagans	1	Kaleidoscope	5.2.1		1			NHDOT Southern FEET site A-2 m 7/24/2021
Eptesicus fuscus	4	Kaleidoscope	5.2.1		0.0119681			NHDOT Southern FEET site A-2 m 7/25/2021
Lasiurus borealis	1	Kaleidoscope	5.2.1		0.0408745			NHDOT Southern FEET site A-2 m 7/25/2021
Lasiurus cinereus	3	Kaleidoscope	5.2.1		0.0153858			NHDOT Southern FEET site A-2 m 7/25/2021
Lasionycteris noctivagans	2	Kaleidoscope	5.2.1		0.7843027			NHDOT Southern FEET site A-2 m 7/25/2021
Eptesicus fuscus	3	Kaleidoscope	5.2.1		0.3239648			NHDOT Southern FEET site A-2 m 7/26/2021
Lasiurus cinereus	10	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-2 m 7/26/2021
Lasionycteris noctivagans	4	Kaleidoscope	5.2.1		0.73122			NHDOT Southern FEET site A-2 m 7/26/2021
Eptesicus fuscus	2	Kaleidoscope	5.2.1		0.2802787			NHDOT Southern FEET site A-2 m 7/27/2021
Lasiurus cinereus	1	Kaleidoscope	5.2.1		0.5285932			NHDOT Southern FEET site A-2 m 7/27/2021
Lasionycteris noctivagans	3	Kaleidoscope	5.2.1		0.0978171			NHDOT Southern FEET site A-2 m 7/27/2021
Eptesicus fuscus	4	Kaleidoscope	5.2.1		0.0002315			NHDOT Southern FEET site A-3 m 7/22/2021
Myotis lucifugus	1	Kaleidoscope	5.2.1		0.1175996			NHDOT Southern FEET site A-3 m 7/22/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.2530162			NHDOT Southern FEET site A-3 m 7/23/2021
Lasiurus cinereus	1	Kaleidoscope	5.2.1		0.1652346			NHDOT Southern FEET site A-3 m 7/23/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.3902262			NHDOT Southern FEET site A-3 m 7/24/2021
Lasionycteris noctivagans	1	Kaleidoscope	5.2.1		0.3960653			NHDOT Southern FEET site A-3 m 7/24/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.6768473			NHDOT Southern FEET site A-3 m 7/25/2021
Lasiurus cinereus	4	Kaleidoscope	5.2.1		0.0001543			NHDOT Southern FEET site A-3 m 7/25/2021
Lasionycteris noctivagans	1	Kaleidoscope	5.2.1		0.9996728			NHDOT Southern FEET site A-3 m 7/25/2021
Myotis septentrionalis	1	Kaleidoscope	5.2.1		0.0097474	0	Christine Perron	NHDOT Southern FEET site A-3 m 7/25/2021
Eptesicus fuscus	15	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-3 m 7/26/2021
Lasiurus cinereus	5	Kaleidoscope	5.2.1		0.0247941			NHDOT Southern FEET site A-3 m 7/26/2021
Lasionycteris noctivagans	9	Kaleidoscope	5.2.1		0.0305886			NHDOT Southern FEET site A-3 m 7/26/2021
Eptesicus fuscus	3	Kaleidoscope	5.2.1		0.0079851			NHDOT Southern FEET site A-3 m 7/27/2021

Lasiurus cinereus	2	Kaleidoscope	5.2.1		0.0472435			NHDOT Southern FEET site A-3 m 7/27/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.1232995			NHDOT Southern FEET site A-4 m 7/21/2021
Eptesicus fuscus	3	Kaleidoscope	5.2.1		0.0018745			NHDOT Southern FEET site A-4 m 7/22/2021
Eptesicus fuscus	4	Kaleidoscope	5.2.1		0.0020506			NHDOT Southern FEET site A-4 m 7/23/2021
Lasiurus cinereus	3	Kaleidoscope	5.2.1		0.008036			NHDOT Southern FEET site A-4 m 7/23/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.2530162			NHDOT Southern FEET site A-4 m 7/24/2021
Lasiurus cinereus	1	Kaleidoscope	5.2.1		0.1652346			NHDOT Southern FEET site A-4 m 7/24/2021
Eptesicus fuscus	6	Kaleidoscope	5.2.1		0.0000622			NHDOT Southern FEET site A-4 m 7/25/2021
Lasiurus borealis	3	Kaleidoscope	5.2.1		0.0000683			NHDOT Southern FEET site A-4 m 7/25/2021
Lasiurus cinereus	2	Kaleidoscope	5.2.1		0.1202134			NHDOT Southern FEET site A-4 m 7/25/2021
Lasionycteris noctivagans	1	Kaleidoscope	5.2.1		1			NHDOT Southern FEET site A-4 m 7/25/2021
Eptesicus fuscus	20	Kaleidoscope	5.2.1		0			NHDOT Southern FEET site A-4 m 7/26/2021
Lasiurus cinereus	4	Kaleidoscope	5.2.1		0.1289707			NHDOT Southern FEET site A-4 m 7/26/2021
Lasionycteris noctivagans	8	Kaleidoscope	5.2.1		0.1137364			NHDOT Southern FEET site A-4 m 7/26/2021
Myotis lucifugus	1	Kaleidoscope	5.2.1		0.1320412			NHDOT Southern FEET site A-4 m 7/26/2021
Myotis septentrionalis	1	Kaleidoscope	5.2.1		0.0380753	0	Christine Perron	NHDOT Southern FEET site A-4 m 7/26/2021
Eptesicus fuscus	1	Kaleidoscope	5.2.1		0.5863602			NHDOT Southern FEET site A-4 m 7/27/2021
Lasionycteris noctivagans	2	Kaleidoscope	5.2.1		0.0764789			NHDOT Southern FEET site A-4 m 7/27/2021

Section 106 Effect Memo

NASHUA-MERRIMACK-BEDFORD
13761
RPR 8452

No Adverse Effect Memo

Pursuant to meetings and discussions on March 9, 2017, April 12, 2018, and November 7, 2018, and for the purpose of compliance with regulations of the National Historic Preservation Act, the Advisory Council on Historic Preservation's *Procedures for the Protection of Historic Properties* (36 CFR 800), the US Army Corps of Engineers' *Appendix C and NH RSA 227C:9 regarding the Preservation of State Historic Resources*; the NH Division of Historical Resources, NH Department of Transportation and the US Army Corps of Engineers (ACOE) have coordinated the identification and evaluation of cultural resources with plans to widen three segments of the F.E. Everett Turnpike (FEET) in the towns of Nashua, Merrimack and Bedford, New Hampshire.

Project Description

This project involves widening three segments of the FEET, totaling approximately 8 miles in length, from two lanes to three in each direction. The Area of Potential Effect extends approximately 300 feet from the centerline of the turnpike. The three segments include approximately 1.5 miles of the southern segment, beginning approximately 2,000 feet north of Exit 8 in Nashua, ending approximately 1,000 feet south of the Exit 10 overpass bridge in Merrimack. The middle segment runs for approximately 5.5 miles in Merrimack, starting approximately 3,500 south the Exit 11 overpass, includes the interchange at Exit 12 and ends approximately one mile south of the Bedford Toll Plaza. The northern segment begins approximately 0.6 miles south of the US Route 3 overpass bridge, running northerly for approximately 1.3 miles, ending at the northern limit of the I-293/NH Route 101 interchange in Bedford.

Although the Federal Highway Administration (FHWA) took interest in the undertaking due to its relation to the I-293 interchange, FHWA has since determined that they will not participate as a federal agency for this undertaking and as such the ACOE is the lead for their permitted areas.

Analysis

The FEET was reviewed in 2010 and was determined not eligible for the National Register of Historic Places. The Pennichuck Water Works (PWW) in Nashua was determined eligible for the National Register in 1993 and confirmed in 2003. Portions of the PWW are located within the Southern Segment, as it spans both sides of the FEET. There are three stormwater treatment areas proposed adjacent to and within the PWW property, in what is currently cleared ROW or undeveloped land.

An RPR addendum was submitted in March 2018 to NHDHR, and identified all of the structures located with the APE built prior to 1968. Comparing those properties to the proposed impacts, it has been determined that all tree clearing and grading will occur within the turnpike right-of-way (ROW). All impacts are outlined in Table A1 of the RPR Addendum.

There are seven proposed noise barriers, ranging in height from 15-17 feet, proposed along the project. Of the properties that contain structures built prior to 1968, and are directly adjacent to the FEET, there are three individual properties (3 Gull Lane, 6 Camp Sargent Road, and 9 Smith Road) and one historic district (Bigwood Historic District) that would have noise barriers built adjacent to the properties. Tree clearing will be necessary for the installation of the noise barriers; however vegetation buffers will remain at these four noise barrier locations.

For the properties older than 50 years that abut the FEET where no noise barriers are proposed, tree cover will remain along Hoyt Street, Hillcrest Drive, Chamberlain Road, Wire Road, DW Highway, Harris Avenue, South River Road, Brookfield Drive, and Back River Road. The noise analysis was completed and the impacts were reviewed with SHPO in relation to the Area of Potential Effect at the November 7, 2018 meeting. The attached memo details that review.

There are a limited number of properties that abut the FEET that have limited vegetation buffers currently. There will be limited visual change at these locations, and noise analysis has shown that any noise decibel increases will likely not be noticeable. Properties include 15 Harris Avenue that currently abuts the northbound Exit 12 off ramp, 11 Sunset Avenue, 8 and 7 Priscilla Lane and 232 and 258 South River Road.

Other impacts that are adjacent to or need easements for properties along the FEET include tree clearing, stormwater treatment areas, and slope and grading work. All of the tree clearing, slope work and grading will take place within the ROW. There is one proposed stormwater treatment area that is adjacent to/and possibly within the parcel at 20 Wire Road. Tree cover will remain between the house and the proposed stormwater treatment location.

A Phase IA/IB Archaeological Investigation was completed along the project corridor and Phase II Determinations of Eligibility were completed at various location. It was determined that the Naticook Brook I Site is eligible for the National Register of Historic Places and is located within the APE. Should the site need to be impacted, NH Division of Historical Resources will be consulted and all necessary phases of archaeology will be completed.

Public Consultation

Town official meetings were held in each of the municipalities in 2016. Public meetings were held March 29, 2018 in Bedford, April 3, 2018 in Nashua, and May 1, 2018 in Merrimack. Initial contact letters were sent to Land and Community Heritage Investment Program (LCHIP), Land and Water Conservation Fund (LWCF), Conservation Land Stewardship (CLS) programs. Continued consultation with the Pennichuck Water Works will continue throughout the planning process.

Determination of Effect

Applying the criteria of effect at 36 CFR 800.5, we mutually agreed that the proposed actions will not have an adverse effect on historic properties. The limited impacts to the Pennichuck Water Works Historic District will not impact any of the contributing features of the district. The stormwater treatment areas will further advance the role that the Pennichuck Water Works plays in the watershed treatment area. The noise barrier that will be added adjacent to the Bigwood Historic District will not impact the character defining features of the district, and a tree line will remain between the district and the noise barrier. The other remaining properties that are adjacent to the APE will retain their tree lines, and all slopework to be done will be within the ROW. No additional above ground survey is required and all necessary phases of archaeology will be completed.

The ACOE has reviewed the proposed plans in relation to their permit area and determined the project would not adversely affect historic resources.

In accordance with the Advisory Council's regulations, we will continue to consult, as appropriate, as this project proceeds.

Jill Edelmann 12/10/2018

Jill Edelmann Date
Cultural Resources Manager

Concurred with by the NH State Historic Preservation Officer:

Nadine Miller, DSHPO for 12/13/18

Elizabeth H. Muzzey Date
State Historic Preservation Officer
NH Division of Historical Resources

c.c. Mike Hicks, ACOE
Jon Evans, NHDOT
Wendy Johnson, NHDOT
Chris St. Louis, NHDHR

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NH GP Appendix B – USACE Section 404 Checklist and Supplemental Narrative

US Army Corps of Engineers®
New England District

Appendix B
New Hampshire General Permits
Required Information and USACE Section 404Checklist

USACE Section 404 Checklist

1. Attach any explanations to this checklist. Lack of information could delay a USACE permit determination.
2. All references to “work” include all work associated with the project construction and operation. Work includes filling, clearing, flooding, draining, excavation, dozing, stumping, etc.
3. See GC 3 for information on single and complete projects.
4. Contact USACE at (978) 318-8832 with any questions.
5. The information requested below is generally required in the NHDES Wetland Application. See page 61 for NHDES references and Admin Rules as they relate to the information below.

1. Impaired Waters	Yes	No
1.1 Will any work occur within 1 mile upstream in the watershed of an impaired water? See the following to determine if there is an impaired water in the vicinity of your work area. * https://nhdes-surface-water-quality-assessment-site-nhdes.hub.arcgis.com/ https://www.des.nh.gov/water/rivers-and-lakes/water-quality-assessment https://www4.des.state.nh.us/onestopdatamapper/onestopmapper.aspx	X	
2. Wetlands	Yes	No
2.1 Are there are streams, brooks, rivers, ponds, or lakes within 200 feet of any proposed work?	X	
2.2 Are there proposed impacts to tidal SAS, prime wetlands, or priority resource areas? Applicants may obtain information from the NH Department of Resources and Economic Development Natural Heritage Bureau (NHB) DataCheck Tool for information about resources located on the property at https://www4.des.state.nh.us/NHB-DataCheck/.	X	
2.3 If wetland crossings are proposed, are they adequately designed to maintain hydrology, sediment transport & wildlife passage?	X	
2.4 Would the project remove part or all of a riparian buffer? (Riparian buffers are lands adjacent to streams where vegetation is strongly influenced by the presence of water. They are often thin lines of vegetation containing native grasses, flowers, shrubs and/or trees that line the stream banks. They are also called vegetated buffer zones.)	X	
2.5 The overall project site is more than 40 acres?	X	
2.6 What is the area of the previously filled wetlands?	UNKNOWN	
2.7 What is the area of the proposed fill in wetlands?	24,318 SF	
2.8 What % of the overall project sire will be previously and proposed filled wetlands?	UNKNOWN	
3. Wildlife	Yes	No
3.1 Has the NHB & USFWS determined that there are known occurrences of rare species, exemplary natural communities, Federal and State threatened and endangered species and habitat, in the vicinity of the proposed project? (All projects require an NHB ID number & a USFWS IPAC determination.) NHB DataCheck Tool: https://www4.des.state.nh.us/NHB-DataCheck/. USFWS IPAC website: https://ipac.ecosphere.fws.gov/	X	

3.2 Would work occur in any area identified as either "Highest Ranked Habitat in N.H." or "Highest Ranked Habitat in Ecological Region"? (These areas are colored magenta and green, respectively, on NH Fish and Game's map, "2010 Highest Ranked Wildlife Habitat by Ecological Condition.") Map information can be found at: • PDF: https://wildlife.state.nh.us/wildlife/wap-high-rank.html. • Data Mapper: www.granit.unh.edu. • GIS: www.granit.unh.edu/data/downloadfreedata/category/databycategory.html.	X	
3.3 Would the project impact more than 20 acres of an undeveloped land block (upland, wetland/waterway) on the entire project site and/or on an adjoining property(s)?		X
3.4 Does the project propose more than a 10-lot residential subdivision, or a commercial or industrial development?		X
3.5 Are stream crossings designed in accordance with the GC 31?	X	
4. Flooding/Floodplain Values	Yes	No
4.1 Is the proposed project within the 100-year floodplain of an adjacent river or stream?	X	
4.2 If 4.1 is yes, will compensatory flood storage be provided if the project results in a loss of flood storage?		X
5. Historic/Archaeological Resources		
For a minimum, minor or major impact project - a copy of the RPR Form (www.nh.gov/nhdhr/review) with your DES file number shall be sent to the NH Division of Historical Resources as required on Page 37 GC 14(d) of the GP document**	X	
6. Minimal Impact Determination (for projects that exceed 1 acre of permanent impact)	Yes	No
Projects with greater than 1 acre of permanent impact must include the following: • Functional assessment for aquatic resources in the project area. • On and off-site alternative analysis. • Provide additional information and description for how the below criteria are met.		
6.1 Will there be complete loss of aquatic resources on site?		X
6.2 Have the impacts to the aquatic resources been avoided and minimized to the greatest extent practicable?	X	
6.3 Will all aquatic resource function be lost?		X
6.4 Does the aquatic resource (s) have regional significance (watershed or ecoregion)?	X	
6.5 Is there an on-site alternative with less impact?		X
6.6 Is there an off-site alternative with less impact?		X
6.7 Will there be a loss to a resource dependent species?		X
6.8 Are indirect impacts greater than 1 acre within and adjacent to the project area?		X
6.9 Does the proposed mitigation replace aquatic resource function for direct, indirect, and cumulative impacts?	X	

*Although this checklist utilizes state information, its submittal to USACE is a federal requirement.

** If your project is not within Federal jurisdiction, coordination with NH DHR is not required under Federal law.

1.1 Will any work occur within 1 mile upstream in the watershed of an impaired water?

Bowers Pond (AUID: NHLAK700061001-04-02) is located within the project area and is listed as impaired for iron (aquatic life integrity) on the NHDES 2020/2022 303(d) List (most recent available).

The proposed project is also located within one mile upstream from Harris Pond (AUID: NHLAK700061001-04-01). Harris Pond is located downstream (east) of the project area, below the Bowers Dam and upstream from the Harris Dam along Pennichuck Brook. According to the NHDES 2020/2022 303(d) List, Harris Pond is impaired for cyanobacteria hepatotoxic microcystins (primary contact recreation) and iron (aquatic life integrity).

The Merrimack River is located east of the 13761A project area. The portion of the Merrimack River located within one mile of the project area (NHRIV700061002-13) is not included on the NHDES 2020/2022 303(d) List.

Four stormwater treatment BMP areas are proposed along the 13761A project that will treat a total of 14.8 acres of impervious pavement surfaces. The proposed project is not anticipated to cause or contribute to surface water impairments.

2.1 Are there streams, brooks, rivers, ponds, or lakes within 200 feet of any proposed work?

The existing F.E. Everett Turnpike crosses Pennichuck Brook (aka Bowers Pond) in the middle of the 13761A project corridor. The existing crossing consists of two 87-foot-long single span bridges carrying the northbound and southbound barrels of the turnpike. The crossing structure also includes two causeways along the northern and southern approaches that are approximately 200 feet to 250 feet long, 75 feet wide, and 12 feet high.

2.2 Are there proposed impacts to tidal SAS, prime wetlands, or priority resource areas?

Delineated wetlands W-4 and W-6 are adjacent to Pennichuck Brook and are also located within the FEMA mapped 100-year floodplain associated with Pennichuck Brook. Therefore, under the NHDES Wetland Rules these wetlands are identified as floodplain wetlands adjacent to a Tier 3 watercourse, a Priority Resource Area type. There are approximately 2,100 square feet of permanent impacts and 1,145 SF of temporary impacts to W-6 associated with the proposed roadway widening, alignment shifts, drainage outlet construction, construction access, and installation of perimeter controls. W-4 is located in Nashua and is adjacent to Pennichuck Brook. In Nashua the surface water of Pennichuck Brook and contiguous wetlands have been designated as Prime Wetlands. Impacts to W-4 were minimized to the maximum extent practicable, but approximately 242 square feet of temporary impacts are required for construction access and the installation of perimeter controls. Permanent impacts to W-4 have been avoided. The proposed project will require approximately 16,665 SF of permanent lacustrine surface water impacts (below OHW) within Pennichuck Brook located in Nashua. These impacts are considered Designated Prime Wetland impacts.

2.3 If wetland crossings are proposed, are they adequately designed to maintain hydrology, sediment transport, & wildlife passage?

The proposed project includes the replacement of the existing bridges carrying the F.E. Everett Turnpike over Pennichuck Brook. At the crossing location, Pennichuck Brook is an impoundment formed by Bowers Dam located downstream (east) of the project area. Water velocities through the structure are negligible. A Hydraulic Report with additional details has been prepared and is included with this permit application. The proposed structure will be constructed behind the existing abutments and the existing abutments and piles will be removed to a minimum depth of one foot below grade. The proposed bridge consists of a 100-foot, single span bridge with a 123-foot out-to-out width. The widening to accommodate the additional travel lanes will occur to the east side of the existing causeways. The proposed bridge structure also includes a two-foot-wide terrestrial wildlife shelf in front of both abutments. The wildlife shelves will tie into the 2:1 vegetated slopes along the causeways. The proposed bridge structure has been designed to adequately maintain and/or improve the hydrology, sediment transport, wildlife passage, and aquatic organism/fish passage of the crossing.

2.4 Would the project remove part or all of a riparian buffer?

The proposed project will require some vegetation clearing and removal adjacent to Pennichuck Brook to accommodate the proposed bridge replacement, roadway widening, and installation of stormwater BMPs. Tree clearing has been minimized to the maximum extent practicable, and impacts to the riparian buffer are located directly adjacent to the existing highway infrastructure along the edges of buffer areas.

3.1 Has the NHB & USFWS determined that there are known occurrences of rare species, exemplary natural communities, Federal and State threatened and endangered species and habitat, in the vicinity of the proposed project?

The US Fish and Wildlife Service Information for Planning and Consultation (IPaC) Tool Official Species List indicated that the proposed project area is within the documented range of the northern Long-eared bat (NLEB). The proposed project is anticipated to require approximately 11.2 acres of tree clearing. An acoustic survey for the 13761A project was conducted between July 21 through July 28, 2021. Four detectors were deployed for a total of seven nights, three of which experienced unsuitable weather conditions as defined by the USFWS Range-Wide Indiana Bat & Northern Long Eared Bat Summer Survey Guidelines (Survey Guidelines). Based on an analysis of the data collected during all seven nights, no acoustic files were manually identified as NLEB at any detector site. An inspection of both bridges (107/042 and 106/042) was completed on May 23, 2023, for evidence of use by bats and the Bridge/Structure Bat Assessment Form was completed. No evidence of bats (visual, audible, odor, staining, or guano) was observed. Since NLEB was not detected during the acoustic survey, it seems unlikely that NLEB would be present within the project area during the active season when tree clearing is proposed. Therefore, the project would be not likely to cause adverse effects on the NLEB. The NHDOT would implement the following measures to further minimize and avoid effects to NLEB:

- The project would only clear the trees necessary to achieve project objectives and would mark all trees prior to clearing; and
- The contractor would report any dead or sick bats.

Based on the information above, NHDOT is making a not likely to adversely affect determination on behalf of the Army Corps (the lead federal agency) for NLEB.

The NH Natural Heritage Bureau (NHB) reviewed the project area and identified documented records of the following species in the vicinity of the proposed project area (NHB23-0523):

- Bird-Foot Violet
- Clasping Milkweed
- Long-Spined Sandbur
- Blanding's Turtle
- Eastern Hognose Snake
- Northern Black Racer

A survey for bird's foot violet and clasping milkweed was completed by McFarland-Johnson, Inc. in September 2021. Based on coordination with NHB surveys were not required for the long-spined sandbur. Three populations of bird-foot violet were documented in the Contract A project area. No clasping milkweed was identified in the survey area. A population of bird's foot violet located on the west side of the turnpike (Population 3) will be impacted by the proposed project. Impacts to Populations 1 and 2 on the east side of the turnpike were avoided. Consultation with the NHB resulted in the recommendation of transplanting the impacted population to a new location between Populations 1 and 2. A transplanting protocol will be prepared based on NHB's recommendations, which will be included in the construction contract.

The following measures will be implemented to avoid or minimize impacts to wildlife species:

- All manufactured erosion and sediment control products, with the exception of turf reinforcement mats, utilized for, but not limited to, slope protection, runoff diversion, slope interruption, perimeter control, inlet protection, check dams, and sediment traps shall not contain plastic, or multifilament or monofilament polypropylene netting or mesh with an opening size of greater than 1/8 inches.

- All observations of threatened or endangered species on the project site shall be reported to the NHFG nongame and endangered wildlife environmental review program by phone at 603-271-2461 and by email at NHFGreview@wildlife.nh.gov, with the email subject line containing the NHB DataCheck tool results letter assigned number, the project name, and the term Wildlife Species Observation.

- Photographs of the observed species and nearby elements of habitat or areas of land disturbance shall be provided to NHFG in digital format at the above email address for verification, as feasible.

- In the event a threatened or endangered species is observed on the project site during the term of the permit, the species shall not be disturbed, handled, or harmed in any way prior to consultation with NHFG and implementation of corrective actions recommended by NHFG.

- Site operators shall be allowed to relocate wildlife encountered if discovered within the active work zone if in direct harm from project activities. Wildlife shall be relocated in close proximity to the capture location but outside of the work zone and in the direction the individual was heading. NHFG shall be contacted immediately if this action occurs.

- NHFG, including its employees and authorized agents, shall have access to the property during the term of the permit.

3.1 Would work occur in any area identified as either "Highest Ranked Habitat in N.H." or "Highest Ranked Habitat in Ecological Region"? (These areas are colored magenta and green, respectively, on NH Fish and Game's map, "2010 Highest Ranked Wildlife Habitat by Ecological Condition.")

There is no "Highest Ranked Habitat in N.H" in the project area. However, almost the entire project corridor is bordered by "Highest Ranked Habitat in Ecological/Biological Region" to the east and west. The existing F.E. Everett Turnpike has fragmented these habitats. The proposed project is limited to widening of the existing infrastructure. The proposed impacts are located along the edges of these habitats and is not anticipated to result in additional fragmentation or a substantial loss or change in value of the habitat for wildlife.

4.1 Is the proposed project within the 100-year floodplain of an adjacent river or stream?

Portions of the proposed project are located within the 100-year floodplain of Pennichuck Brook.

4.2 If 4.1 is yes, will compensatory flood storage be provided if the project results in a loss of flood storage?

A hydraulic analysis was completed, and the proposed project is not anticipated to result in a loss of flood storage or a change in the base flood elevation of Pennichuck Brook. The water levels in the impoundment are controlled by the series of dams located upstream and downstream from the project area. Refer to the Hydraulic Report included with this submittal for additional information and the FEMA No-Rise Certification.

5. Historic/Archaeological Resources

The Request for Project Review (RPR) was sent to NH DHR and Section 106 consultation was carried out for the project. It was determined that the proposed project would have no adverse effect on known or potential cultural, historic, or archaeological resources. The No Adverse Effect memo is included with this submittal.

6.2 Have the impacts to the aquatic resources been avoided and minimized to the extent practicable?

Avoidance and minimization measures include refining and steepening roadway slopes to specifically avoid and minimize wetland and stream impacts. Stormwater treatment BMPs have also been incorporated into the design in order to treat runoff from additional pavement surfaces, thereby ensuring water quality of surface waters in the vicinity is maintained.

6.4 Does the aquatic resource (s) have regional significance (watershed or ecoregion)?

Pennichcuk Brook is a Designated Prime Wetland within the City of Nahsua. Pennichuck Brook also provides the drinking water supply for the City of Nashua and surrounding municipalities. The water supply intake is located downstream from the project area at the Supply Pond. Pennichuck Brook is not a Class A surface water or an Outstanding Resource Water.

Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: 13761A City/County: NASHUA Sampling Date: 7/28/2021

Applicant/Owner: NHDOT State: NH Sampling Point: W-4 WET

Investigator(s): SH / JT Section, Township, Range: Hillsborough County

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope %: 0-1

Subregion (LRR or MLRA): LRR R Lat: 42.8039 Long: -71.4991 Datum: NAD83

Soil Map Unit Name: Water (less than 40 acres) NWI classification: PFO1E

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**
Hydric Soil Present?	Yes X No ___	**within a Wetland? Yes** X **No** ___
Wetland Hydrology Present?	Yes X No ___	If yes, optional Wetland Site ID: W-4

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)	X Water-Stained Leaves (B9)	
X High Water Table (A2)	___ Aquatic Fauna (B13)	
X Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ 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 ___	Depth (inches): ___
Water Table Present?	Yes X	No ___	Depth (inches): 1
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes X **No** ___

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

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W-4 WET

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	65	Yes	FAC
2. *Pinus strobus*	15	No	FACU
3.			
4.			
5.			
6.			
7.			
	80	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Acer rubrum*	10	Yes	FAC
2. *Pinus strobus*	3	No	FACU
3. *Alnus incana*	1	No	FACW
4. *Clethra alnifolia*	20	Yes	FAC
5.			
6.			
7.			
	34	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Thelypteris palustris*	15	Yes	FACW
2. *Rubus hispidus*	7	No	FACW
3. *Osmundastrum cinnamomeum*	5	No	FACW
4. *Clethra alnifolia*	10	Yes	FAC
5. *Carex stricta*	5	No	OBL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	42	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	28	x 2 =	56
FAC species	105	x 3 =	315
FACU species	18	x 4 =	72
UPL species	0	x 5 =	0
Column Totals:	156 (A)		448 (B)

Prevalence Index = B/A = 2.87

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 Vegetation Strata:

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

Sapling/shrub – Woody plants 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 vines – 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.)

SOIL

Sampling Point W-4 WET

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

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-9	2.5Y 2.5/1	100					Loamy/Clayey	
9-11	10YR 2/2	100					Loamy/Clayey	
11-18	10YR 4/2	90	10YR 4/6	10	C	M	Sandy	Prominent redox concentrations

[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)
X Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ 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:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: 13761A City/County: NASHUA Sampling Date: 7/28/2021

Applicant/Owner: NHDOT State: NH Sampling Point: W-4 UPL

Investigator(s): SH / JT Section, Township, Range: Hillsborough County

Landform (hillside, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope %: 2-3

Subregion (LRR or MLRA): LRR R Lat: 42.8038 Long: -71.4991 Datum: NAD83

Soil Map Unit Name: Windsor loamy sand, 3 to 8 percent slopes NWI classification: UPL

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 ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

If yes, optional Wetland Site ID: ___

Remarks: (Explain alternative procedures here or in a separate report.)

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)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ 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)
- ___ 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)
- ___ 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:

VEGETATION – Use scientific names of plants.

Sampling Point: W-4 UPL

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	10	No	FAC
2. *Pinus strobus*	25	Yes	FACU
3. *Quercus rubra*	20	Yes	FACU
4. *Quercus alba*	15	No	FACU
5. *Betula papyrifera*	5	No	FACU
6. *Castanea dentata*	5	No	UPL
7.			
	80	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Pinus strobus*	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Pinus strobus*	3	No	FACU
2. *Quercus rubra*	5	Yes	FACU
3. *Lysimachia borealis*	2	No	FAC
4. *Maianthemum canadense*	2	No	FACU
5. *Vaccinium angustifolium*	10	Yes	FACU
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	22	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	12	x 3 =	36
FACU species	100	x 4 =	400
UPL species	5	x 5 =	25
Column Totals:	117 (A)		461 (B)

Prevalence Index = B/A = 3.94

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 Vegetation Strata:

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

Sapling/shrub – Woody plants 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 vines – 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.)

SOIL

Sampling Point W-4 UPL

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/1	100					Sandy	
7-18	10YR 3/4	100					Loamy/Clayey	

[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)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ 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:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: 13761A City/County: MERRIMACK Sampling Date: 7/28/2021

Applicant/Owner: NHDOT State: NH Sampling Point: W-6 WET

Investigator(s): SH / JT Section, Township, Range: Hillsborough County

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope %: 0-1

Subregion (LRR or MLRA): LRR R Lat: 42.8059 Long: -71.4985 Datum: NAD83

Soil Map Unit Name: Agawam fine sandy loam, 3 to 8 percent slopes NWI classification: PFO1E

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 ___	If yes, optional Wetland Site ID: W-6

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)	X Water-Stained Leaves (B9)
X High Water Table (A2)	___ Aquatic Fauna (B13)
X Saturation (A3)	___ Marl Deposits (B15)
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)
___ Sparsely Vegetated Concave Surface (B8)	

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ 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 ___	Depth (inches): ___
Water Table Present?	Yes X	No ___	Depth (inches): 5
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ___

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

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W-6 WET

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	60	Yes	FAC
2. *Pinus strobus*	20	Yes	FACU
3. *Nyssa sylvatica*	10	No	FAC
4.			
5.			
6.			
7.			
	90	=Total Cover	

Sapling/Shrub Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	15	Yes	FAC
2. *Clethra alnifolia*	7	Yes	FAC
3. *Quercus rubra*	5	No	FACU
4. *Corylus americana*	5	No	FACU
5.			
6.			
7.			
	32	=Total Cover	

Herb Stratum (Plot size: 5)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Dennstaedtia punctilobula*	65	Yes	UPL
2. *Osmundastrum cinnamomeum*	15	No	FACW
3. *Pinus strobus*	5	No	FACU
4. *Maianthemum canadense*	2	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	87	=Total Cover	

Woody Vine Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	15	x 2 =	30
FAC species	92	x 3 =	276
FACU species	37	x 4 =	148
UPL species	65	x 5 =	325
Column Totals:	209 (A)		779 (B)

Prevalence Index = B/A = 3.73

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 Vegetation Strata:

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

Sapling/shrub – Woody plants 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 vines – 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.)

SOIL

Sampling Point W-6 WET

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 %	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5Y 2.5/1	100					Loamy/Clayey	
2-5	10YR 2/2	100					Loamy/Clayey	
5-16	10YR 4/2	80	10YR 4/4	20	C	PL/M	Loamy/Clayey	Distinct redox concentrations

[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)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ? Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ 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:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: 13761A City/County: MERRIMACK Sampling Date: 7/28/2021

Applicant/Owner: NHDOT State: NH Sampling Point: W-6 UPL

Investigator(s): SH / JT Section, Township, Range: Hillsborough County

Landform (hillside, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope %: 2-3

Subregion (LRR or MLRA): LRR R Lat: 42.806 Long: -71.4986 Datum: NAD83

Soil Map Unit Name: Agawam fine sandy loam, 3 to 8 percent slopes NWI classification: UPL

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 ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

If yes, optional Wetland Site ID: ___

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)	X Water-Stained Leaves (B9)
___ High Water Table (A2)	___ Aquatic Fauna (B13)
___ Saturation (A3)	___ Marl Deposits (B15)
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)
___ Sparsely Vegetated Concave Surface (B8)	

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ 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)
- ___ 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 X	No ___	Depth (inches): 15

Wetland Hydrology Present? **Yes** ___ **No** X

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

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: W-6 UPL

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	20	Yes	FAC
2. *Pinus strobus*	50	Yes	FACU
3. *Tsuga canadensis*	7	No	FACU
4. *Quercus rubra*	5	No	FACU
5.			
6.			
7.			
	82	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Quercus rubra*	5	Yes	FACU
2. *Corylus americana*	10	Yes	FACU
3. *Alnus incana*	2	No	FACW
4. *Acer rubrum*	2	No	FAC
5. *Prunus serotina*	1	No	FACU
6.			
7.			
	20	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Dennstaedtia punctilobula*	50	Yes	UPL
2. *Rubus hispidus*	10	No	FACW
3. *Mitchella repens*	10	No	FACU
4. *Maianthemum canadense*	5	No	FACU
5. *Lysimachia borealis*	2	No	FAC
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	77	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
		=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: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 20.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	12	x 2 =	24
FAC species	24	x 3 =	72
FACU species	93	x 4 =	372
UPL species	50	x 5 =	250
Column Totals:	179 (A)		718 (B)

Prevalence Index = B/A = 4.01

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 Vegetation Strata:

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

Woody vines – 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.)

SOIL

Sampling Point W-6 UPL

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-11	10YR 2/1	100					Loamy/Clayey	
11-20	10YR 5/4	100					Loamy/Clayey	

[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)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ 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:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

Photographs

Photo 1: W-4 PFO Wetland adjacent to Pennichuck Brook in Nashua – Prime Wetland & PRA (July 2021) IMPACT AREA: TB

Photo 2: W-6 PFO adjacent to Pennichuck Brook in Merrimack – PRA (July 2021) IMPACT AREA: F / G / TH / TI

Photo 3: W-5 PFO Wetland – NO IMPACTS (July 2021)

Photo 4: W-7 PFO Wetland – NO IMPACTS (July 2021)

Photo 5: W-3 PFO Wetland – NO IMPACTS (July 2021)

Photo 6: Pennichuck Brook Crossing SE Bridge Quadrant (May 2023) IMPACT AREA: A / B

Photo 7: Pennichuck Brook Crossing Southern Abutment (May 2023) IMPACT AREA: A

Photo 8: Pennichuck Brook Crossing facing North from SE Bridge Quadrant (May 2023) IMPACT AREA: C / D / TD

Photo 9: Pennichuck Brook Crossing facing North from SW Bridge Quadrant (May 2023) IMPACT AREA: D / E/ TD / TF

Photo 10: Pennichuck Brook Crossing Southern Abutment facing East (May 2023) IMPACT AREA: A

Photo 11: SW Bridge Quadrant Causeway Slope (May 2023) IMPACT AREA: A / TC

Photo 12: NE Bridge Quadrant Causeway Slope (May 2023) IMPACT AREA: C/ D

Photo 13: NE Bridge Quadrant Causeway Slope (May 2023) IMPACT AREA: D

Photo 14: Northern Bridge Abutment NE Bridge Quadrant facing West (May 2023) IMPACT AREA: D

Photo 15: Northern Bridge Abutment NW Bridge Quadrant facing East (May 2023) IMPACT AREA: D

Photo 16: SW Bridge Quadrant from NW Bridge Quadrant facing South (May 2023) IMPACT AREA: A / TC / TD

Photo 17: NW Bridge Quadrant Existing Causeway Slope (May 2023) IMPACT AREA: TF / TG / D

Photo 18: NW Bridge Quadrant (May 2023) IMPACT AREA: E / TF / D

Photo 19: Pennichuck Brook STA 790 + 00 (September 2016) IMPACT AREA: TA

Photo 20: Pennichuck Brook (September 2016) Impact Area: TE

Construction Sequence

ANTICIPATED PROJECT CONSTRUCTION SEQUENCING

TEMPORARY LANE USE WIDTHS (MINIMUM):
F.E. EVERETT TURNPIKE = 4' SHOULDER* / 12' TRAVEL LANE / 12' TRAVEL LANE / 4' SHOULDER*
RAMPS = 2' SHOULDER / 12' TRAVEL LANE / 2' SHOULDER
* MINIMUM SHOULDER WIDTH AT PENNICHUCK BROOK BRIDGE IS 3'.

GENERAL TRAFFIC CONTROL NOTES

1. REFER TO NHDOT WORK ZONE TRAFFIC CONTROL STANDARD PLANS FOR TYPICAL SIGN LAYOUTS. SIGNS SHALL NOT BLOCK OTHER ROADWAY SIGNS. REFER TO MUTCD FOR CONDITIONS NOT ADDRESSED BY THE STANDARD PLANS.

2. ALL TEMPORARY TRAFFIC LANES ALONG MAINLINE AND RAMPS SHALL BE A MINIMUM OF 12 FEET IN WIDTH UNLESS OTHERWISE NOTED. PLACE ALL TEMPORARY PAVEMENT MARKINGS, SYMBOLS AND WORDS IN ACCORDANCE WITH NHDOT STANDARD PLANS, STANDARD NOS. PM-1 THROUGH PM-15.

3. ALL PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (ITEM 606.417) SHALL HAVE SLOTTED BOTTOM.

4. TWO LANES OF TRAFFIC WILL BE MAINTAINED AT ALL TIMES ALONG THE F.E.E.T. NORTHBOUND AND SOUTHBOUND UNLESS OTHERWISE NOTED.

5. IMPACT ATTENUATORS (ITEM 606.9523) AND START OF PORTABLE CONCRETE BARRIER (ITEM 606.417) MUST BE ILLUMINATED AT ALL TIMES.

6. THE CONTRACTOR SHALL LIMIT THE AREA OF DISTURBANCE COMMENSURATE WITH THE CONTRACTOR’S CAPABILITIES AND PROGRESS IN KEEPING GRADING, MULCHING, SEEDING AND UTILIZING TEMPORARY AND PERMANENT EROSION CONTROL MEASURES CONCURRENT WITH OPERATIONS. EARTHWORK STOCKPILES ARE TO BE SEEDED AND MULCHED AND HAVE SILT FENCE INSTALLED ON THE DOWNSLOPE SIDE.

7. INSTALL DRAINAGE SYSTEMS, PIPES, CULVERTS, DITCHES AND TEMPORARY EROSION CONTROL PROTECTIONS IN A SEQUENCE FROM OUTLET TO INLET IN ORDER TO STABILIZE AREAS BEFORE RUNOFF IS DIRECTED TO THEM.

8. THE FINAL SURFACE COURSE OF PAVEMENT AND FINAL STRIPING IS ASSUMED TO BE PLACED AFTER THE FINAL CONSTRUCTION PHASE. FINAL PAVING AND STRIPING IS ASSUMED TO BE COMPLETED USING TEMPORARY LANE CLOSURES.

9. TRANSITION FROM ONE PHASE TO THE NEXT SHALL BE CONDUCTED WITH TEMPORARY LANE CLOSURES DURING NIGHT WORK OR OFF-PEAK HOURS. THIS INCLUDES BUT NOT LIMITED TO: REMOVING EXISTING MARKINGS, MOVING BARRIER, AND INSTALLING TRAFFIC CONTROL SIGNS.

10. EXISTING SIGNS IN CONFLICT WITH TRAFFIC CONTROL SHALL BE COVERED.

11. EXISTING LIGHTING SHALL BE USED WHEN APPLICABLE DURING CONSTRUCTION PHASING.

12. THE USE OF SAND BARRELS AS CRASH ATTENUATORS WILL NOT BE ALLOWED DURING WINTER.

13. IN AREAS WHERE THE TEMPORARY WIDENING IS LOWER THAN THE FINAL CONDITION ADDITIONAL CRUSHED STONE (FINE) WILL BE UTILIZED TO PROVIDE A MINIMUM OF 12 INCHES OF CRUSHED STONE.

14. ALL TEMPORARY PAVEMENT AND EARTHWORK REQUIRED FOR TEMPORARY WIDENING WILL BE FULLY
REMOVED AND PROPOSED ULTIMATE CONDITION WILL BE RESTORED.

15. CONTRACTOR MAY CONSTRUCT CONSTRUCTION ACCESS TO THE WORK ZONES. THE LOCATION OF THE CONTRUCTION ACCESS SHALL BE DETERMINED ON SITE WITH APPROVAL FROM THE RESIDENT.

TRAFFIC CONTROL NOTES (NORTHBOUND AND SOUTHBOUND)

PHASE 1:

SOUTHBOUND:
1. UTILIZE SHORT-TERM OUTSIDE LANE CLOSURE TO PLACE 2% SHIM ON OUTSIDE SHOULDER.

2. SHIFT TRAFFIC TOWARDS OUTSIDE AND MAINTAIN TRAFFIC WITH 4-FOOT SHOULDERS.

3. UTILIZE SHORT-TERM INSIDE LANE CLOSURE TO PLACE TEMPORARY BARRIER ADJACENT TO INSIDE SHOULDER.

NORTHBOUND:
1. UTILIZE SHORT-TERM OUTSIDE LANE CLOSURE TO PLACE 2% SHIM ON OUTSIDE SHOULDER.

2. SHIFT TRAFFIC TOWARDS OUTSIDE AND MAINTAIN TRAFFIC WITH 4-FOOT SHOULDERS.

3. UTILIZE SHORT-TERM INSIDE LANE CLOSURE TO PLACE TEMPORARY BARRIER ADJACENT TO INSIDE SHOULDER.

AREA OF CONSTRUCTION:
1. REMOVE EXISTING MEDIAN BARRIER.

2. CONSTRUCT TEMPORARY PAVEMENT IN MEDIAN.

PHASE 2:

SOUTHBOUND:
1. MAINTAIN TRAFFIC IN PREVIOUS CONFIGURATION.

NORTHBOUND:
1. UTILIZE SHORT-TERM LANE CLOSURE TO REMOVE TEMPORARY BARRIER ON INSIDE MEDIAN.

2. SHIFT TRAFFIC TOWARDS INSIDE SHOULDER AND MAINTAIN TRAFFIC WITH 4-FOOT SHOULDERS.

3. UTILIZE SHORT-TERM OUTSIDE LANE CLOSURE TO PLACE TEMPORARY BARRIER ADJACENT TO OUTSIDE SHOULDER.

AREA OF CONSTRUCTION:
1. EXCAVATE FOR AND CONSTRUCT STORMWATER BASINS 788, 814, AND 821 AND RELATED PIPE CROSSINGS.

2. CONSTRUCT ACCESS ROADS FOR BRIDGE CONSTRUCTION.

3. CONSTRUCT EASTERN PORTION OF NEW BRIDGE.

4. CONSTRUCT NORTHBOUND PERMANENT AND TEMPORARY ROADWAY WIDENING. PAVE OUTSIDE AND MIDDLE LANE TO TOP OF BINDER, SHOULDER AND WIDENING TO TEMPORARY CROSS SLOPE.

5. CONSTRUCT EXIT 10 NORTHBOUND OFF-RAMP AND REMOVE REMAINING TOLL FACILITY INFRASTRUCTURE.

6. INSTALL NORTHBOUND GUARDRAIL WHERE SHOWN.

7. CONSTRUCT NORTHBOUND DITCHES AND BERMS.

8. CONSTRUCT PERMANENT NORTHBOUND DITCHLINE DRAINAGE.

PHASE 3:

SOUTHBOUND:
1. MAINTAIN TRAFFIC IN PREVIOUS CONFIGURATION.

NORTHBOUND:

1. UTILIZE SHORT-TERM OUTSIDE LANE CLOSURE TO REMOVE TEMPORARY BARRIER ADJACENT TO OUTSIDE SHOULDER.

2. SHIFT NORTHBOUND TRAFFIC TO NEWLY CONSTRUCTED PAVEMENT AND BRIDGE AND

MAINTAIN TRAFFIC WITH 4-FOOT SHOULDERS.

3. UTILIZE SHORT-TERM INSIDE LANE CLOSURE TO PLACE TEMPORARY BARRIER ADJACENT TO NEW INSIDE SHOULDER.

AREA OF CONSTRUCTION:
1. EXCAVATE MEDIAN AND CONSTRUCT MEDIAN DRAINAGE.

2. CONSTRUCT NORTHBOUND HIGH SPEED LANE AND SHOULDER.

3. PAVE INSIDE LANE TO TOP OF BINDER, SHOULDER/ MEDIAN TO TEMPORARY CROSS SLOPE.

4. CONSTRUCT MIDDLE PORTION OF NEW BRIDGE.

PHASE 4:

SOUTHBOUND:
1. UTILIZE SHORT-TERM INSIDE LANE CLOSURE TO PLACE TEMPORARY BARRIER ON SHOULDER AND ADJACENT TO NORTHBOUND TRAVEL LANES.

2. SHIFT SOUTHBOUND TRAFFIC TOWARDS INSIDE SHOULDER AND DIVERT SOUTHBOUND TRAFFIC ONTO NORTHBOUND BARREL AND NEWLY CONSTRUCTED BRIDGE STRUCTURE.

3. UTILIZE SHORT-TERM OUTSIDE LANE CLOSURE TO PLACE TEMPORARY BARRIER ADJACENT TO OUTSIDE SHOULDER.

NORTHBOUND:
1. MAINTAIN TRAFFIC IN PREVIOUS CONFIGURATION.

AREA OF CONSTRUCTION:
1. EXCAVATE FOR AND CONSTRUCT STORMWATER BASIN 867.

2. CONSTRUCT WESTERNMOST (SOUTHBOUND SIDE) PORTION OF BRIDGE STRUCTURE.

3. ON SOUTHBOUND SIDE EXCAVATE FOR AND CONSTRUCT PERMANENT WIDENING AND PAVEMENT ALONG FULL WIDTH OF ROADWAY FROM STA. 778+00+/- TO STA. 870+00+/-.

4. CONSTRUCT PERMANENT DRAINAGE IN THE SOUTHBOUND OUTSIDE DITCHLINE.

5. CONSTRUCT FOUNDATIONS FOR NEW CANTILEVER SIGN STRUCTURES ON SOUTHBOUND SIDE.

6. CONSTRUCT EXIT 10 SOUTHBOUND ON-RAMP AND REMOVE REMAINING TOLL FACILITY INFRASTRUCTURE.

7. INSTALL GUARDRAIL ON SOUTHBOUND SIDE WHERE SHOWN.

PHASE 5:

SOUTHBOUND:
1. UTILIZE SHORT-TERM OUTSIDE LANE CLOSURE TO REMOVE TEMPORARY BARRIER ON OUTSIDE SHOULDER.

2. SHIFT SOUTHBOUND TRAFFIC TOWARDS OUTSIDE SHOULDER AND ONTO THE NEWLY CONSTRUCTED TWO OUTSIDE LANES.

3. UTILIZE SHORT-TERM INSIDE LANE CLOSURE TO PLACE TEMPORARY BARRIER ADJACENT TO SHOULDER.

NORTHBOUND:
1. MAINTAIN TRAFFIC IN CURRENT CONFIGURATION.

AREA OF CONSTRUCTION:
1. CONSTRUCT PERMANENT PAVEMENT BARRIER IN MEDIAN.

2. CONSTRUCT REMAINING PORTION OF BRIDGE STRUCTURE.

3. PAVE INSIDE SHOULDERS TO PERMANENT CROSS SLOPE.

PHASE 6:

SOUTHBOUND AND NORTHBOUND:
1. UTILIZE SHORT-TERM INSIDE LANE CLOSURES TO REMOVE TEMPORARY BARRIER FROM NORTHBOUND AND SOUTHBOUND INSIDE SHOULDERS.

2. SHIFT TRAFFIC TO NEWLY CONSTRUCTED INSIDE SHOULDERS AND LANES.

AREA OF CONSTRUCTION:
1. REMOVE TEMPORARY PAVEMENT AND RESHAPE SLOPES TO FINAL GRADES.

2. INSTALL/RESET FINAL GUARDRAIL ON OUTSIDE SHOULDERS.

PHASE 7:

1. OPEN TRAFFIC UP TO NEW LANE CONFIGURATION.

AREA OF CONSTRUCTION:
1. PLACE FINAL SURFACE COURSE UNDER NIGHTLY LANE CLOSURES.

Turbidity Mixing Zone Designation

TURBIDITY MIXING ZONE DESIGNATION

When implementing this mixing zone, turbidity in Bowers Pond as needed for in-water work and construction discharges, it shall be monitored, and controlled as follows to meet New Hampshire Surface Water Quality Standards Env-Wq 1703.11. Such mixing zones shall meet the criteria in New Hampshire Surface Water Quality Standards Env-Wq 1707.02.

1. **Consistency with Env-Wq 1707.02 Criteria for Approval of Mixing Zones:**
   The NHDES may only approve a mixing zone if it:

   (a) *Meets the criteria in Env-Wq 1703.03(c)(1),*
   Adherence to this procedure, environmental commitments made for this project, the contract documents, as applicable, and all necessary environmental permits ensures that the criteria of this rule are met. Any potential impacts shall be limited to a short duration, and low intensity. Additional detail may be found in the **Compliance Summary** section (9) below.

   (b) *Does not interfere with biological communities or populations of indigenous species,*
   Adherence to this procedure, environmental commitments made for this project, the contract documents, as applicable, and all necessary environmental permits ensures that the criteria of this rule are met. Any potential impacts shall be limited to a short duration, and low intensity. Additional detail may be found in the **Compliance Summary** section (9) below.

   (c) *Does not result in the accumulation of pollutant s in the sediment or biota,*
   Adherence to this procedure, environmental commitments made for this project, the contract documents, as applicable, and all necessary environmental permits ensures that the criteria of this rule are met. Additional detail may be found in the **Compliance Summary** section (9) below.

   (d) *Allows a zone of passage for swimming and drifting organisms,*
   Adherence to this procedure, environmental commitments made for this project, the contract documents, as applicable, and all necessary environmental permits ensures that the criteria of this rule are met. Any potential impacts shall be limited to a short duration, and low intensity. Additional detail may be found in the **General Conditions** section (2), and **Compliance Summary** section (9) below.

   (e) *Does not interfere with existing and designated uses of the surface water,*
   Adherence to this procedure, environmental commitments made for this project, the contract documents, as applicable, and all necessary environmental permits ensures that the criteria of this rule are met. Additional detail may be found in the **Compliance Summary** section (9) below.

   (f) *Does not impinge upon spawning grounds or nursery areas, or both, of any indigenous aquatic species,*
   Adherence to this procedure, environmental commitments made for this project, the contract documents, as applicable, and all necessary environmental permits ensures that the criteria of this rule are met. Additional detail may be found in the **General Conditions** section (2), and **Compliance Summary** section (9) below.

(g) *Does not result in the mortality of any plants, animals, humans, or aquatic life within the mixing zone,*
Adherence to this procedure, environmental commitments made for this project, the contract documents, as applicable, and all necessary environmental permits ensures that the criteria of this rule are met. Additional detail may be found in the **General Conditions** section (2), and **Compliance Summary** section (9) below.

(h) *Does not exceed the chronic toxicity value of 1.0 TUc at the mixing zone boundary; and*
This criterion is not applicable to this mixing zone, which is only designated for short term, low intensity turbidity.

(i) *Does not result in an overlap with another mixing zone.*
This mixing zone does not overlap with another mixing zone.

2. General Conditions:

a. All proposed monitoring for turbidity in the waterbody during in-water work, as needed, shall be completed by a qualified Contractor approved by NHDOT and shall be conducted in accordance with the specifications below.
b. All turbidity monitoring measurements, and visual monitoring (with photo documentation) shall be conducted as described in sections below.
c. With NHDOT approval, turbidity measurements using turbidity meters or probes do not need to be made if the Contractor believes that it would be unsafe for personnel to collect turbidity measurements due to conditions such as high-water velocity and/or icy conditions. In these instances, NHDES shall be notified consistent with the **Notification** section (8) below.
d. At the discretion of NHDOT, the use of this mixing zone may be suspended and/or started on an as needed basis. NHDES shall be notified consistent with the **Notification** section (8) below.
e. The proposed mixing zone area will extend from the discharge location to Monitoring Station P-3 as shown in the figure below in Section 3. All in-water work will be conducted in discrete work zones that will not cause a visible turbid plume that would span the entire width of the pond at any given time. A zone of passage from the discharge location to Monitoring Station P-1 shall be maintained by implementing the monitoring program described in Section 3 below and implementing the **Required Actions to Control Turbidity** section (4) below.

3. Monitoring Stations and Monitoring Frequency:

Markers (buoys or similar devices) shall be set up in the waterbody at the locations, and monitored, as described below:

a. **Background (B-1):** A marker designating the background station shall be placed in the waterbody sufficient distance away from the work site in an area not disturbed by the construction activity. The purpose of this station is to provide baseline/background turbidity information. Visual observations with photo-documentation and in-water turbidity measurements shall be taken as follows, each day that in-water work is conducted under this mixing zone, and/or when any construction activity is undertaken that could potentially result in increased in-water turbidity:
   i. Daily prior to the commence of in-water work.

   ii. Midday while in-water work is being performed; and
   iii. Daily at the conclusion of in-water work.

b. **Pond 1 (P-1):** A marker shall be placed 50 feet away from the work site in the pond. Aquatic organism passage will be assessed on a line from shore to shore at this location. During construction activities that could potentially result in increased in-water turbidity, visual monitoring shall take place every hour.

c. **Pond 2 (P-2):** A marker shall be placed 100 feet away from the work site in the pond. During construction activities that could potentially result in increased in-water turbidity, monitoring for turbidity shall be conducted on a line from shore to shore at this location as follows:
   i. Visual Monitoring shall take place every hour.
   ii. Turbidity measurements shall be taken hourly if there is visible turbidity.

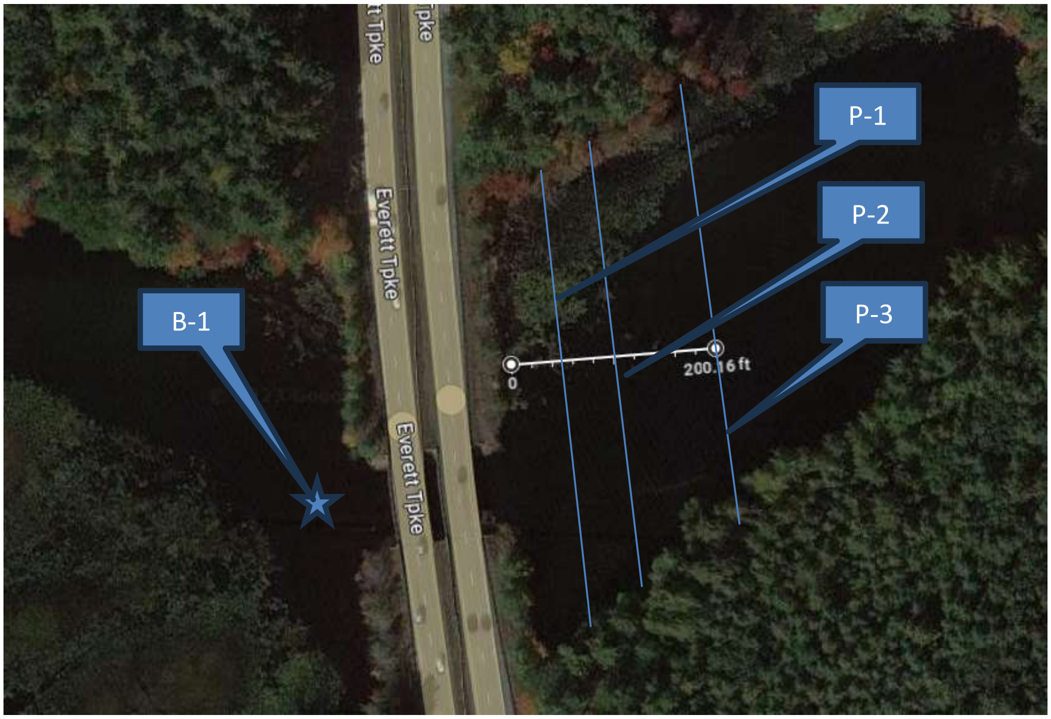
d. **Pond 3 (P-3):** A marker shall be placed 200 feet away from the work site in the pond. The purpose of this station is to designate the end of the mixing zone and determine compliance with turbidity-related surface water quality standards. At this location, there shall be no visible turbidity, or turbidity measurements in any part of the pond on a line from shore to shore that exceeds 10 NTUs above the measured background at B-1. During construction activities that could potentially result in increased in-water turbidity, monitoring for turbidity shall be conducted as follows:
   i. Visual monitoring with photo-documentation shall take place every hour.
   ii. Turbidity measurements shall be taken hourly if there is visible turbidity.
   iii. If there is visible turbidity at P-2, visual monitoring with photo-documentation and turbidity measurements shall be taken every hour at P-3 for a minimum of 2 hours after visible turbidity is observed at P-2.

4. **Required Actions to Control Turbidity:**

   a. **P-1:** If turbidity is visible in more than ¼ of the pond width at this station, work shall be assessed immediately to determine the cause of the increased turbidity, and corrective actions shall be taken to limit visible turbidity to no more than ¼ of the pond width. It is assumed that if turbidity is visible in more than ¼ of the pond width, the turbid discharge could be impacting aquatic organism passage.

   b. **P-2:** If turbidity is visible in any part of the pond on a line form shore to shore at this station, a turbidity measurement shall be taken. If turbidity is greater than 25 NTUs above background, work shall be assessed immediately to determine the cause of the increased turbidity, and corrective actions shall be taken. It is assumed that if there is visible turbidity at this station, there is a high potential that turbidity will not meet the turbidity water quality standard at P-3.

   c. **P-3:** If turbidity is visible in any part of the pond on a line from shore to shore at this compliance station, a turbidity measurement shall be taken within the turbid plume. If the turbidity measurement is greater than 10 NTUs above the background measurement at B-1, work shall be stopped and assessed immediately to determine the cause of the increased turbidity, and corrective actions shall be taken to bring turbidity levels to no more than 10 NTUs above the background measurement at B-1. A description of the corrective action(s) shall be included in a monitoring report. The report shall be provided to NHDES consistent with the **Notification** section (8) below.



5. **Meter Monitoring Protocols:**
   Field measurements of turbidity using turbidity meters shall comply with the following:
   a. Monitoring frequency at each location shall comply with item 2 above.
   b. Results for in water measurements, calibration and QA/QC shall be recorded on field data sheets, as well as the date, time, location, and the names of those conducting the monitoring.
   c. Sampling Procedures for Hand-held Meters
      i. Rinse the sampling container three times with water from the waterbody.
      ii. Submerge the sampling container a minimum of an arm's length upstream and allow the container to fill. Collect samples approximately one foot below the surface or at mid-depth (whichever is less) by placing a finger or thumb over the container opening, submersing the container to the appropriate depth, and then removing your finger or thumb from the container opening and allowing the container to fill.
      iii. Do not collect any water immediately adjacent to legs or boots.
      iv. Ensure that any introduced air bubbles are removed prior to analysis.
      v. Immediately cap the sample container, measure in the field using a turbidity meter and record results on the field data sheet.
   d. Sampling Procedures Using Dataloggers (Optional):
      i. Dataloggers can be used instead of hand-held meters to automatically collect the majority of near-continuous (i.e., every 15 minutes) turbidity measurements.
      ii. Dataloggers shall be calibrated according to manufacturer's instructions, with results recorded on the field data sheet.

iii. On the same day that dataloggers are deployed as well as prior to and on the same day that dataloggers are retrieved, hand-held turbidity measurements shall be made in the water next to the datalogger for comparison to datalogger results.
iv. Dataloggers shall be retrieved, data downloaded, recalibrated, and redeployed at least once every 2 weeks.
v. If dataloggers are used, hand-held turbidity meter measurements shall also be taken at least twice per day as a back-up in case the datalogger malfunctions and/or the data (which is downloaded at least once every 2 weeks) is later found to be invalid.

e. Quality Control and Quality Assurance
   i. Turbidity meters shall have an accuracy of + 2% for readings below 100 NTUs and + 3% for readings above 100 NTUs, and a resolution of $\pm$ 0.1 NTU. Prior to monitoring, meter specifications shall be provided to NHDOT for approval.
   ii. Hand-held meters shall be recalibrated daily with results recorded on the field data sheet.
   iii. Duplicate samples shall be taken for every 10th sample with results and identification of the duplicate sample clearly identified and recorded on the field data sheet. If the relative difference[1] between the duplicate measurement and the original measurement exceeds 10%, recalibrate the turbidity meter and re-measure turbidity.
   iv. Blank samples shall be taken every 10^{th} sample and recorded on the field data sheet. Blank samples shall be taken by filling a sample container with deionized water and measuring the turbidity immediately following measurement of the 10^{th} sample.

6. Visual Monitoring with Photo Documentation Protocols:

Visual monitoring for turbidity and photo documentation shall comply with the following:

a. Visual monitoring results shall be recorded on field data sheets. Field data sheets for visual monitoring shall include the names of the individual conducting the observations, the date, time, location, and result (i.e., visual turbidity or no visual turbidity) of each observation, and the date/time when work was ordered to be stopped and the date/time when work was allowed to resume.
b. Photos of each station shall be taken during each observation. Each photo shall include the date, time, and location.

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1 The relative percent difference (RPD) is equal to the following:

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100\%$$

where x_1 is the original sample concentration and x_2 is the replicate sample concentration

c. Photos must be taken from a location and angle that will clearly show visible turbidity should it occur. Use of drones for this purpose is allowed. Prior to construction, the Contractor shall provide photos of each monitoring location to NHDOT for approval proving that the proposed method to photograph conditions in-water will clearly show visible turbidity should it occur.

7. **Documentation, Notification and Reporting:**
    a. The Contractor shall maintain electronic copies of all field data sheets, datalogger data in MS Excel format (if dataloggers are used) and photos (with date, time, and location) and submit them to NHDOT and/or NHDES within 48 hours of receiving a request.
    b. Reports that include the results from the previous week shall be transmitted to NHDOT by Tuesday of the following week. The weekly reports shall include the following:
        i. If turbidity data was not collected, an explanation as to why and when it wasn't collected with supporting information (i.e., gage information showing high flows, photos showing ice build-up, etc.).
        ii. A summary of any data that was collected that did not meet the QA/QC requirements.
        iii. Turbidity meter results including the date, time, and location.
        iv. The dates, times, locations, and associated photos.
        v. The dates and times when work was stopped due to exceedances of any of the criteria above.
        vi. The dates, times, associated photos at each location and turbidity meter results, when work was allowed to resume.
        vii. The dates, times, and nature of corrective actions.
        viii. If dataloggers are used and retrieved the previous week, an MS Excel plot showing all datalogger results with NTUs on the y-axis and time/date on the x-axis.

8. **Notification:**
    a. NHDOT shall be notified **immediately** when turbidity measurements at the downstream mixing zone compliance station P-3 indicate that an exceedance of the surface water quality standard for turbidity has occurred.
    b. NHDES shall be notified **within 24 hours** when it is determined that monitoring cannot be conducted due to unsafe conditions.
    c. If use of this mixing zone has been suspended due to no work that could reasonably cause turbid conditions, or not yet started, NHDES shall be notified **within 24 hours** of the start or resumption of use of this mixing zone.
    d. NHDES shall be notified **within 24 hours** if a failure is discovered in maintaining a zone of passage during in-water work in accordance with General Condition 2e.
    e. Notifications relating to a non-compliance event (identified in Section 8a and 8d above) shall include:
        i. A description of the exceedance,
        ii. The probable cause of the exceedance,

   iii. Corrective actions that were taken, or that will be taken, to address the exceedance, and
   iv. An estimate of the amount of time needed until the exceedance is corrected, if not already corrected.
f. Notifications shall be submitted to the NHDES Water Quality Certification Program at wqc@des.nh.gov, and to James Tilley (Water Quality Certification Supervisor) at james.w.tilley@des.nh.gov, or (603) 271-0699.

9. **Compliance Summary:**
   a. At the mixing zone compliance station P-3, water quality standards for turbidity shall be met. If turbidity exceeds water quality standards (no more than 10 NTU above background), work shall be stopped, and corrective actions undertaken.
   b. Examples of corrective actions that may be taken by the Contractor, with approval of NHDOT include, but are not limited to:
      i. Work stoppage until turbidity at the end of the mixing zone P-3 returns to a compliant measurement,
      ii. Stabilizing any un-stabilized soil,
      iii. Modification of construction procedures,
      iv. Evaluation and correction of water quality control measures,
      v. Evaluation and correction of erosion and sediment controls (Stormwater Control Measures (SCM)),
      vi. Enhanced SCM deployment; and/or
      vii. Use of other SCMs.
   c. Expected in-water measurements of between 50 NTU and 10 NTU above background fall within a range of toxicity that is not acutely toxic to aquatic organisms, meaning that short durations of exposure are not detrimentally harmful.
   d. According to the EPA, "*All species of fish and other aquatic life must tolerate a range of dissolved solids concentrations in order to survive under natural conditions… Major increases in stream suspended solids (25 ppm [7 NTU] turbidity upstream versus 390 ppm [114 NTU] downstream) caused smothering of bottom invertebrates, reducing organism density to only 7.3 per square foot versus 25.5 per square foot upstream (Tebo, 1955)…"Quality Criteria for Water 1986, EPA, Publication 440/5-86-001, May 1, 1986 p270* (https://www.epa.gov/sites/default/files/2018-10/documents/quality-criteria-water-1986.pdf).
   e. NOAA reports here: Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region | NOAA Fisheries that, "S*tudies of the effects of turbid water on fish suggest that concentrations of suspended sediment can reach thousands of milligrams per liter [1,000 mg/L = 292 NTU] before an acute toxic reaction is expected (Burton 1993)"*
   f. The use of short duration construction turbidity mixing zones is limited to:
      i. Daily, only when needed;
      ii. Suspension at the completion of each day of work; and
      iii. Used only during active construction discharges and associated in-water construction operations.

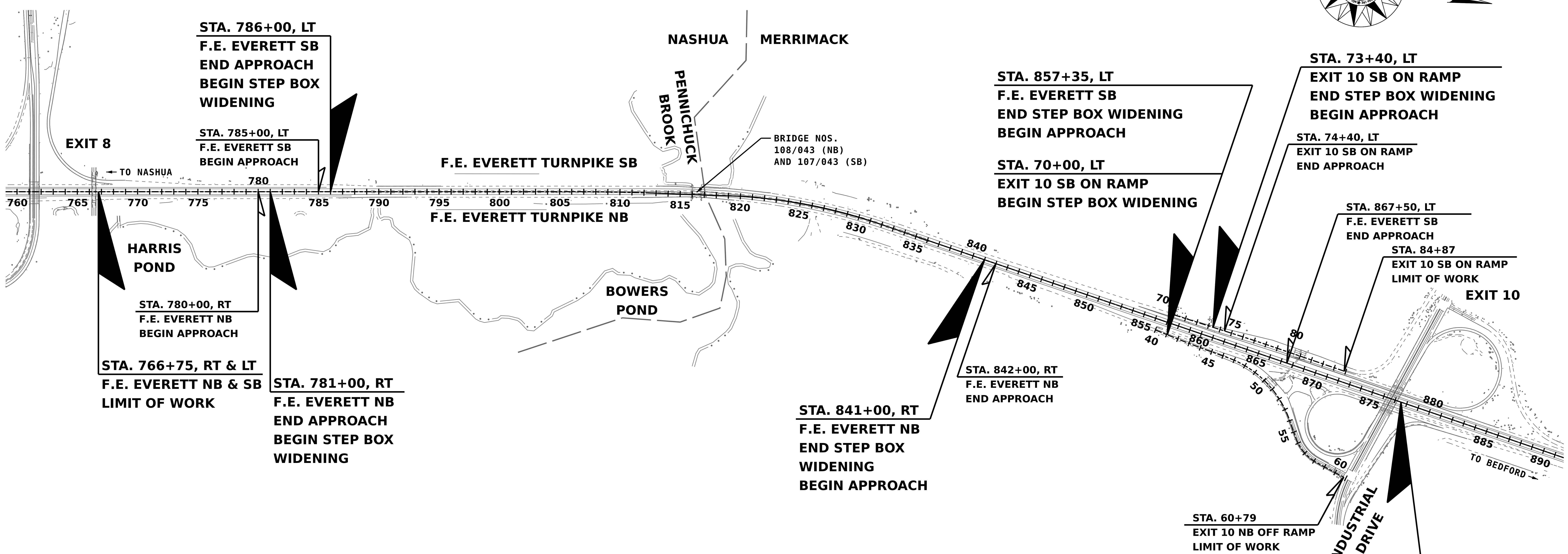
Wetland Impact and Erosion Control Plans

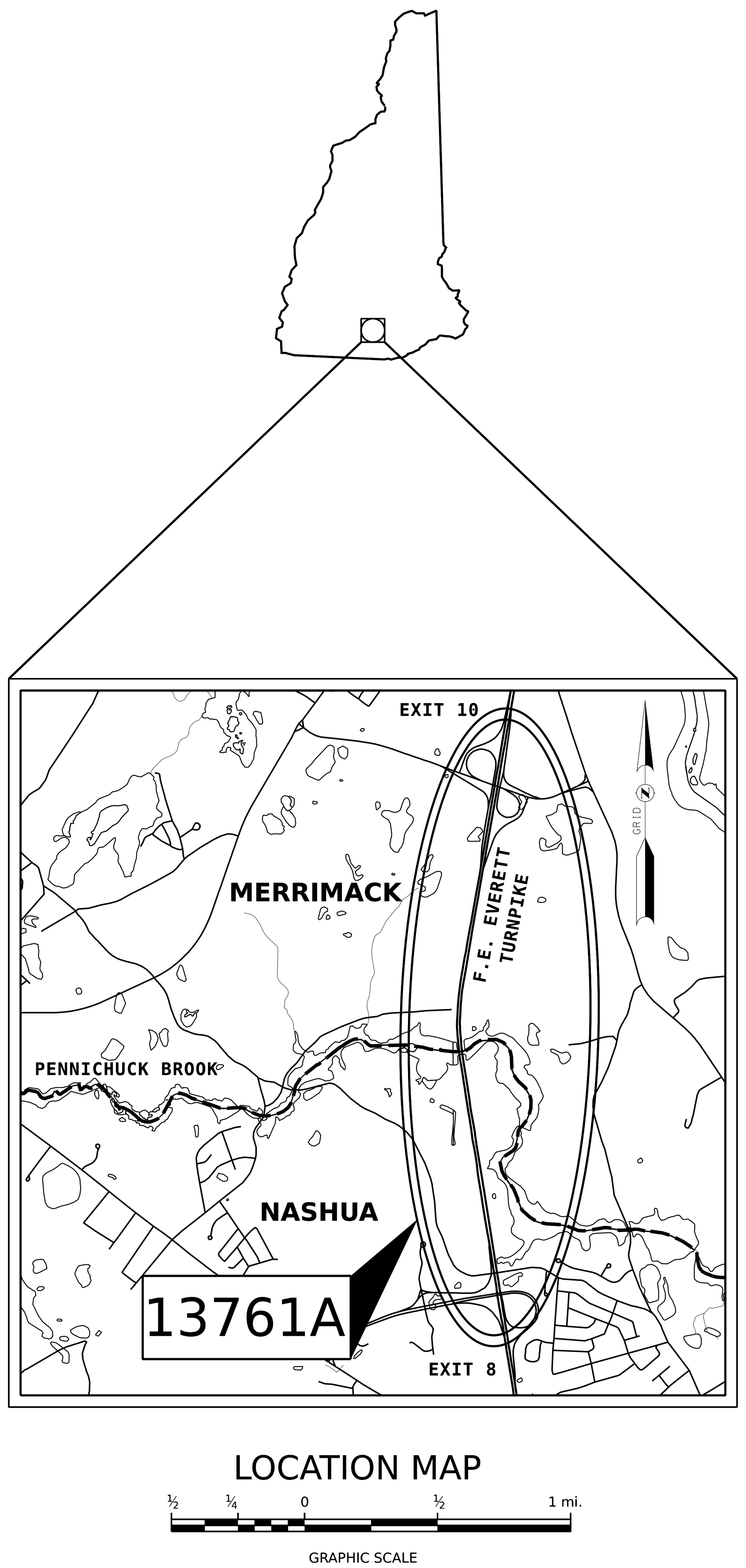
STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
WETLAND IMPACT PLANS

DESIGN DATA

F.E. EVERETT TURNPIKE NB		F.E. EVERETT TURNPIKE SB	
AVERAGE DAILY TRAFFIC 2024	38,000	AVERAGE DAILY TRAFFIC 2024	38,000
AVERAGE DAILY TRAFFIC 2044	48,000	AVERAGE DAILY TRAFFIC 2044	49,000
PERCENT OF TRUCKS	9%	PERCENT OF TRUCKS	9%
DESIGN SPEED	70 MPH	DESIGN SPEED	70 MPH
LENGTH OF PROJECT	6,200'	LENGTH OF PROJECT	8,400'
F.E. EVERETT TURNPIKE NB OFF RAMP		**F.E. EVERETT TURNPIKE SB ON RAMP**	
AVERAGE DAILY TRAFFIC 2024	14,000	AVERAGE DAILY TRAFFIC 2024	9,900
AVERAGE DAILY TRAFFIC 2044	17,000	AVERAGE DAILY TRAFFIC 2044	13,000
PERCENT OF TRUCKS	9%	PERCENT OF TRUCKS	9%
DESIGN SPEED	50 MPH	DESIGN SPEED	50 MPH
LENGTH OF PROJECT	2,080'	LENGTH OF PROJECT	1,772'

N.H. PROJECT NO. 13761A
F.E. EVERETT TURNPIKE CORRIDOR WIDENING PROJECT

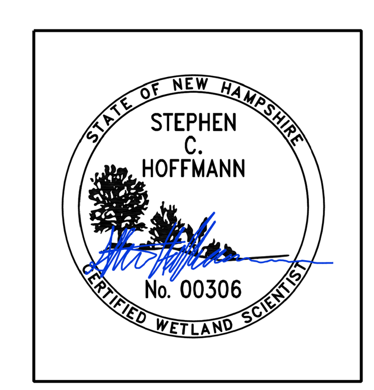


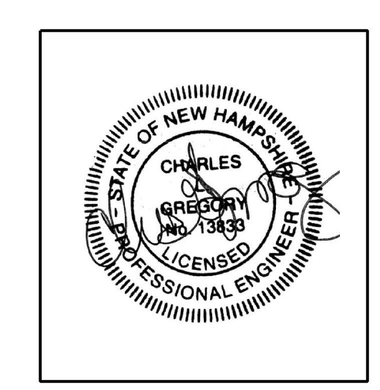


LOCATION MAP

INDEX OF SHEETS

DRAWN BY VHB TEAM DATE 11/10/2023
CHECKED BY DATE





CITY OF NASHUA & TOWN OF MERRIMACK

COUNTY OF HILLSBOROUGH

SCALE: 1"=500'

FOR CONSTRUCTION AND ALIGNMENT DETAILS - SEE CONSTRUCTION PLANS

vhb

NHDOT THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

RECOMMENDED FOR APPROVAL:

DIRECTOR OF PROJECT DEVELOPMENT — DATE

APPROVED:

ASSISTANT COMMISSIONER AND CHIEF ENGINEER — DATE

DRAWING NAME	FEDERAL PROJECT NO.	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_FSW		13761A	1	55

GENERAL

	PROPOSED ROADWAY	existing roadway	(pavement removed outside slope lines)
EDGE OF PAVEMENT			
TRAVELED WAY			

DRIVEWAYS — (label surface type)

BUILDINGS — (label house or type of building); (building to be removed)

FOUNDATION — (label type)

LEACH FIELD — leach field

BRIDGE CROSSINGS — STREAM; OVERPASS

STEPS AND WALK — (label type)

DITCH LINE

INTERMITTENT WATER COURSE/STREAM — ST

SHORE LINE — river/stream; pond; (label name of water body)

POTENTIAL WET AREA SYMBOL

BRUSH OR WOODS LINE

TREES (PLANS) — (deciduous); (coniferous); (stump)

TREE OR STUMP (CROSS-SECTIONS) — (show station, circumference in feet & type)

HEDGE — (label type)

MONITORING WELL — mon

WELL

FLAG POLE — fp

ORIGINAL GROUND (TYPICALS)

ROCK OUTCROP

ROCK LINE (TYPICALS & SECTIONS ONLY)

	existing	PROPOSED
GUARDRAIL (label type)	bgr; cgr	
JERSEY BARRIER		
CURB (LABEL TYPE)		
STONE WALL		
RETAINING WALL (LABEL TYPE)		(points toward retained ground)
FENCE (LABEL TYPE)		
SIGNS	(single post); (double post)	

GAS PUMP — gp

FUEL TANK (ABOVE GROUND) — ft (label size & type)

STORAGE TANK FILLER CAP — fc

SEPTIC TANK — S

GRAVE — gr

MAILBOX — mb

VENT PIPE — vp

SATELLITE DISH ANTENNA — da

PHONE — ph

GROUND LIGHT/LAMP POST — gl; lp

BORING LOCATION

TEST PIT

INTERSTATE NUMBERED HIGHWAY — 93

UNITED STATES NUMBERED HIGHWAY — 3

STATE NUMBERED HIGHWAY — 102

SHORELAND - WETLAND

WETLAND DESIGNATION AND TYPE	2 PUB2E
DELINEATED WETLAND	DW
ORDINARY HIGH WATER	OHW
TOP OF BANK	TOB
TOP OF BANK & ORDINARY HIGH WATER	TOBOHW
NORMAL HIGH WATER	NHW
WIDTH AT BANK FULL	WBF
PRIME WETLAND	PWET
PRIME WETLAND 100' BUFFER	PWET100
NON-JURISDICTIONAL DRAINAGE AREA	NJDA
COWARDIN DISTINCTION LINE	CDL
TIDAL BUFFER ZONE	TBZ
DEVELOPED TIDAL BUFFER ZONE	DTBZ
HIGHEST OBSERVABLE TIDE LINE	HOTL
MEAN HIGH WATER	MHW
MEAN LOW WATER	MLW
VERNAL POOL	VP
SPECIAL AQUATIC SITE	SAS
REFERENCE LINE	REF
WATER FRONT BUFFER	WB50
NATURAL WOODLAND BUFFER	NWB150
PROTECTED SHORELAND	PS250
INVASIVE SPECIES LABEL	I.S. I; I.S. II
INVASIVE SPECIES	INV

FLOODPLAIN / FLOODWAY

500 YEAR FLOODPLAIN BOUNDARY	FP500
100 YEAR FLOODPLAIN BOUNDARY	FP100
FLOODWAY	FW

ENGINEERING

CONSTRUCTION BASELINE — 30, 31, 32

PC, PT, POT (ON CONST BASELINE)

PI (IN CONSTRUCTION BASELINES)

INTERSECTION OR EQUATION OF TWO LINES

ORIGINAL GROUND LINE (PROFILES AND CROSS-SECTIONS)

PROFILE GRADE LINE (PROFILES AND CROSS-SECTIONS)

CLEARING LINE

SLOPE LINE

(SLOPE LINE; CLEARING LINE)

SLOPE LINE (FILL)

SLOPE LINE (CUT)

PROFILES AND CROSS SECTIONS:
ORIGINAL GROUND ELEVATION (LEFT)
FINISHED GRADE ELEVATION (RIGHT)

72.5 79.14 — 818.4 822.40

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

STANDARD SYMBOLS

	REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
STD SYMB SHT 1 OF 2	07-31-2023	13761A_Symb	13761A	2	55

DRAINAGE

MANHOLE
CATCH BASIN — cb — (existing) — (PROPOSED)
DROP INLET — di

DRAINAGE PIPE (existing) — DP — DP — (label size & type)
DRAINAGE PIPE (PROPOSED) — PDP — PDP
UNDERDRAIN (existing) W/ FLUSHING BASIN — fb — DP — DP — (label size & type)
UNDERDRAIN (PROPOSED) W/ FLUSHING BASIN — PDP — PDP
HEADER (existing & PROPOSED) — DP — PDP — (with stone outlet protection)
END SECTION (existing & PROPOSED) — DP — PDP — METAL or PLASTIC
DP — PDP — RCP
OPEN DITCH (PROPOSED)
show direction of flow
EROSION CONTROL/ STONE SLOPE PROTECTION

BOUNDARIES / RIGHT-OF-WAY

RIGHT-OF-WAY LINE — (label type)
RR RIGHT-OF-WAY LINE
PROPERTY LINE — ℙ — ℙ
PROPERTY LINE (COMMON OWNER) — Z — Z
TOWN LINE — BOW / CONCORD
COUNTY LINE — COOS / GRAFTON
STATE LINE — MAINE / NEW HAMPSHIRE
NATIONAL FOREST
CONSERVATION LAND — LC — LC
BENCH MARK / SURVEY DISK
BOUND — bnd — (PROPOSED)
STATE LINE/ TOWN LINE MONUMENT — S/L — T/L
NHDOT PROJECT MARKER
IRON PIPE OR PIN — ip
DRILL HOLE IN ROCK — dh
TAX MAP AND LOT NUMBER — 156 / 14 — 1642/341 — 6.80 Ac.±
PROPERTY PARCEL NUMBER — 12
HISTORIC PROPERTY — H

UTILITIES

existing — PROPOSED

TELEPHONE POLE
POWER POLE
JOINT OCCUPANCY — (plot point at face not center of symbol)
MISCELLANEOUS/UNKNOWN POLE
GUY POLE OR PUSH BRACE
LIGHT POLE
LIGHT ON POWER POLE
LIGHT ON JOINT POLE

POLE STATUS:
REMOVE, LEAVE, PROPOSED, OR TEMPORARY AS APPLICABLE e.g.: — R — L — P+04 25.0' — T+04 25.0'

RAILROAD — (label ownership)
RAILROAD SIGN
RAILROAD SIGNAL
UTILITY JUNCTION BOX — jb — JB
OVERHEAD WIRE — OW — OW — (label type)

UNDERGROUND UTILITIES

WATER — (on existing lines label size, type and note if abandoned) — W — W — PW — PW
SEWER — S — S — PS — PS
TELEPHONE — T — T — PT — PT
ELECTRIC — E — E — PE — PE
GAS — G — G — PG — PG
LIGHTING — L — L — PL — PL
INTELLIGENT TRANSPORTATION SYSTEM — ITS — ITS — PITS — PITS
FIBER OPTIC — FO — FO — PFO — PFO
WATER SHUT OFF — wso — WSO
GAS SHUT OFF — gso — GSO
HYDRANT — hyd — HYD

MANHOLES

SEWER — MHS
TELEPHONE — MHT
ELECTRICAL — MHE
GAS — MHG
UNKNOWN
WATER — MHW

TRAFFIC SIGNALS / ITS

existing — PROPOSED

MAST ARM — 30' MA (NOTE ANGLE FROM ℄)
OPTICOM RECEIVER
OPTICOM STROBE
TRAFFIC SIGNAL
PEDESTAL WITH PEDESTRIAN SIGNAL HEADS AND PUSH BUTTON UNIT
SIGNAL CONDUIT — C — C — C — PC — PC — PC
CONTROLLER CABINET — cc — CC
METER PEDESTAL — mp — MP
PULL BOX — pb — PB
LOOP DETECTOR (QUADRUPOLE) — (label size)
LOOP DETECTOR (RECTANGULAR) — (label size)
CAMERA POLE (CCTV)
FIBER OPTIC DELINEATOR — fod — FOD
FIBER OPTIC SPLICE VAULT — f — SVF
ITS EQUIPMENT CABINET — its — ITS
MOTOR VEHICLE DETECTION SYSTEM (MVDS)
VARIABLE SPEED LIMIT SIGN
DYNAMIC MESSAGE SIGN
ROAD AND WEATHER INFO SYSTEM

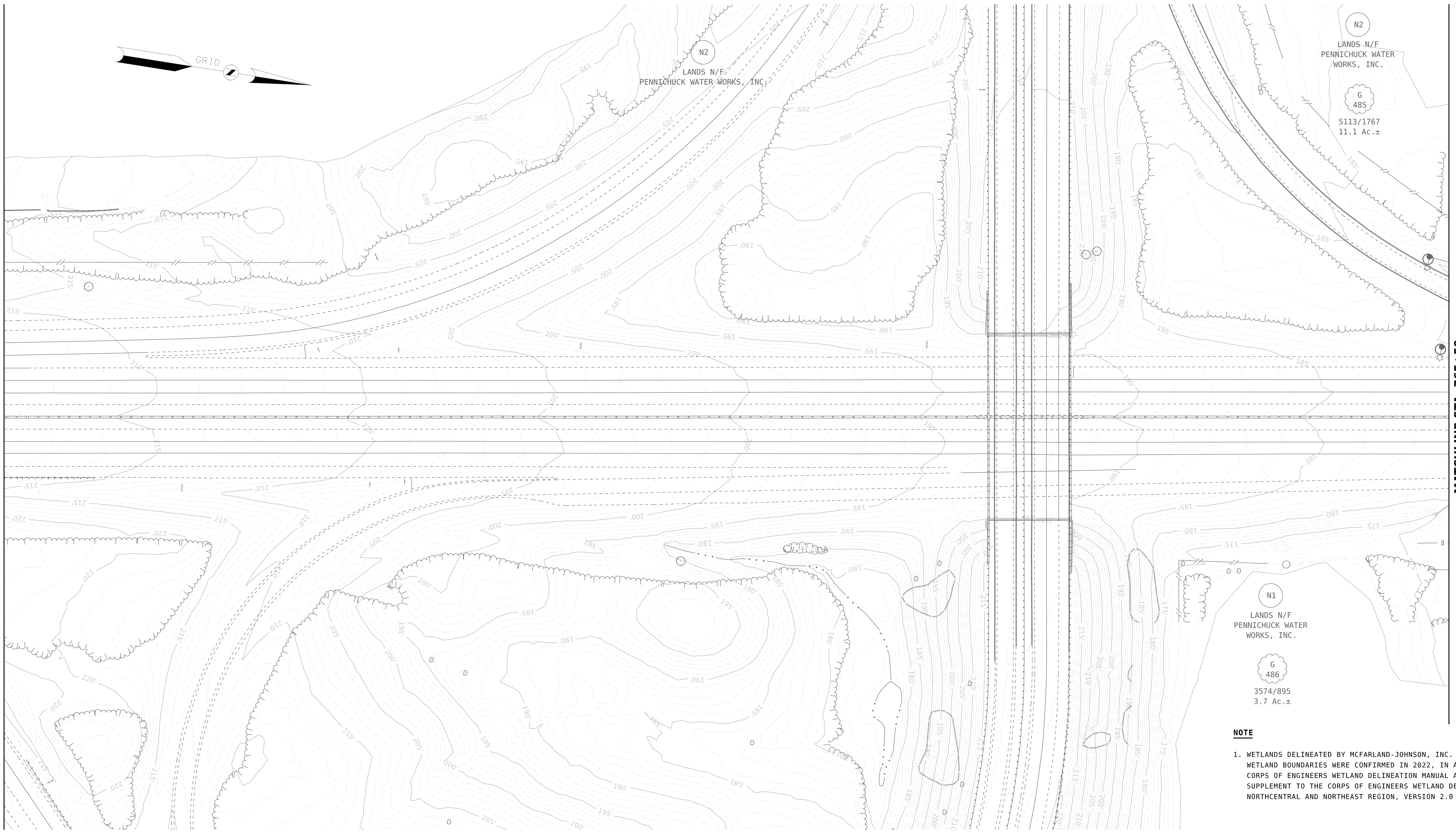
CONSTRUCTION NOTES

CURB MARK NUMBER - BITUMINOUS — B-1
CURB MARK NUMBER - GRANITE — G-1
CLEARING AND GRUBBING AREA — A
DRAINAGE NOTE — 1
EROSION CONTROL NOTE — A
FENCING NOTE — A
GUARDRAIL NOTE — 1
ITS NOTE — 1
LIGHTING NOTE — A
TRAFFIC SIGNAL NOTE — 1

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

STANDARD SYMBOLS

	REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
STD SYMB SHT 2 OF 2	07-31-2023	13761A_Symb	13761A	3	55



NOTE

1. WETLANDS DELINEATED BY MCFARLAND-JOHNSON, INC. IN 2016-2017 AND WETLAND BOUNDARIES WERE CONFIRMED IN 2022, IN ACCORDANCE WITH THE CORPS OF ENGINEERS WETLAND DELINEATION MANUAL AND THE REGIONAL SUPPLEMENT TO THE CORPS OF ENGINEERS WETLAND DELINEATION MANUAL: NORTHCENTRAL AND NORTHEAST REGION, VERSION 2.0 (JANUARY 2012).

WETLAND CLASSIFICATION CODES	
PSS1E	PALUSTRINE, SCRUB-SHRUB. BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
PEM1Eh	PALUSTRINE, EMERGENT, PERSISTENT, SEASONALLY FLOODED/SATURATED, DIKED/IMPOUNDED
PF01E	PALUSTRINE, FORESTED, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
VP	VERNAL POOL
L1UBHh	LACUSTRINE, LIMNETIC, UNCONSOLIDATED BOTTOM, PERMANENTLY FLOODED, DIKED/IMPOUNDED

50 0 50 100

SCALE IN FEET

STATE OF NEW HAMPSHIRE
STEPHEN C. HOFFMANN
No. 00306
CERTIFIED WETLAND SCIENTIST

vhb

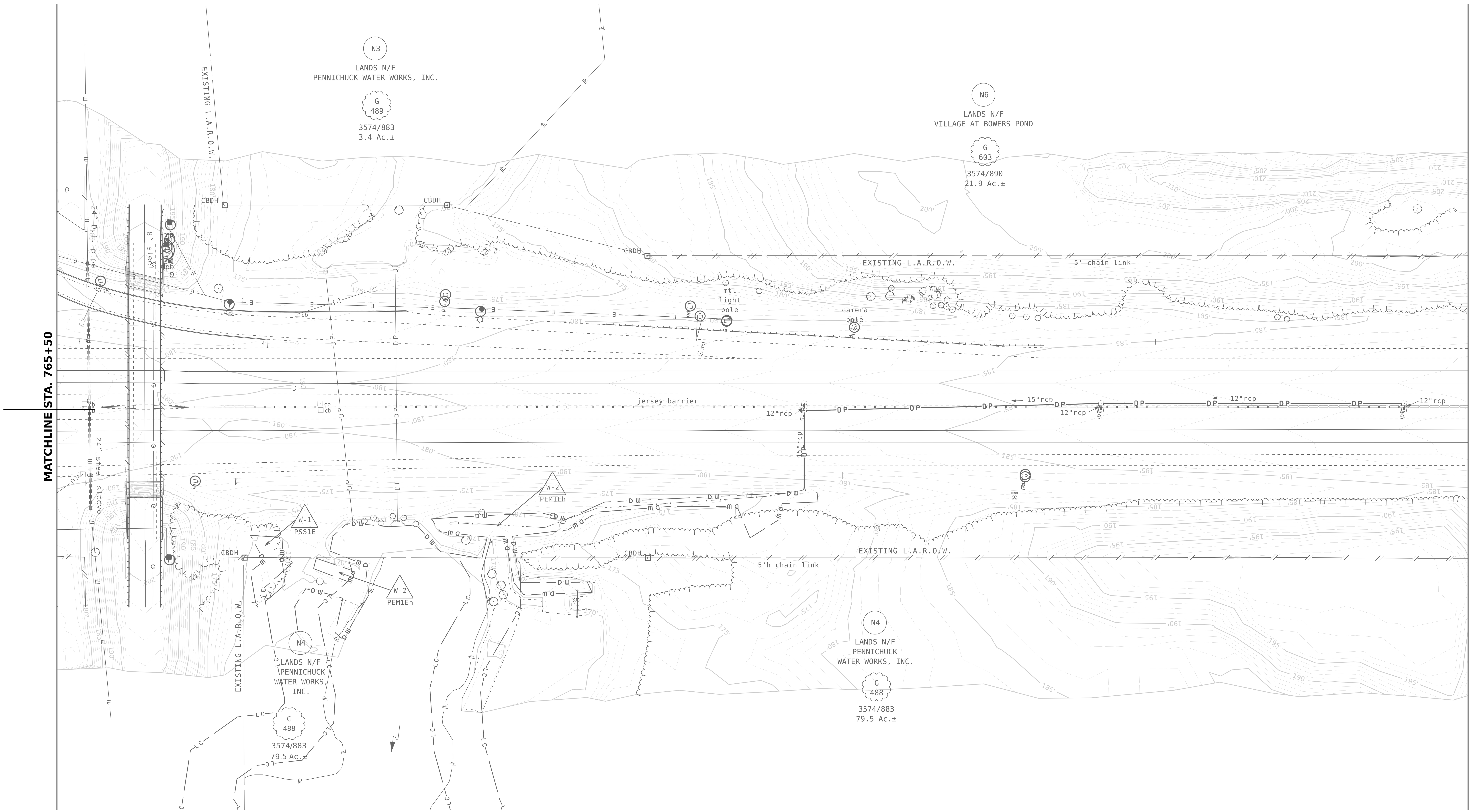
REVISIONS AFTER PROPOSAL				
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 01

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_01	11/10/2023	52775.00	13761A_Ex_Cond	13761A	4	55



50 0 50 100

SCALE IN FEET

GRID

NUMBER	DATE	STATION	STATION	DESCRIPTION

REVISIONS AFTER PROPOSAL

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

vhb

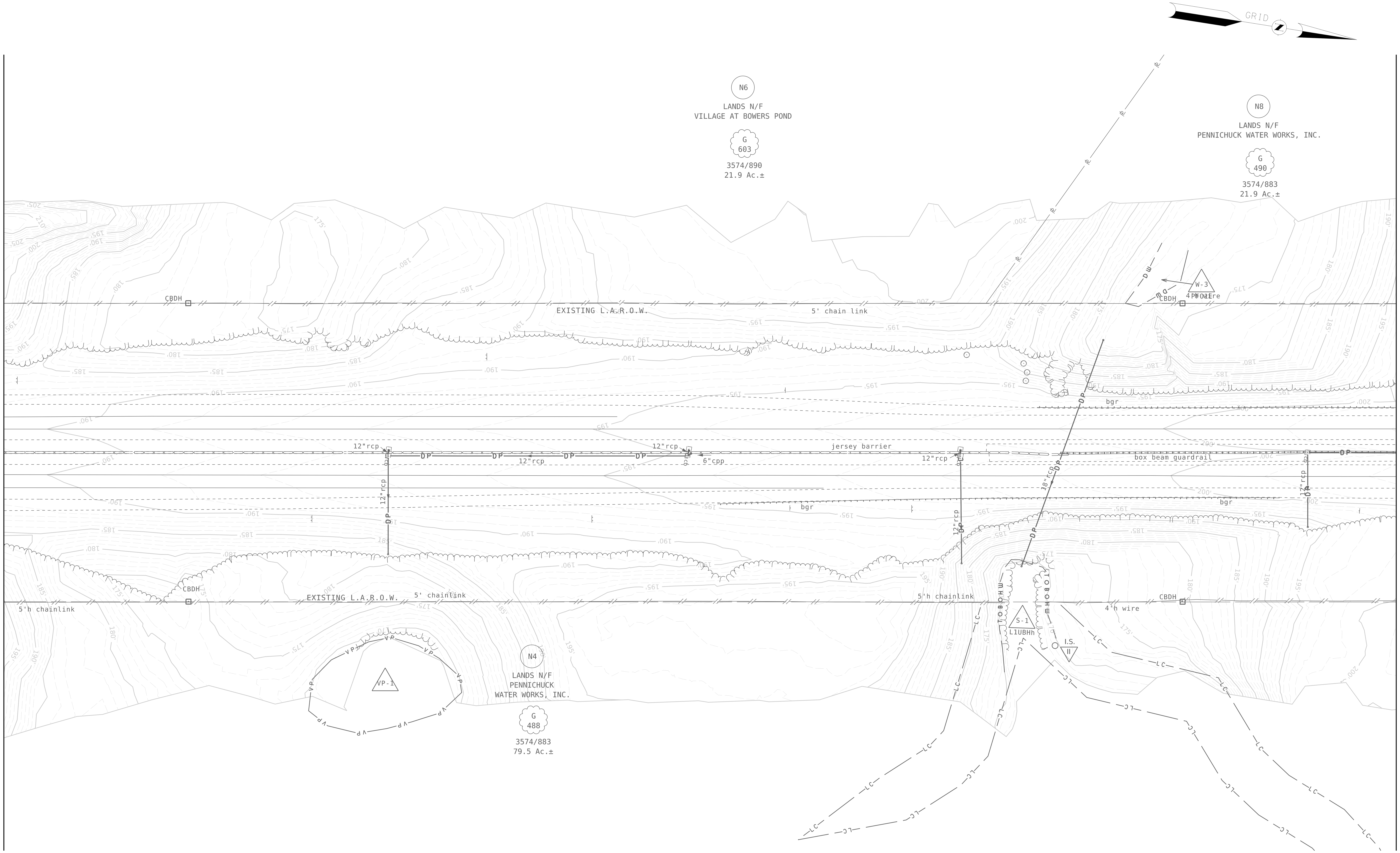
STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 02

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_02	11/10/2023	52775.00	13761A_Ex_Cond	13761A	5	55

MATCHLINE STA. 779+50



MATCHLINE STA. 793+50

50 0 50 100

SCALE IN FEET

REVISIONS AFTER PROPOSAL				
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
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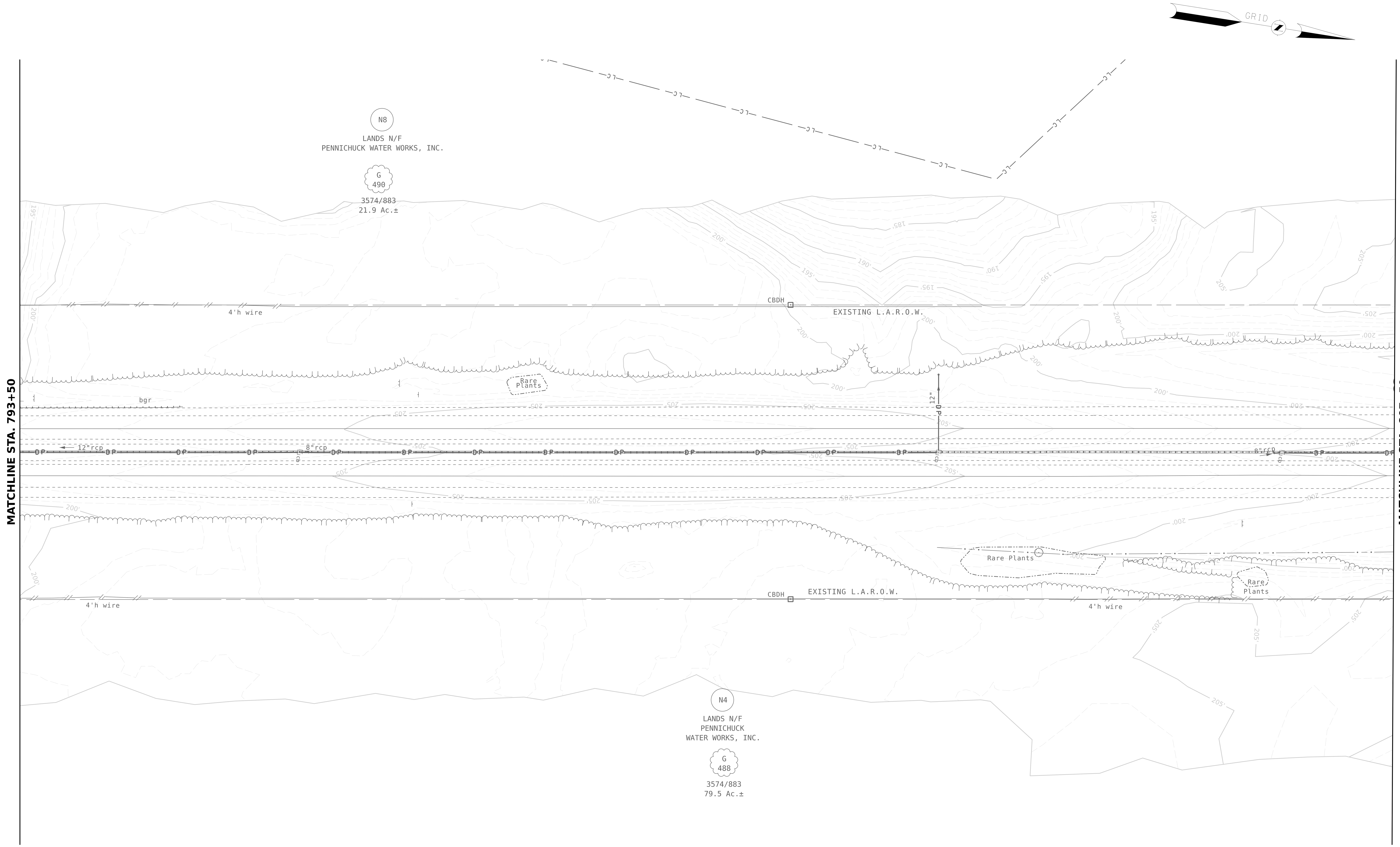
EXISTING CONDITIONS PLAN 03

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_03	11/10/2023	52775.00	13761A_Ex_Cond	13761A	6	55



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SCALE IN FEET

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

vhb

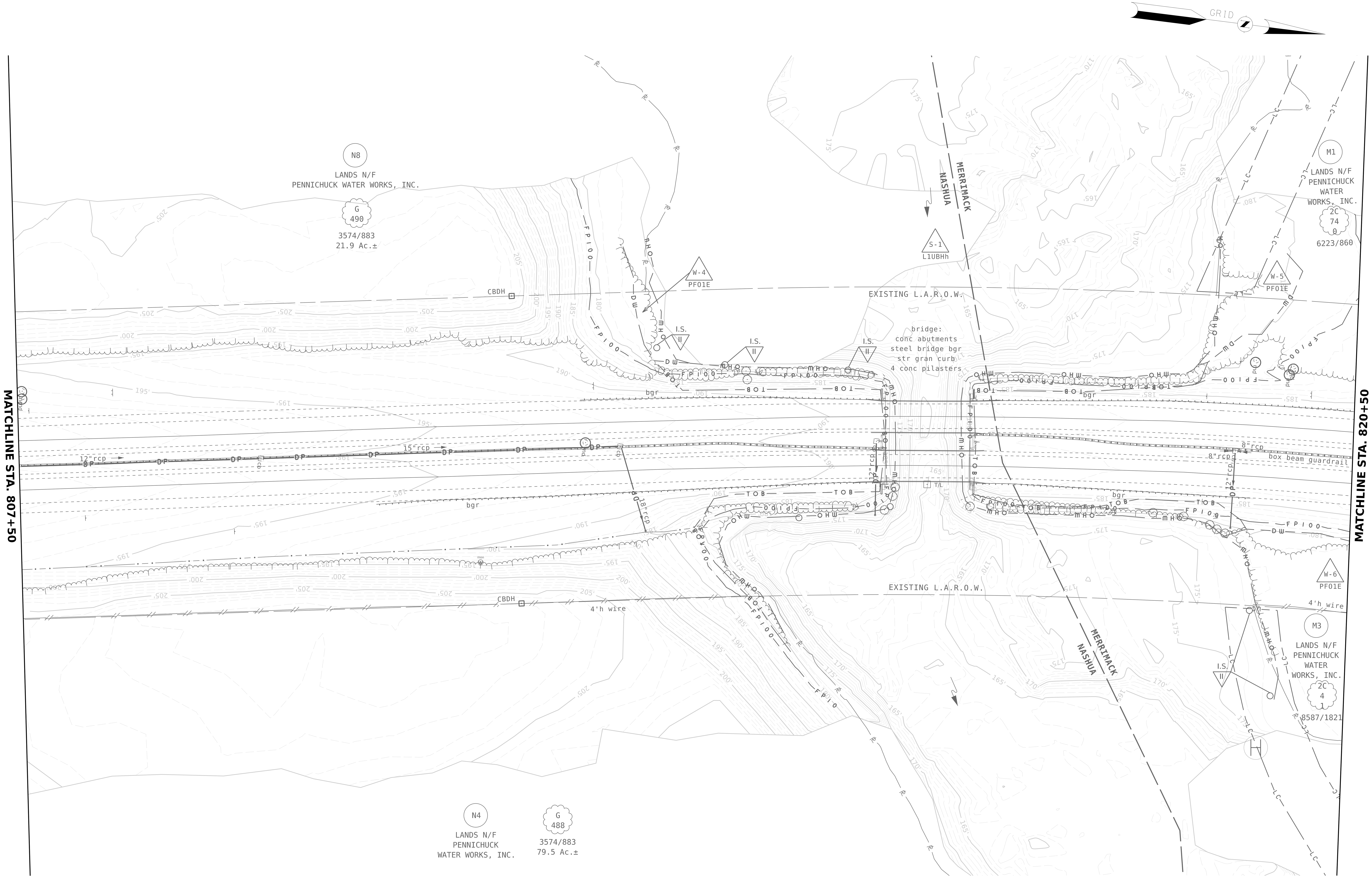
STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 04

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_04	11/10/2023	52775.00	13761A_Ex_Cond	13761A	7	55



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SCALE IN FEET

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

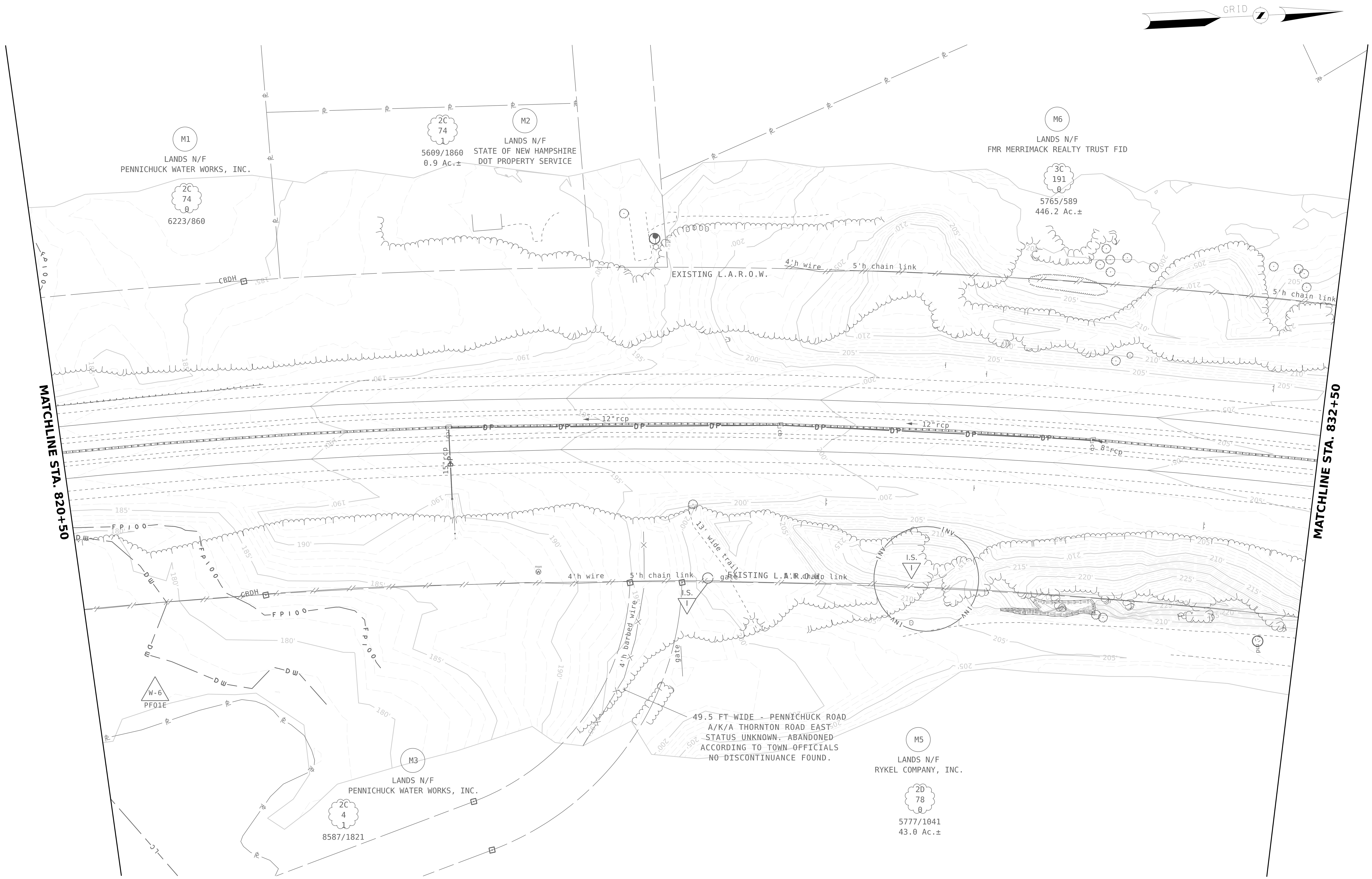
SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 05

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_05	11/10/2023	52775.00	13761A_Ex_Cond	13761A	8	55



50 0 50 100

SCALE IN FEET

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

vhb

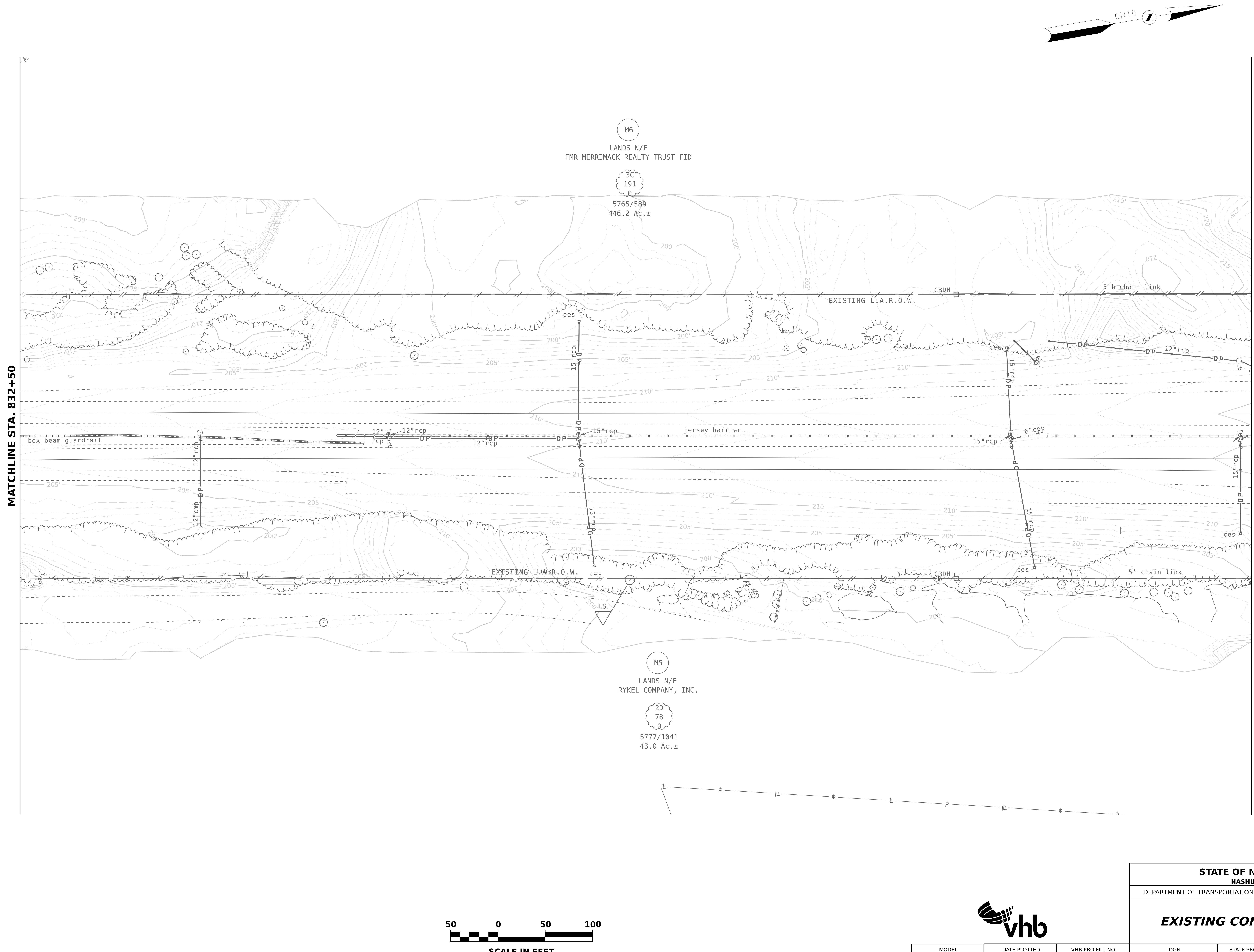
STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 06

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_06	11/10/2023	52775.00	13761A_Ex_Cond	13761A	9	55



REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED		DATE	
AS BUILT DETAILS		DATE	

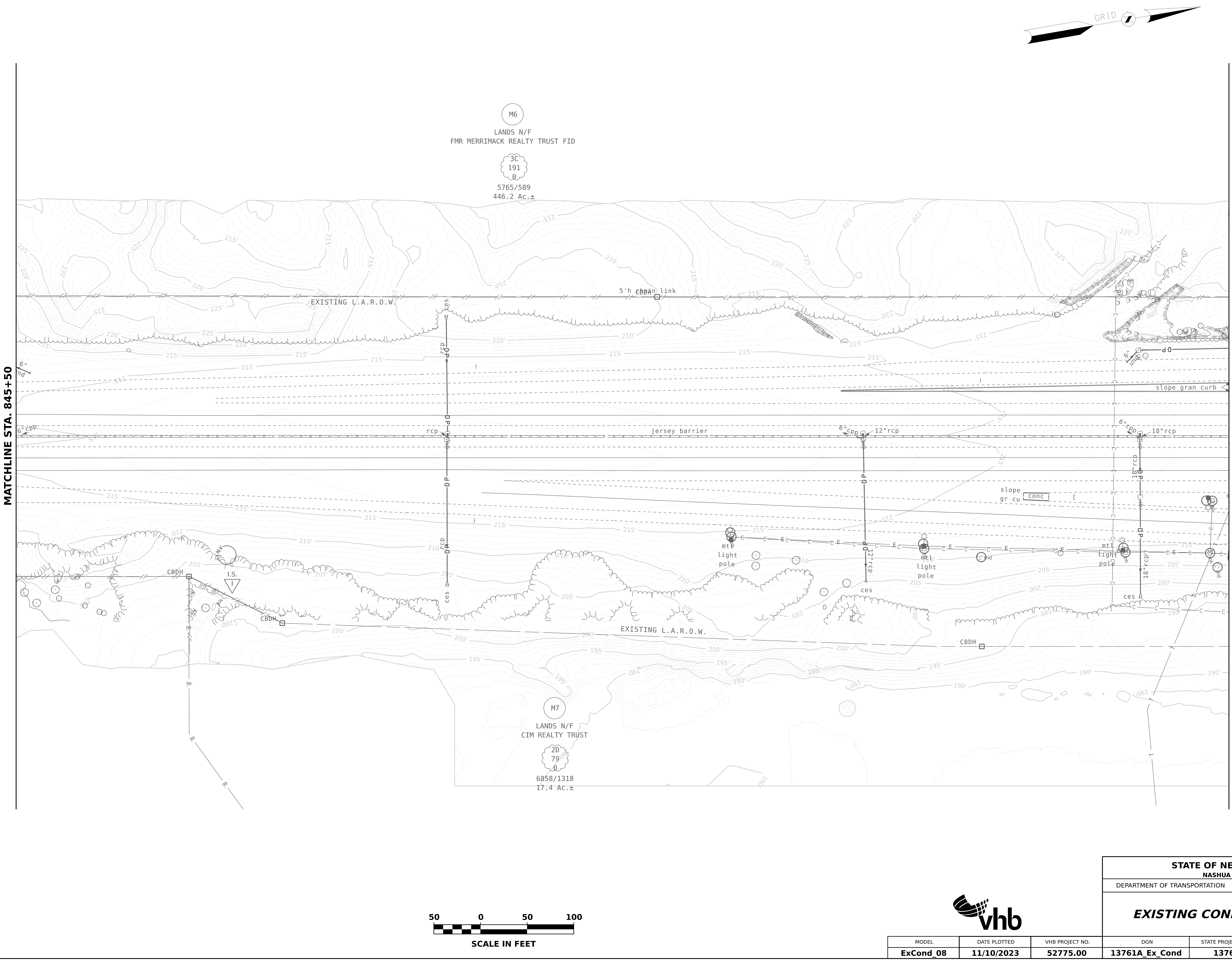
vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 07

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_07	11/10/2023	52775.00	13761A_Ex_Cond	13761A	10	55



REVISIONS AFTER PROPOSAL				
NUMBER	DATE	STATION	STATION	DESCRIPTION

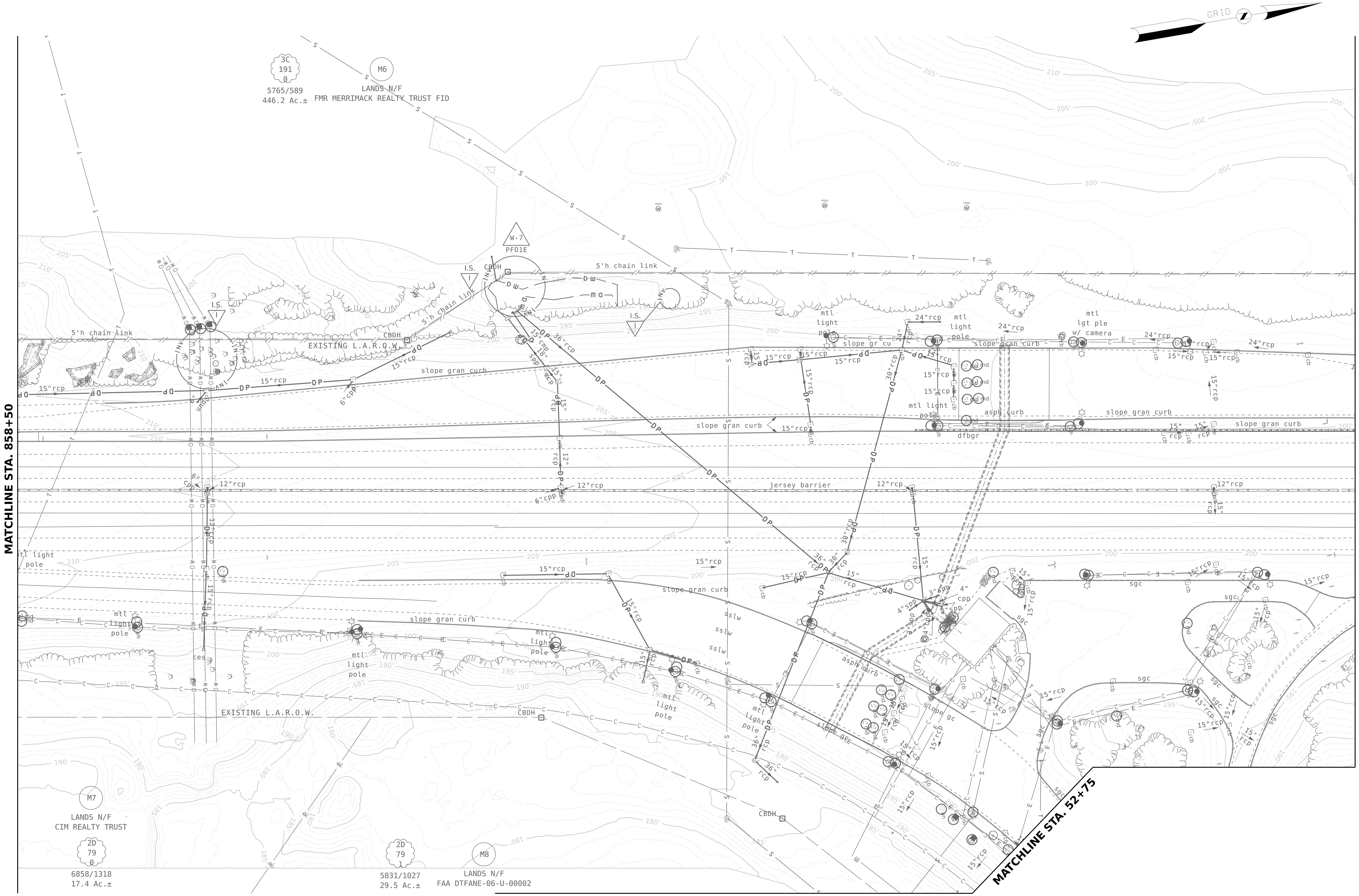
SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 08

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_08	11/10/2023	52775.00	13761A_Ex_Cond	13761A	11	55



SCALE IN FEET (50 0 50 100)

NUMBER	DATE	STATION	STATION	REVISIONS AFTER PROPOSAL DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 09

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_09	11/10/2023	52775.00	13761A_Ex_Cond	13761A	12	55

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

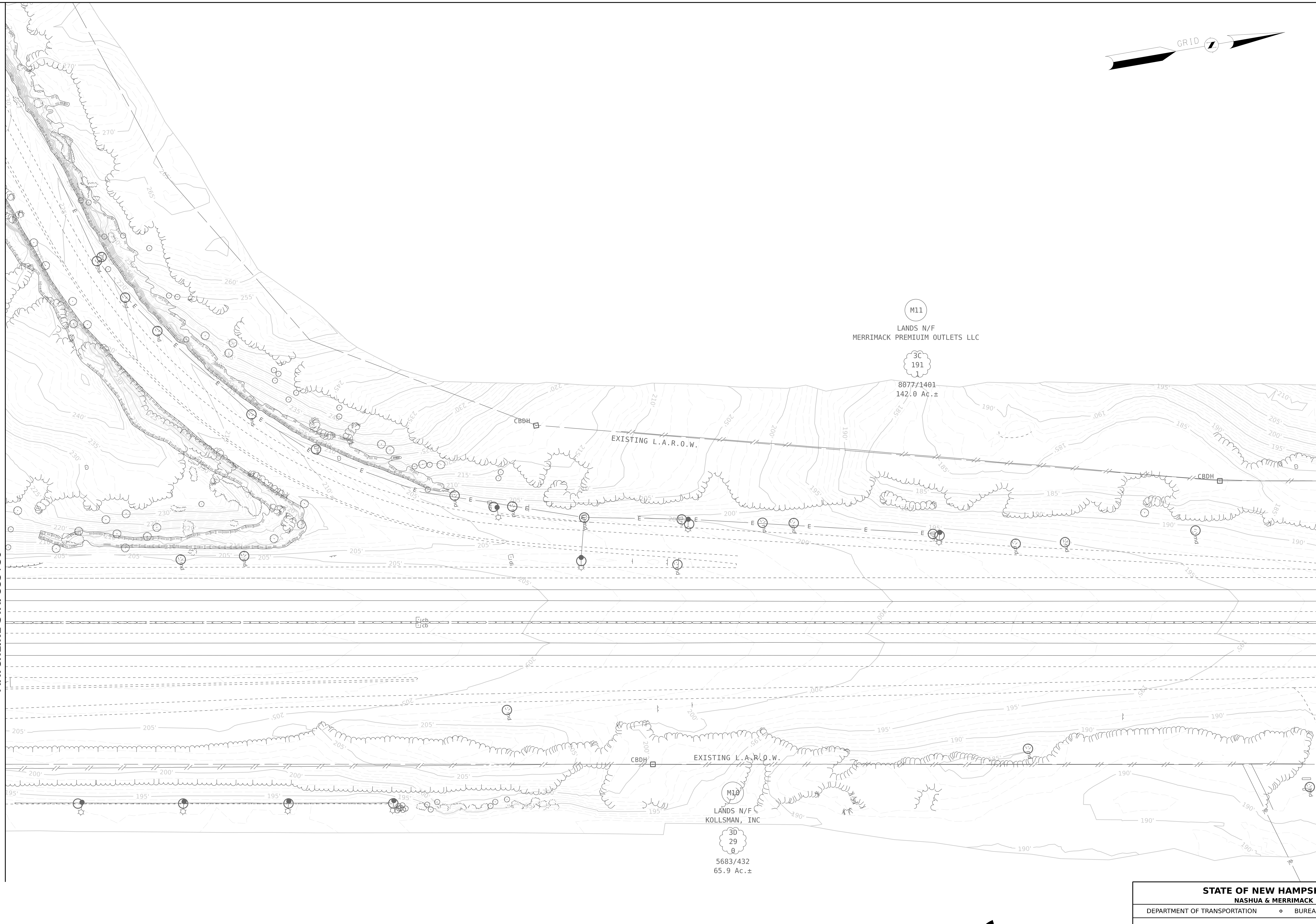
STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 10

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_10	11/10/2023	52775.00	13761A_Ex_Cond	13761A	13	55



REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED		DATE	
AS BUILT DETAILS		DATE	

vhb

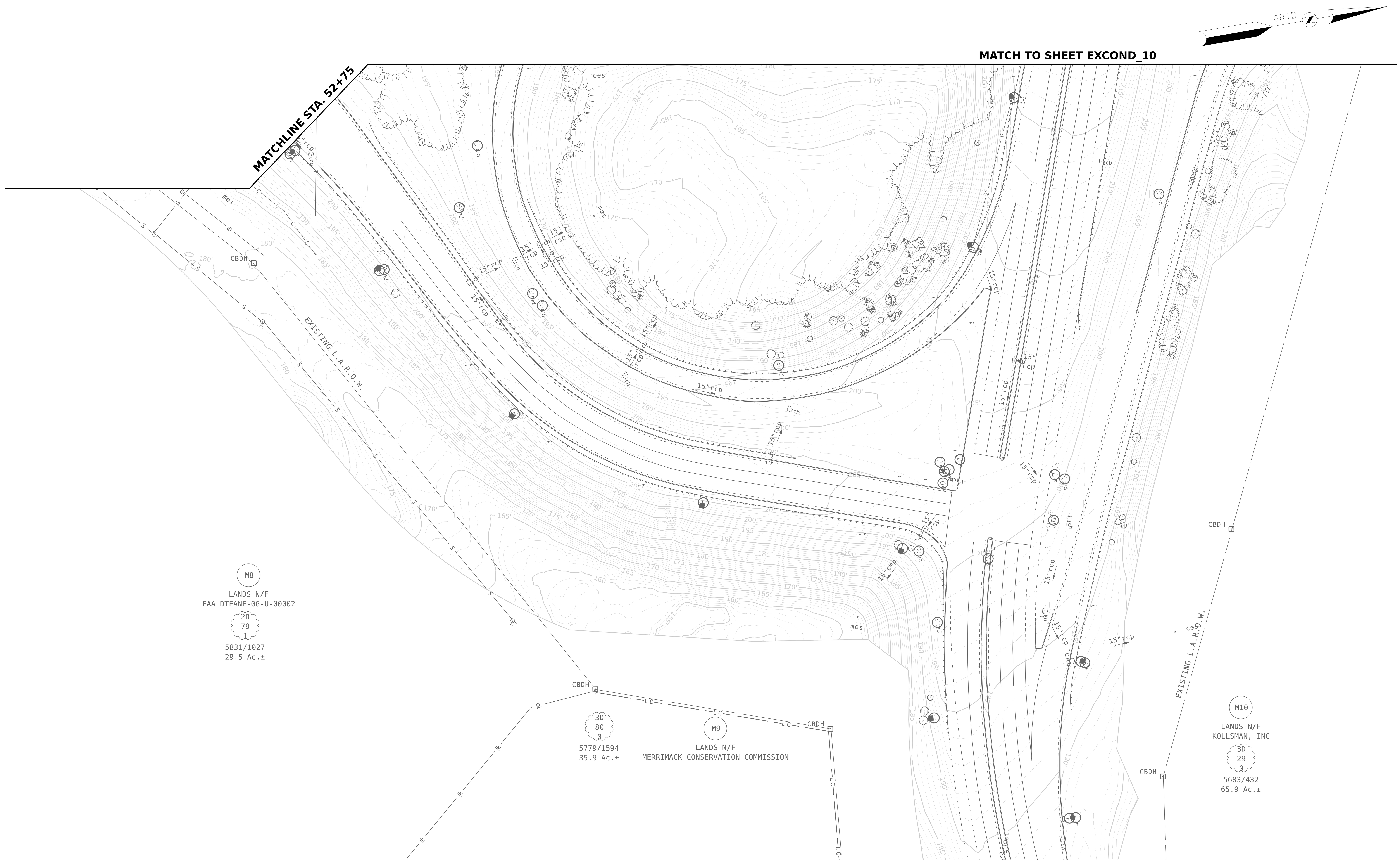
STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 11

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_11	11/10/2023	52775.00	13761A_Ex_Cond	13761A	14	55

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE



50 0 50 100

SCALE IN FEET

vhb

STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLAN 12

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ExCond_12	11/10/2023	52775.00	13761A_Ex_Cond	13761A	15	55

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

WETLAND CLASSIFICATION CODES

PSS1E	PALUSTRINE, SCRUB-SHRUB. BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
PEM1Eh	PALUSTRINE, EMERGENT, PERSISTENT, SEASONALLY FLOODED/SATURATED, DIKED/IMPOUNDED
PF01E	PALUSTRINE, FORESTED, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
VP	VERNAL POOL
L1UBHh	LACUSTRINE, LIMNETIC, UNCONSOLIDATED BOTTOM, PERMANENTLY FLOODED, DIKED/IMPOUNDED

WETLAND IMPACT SUMMARY

WETLAND NUMBER	WETLAND CLASS-IFICATION	LOCATION	AREA IMPACTS						LINEAR STREAM IMPACTS FOR MITIGATION		
			PERMANENT				TEMPORARY		PERMANENT		
			N.H.W.B. (NON-WETLAND)		N.H.W.B. & A.C.O.E. (WETLAND)				BANK LEFT	BANK RIGHT	CHANNEL
			SF	LF	SF	LF	SF	LF	LF	LF	LF
S-1	BANK	A	7924								
S-1	L1UBHh	B			11410						
S-1	L1UBHh	C			10746						
S-1	BANK	D	7004								
S-1	L1UBHh	E			62						
W-6	PF01E	F			1936						
W-6	PF01E	G			164						
S-1	L1UBHh	TA					11				
W-4	PF01E	TB					242				
S-1	BANK	TC					2428				
S-1	L1UBHh	TD					23299				
S-1	BANK	TE					123				
S-1	BANK	TF					681				
S-1	BANK	TG					451				
W-6	PF01E	TH					881				
W-6	PF01E	TI					264				
		TOTAL	14928		24318		28380				

Per guidance from NHDES (see attached email correspondence), and consistent with NHDES and USACE guidelines, mitigation for impacts to lacustrine resource areas (i.e., below the OHW of Pennichuck Brook/Bowers Pond) will be based on a square footage basis for the purpose of this wetlands permit application.

IMPACT LOCATION B: 11410 SF
IMPACT LOCATION C: 10746 SF
IMPACT LOCATION E: 62 SF
TOTAL: 22218 SF

In Nashua, the surface water of Pennichuck Brook has been designated as a Prime Wetland. The total 22,218 SF of permanent impacts to lacustrine resource areas includes 16,665 SF of Prime Wetland impacts located in Nashua, NH, and 5,553 SF of permanent impacts in Merrimack, NH.

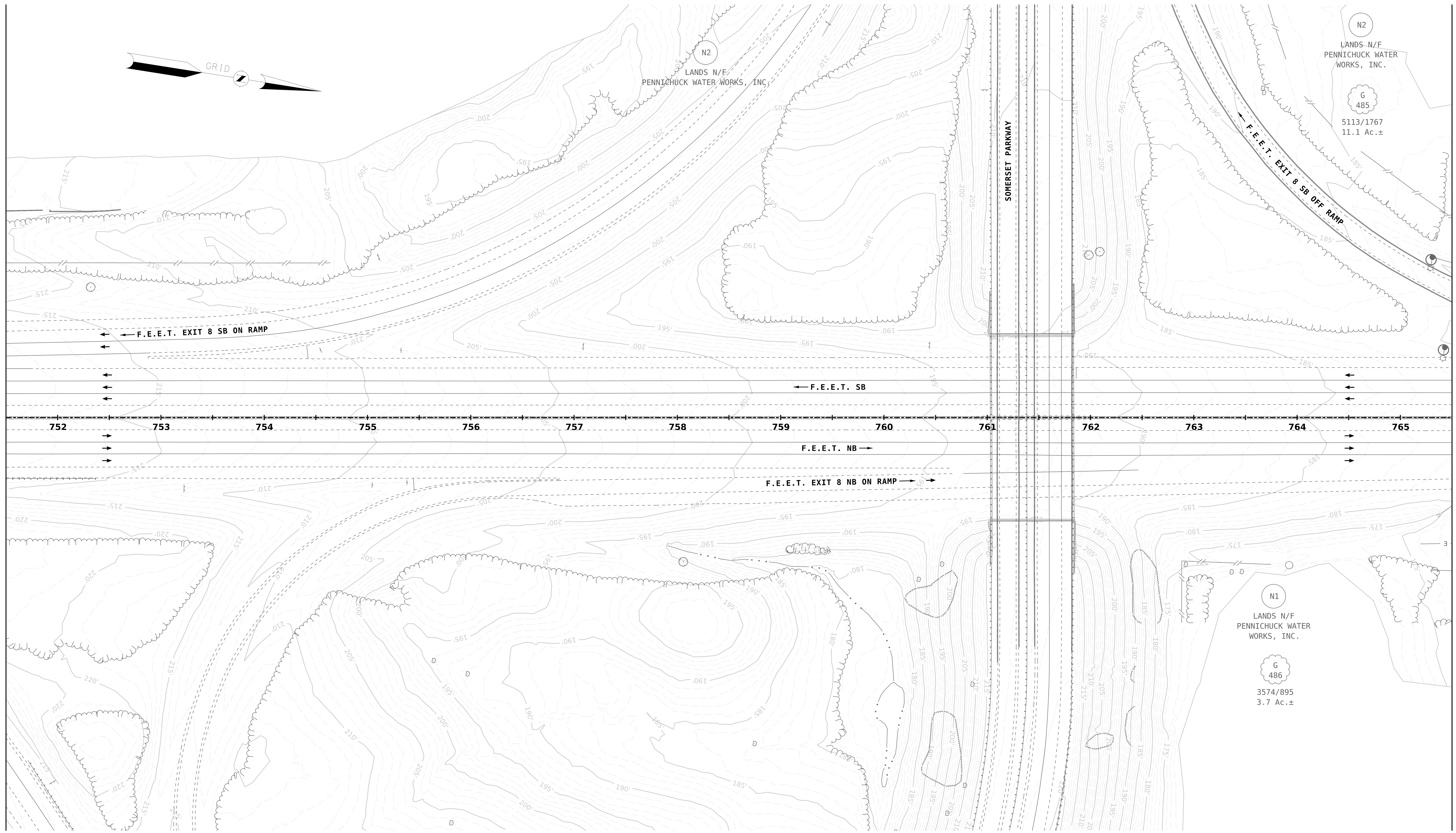
PERMANENT IMPACTS: 39246 SF
TEMPORARY IMPACTS: 28380 SF

TOTAL IMPACTS: 67626 SF

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT SUMMARY

DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
11/10/2023	52775.00	13761A_Wet_Summary	13761A	16	55



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- # WETLAND DESIGNATION NUMBER
- # WETLAND IMPACT LOCATION
- # WETLAND MITIGATION AREA
- MITIGATION

50 0 50 100
SCALE IN FEET

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 01

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_01	11/10/2023	52775.00	13761A_Wet_Plans	13761A	17	55

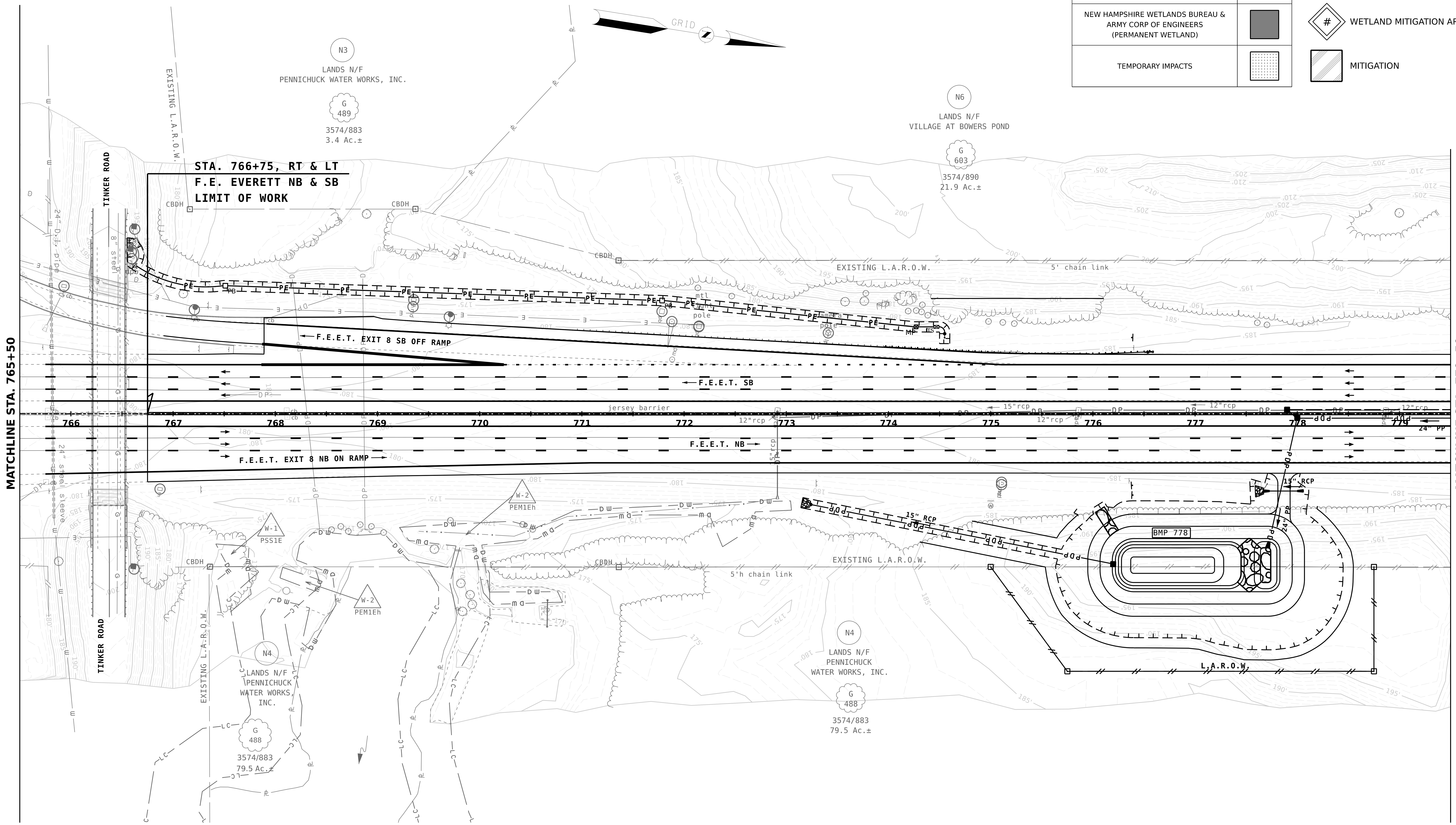
REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED NHDOT DATE 7/2021
NEW DESIGN VHB TEAM DATE 11/10/2023
SHEET CHECKED DATE
AS BUILT DETAILS DATE

LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- # WETLAND DESIGNATION NUMBER
- # WETLAND IMPACT LOCATION
- # WETLAND MITIGATION AREA
- MITIGATION



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SCALE IN FEET

REVISIONS AFTER PROPOSAL				
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

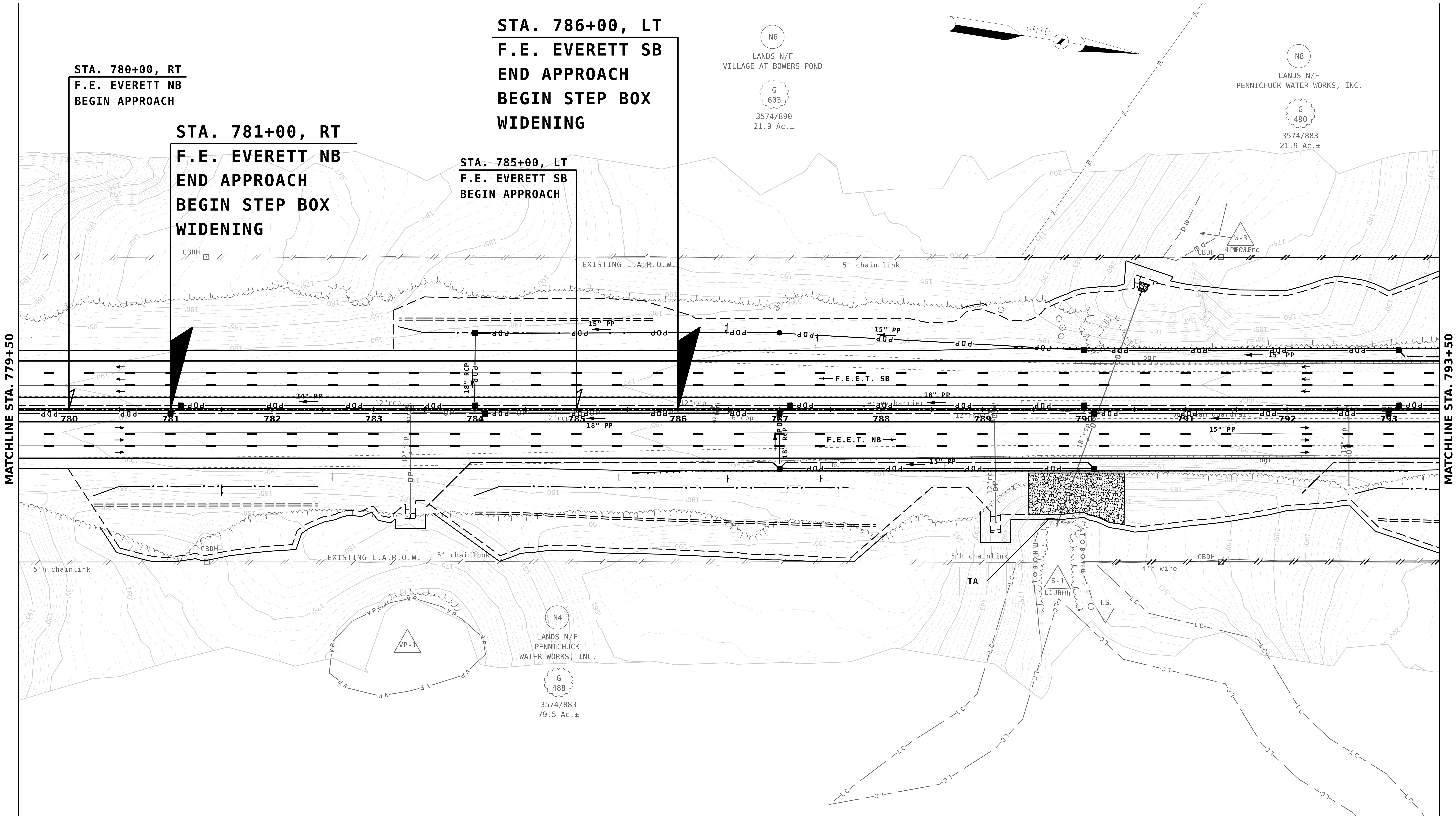
STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 02

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_02	11/10/2023	52775.00	13761A_Wet_Plans	13761A	18	55



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- # WETLAND DESIGNATION NUMBER
- # WETLAND IMPACT LOCATION
- # WETLAND MITIGATION AREA
- MITIGATION

50 0 50 100

SCALE IN FEET

DATE	7/2021	SDR PROCESSED	NHDOT
DATE	11/10/2023	NEW DESIGN	VHB TEAM
DATE		SHEET CHECKED	
DATE		AS BUILT DETAILS	

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

vhb

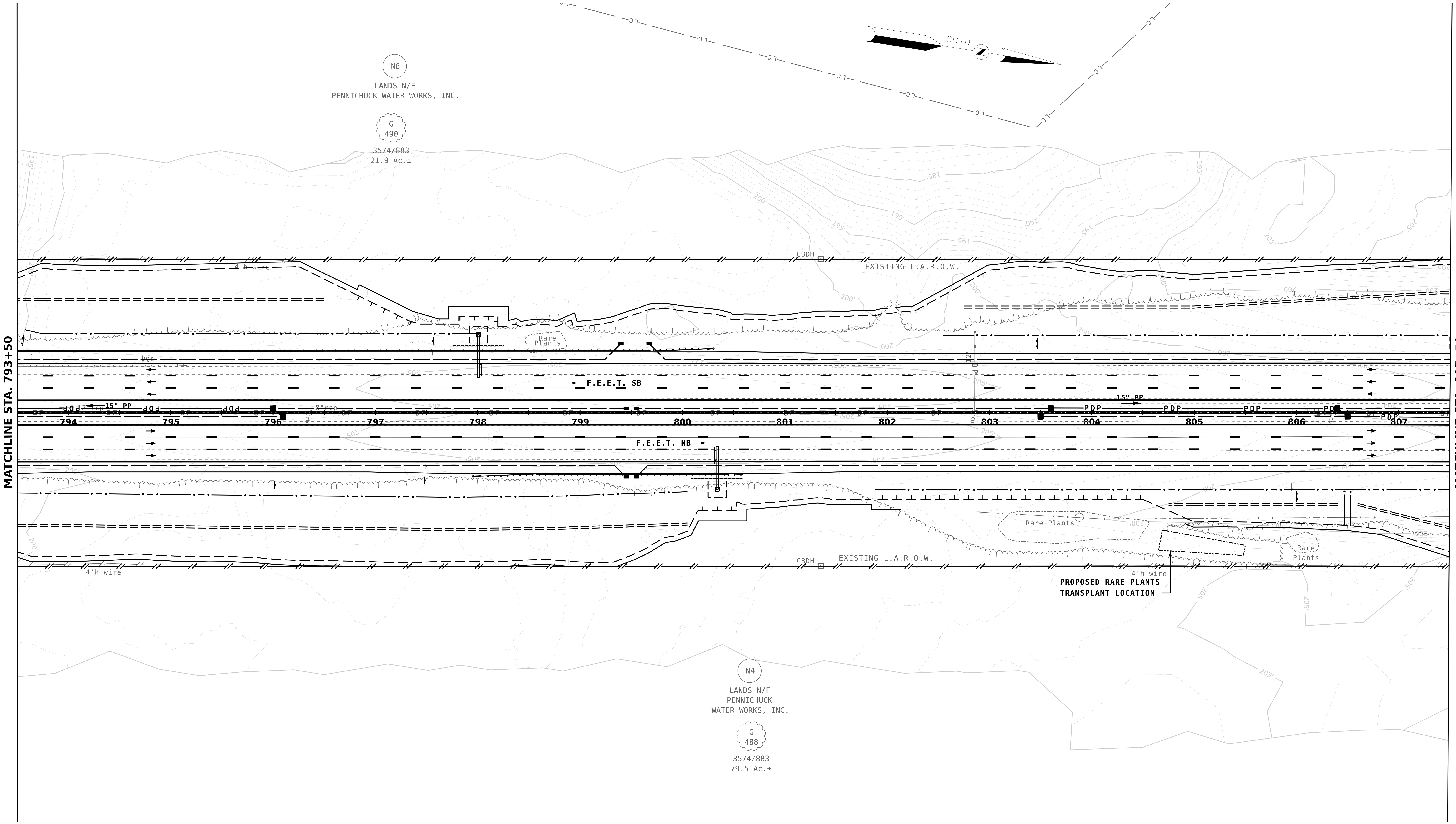
STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 03

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_03	11/10/2023	52775.00	13761A_Wet_Plans	13761A	19	55



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

WETLAND DESIGNATION NUMBER

WETLAND IMPACT LOCATION

WETLAND MITIGATION AREA

MITIGATION

50 0 50 100

SCALE IN FEET

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED NHDOT DATE 7/2021
NEW DESIGN VHB TEAM DATE 11/10/2023
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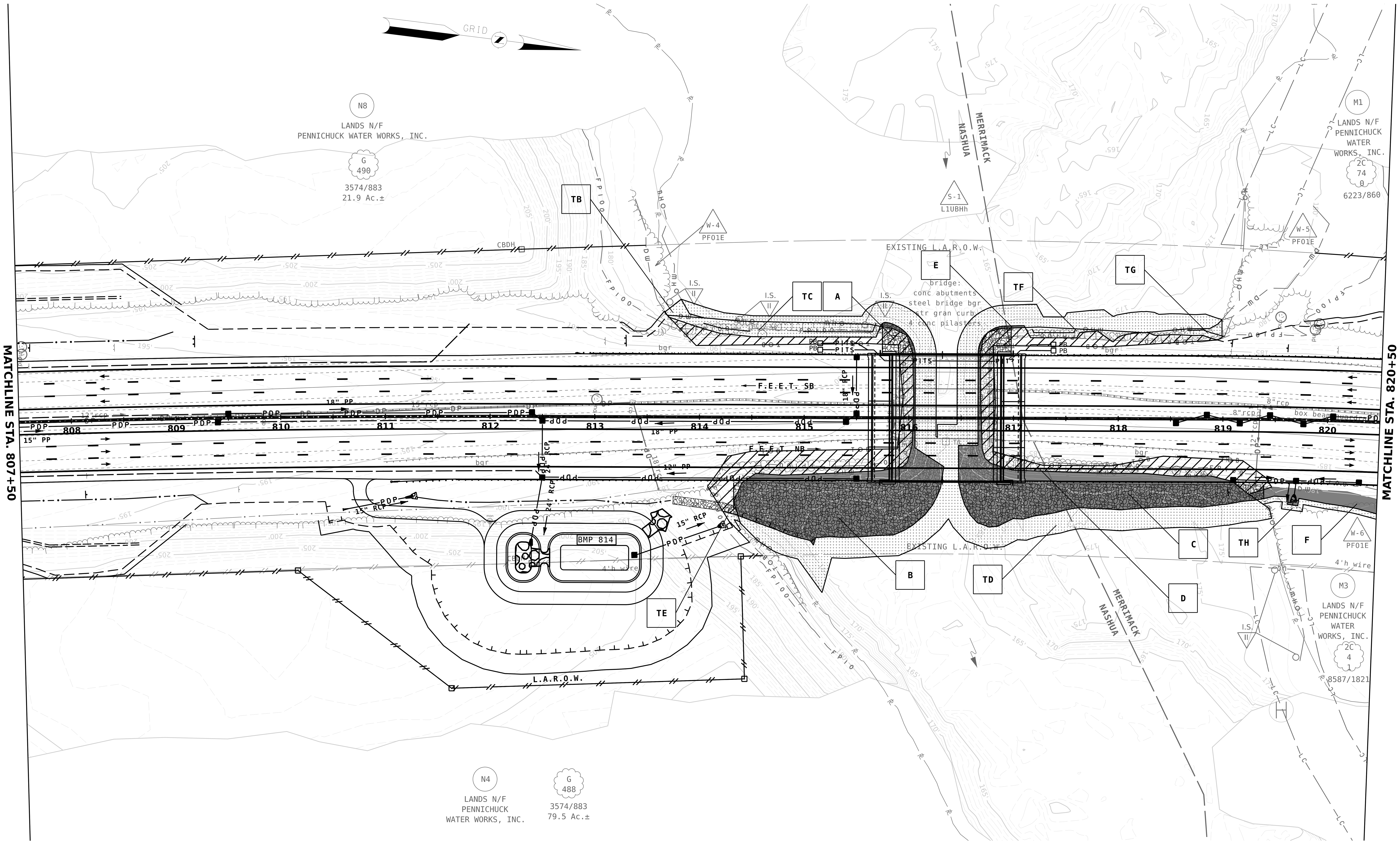
AS BUILT DETAILS DATE

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 04

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_04	11/10/2023	52775.00	13761A_Wet_Plans	13761A	20	55



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- # WETLAND DESIGNATION NUMBER
- # WETLAND IMPACT LOCATION
- # WETLAND MITIGATION AREA
- MITIGATION

50 0 50 100

SCALE IN FEET

STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

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WETLAND IMPACT PLAN 05

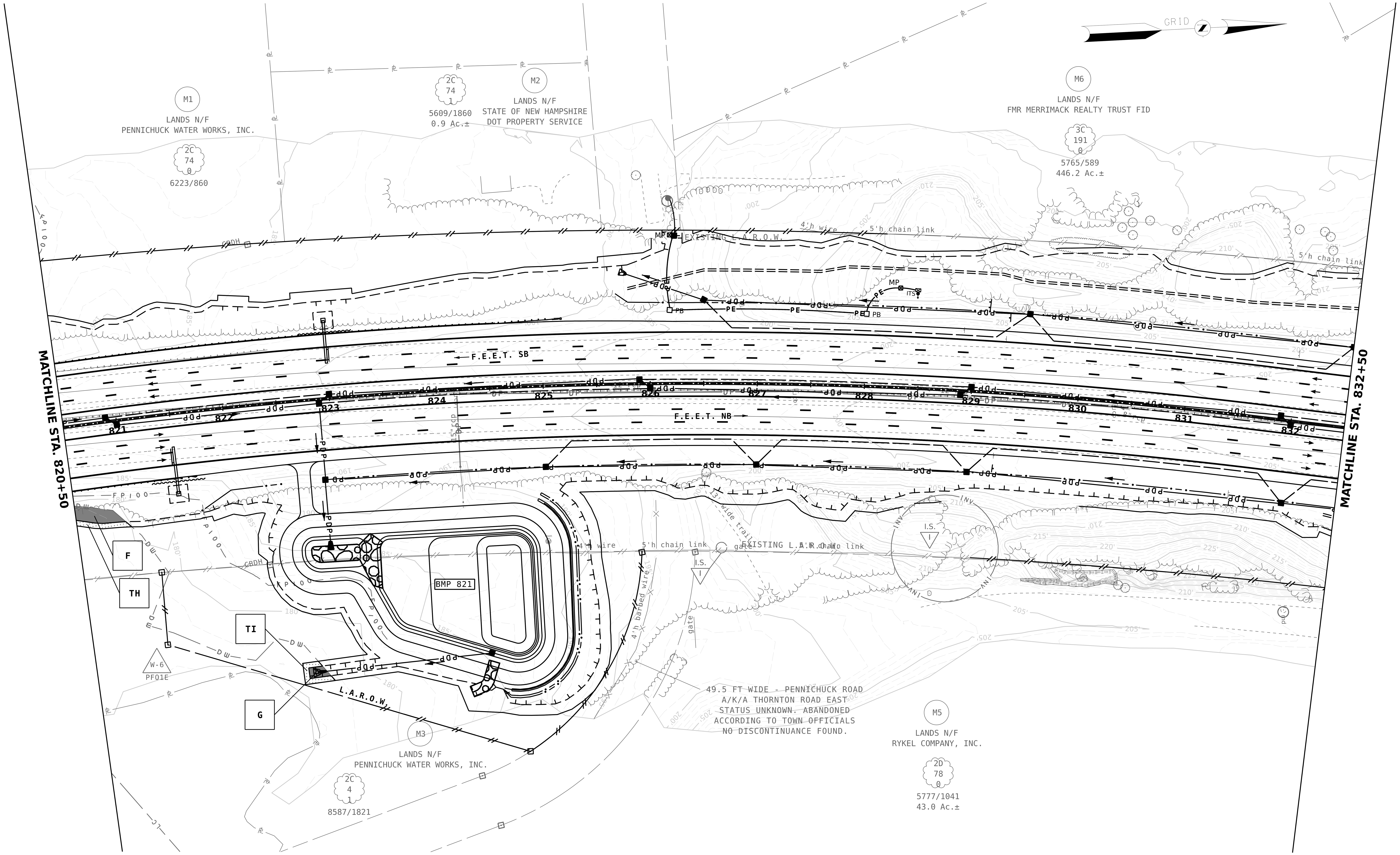
vhb

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_05	11/10/2023	52775.00	13761A_Wet_Plans	13761A	21	55

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED		DATE	
AS BUILT DETAILS		DATE	



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- # WETLAND DESIGNATION NUMBER
- # WETLAND IMPACT LOCATION
- # WETLAND MITIGATION AREA
- MITIGATION

50 0 50 100
SCALE IN FEET

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLANS 06

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_06	11/10/2023	52775.00	13761A_Wet_Plans	13761A	22	55

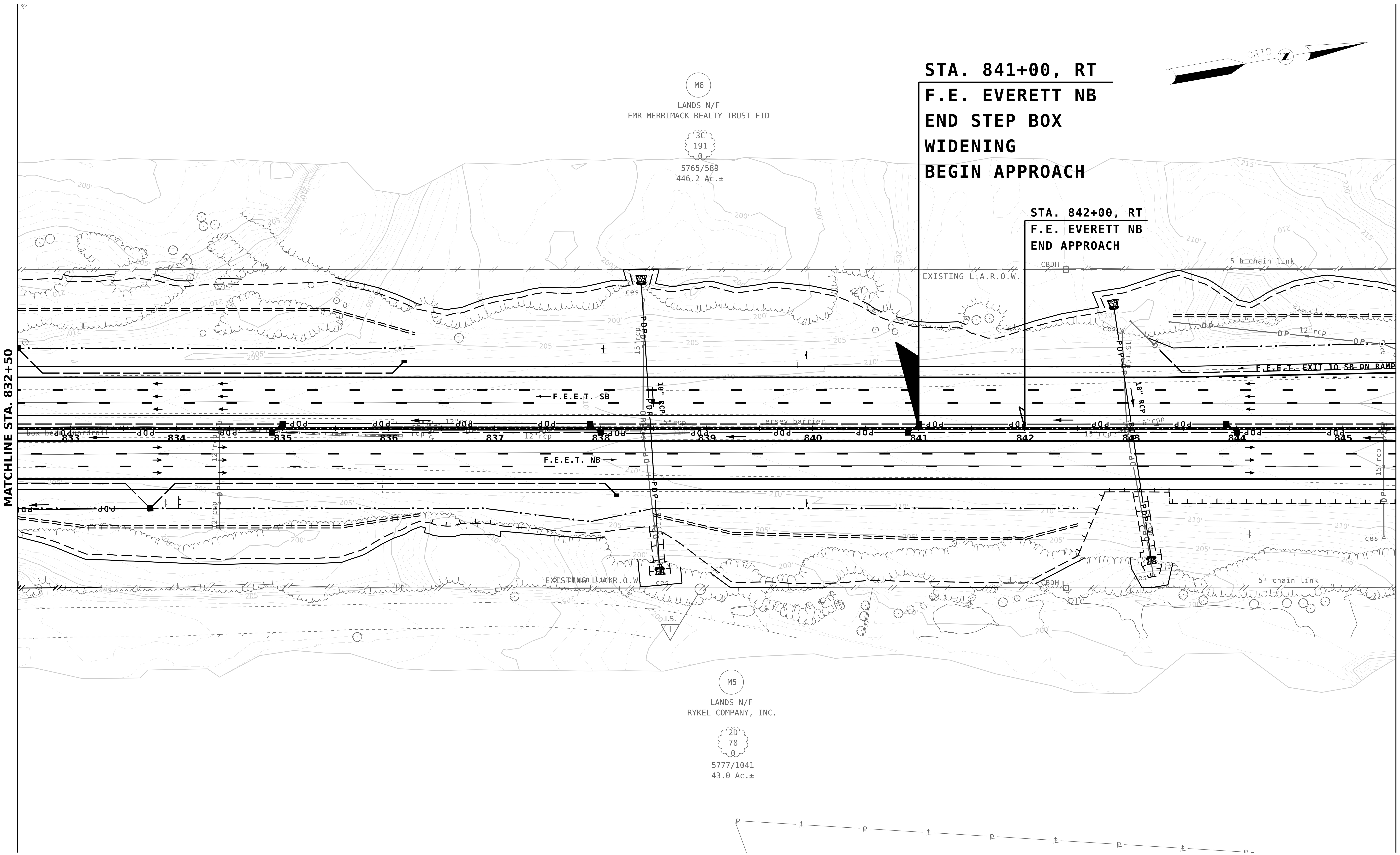
REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED		DATE	
AS BUILT DETAILS		DATE	

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED		DATE	
AS BUILT DETAILS		DATE	



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- # WETLAND DESIGNATION NUMBER
- # WETLAND IMPACT LOCATION
- # WETLAND MITIGATION AREA
- MITIGATION

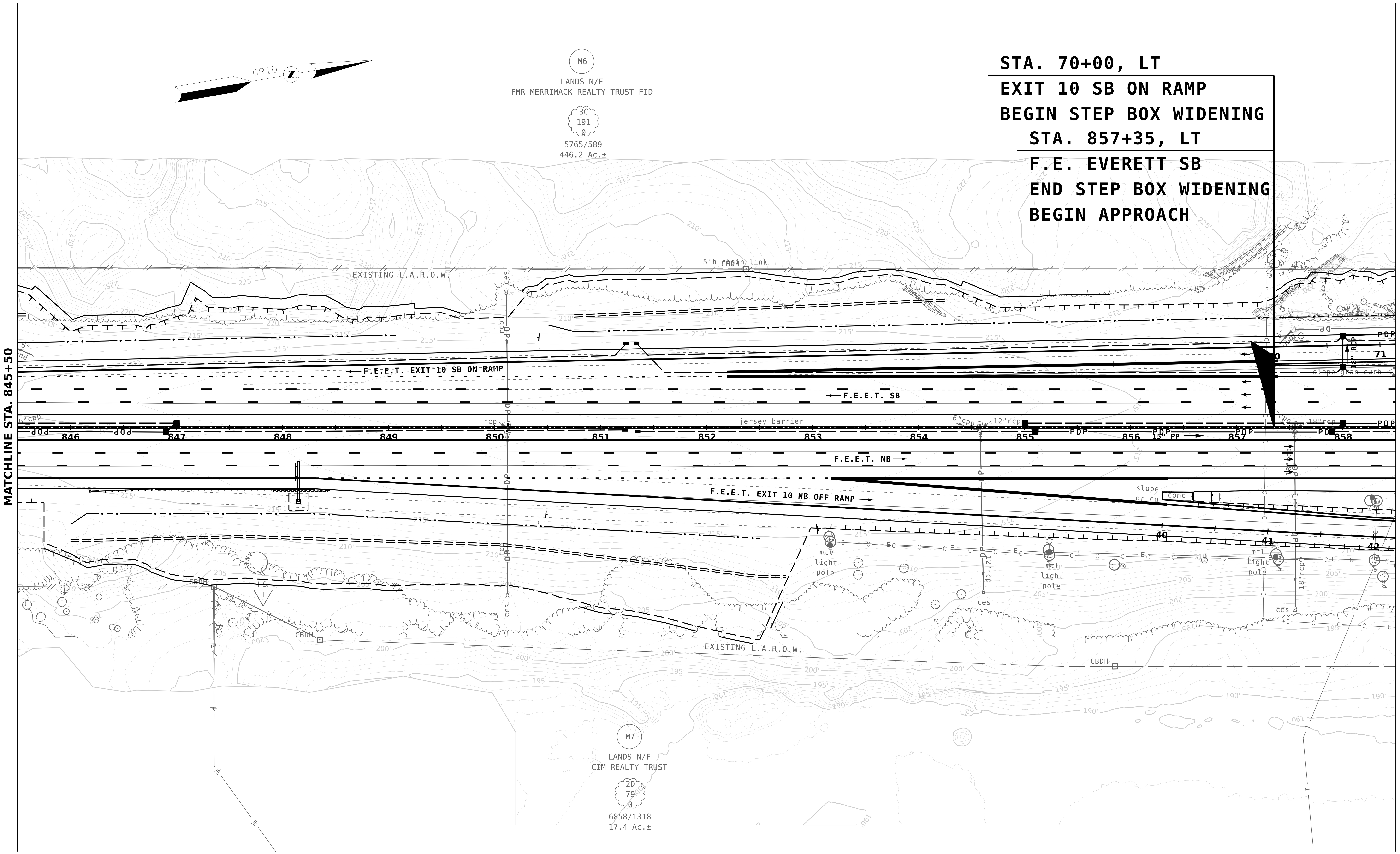
50 0 50 100
SCALE IN FEET

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 07

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_07	11/10/2023	52775.00	13761A_Wet_Plans	13761A	23	55



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- WETLAND DESIGNATION NUMBER
- WETLAND IMPACT LOCATION
- WETLAND MITIGATION AREA
- MITIGATION

50 0 50 100
SCALE IN FEET

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

vhb

STATE OF NEW HAMPSHIRE
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WETLAND IMPACT PLAN 08

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_08	11/10/2023	52775.00	13761A_Wet_Plans	13761A	24	55

LEGEND

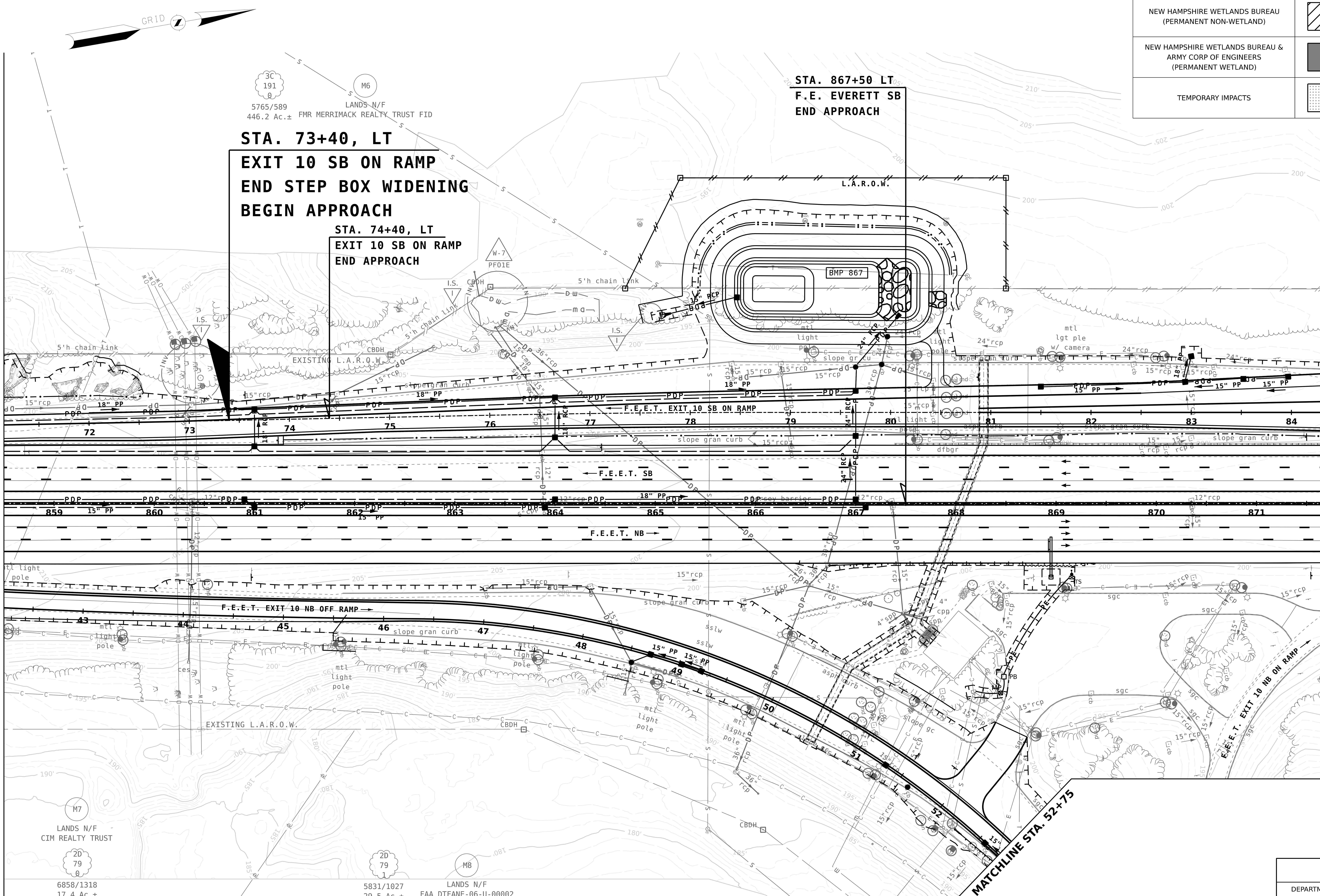
TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

\# WETLAND DESIGNATION NUMBER

\# WETLAND IMPACT LOCATION

\# WETLAND MITIGATION AREA

MITIGATION



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SCALE IN FEET

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

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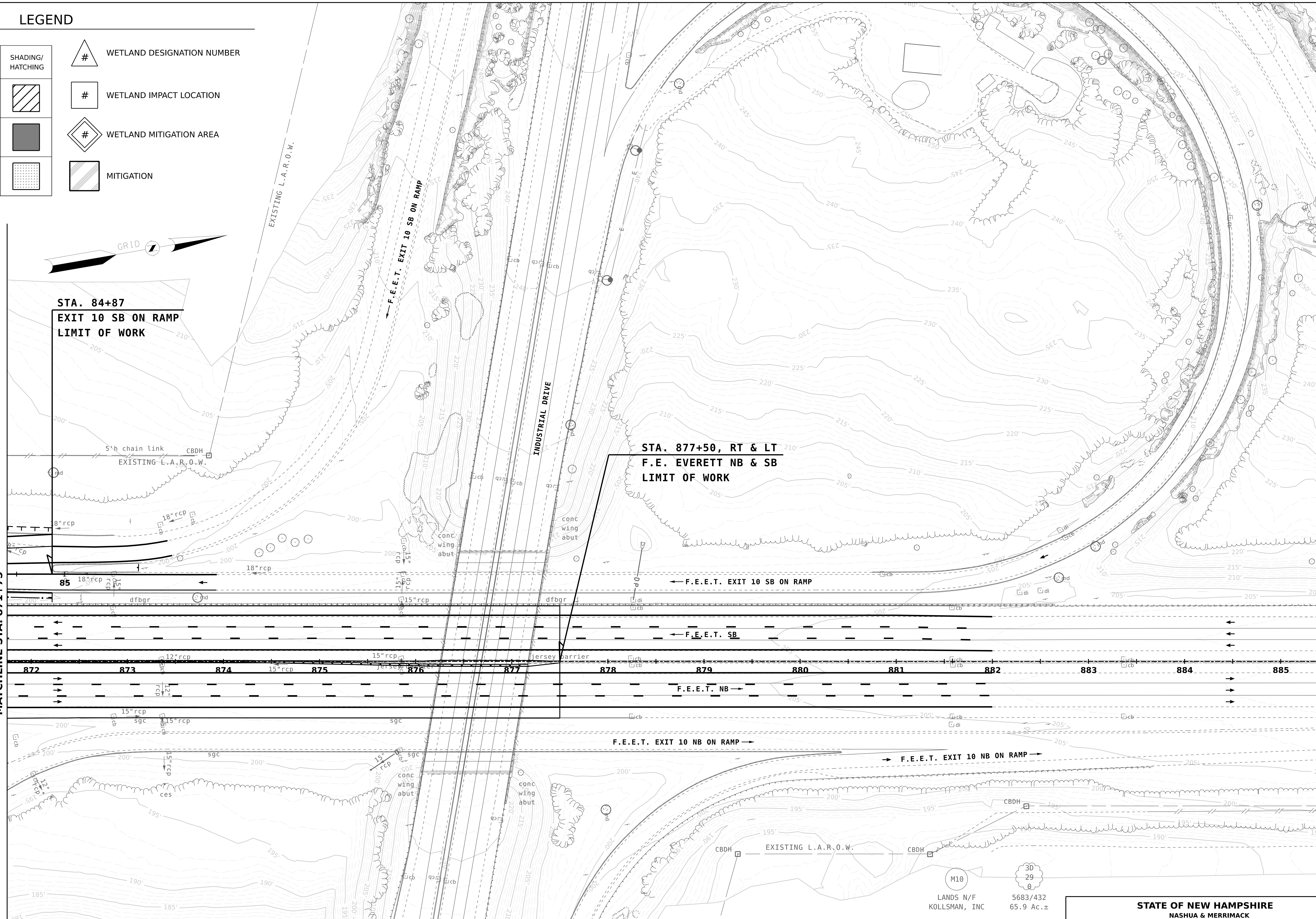
WETLAND IMPACT PLAN 09

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_09	11/10/2023	52775.00	13761A_Wet_Plans	13761A	25	55

LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- WETLAND DESIGNATION NUMBER
- WETLAND IMPACT LOCATION
- WETLAND MITIGATION AREA
- MITIGATION



MATCH TO SHEET WET_12

50 0 50 100

SCALE IN FEET

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE

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DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

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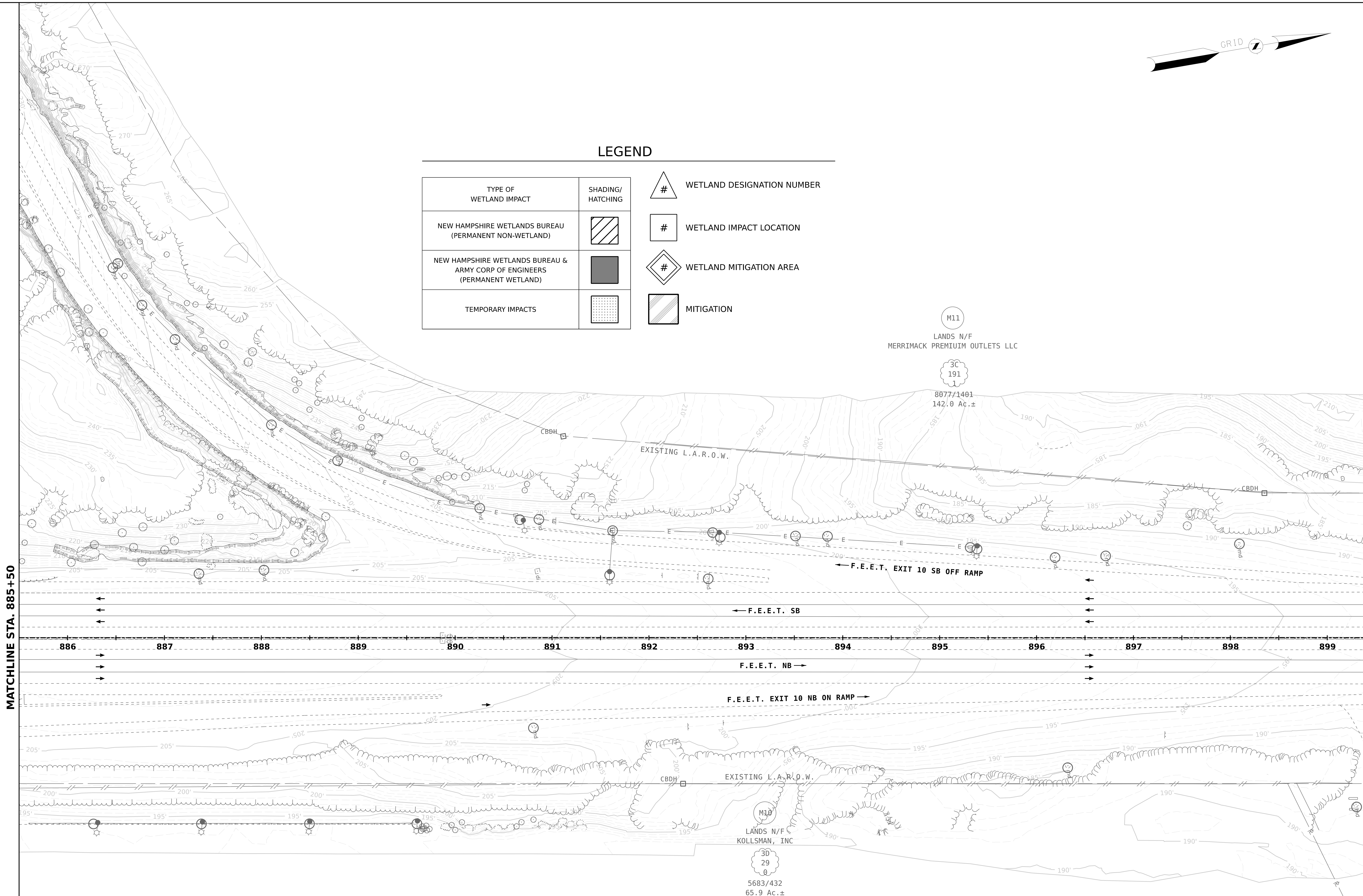
WETLAND IMPACT PLAN 10

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_10	11/10/2023	52775.00	13761A_Wet_Plans	13761A	26	55



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- WETLAND DESIGNATION NUMBER (#)
- WETLAND IMPACT LOCATION (#)
- WETLAND MITIGATION AREA (#)
- MITIGATION

50 0 50 100

SCALE IN FEET

REVISIONS AFTER PROPOSAL				
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 11

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_11	11/10/2023	52775.00	13761A_Wet_Plans	13761A	27	55

LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

WETLAND DESIGNATION NUMBER

WETLAND IMPACT LOCATION

WETLAND MITIGATION AREA

MITIGATION

50 0 50 100
SCALE IN FEET

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED		DATE
AS BUILT DETAILS		DATE

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 12

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET_12	11/10/2023	52775.00	13761A_Wet_Plans	13761A	28	55

EROSION CONTROL NOTES AND STRATEGIES

1. Erosion Control/Stormwater Control Selection, Sequencing and Maintenance
   - 1.1. Comply with RSA 485-A:17 Terrain Alteration.
   - 1.2. Install and maintain all erosion control/stormwater controls in accordance with the New Hampshire Stormwater Management Manual, Volume 3, Erosion and Sediment Controls During Construction, December 2008 (BMP Manual), available from the NH Department of Environmental Services (NHDES).
   - 1.3. Install erosion control/stormwater control measures prior to the start of work and in accordance with the manufacturer's recommendations.
   - 1.4. Select erosion control/stormwater control measures based on the size and nature of the project and physical characteristics of the site, including slope, soil type, vegetative cover, and proximity to jurisdictional areas.
   - 1.5. Install perimeter controls prior to earth disturbing activities.
   - 1.6. Install stormwater treatment ponds and drainage swales before rough grading the site.
   - 1.7. Clean, replace, and augment stormwater control measures and infiltration basins as necessary to prevent sedimentation beyond project limits throughout the project duration.
   - 1.8. Inspect erosion and sediment control measures in accordance with Section 645 of the specifications, weekly, and within 24 hours (during normal work hours), of any storm event greater than 0.25 inches of rain in a 24-hour period.
   - 1.9. Contain stockpiles with temporary perimeter controls. Protect inactive soil stockpiles with soil stabilization measures (temporary erosion control seed mix and mulch, soil binder) or cover them with anchored tarps. If the stockpile is to remain undisturbed for more than 14 days, mulch the stockpile.
   - 1.10. Maintain temporary erosion and stormwater control measures in place until the area has been permanently stabilized.
   - 1.11. An area is considered stable if one of the following has occurred:
     - Base course gravels have been installed in areas to be paved;
     - A minimum of 85% vegetative growth has been established;
     - A minimum of 3”of non-erosive material such as stone or rip-rap has been installed;
     - Temporary slope stabilization has been properly installed (see Table 1).
   - 1.12. Direct runoff to temporary practices until permanent stormwater infrastructure is constructed and stabilized.
   - 1.13. Use temporary mulching, permanent mulching, temporary vegetative cover, and permanent vegetative cover to reduce the need for dust control. Use mechanical sweepers on paved surfaces where necessary to prevent dust buildup. Apply water, or other dust inhibiting agents or tackifiers.
   - 1.14. Plan activities to account for sensitive site conditions
     - Sequence construction to limit the duration and area of exposed soils.
     - Clearly flag areas to be protected in the field and provide construction barrier to prevent trafficking outside of work areas.
     - Protect and maximize existing native vegetation and natural forest buffers between construction activities and sensitive areas.
     - When work is undertaken in a flowing watercourse, implement stream flow diversion methods prior to any excavation or filling activity.
   - 1.15. Utilize storm drain inlet protection to prevent sediment from entering a storm drainage system prior to the permanent stabilization of the contributing disturbed area.
   - 1.16. Use care to ensure that sediments do not enter any existing catch basins during construction. Place temporary inlet protection at inlets in areas of soil disturbance that are subject to sedimentation.
   - 1.17. Construct, stabilize, and maintain temporary and permanent ditches in a manner that will minimize scour. Direct temporary and permanent ditches to drain to sediment basins or stormwater collection areas.
   - 1.18. Supplement channel protection measures with perimeter control measures when ditch lines occur at the bottom of long fill slopes. Install the perimeter controls on the fill slope to minimize the potential for fill slope sediment deposits in the ditch line.
   - 1.19. Divert sediment laden water away from drainage inlet structures to the extent possible.
   - 1.20. Install sediment barriers and sediment traps at drainage inlets to prevent sediment from entering the drainage system.
   - 1.21. Clean catch basins, drainage pipes, and culverts if significant sediment is deposited.
   - 1.22. Construct and stabilize dewatering infiltration basins prior to any excavation that may require dewatering.
   - 1.23. Place and stabilize temporary sediment basins or traps at locations where concentrated flow (channels and pipes) discharge to the surrounding environment from areas of unstabilized earth disturbing activities.
   - 1.24. Stabilize, to appropriate anticipated velocities, conveyance channels or pumping systems needed to convey construction stormwater to basins and discharge locations prior to use.
   - 1.25. Size temporary sediment basins to contain the 2-year, 24 hour storm event.
   - 1.26. Size temporary sediment traps to contain 3,600 cubic feet of storage for each acre of drainage area.
   - 1.27. Construct detention basins to accommodate the 2-year, 24-hour storm event.

2. Construction Planning
   - 2.1. Divert off site runoff or clean water away from the construction activities to reduce the volume that needs to be treated on site.
   - 2.2. Divert storm runoff from upslope drainage areas away from disturbed areas, slopes and around active work areas to a stabilized outlet location.
   - 2.3. Construct impermeable barriers, as necessary, to collect or divert concentrated flows from work or disturbed areas.
   - 2.4. Locate staging areas and stockpiles outside of wetlands jurisdiction.
   - 2.5. Do not store, maintain, or repair mobile heavy equipment in wetlands, unless equipment cannot be practicably removed and secondary containment is provided.
   - 2.6. Provide a water truck to control excessive dust, at the discretion of the Contract Administrator.

3. Site Stabilization
   - 3.1. Stabilize all areas of unstabilized soil as soon as practicable, but no later than 45 days after initial disturbance.
   - 3.2. Limit unstabilized soil to a maximum of 5 acres unless documentation is provided that demonstrates that cuts and fills are such that 5 acres is unreasonable.
   - 3.3. Use erosion control seed mix in all inactive construction areas that will not be permanently seeded within two weeks of disturbance and prior to September 15th of any given year in order to achieve vegetative stabilization prior to the end of the growing season.
   - 3.4. Apply, and reapply as necessary, soil tackifiers in accordance with the manufacturer’s specifications to minimize soil and mulch loss until permanent vegetation is established.
   - 3.5. Stabilize basins, ditches and swales prior to directing runoff to them.
   - 3.6. Stabilize roadway and parking areas within 72 hours of achieving finished grade.
   - 3.7. Stabilize cut and fill slopes within 72 hours of achieving finished grade.
   - 3.8. When temporarily stabilizing soils and slopes, utilize the techniques outlined in Table 1.
   - 3.9. Stabilize all areas that can be stabilized prior to opening up new areas to construction activities.
   - 3.10. Utilize Table 1 when selecting temporary soil stabilization measures.
   - 3.11. Divert off-site water through the project in an appropriate manner so as not to disturb the upstream or downstream soils, vegetation or hydrology beyond the permitted area.
   - 3.12. Install and maintain construction exits anywhere traffic leaves a construction site onto a public right-of-way.
   - 3.13. Sweep all construction related debris and soil from the adjacent paved roadways, as necessary.

4. Slope Protection
   - 4.1. Intercept and divert storm runoff from upslope drainage areas away from unprotected and newly established areas and slopes to a stabilized outlet or conveyance.
   - 4.2. Consider how groundwater seepage on cut slopes may impact slope stability and incorporate appropriate measures to minimize erosion.
   - 4.3. Convey storm water down the slope in a stabilized channel or slope drain.
   - 4.4. The outer face of the fill slope should be in a loose, ruffled condition prior to turf establishment.

5. Winter Construction
   - 5.1. To minimize erosion and sedimentation impacts, limit the extent and duration of winter excavation and earthwork activities. The maximum amount of disturbed earth shall not exceed a total of 5 acres from May 1st through November 30th, or exceed one acre during winter months, unless the contractor demonstrates to the Department that the additional area of disturbance is necessary to meet the contractor’s Critical Path Method (CPM) schedule, and the contractor has adequate resources available to ensure that environmental requirements will be met.
   - 5.2. Construction performed any time between November 30th and May 1st of any year is considered winter construction. During winter construction:
     - Stabilize all proposed vegetation areas which do not exhibit a minimum of 85% vegetative growth by October 15th, or which are disturbed after October 15th, in accordance with Table 1.
     - Stabilize all ditches or swales which do not exhibit a minimum of 85% vegetative growth by October 15th, or which are disturbed after October 15th, in accordance with Table 1.
     - Protect incomplete road surfaces, where base course gravels have not been installed, and where work has stopped for the season after November 30th, in accordance with Table 1.
     - Unless a winter construction plan has been approved by NHDOT, conduct winter excavation and earthwork such that no more than 1 acre of the project is without stabilization an any one time.

6. Wildlife Protection Measures
   - 6.1. Report all observations of threatened and endangered species on the project site to the Department’s Bureau of Environment by phone at 603-271-3226 or by email at Bureau16@dot.nh.gov, indicating in the subject line the project name, number, and that a threatened/endangered species was found.
   - 6.2. Photograph the observed species and nearby elements of habitat or areas of land disturbance and provide them to the Department’s Bureau of Environment at the above email address.
   - 6.3. In the event that a threatened or endangered species is observed on the project during work, the species shall not be disturbed, handled, or harmed prior to receiving direction from the Bureau of Environment.
   - 6.4. Utilize wildlife friendly erosion control methods when:
     - Erosion control blankets are used,
     - A protected species or habitat is documented,
     - The proposed work is in or adjacent to a priority resource area, and/or when specifically requested by NHB or NHF&G

GUIDANCE ON SELECTING TEMPORARY SOIL STABILIZATION MEASURES
TABLE 1

APPLICATION AREAS	DRY MULCH METHODS				HYDRAULICALLY APPLIED MULCHES[2]				ROLLED EROSION CONTROL BLANKETS[3]			
	HMT	WC	SG	CB	HM	SMM	BFM	FRM	SNSB	DNSB	DNSCB	DNCB
SLOPES[1]												
STEEPER THAN 2:1	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES
2:1 SLOPE	YES1	YES1	YES	YES	NO	NO	YES	YES	NO	YES	YES	YES
3:1 SLOPE	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO
4:1 SLOPE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO
WINTER STABILIZATION	4T/AC	YES	YES	YES	NO	NO	YES	YES	YES	YES	YES	YES
CHANNELS												
LOW FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
HIGH FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE
HMT	HAY MULCH & TACK	HM	HYDRAULIC MULCH	SNSB	SINGLE NET STRAW BLANKET
WC	WOOD CHIPS	SMM	STABILIZED MULCH MATRIX	DNSB	DOUBLE NET STRAW BLANKET
SG	STUMP GRINDINGS	BFM	BONDED FIBER MATRIX	DNSCB	2 NET STRAW-COCONUT BLANKET
CB	COMPOST BLANKET	FRM	FIBER REINFORCED MEDIUM	DNCB	2 NET COCONUT BLANKET

NOTES:
1. All slope stabilization options assume a slope length ≤ 10 times the horizontal distance component of the slope, in feet.
2. Do not apply products containing polyacrylamide (PAM) directly to, or within 100 feet of any surface water without NHDES approval.
3. Install all methods in Table 1 per the manufacturer’s recommendation for time of year and steepness of slope.

STATE OF NEW HAMPSHIRE
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DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL NOTES AND STRATEGIES

	REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
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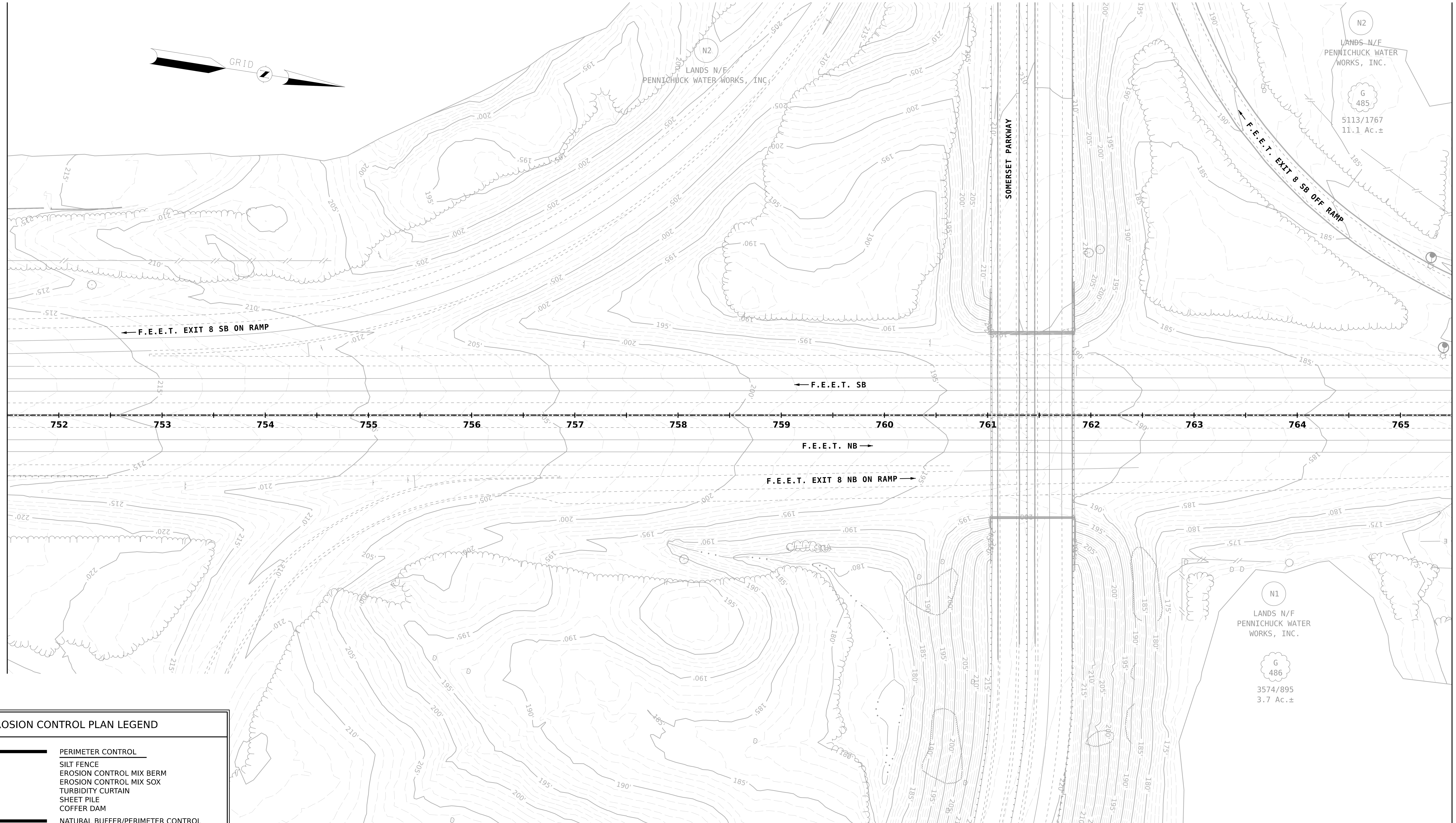

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED NHDOT DATE 7/2021
NEW DESIGN VHB TEAM DATE 11/10/2023
SHEET CHECKED B. ARCIERI DATE 11/10/2023
AS BUILT DETAILS DATE

EROSION CONTROL PLAN LEGEND

PC — PERIMETER CONTROL
- SILT FENCE
- EROSION CONTROL MIX BERM
- EROSION CONTROL MIX SOX
- TURBIDITY CURTAIN
- SHEET PILE
- COFFER DAM

NB/PC — NATURAL BUFFER/PERIMETER CONTROL
- SILT FENCE
- EROSION CONTROL MIX BERM
- EROSION CONTROL MIX SOX
- TURBIDITY CURTAIN
- SHEET PILE
- COFFER DAM

CP — CHANNEL PROTECTION
- STONE CHECK DAMS
- STRAW WATTLES
- CHANNEL MATTING
- CLASS D EROSION STONE
- CLASS C STONE

URS — UNIMPACTED RIVERINE SURFACE WATERS OF THE STATE

ROA — ROUTINE ROADWAY QUALIFYING ACTIVITY

SD — STREAM DIVERSION

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SCALE IN FEET

vhb

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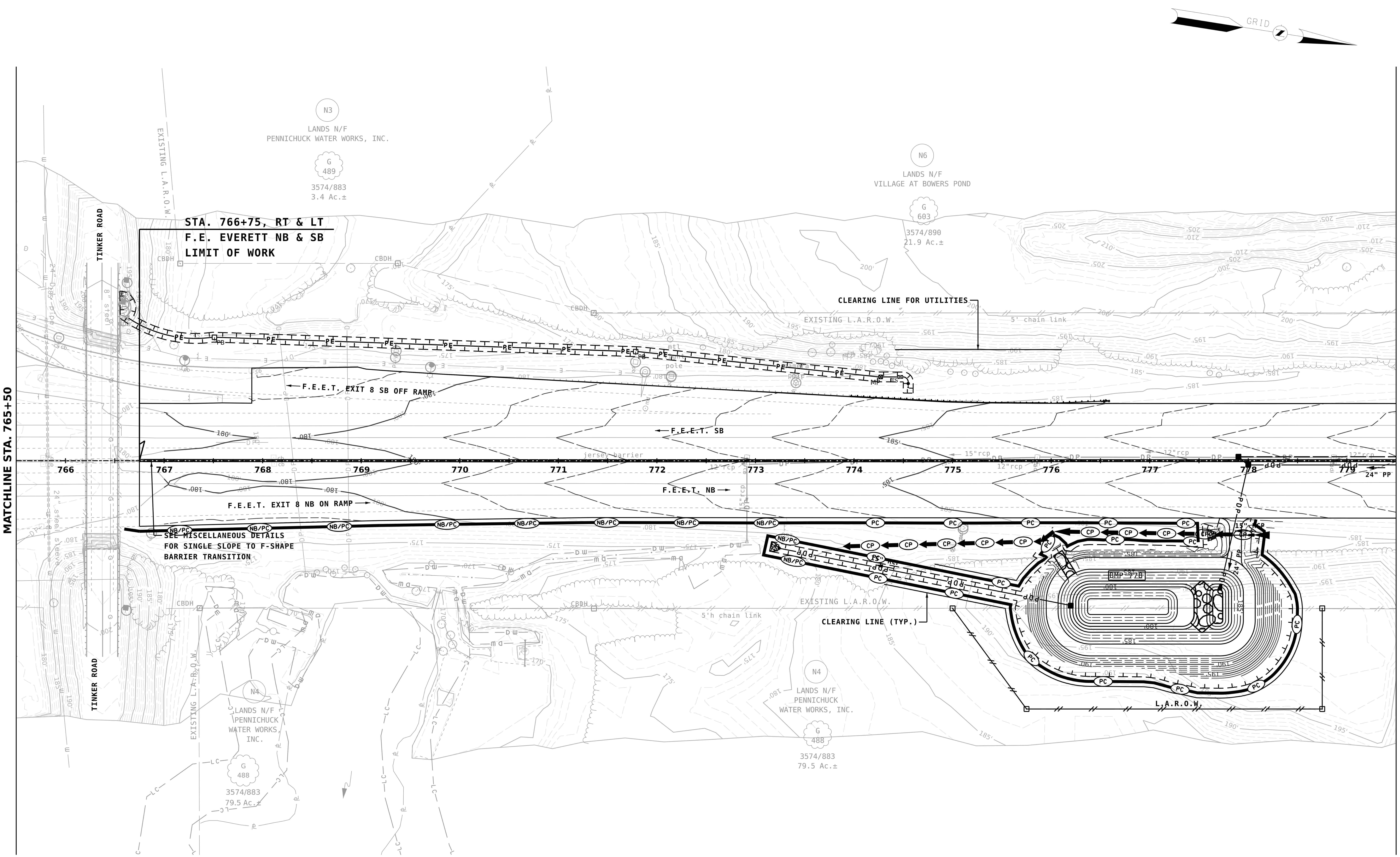
EROSION CONTROL PLAN 01

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_01	11/10/2023	52775.00	13761A_Ero_Plans	13761A	30	55



50 0 50 100

SCALE IN FEET

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	B. ARCIERI	DATE	11/10/2023
AS BUILT DETAILS		DATE	

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

vhb

STATE OF NEW HAMPSHIRE
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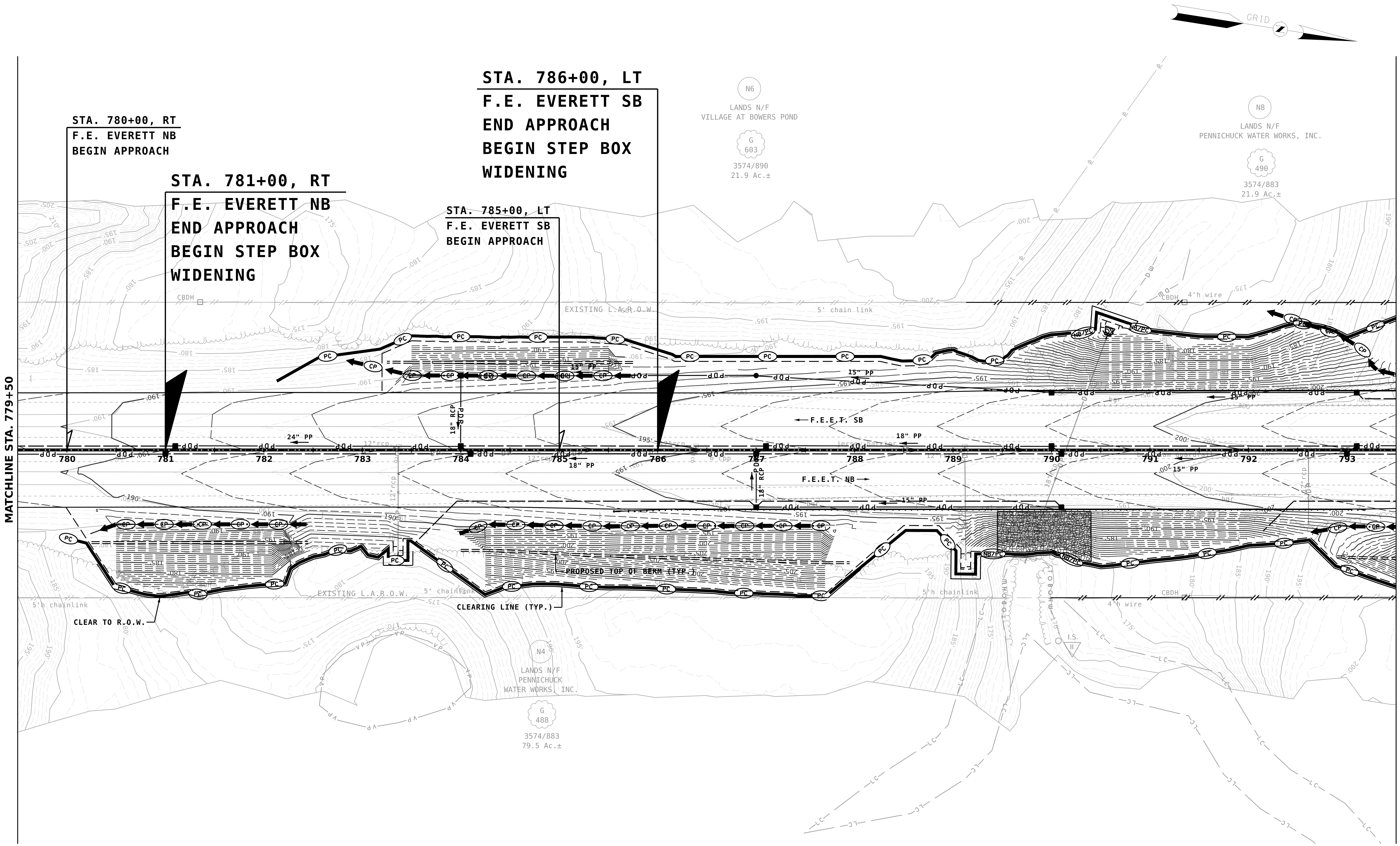
EROSION CONTROL PLAN 02

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_02	11/10/2023	52775.00	13761A_Ero_Plans	13761A	31	55



SDR PROCESSED	NHDOT	DATE	7/2021	
NEW DESIGN	VHB TEAM	DATE	11/10/2023	
SHEET CHECKED	B. ARCIERI	DATE	11/10/2023	
AS BUILT DETAILS		DATE		

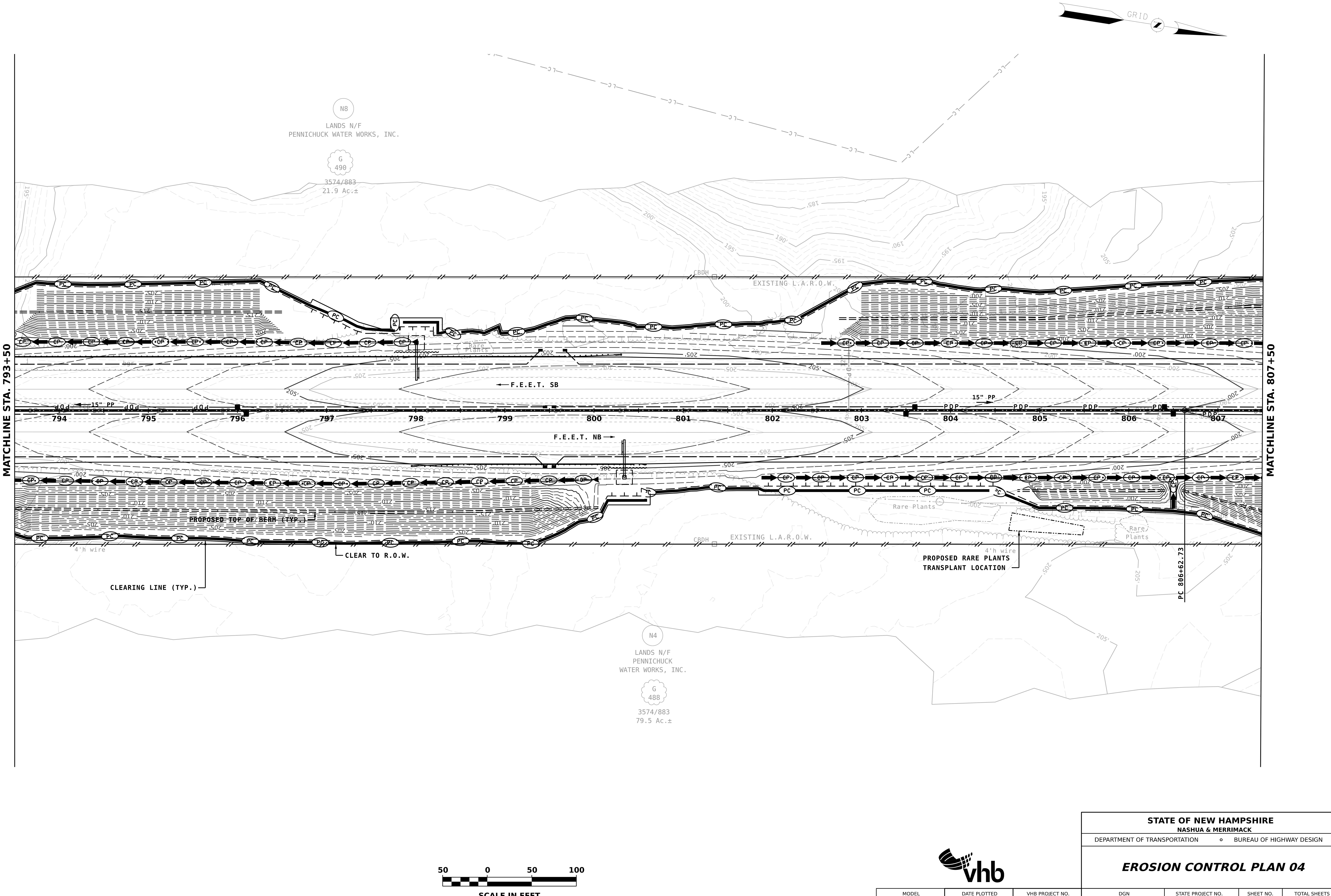
REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 03

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_03	11/10/2023	52775.00	13761A_Ero_Plans	13761A	32	55



REVISIONS AFTER PROPOSAL				
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	B. ARCIERI	DATE 11/10/2023
AS BUILT DETAILS		DATE

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
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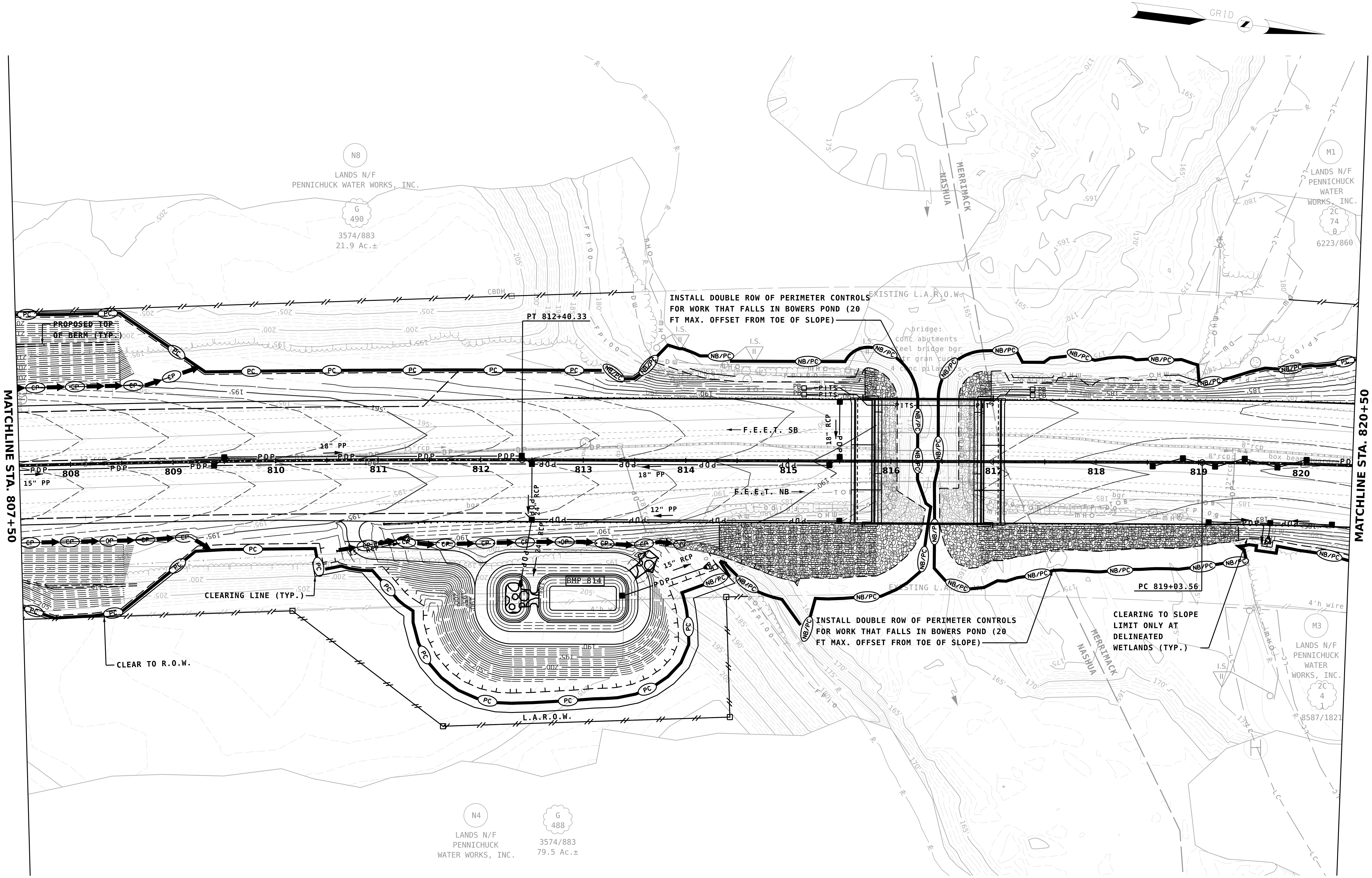
EROSION CONTROL PLAN 04

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_04	11/10/2023	52775.00	13761A_Ero_Plans	13761A	33	55



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SCALE IN FEET

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

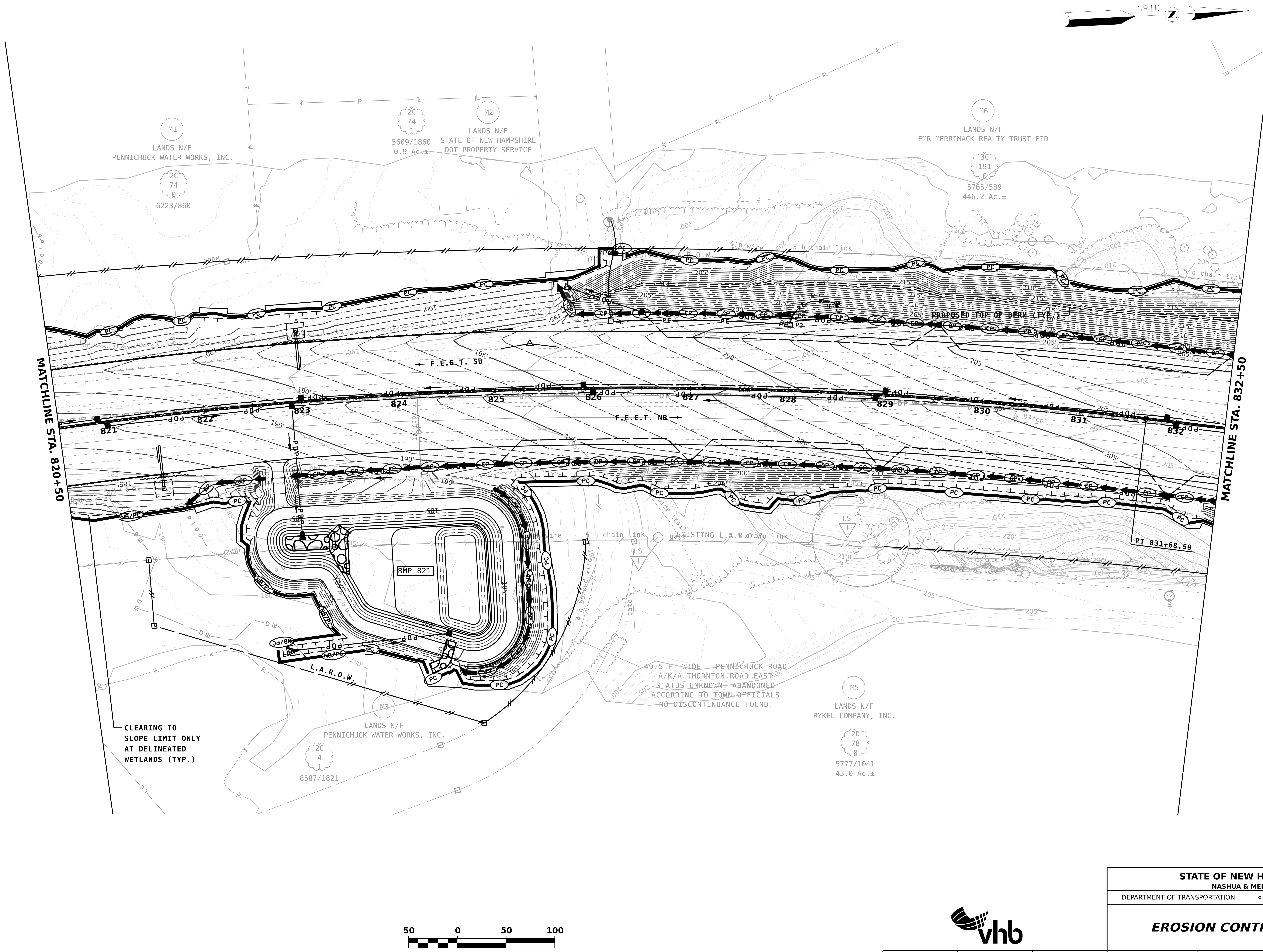
	DATE	
SDR PROCESSED	7/2021	NHDOT
NEW DESIGN	11/10/2023	VHB TEAM
SHEET CHECKED	11/10/2023	B. ARCIERI
AS BUILT DETAILS		

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 05

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_05	11/10/2023	52775.00	13761A_Ero_Plans	13761A	34	55



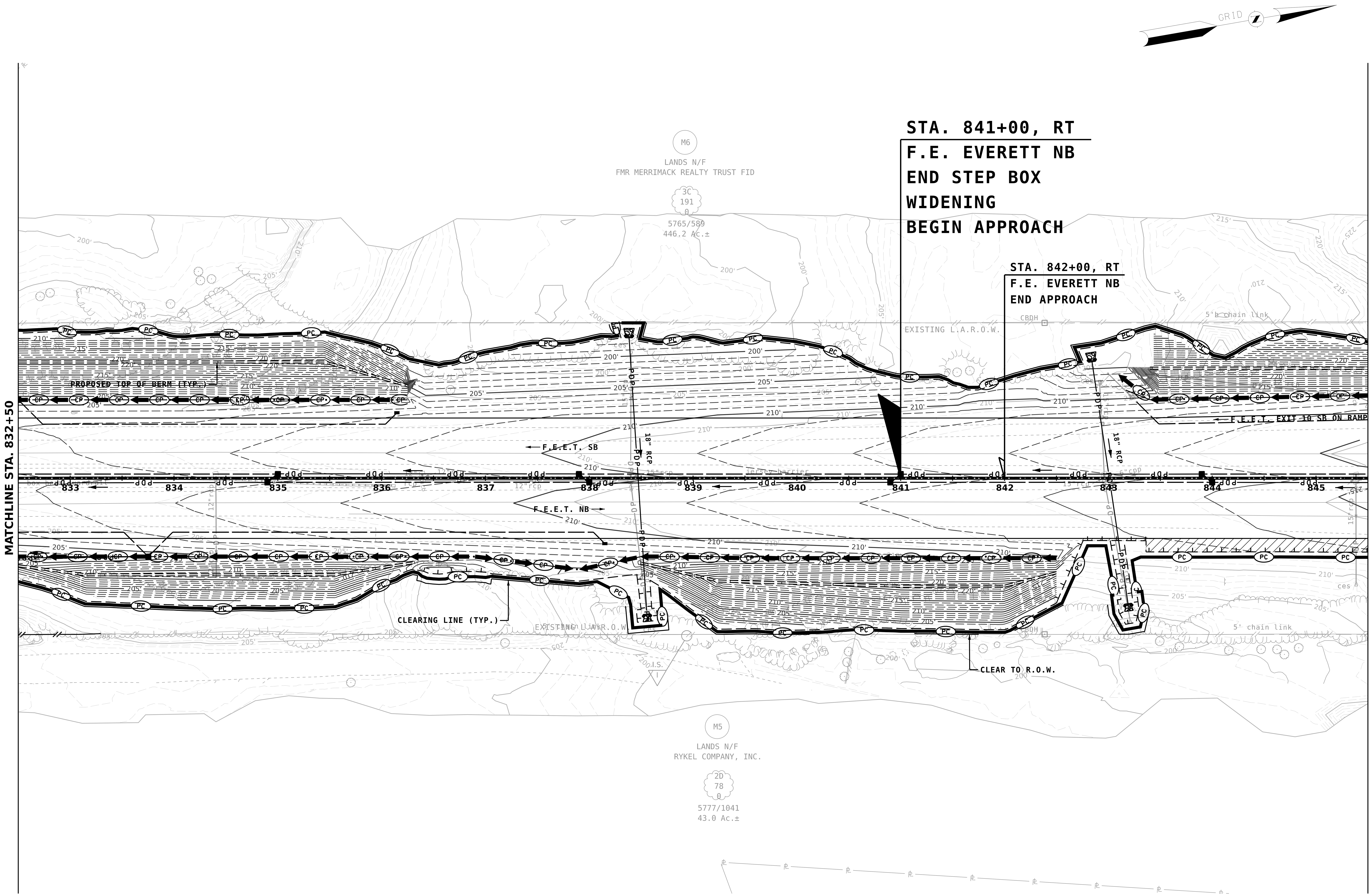
REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	B. ARCIERI	DATE 11/10/2023
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 06

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_06	11/10/2023	52775.00	13761A_Ero_Plans	13761A	35	55



50 0 50 100

SCALE IN FEET

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	B. ARCIERI	DATE	11/10/2023
AS BUILT DETAILS		DATE	

vhb

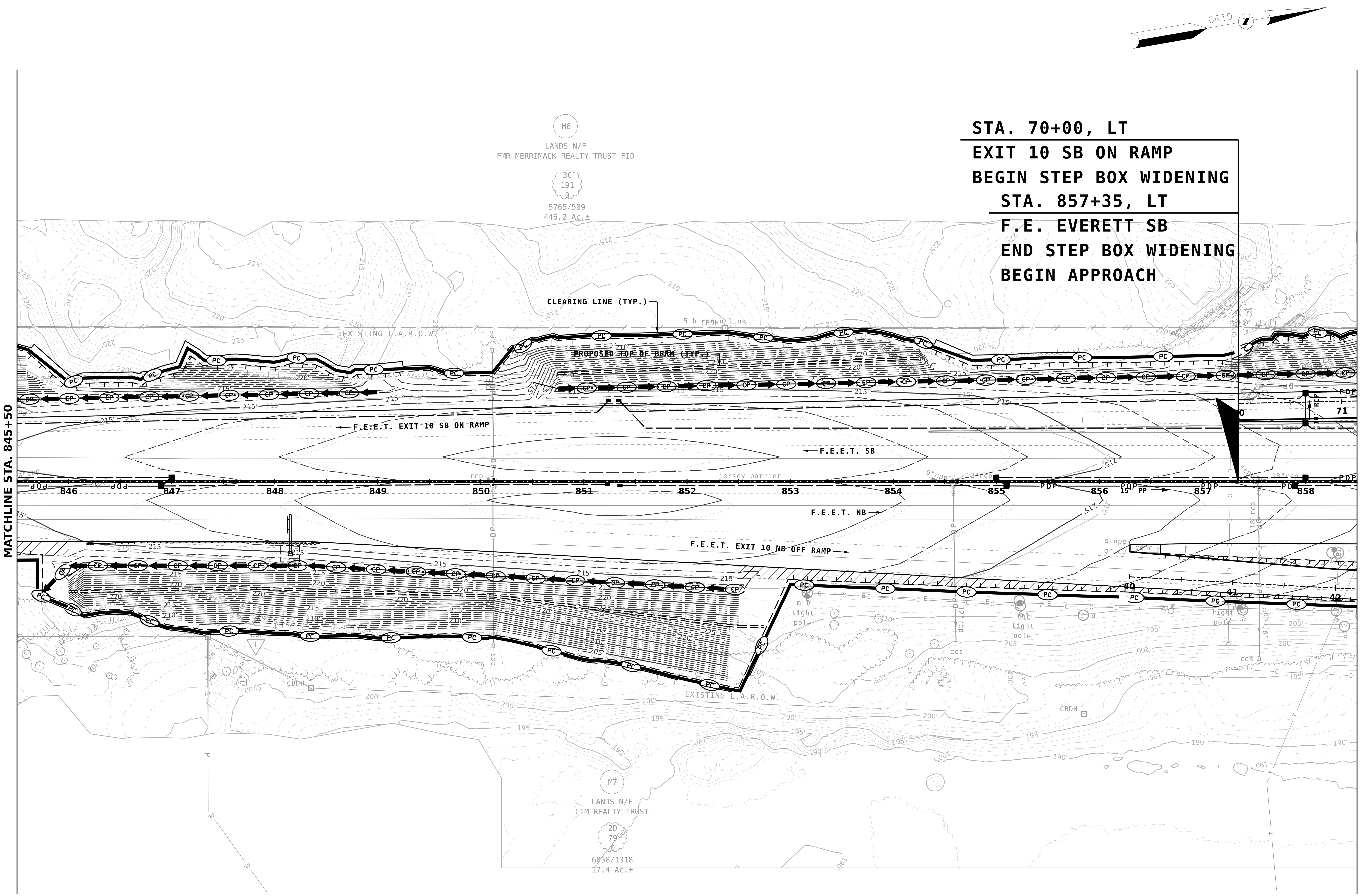
STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 07

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_07	11/10/2023	52775.00	13761A_Ero_Plans	13761A	36	55



REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	B. ARCIERI	DATE 11/10/2023
AS BUILT DETAILS		DATE

50 0 50 100

SCALE IN FEET

vhb

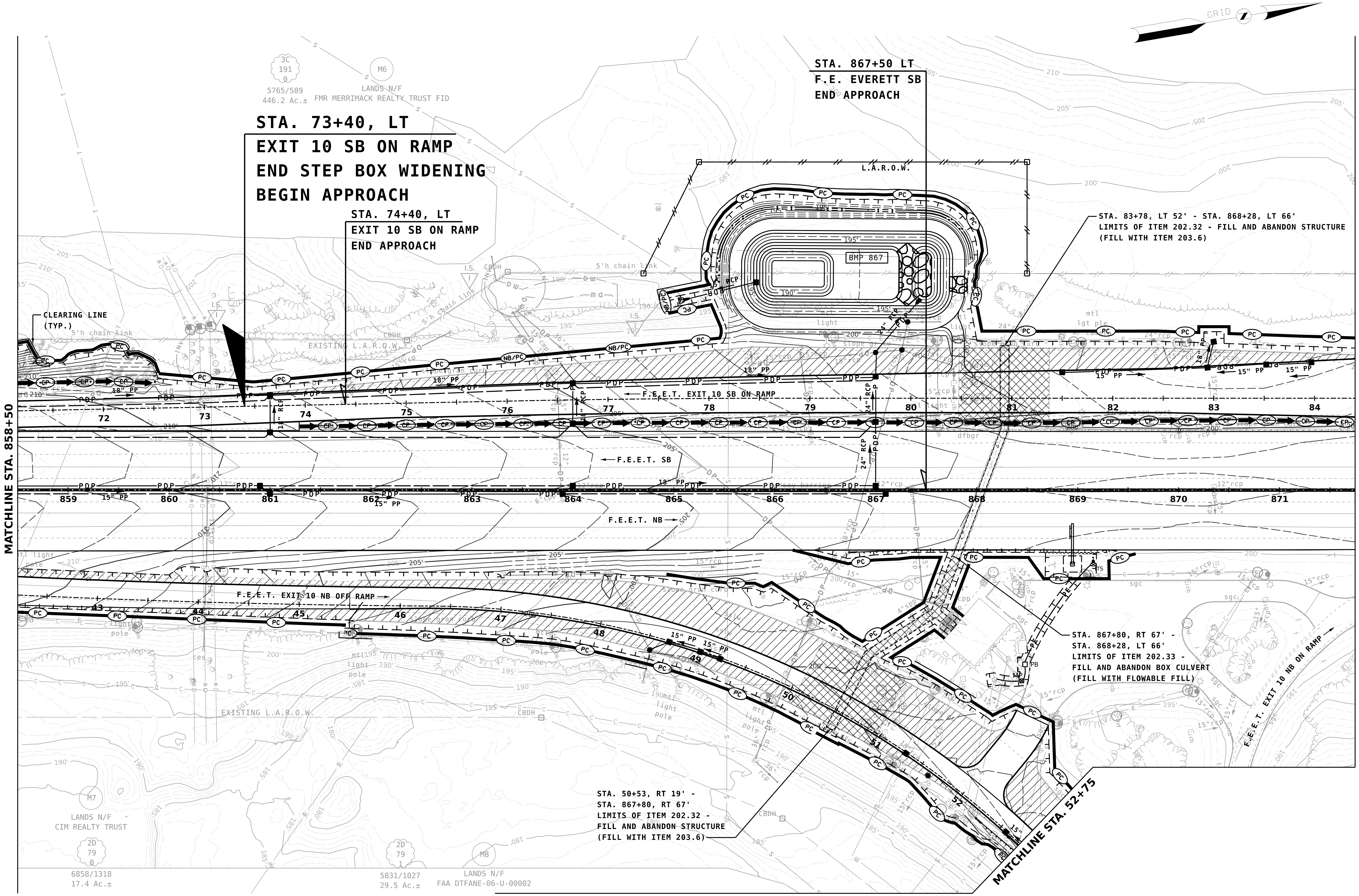
STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 08

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_08	11/10/2023	52775.00	13761A_Ero_Plans	13761A	37	55



50 0 50 100

SCALE IN FEET

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

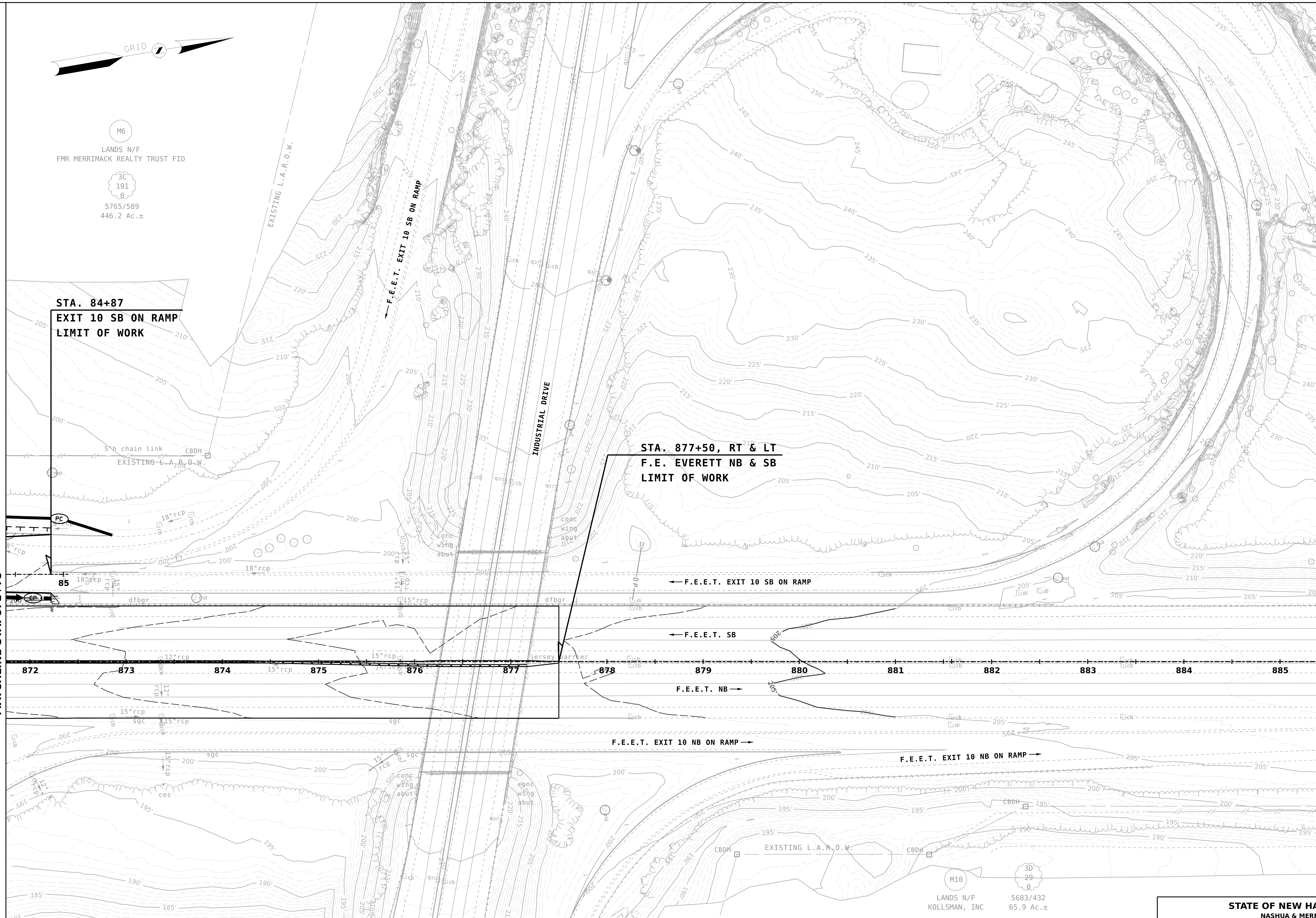
EROSION CONTROL PLAN 09

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_09	11/10/2023	52775.00	13761A_Ero_Plans	13761A	38	55

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	B. ARCIERI	DATE	11/10/2023
AS BUILT DETAILS		DATE	



MATCHLINE STA. 871+75

MATCHLINE STA. 885+50

MATCH TO SHEET GEN12

50 0 50 100

SCALE IN FEET

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	B. ARCIERI	DATE 11/10/2023
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE

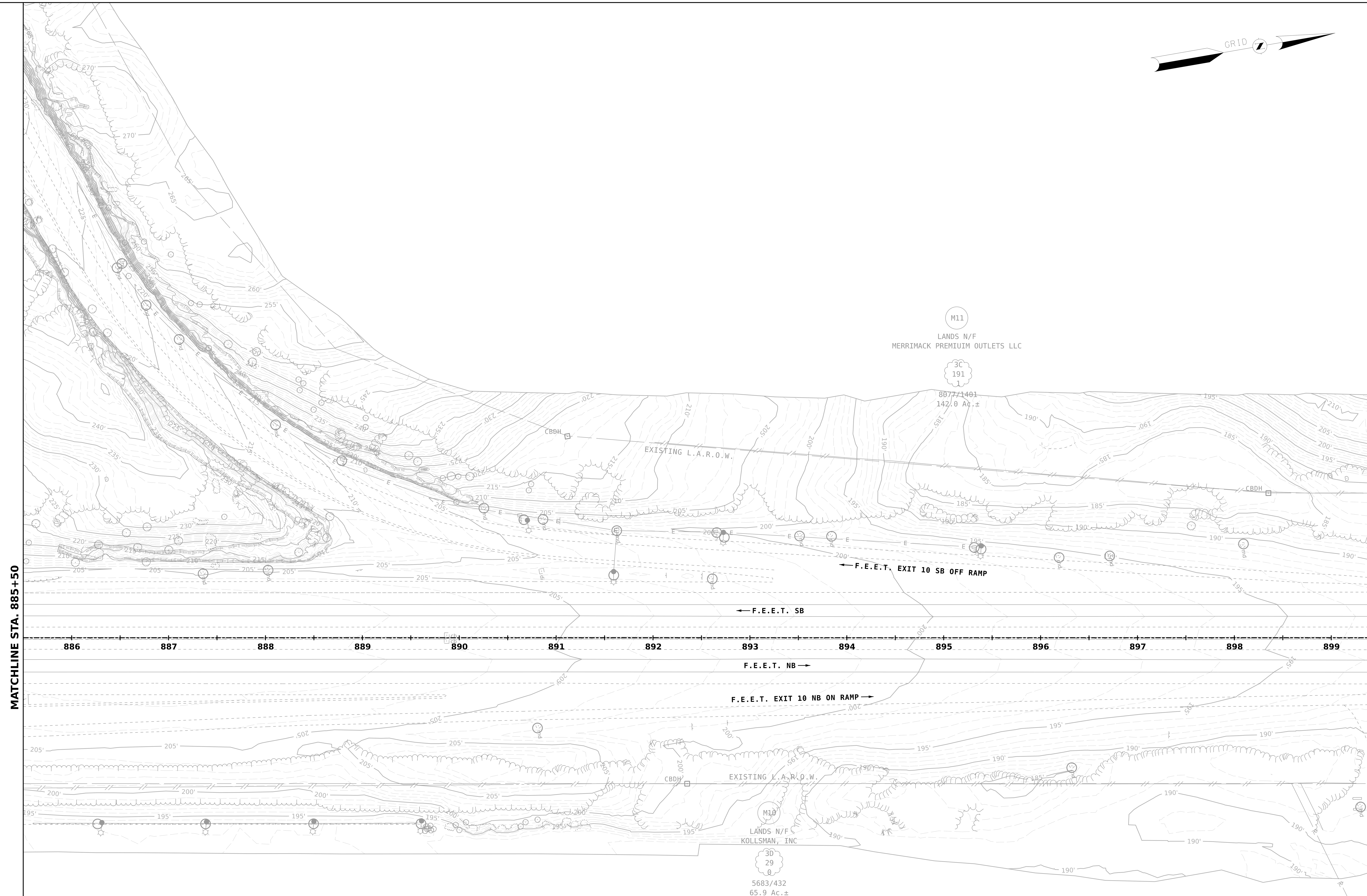
NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

vhb

EROSION CONTROL PLAN 10

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_10	11/10/2023	52775.00	13761A_Ero_Plans	13761A	39	55



REVISIONS AFTER PROPOSAL				
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	B. ARCIERI	DATE 11/10/2023
AS BUILT DETAILS		DATE

50 0 50 100
SCALE IN FEET

vhb

STATE OF NEW HAMPSHIRE
NASHUA & MERRIMACK
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 11

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_11	11/10/2023	52775.00	13761A_Ero_Plans	13761A	40	55

NUMBER	DATE	STATION	STATION	DESCRIPTION
				REVISIONS AFTER PROPOSAL

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	B. ARCIERI	DATE	11/10/2023
AS BUILT DETAILS		DATE	

50 0 50 100

SCALE IN FEET

vhb

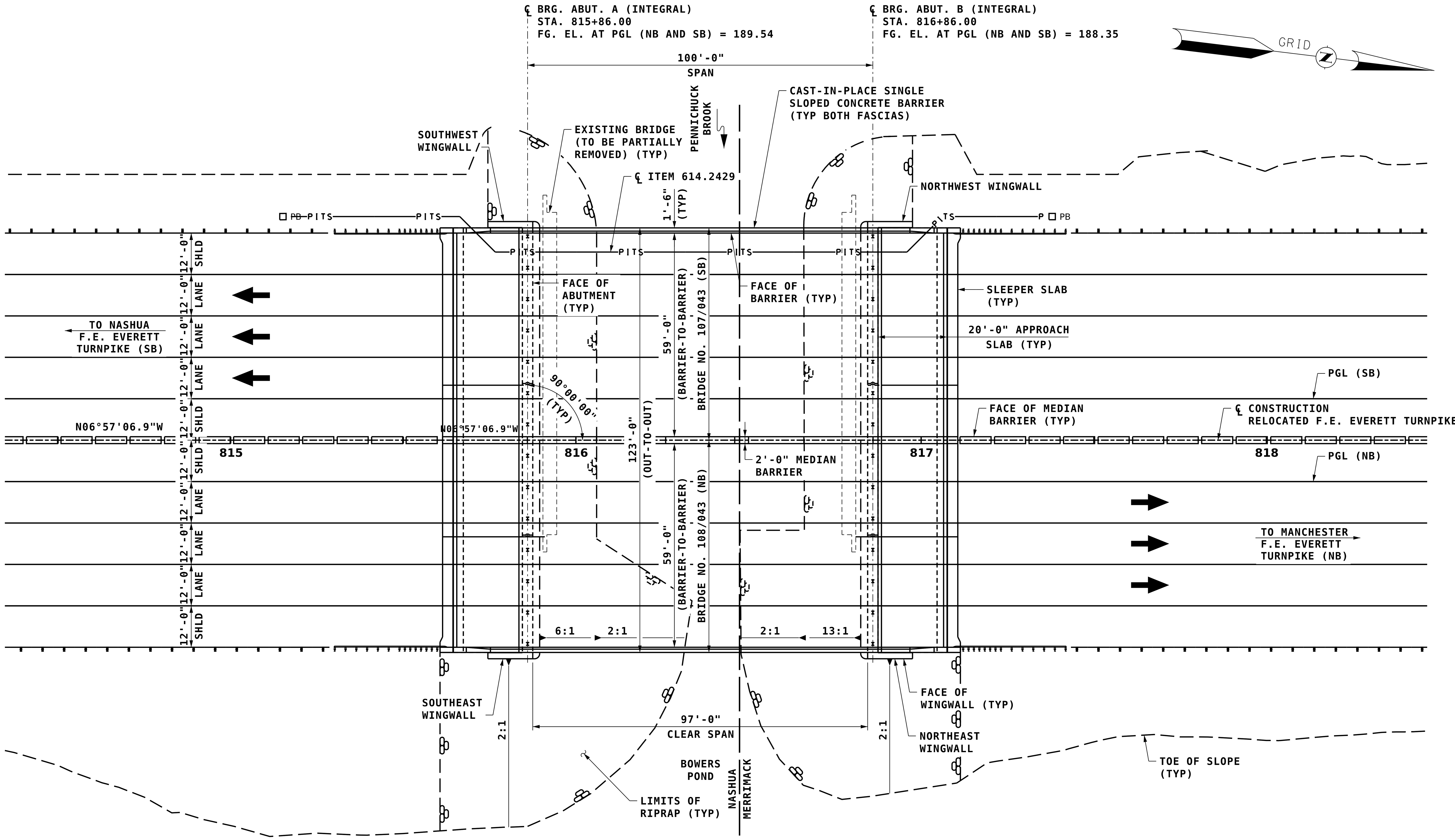
STATE OF NEW HAMPSHIRE

NASHUA & MERRIMACK

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

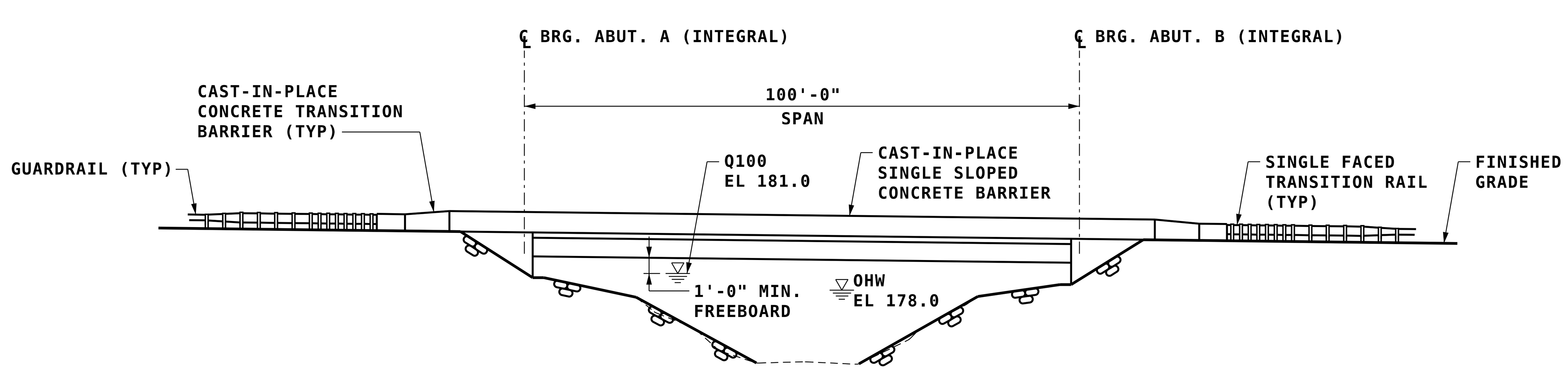
EROSION CONTROL PLAN 12

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ERO_12	11/10/2023	52775.00	13761A_Ero_Plans	13761A	41	55



GENERAL PLAN

SCALE: 1" = 20'-0"



ELEVATION

SCALE: 1" = 20'-0"

HYDRAULIC DATA	
DRAINAGE AREA	23 SQ. MILES
DESIGN FLOOD DISCHARGE (100 YR)	1,150 CFS
DESIGN FLOOD ELEVATION (100 YR)	181.0 FEET
DESIGN FLOOD VELOCITY (100 YR)	1.4 FPS
SCOUR CHECK DISCHARGE (500 YR)	1,640 CFS
ANTICIPATED DEPTH OF SCOUR (CHANNEL) (500 YR)	4.9 FEET
BRIDGE FULL WATERWAY OPENING ⊥ TO RIVER	1,075 SQ. FEET

PPS&E
SUBJECT TO CHANGE
DATE 10/11/2023

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN MERRIMACK AND NASHUA — BRIDGE NO. 107/043 AND 108/043 — STATE PROJECT 13761A

LOCATION F.E. EVERETT TURNPIKE OVER PENNICHUCK BROOK

GENERAL PLAN AND ELEVATION

BRIDGE SHEET 42 OF 51

REVISIONS AFTER PROPOSAL

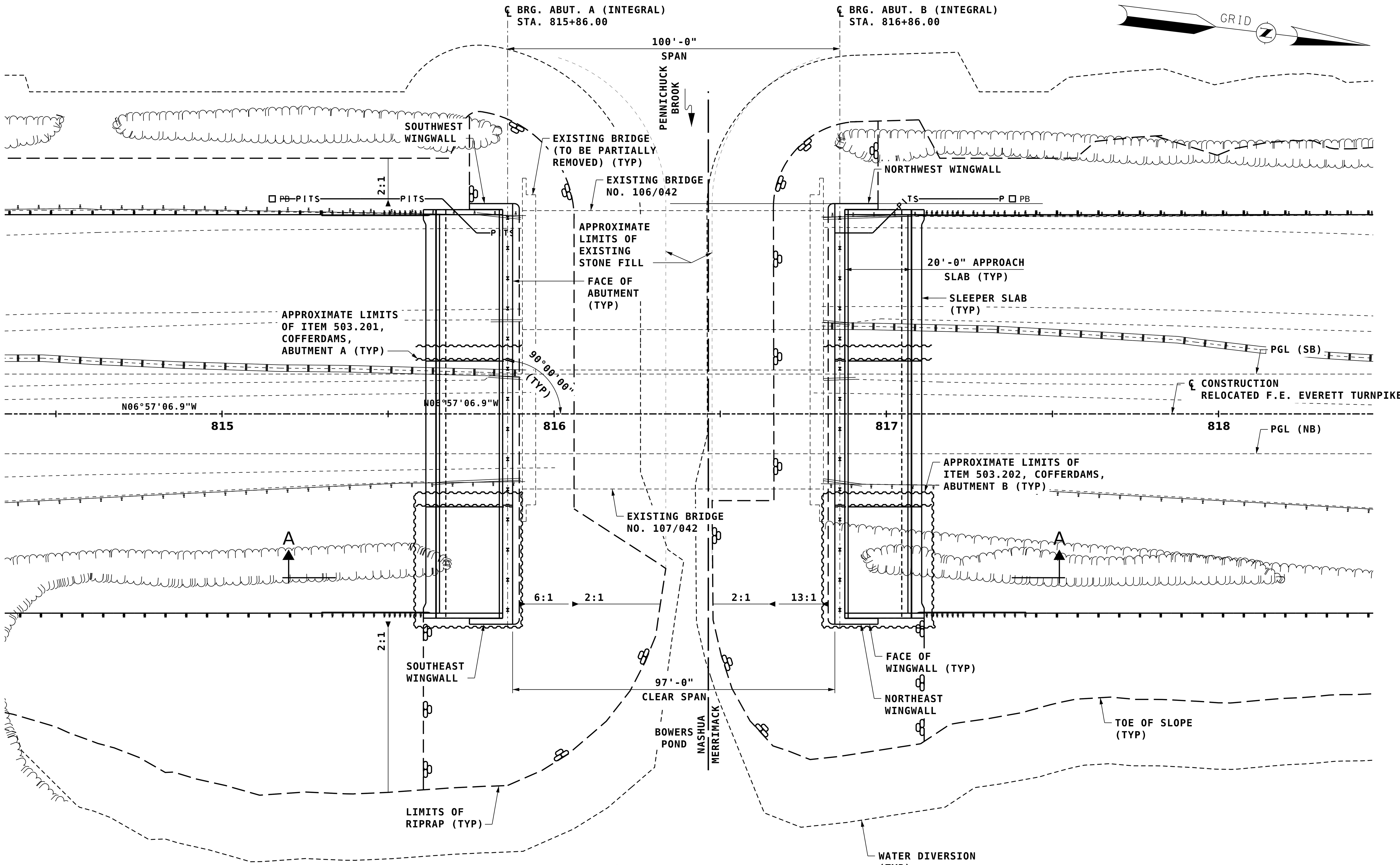
	BY	DATE		BY	DATE
DESIGNED	AMS	10/23	CHECKED	KCD	10/23
DRAWN	KDW	10/23	CHECKED	KCD	10/23
QUANTITIES			CHECKED		

FILE NUMBER 143-4-4

ISSUE DATE
REV. DATE

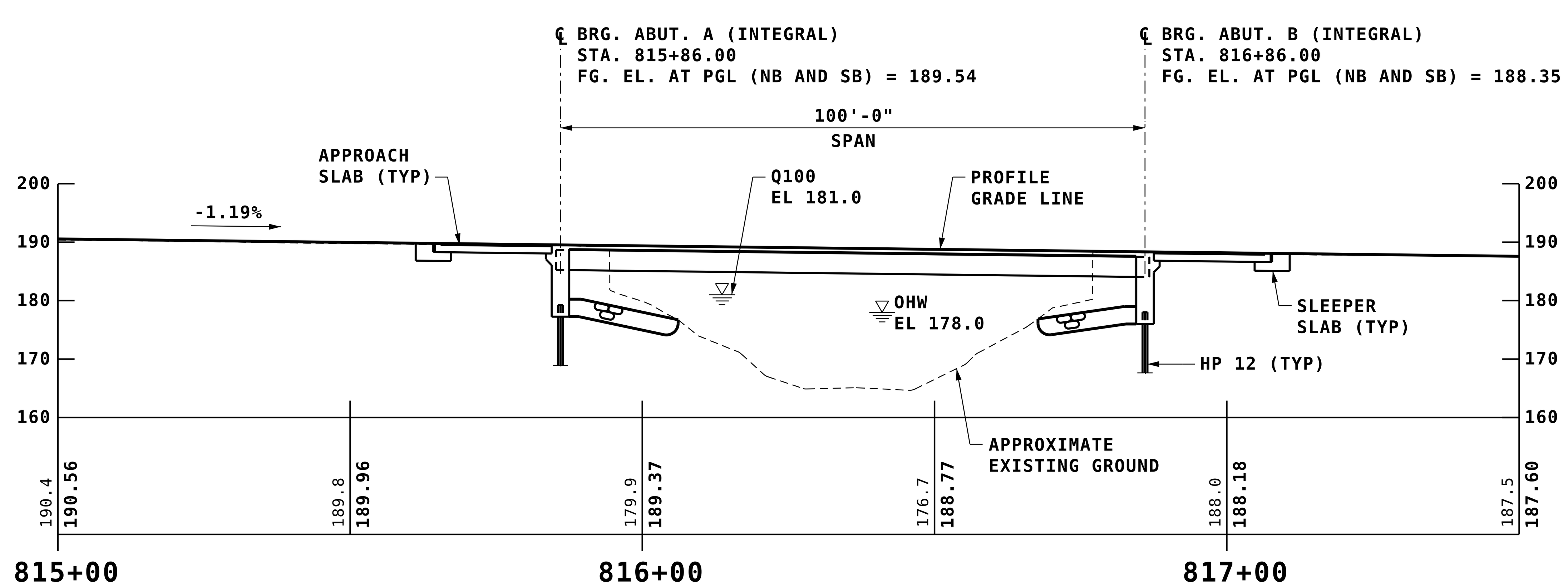
FEDERAL PROJECT NO. | SHEET NO. | TOTAL SHEETS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
BRC	18021_plan&el	AS NOTED



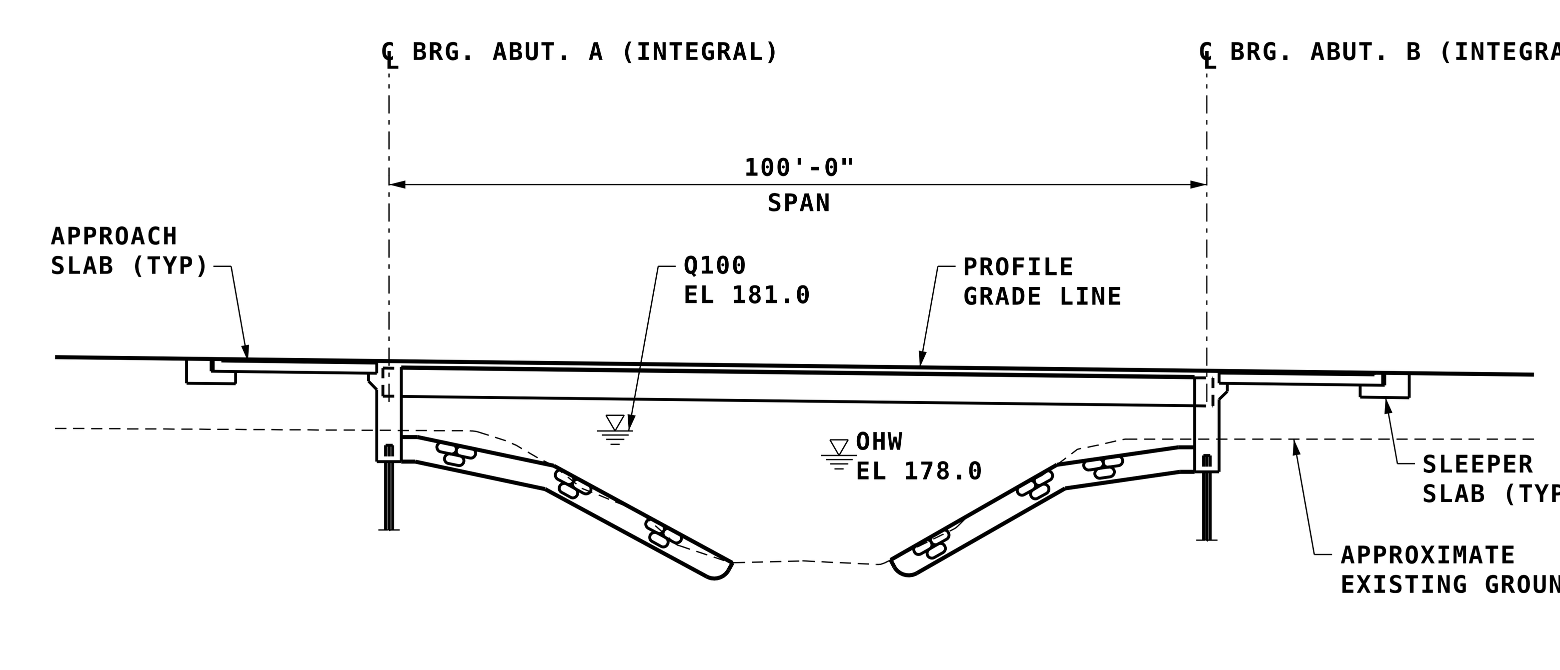
SITE PLAN

SCALE: 1" = 20'-0"



PROFILE

(NORTHBOUND PROFILE GRADE LINE SHOWN, SOUTHBOUND PROFILE GRADE LINE SIMILAR)
SCALE: 1" = 20'-0"



SECTION A-A

SCALE: 1" = 20'-0"

PPS&E
SUBJECT TO CHANGE
DATE 10/11/2023

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN MERRIMACK AND NASHUA — BRIDGE NO. 107/043 AND 108/043 — STATE PROJECT 13761A
LOCATION F.E. EVERETT TURNPIKE OVER PENNICHUCK BROOK

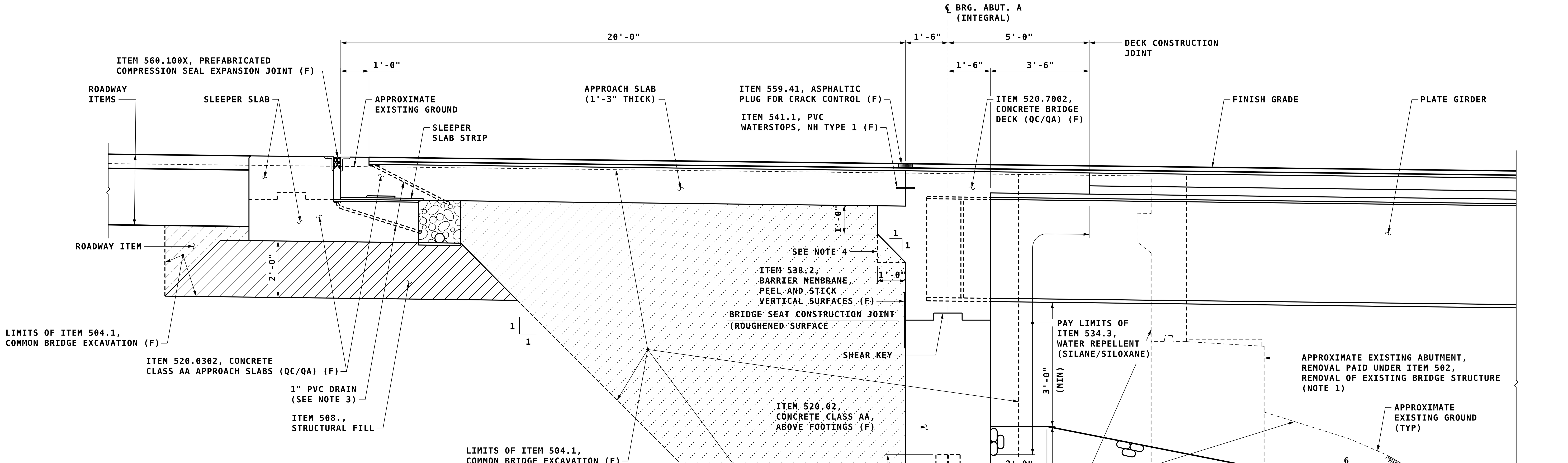
SITE PLAN AND PROFILE

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	AMS	10/23	CHECKED	KCD	10/23
	DRAWN	KDW	10/23	CHECKED	KCD	10/23
	QUANTITIES			CHECKED		
	ISSUE DATE					
	REV. DATE					

BRIDGE SHEET 43 OF 51
FILE NUMBER 143-4-4

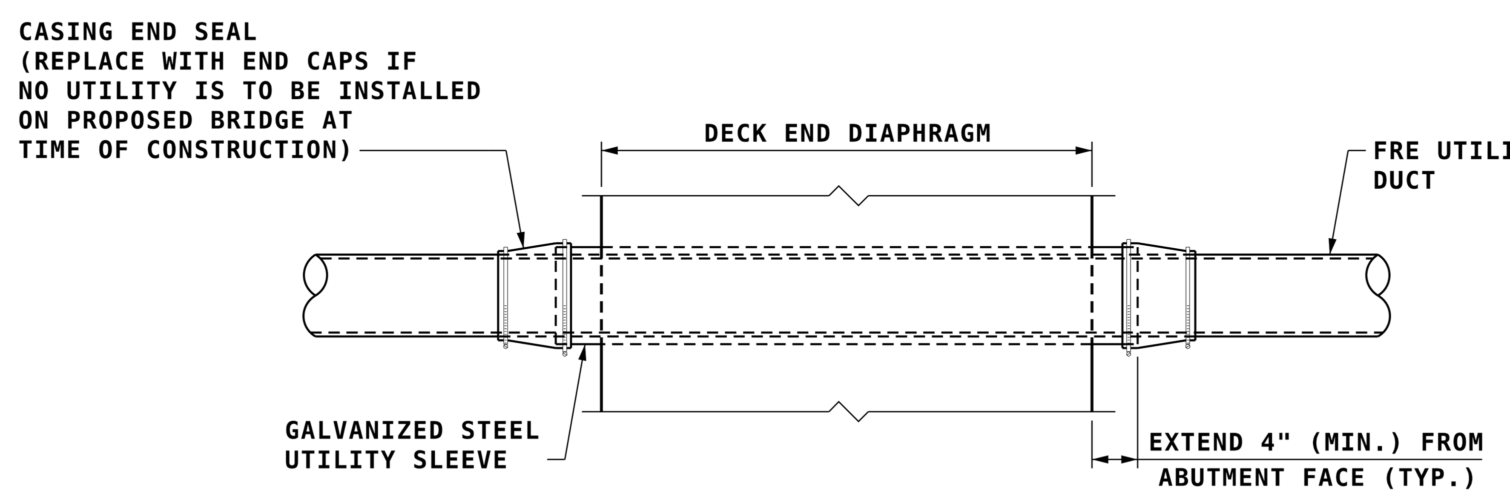
FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
BRC	18021_site	AS NOTED



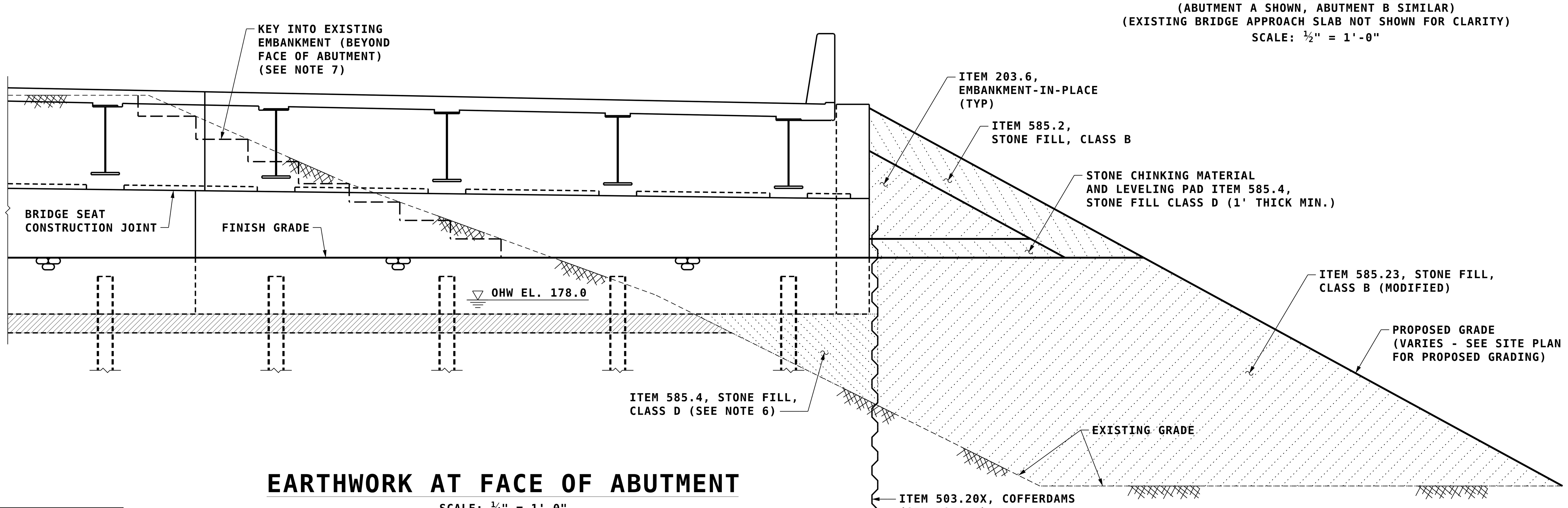
ABUTMENT SECTION

(ABUTMENT A SHOWN, ABUTMENT B SIMILAR)
(EXISTING BRIDGE APPROACH SLAB NOT SHOWN FOR CLARITY)
SCALE: ½" = 1'-0"



DETAIL A - UTILITY SLEEVE

SCALE: 1" = 1'-0"



EARTHWORK AT FACE OF ABUTMENT

SCALE: ¼" = 1'-0"

NOTES:

1. EXISTING BRIDGE ABUTMENTS AND WINGWALLS SHALL BE REMOVED IN ITS ENTIRETY. EXISTING PILES SHALL BE REMOVED TO A MINIMUM OF 1 FOOT BELOW STONE FILL.
2. PIPE UNDERDRAIN BEHIND ABUTMENT IS PROVIDED AT BOTH ABUTMENT A AND B. PIPE UNDERDRAIN AT SLEEPER SLAB IS ONLY PROVIDED AT ABUTMENT B.
3. PVC DRAINS IN THE BOTTOM OF THE EXPANSION JOINT TROUGH TO BE PROVIDED AT ALL LOW POINTS (MEDIANS AND SHOULDERS) AT BOTH ABUTMENTS. PVC DRAINS BELOW THE PAVEMENT AT THE END OF APPROACH SLAB ARE ONLY PROVIDED AT ABUTMENT B.
4. NEGATE CHAMFER IN APPROACH SLAB SEAT IN THE VICINITY OF THE UTILITIES TO ACCOMMODATE UTILITY SLEEVE.
5. COFFERDAMS FOR DEWATERING AND EXCAVATION TO FACILITATE ABUTMENT CONSTRUCTION. FINAL DESIGN SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
6. STONE FILL CLASS D TO BE USED IN PLACE OF CLASS B IN AREAS PILES ARE TO BE DRIVEN.
7. BENCHING OR TERRACING OF SLOPES STEEPER THAN 3:1 (HORIZONTAL TO VERTICAL) SHALL BE PERFORMED IN CONJUNCTION WITH THE PLACING OF EMBANKMENTS ABUTTING SUCH SLOPES.

PPS&E
SUBJECT TO CHANGE
DATE 10/11/2023

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN MERRIMACK AND NASHUA — BRIDGE NO. 107/043 AND 108/043 — STATE PROJECT 13761A
LOCATION F.E. EVERETT TURNPIKE OVER PENNICHUCK BROOK

ABUTMENT SECTION AND DETAILS

BRIDGE SHEET 44 OF 51

REVISIONS AFTER PROPOSAL

	BY	DATE		BY	DATE
DESIGNED	AMS	10/23	CHECKED	KCD	10/23
DRAWN	KDW	10/23	CHECKED	KCD	10/23
QUANTITIES			CHECKED		

FILE NUMBER 143-4-4

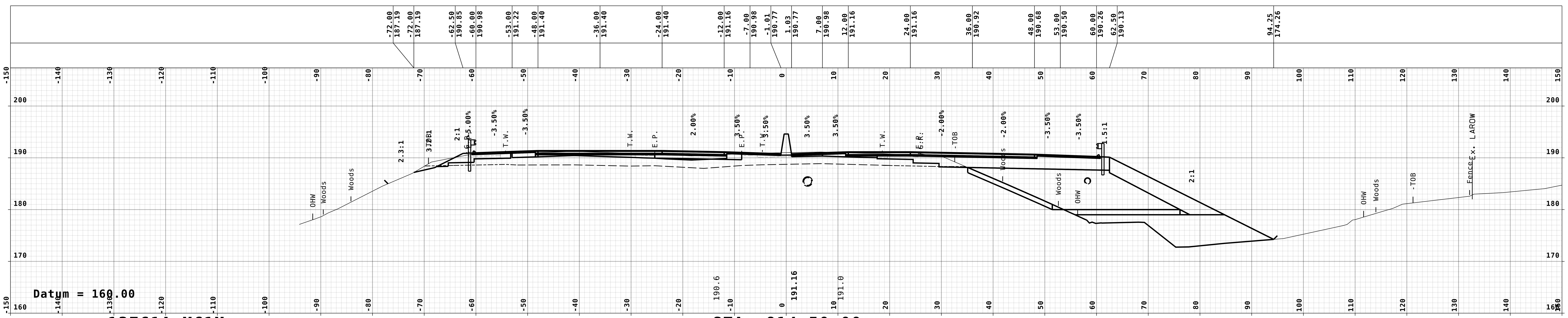
ISSUE DATE
REV. DATE
FEDERAL PROJECT NO. | SHEET NO. | TOTAL SHEETS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
BRC	18021_abutsec	AS NOTED

NUMBER	DATE	STATION	STATION	DESCRIPTION

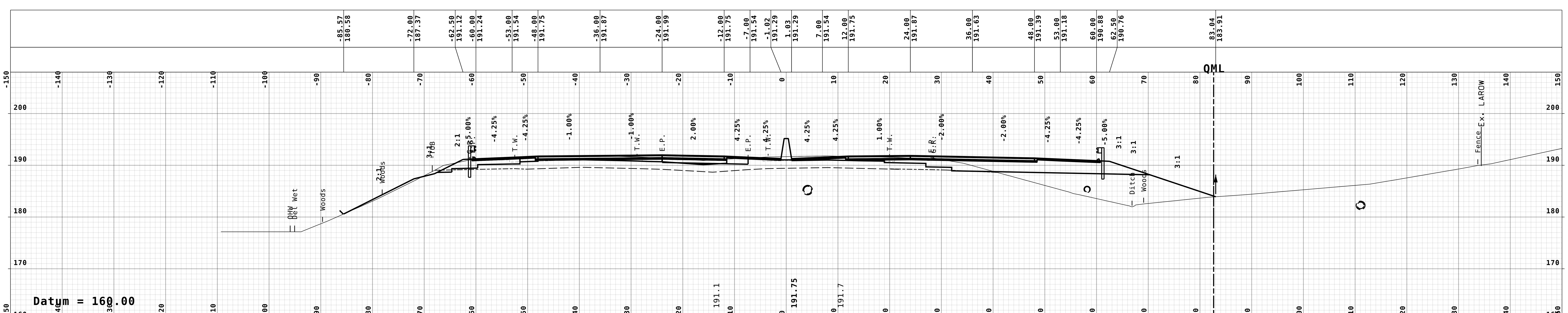
REVISIONS AFTER PROPOSAL

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE 11/10/2023
AS BUILT DETAILS		DATE



13761A_MC1M

STA. 814+50.00



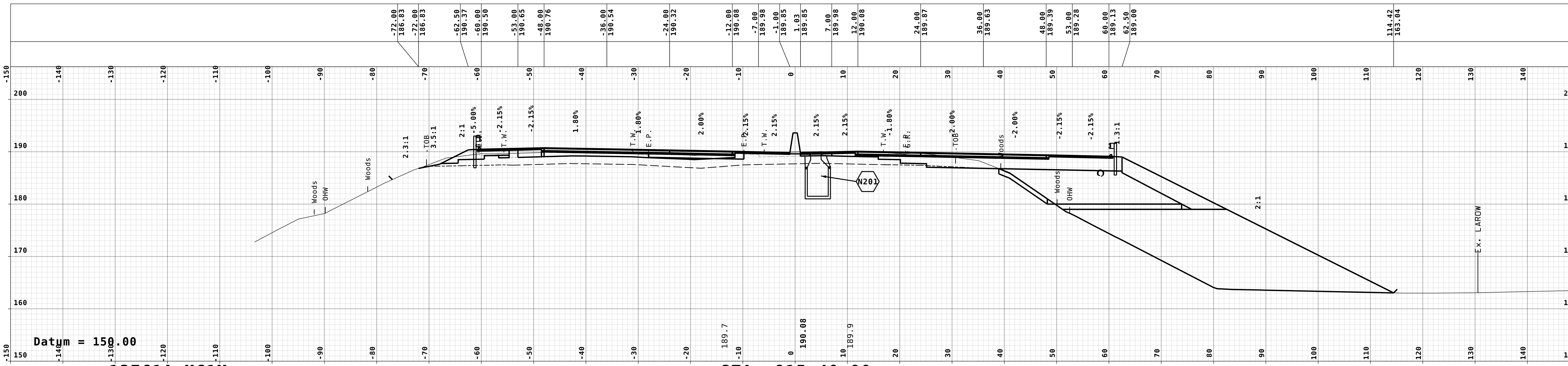
13761A_MC1M

STA. 814+00.00

13761A_mc1m - 814+00.00 [Sheet]

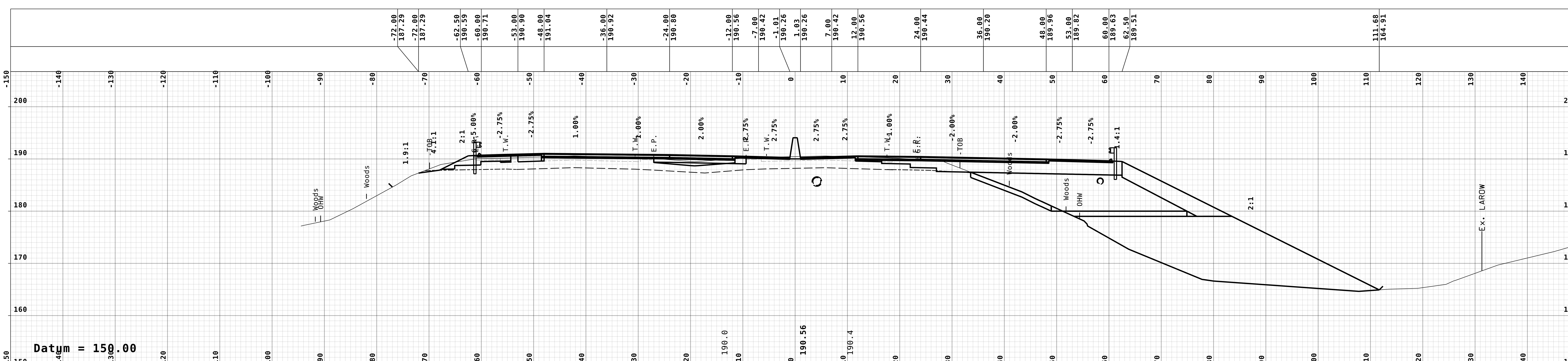
NASHUA & MERRIMACK

DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_XS_ML_02	13761A	45	55



13761A_MC1M

STA. 815+40.00



13761A_MC1M

STA. 815+00.00

REVISIONS AFTER PROPOSAL

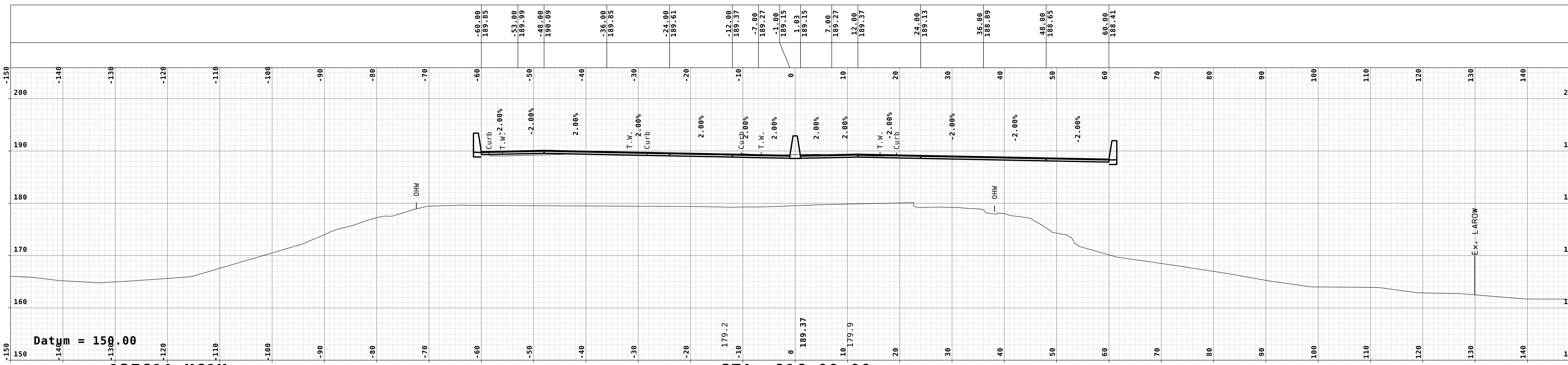
NUMBER	STATION	STATION	DATE	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE	11/10/2023
AS BUILT DETAILS		DATE	

NASHUA & MERRIMACK

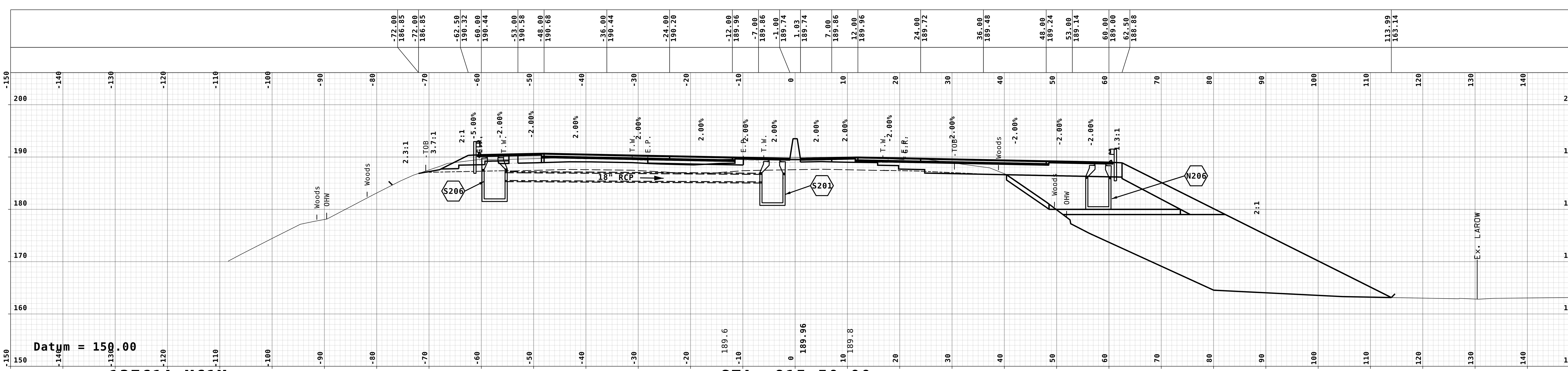
DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_XS_ML_02	13761A	46	55

13761A_mc1m - 815+00.00 [Sheet]



13761A_MC1M

STA. 816+00.00



13761A_MC1M

STA. 815+50.00

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE	11/10/2023
AS BUILT DETAILS		DATE	

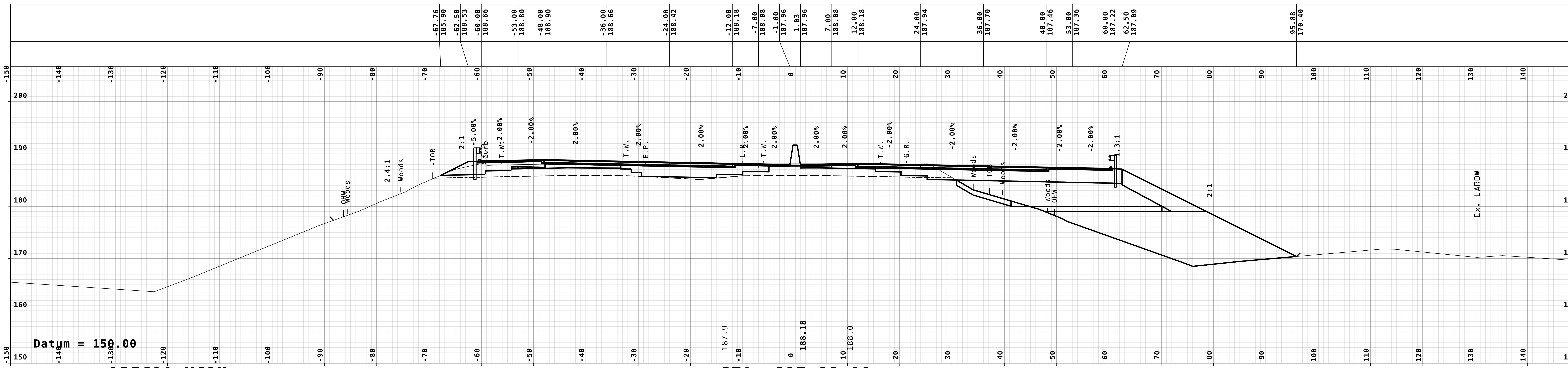
13761A_mc1m - 815+50.00 [Sheet]

NASHUA & MERRIMACK

DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_XS_ML_02	13761A	47	55

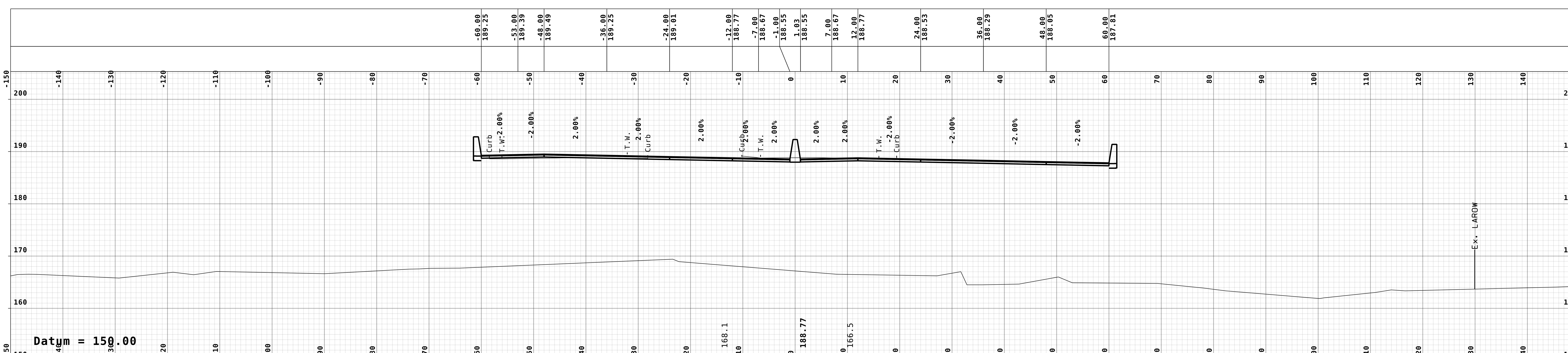
REVISIONS AFTER PROPOSAL			
NUMBER	STATION	STATION	DATE	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE	11/10/2023
AS BUILT DETAILS		DATE	



13761A_MC1M

STA. 817+00.00



13761A_MC1M

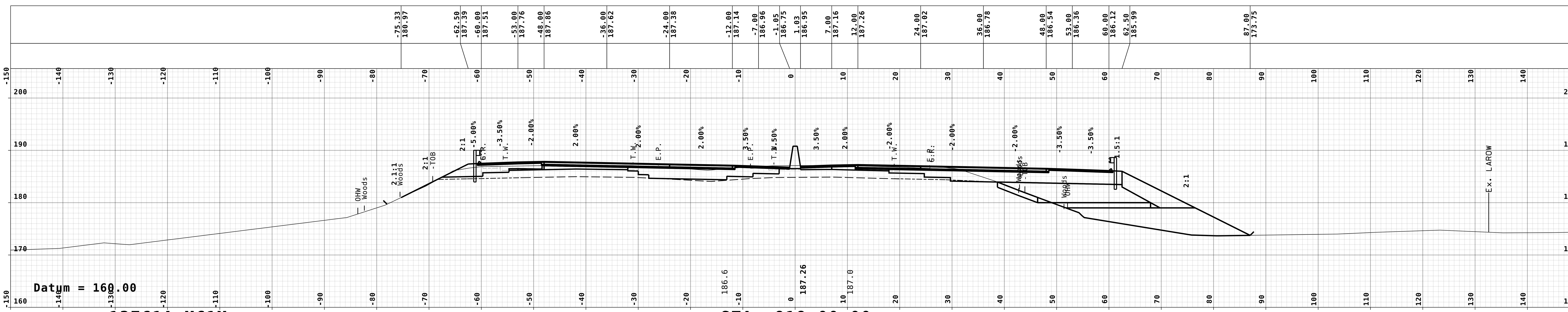
STA. 816+50.00

NASHUA & MERRIMACK

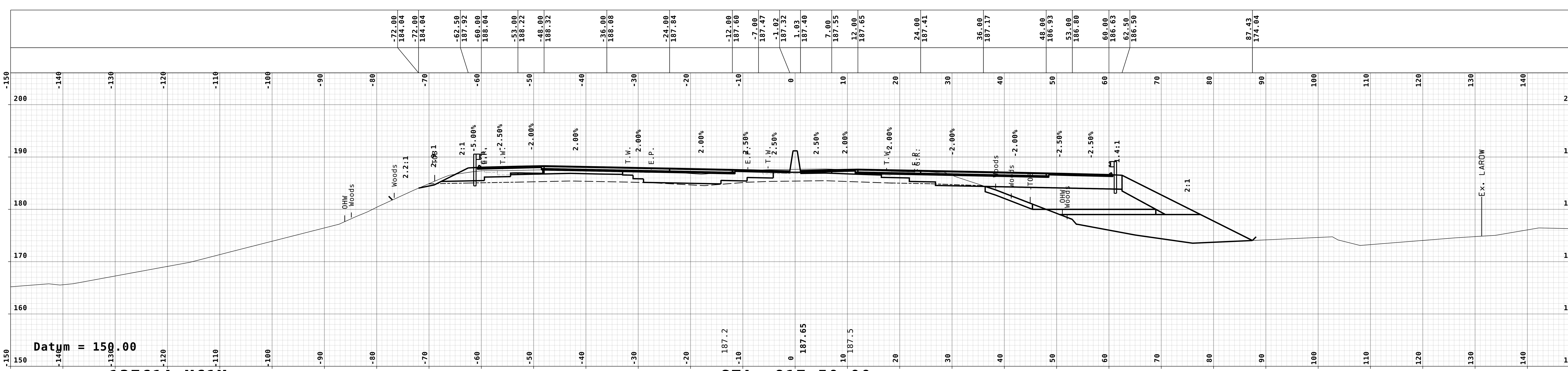
	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_mc1m - 816+50.00 [Sheet]	13761A_XS_ML_03	13761A	48	55

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE 11/10/2023
AS BUILT DETAILS		DATE



13761A_MC1M STA. 818+00.00



13761A_MC1M STA. 817+50.00

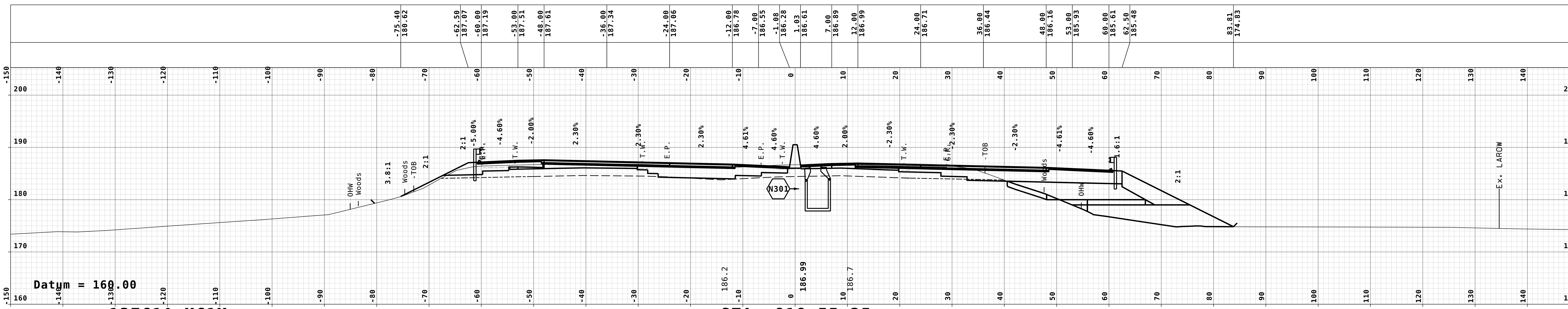
NASHUA & MERRIMACK

	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_mc1m - 817+50.00 [Sheet]	13761A_XS_ML_03	13761A	49	55

REVISIONS AFTER PROPOSAL

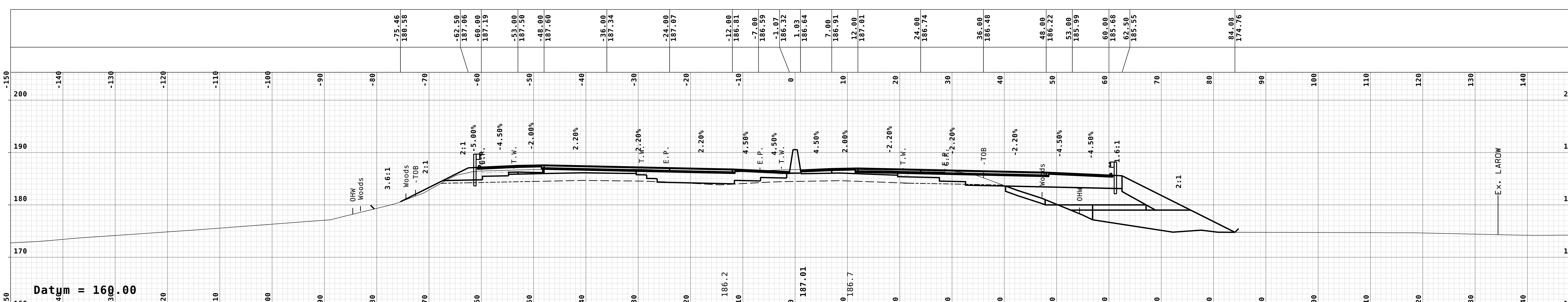
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE 11/10/2023
AS BUILT DETAILS		DATE



13761A_MC1M

STA. 818+55.25



13761A_MC1M

STA. 818+50.00

NASHUA & MERRIMACK

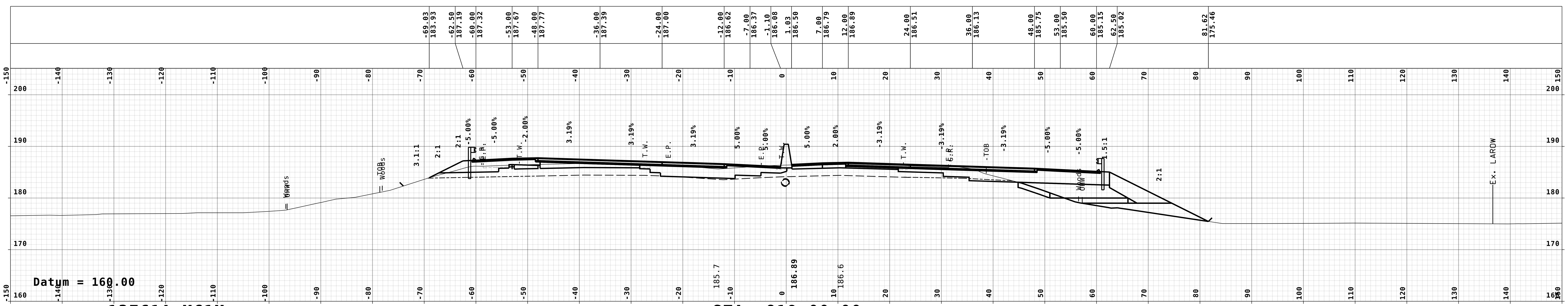
DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_XS_ML_03	13761A	50	55

13761A_mc1m - 818+50.00 [Sheet]

REVISIONS AFTER PROPOSAL

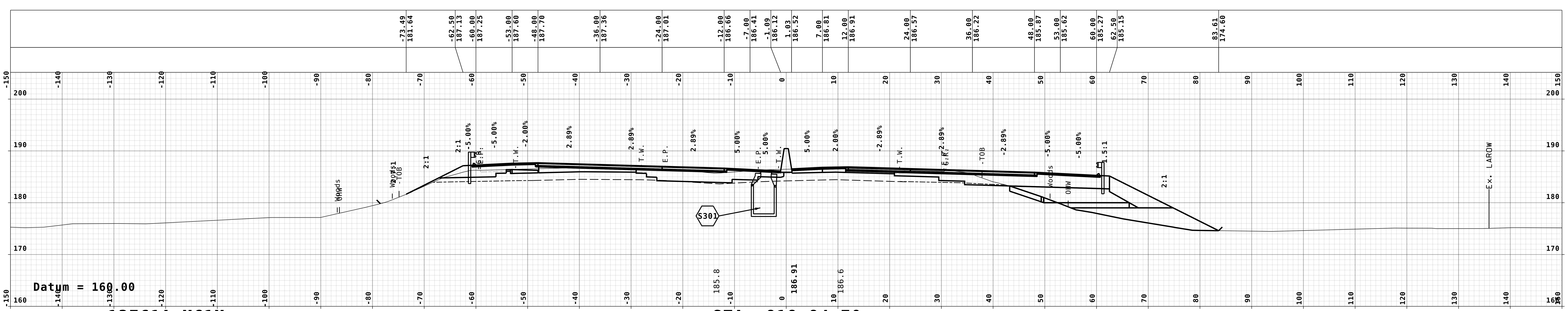
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE	11/10/2023
AS BUILT DETAILS		DATE	



13761A_MC1M

STA. 819+00.00



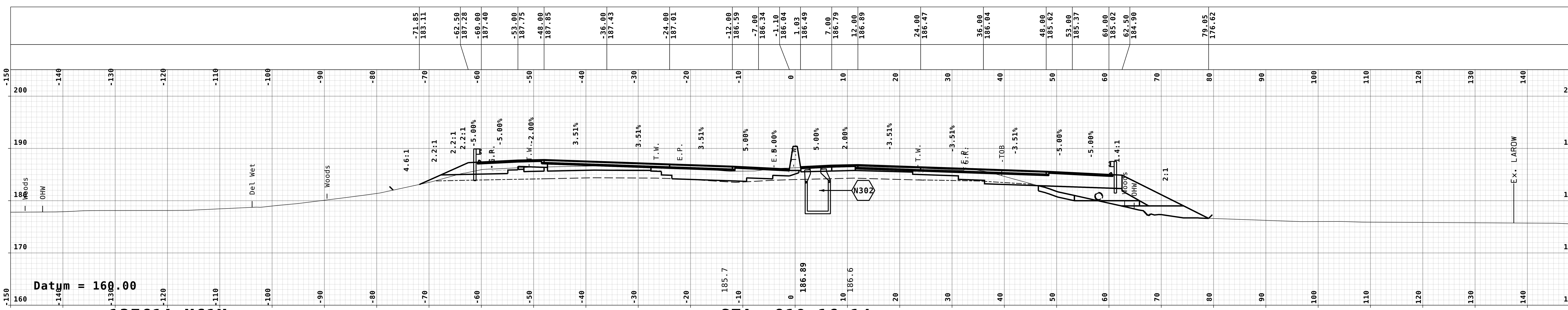
13761A_MC1M

STA. 818+84.70

NASHUA & MERRIMACK

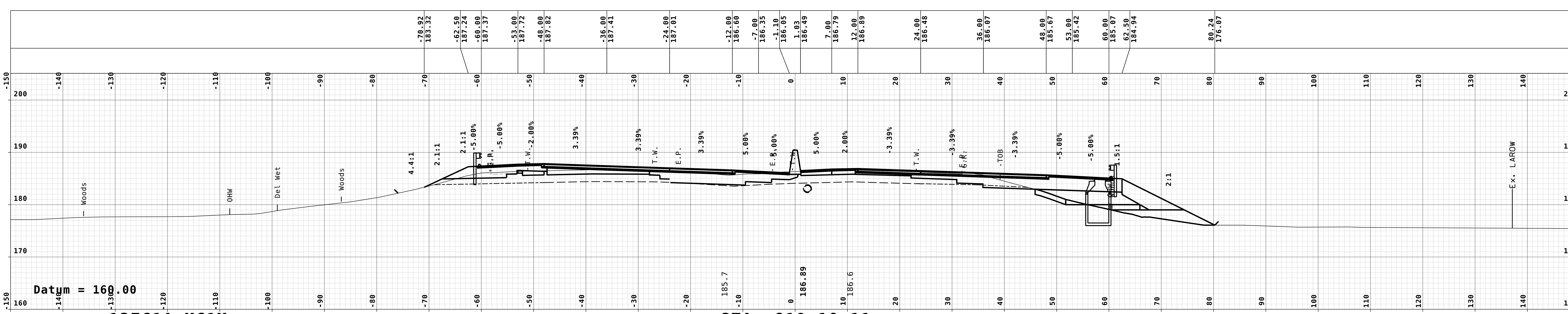
DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_XS_ML_03	13761A	51	55

13761A_mc1m - 818+84.70 [Sheet]



13761A_MC1M

STA. 819+16.14



13761A_MC1M

STA. 819+10.11

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

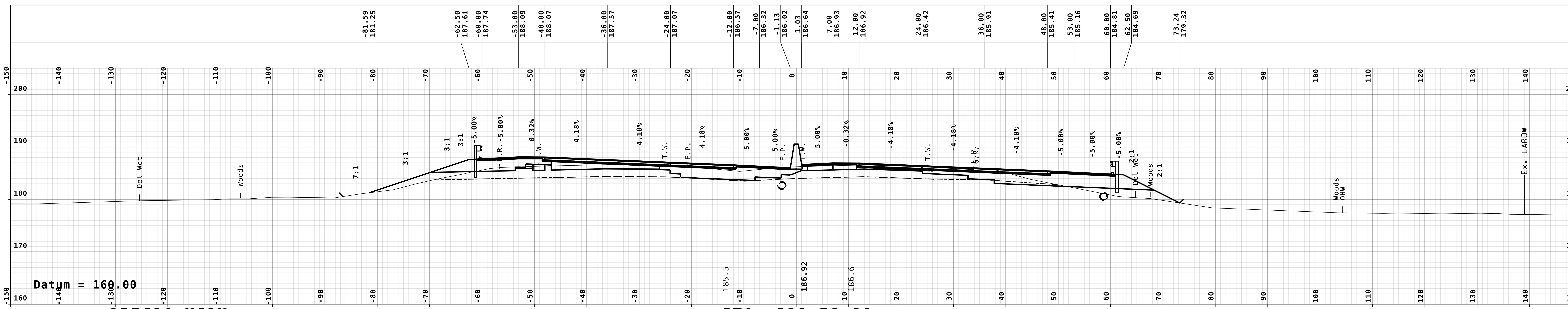
SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE	11/10/2023
AS BUILT DETAILS		DATE	

NASHUA & MERRIMACK

DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_XS_ML_03	13761A	52	55

13761A_mc1m - 819+10.11 [Sheet]

REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	STATION	DESCRIPTION



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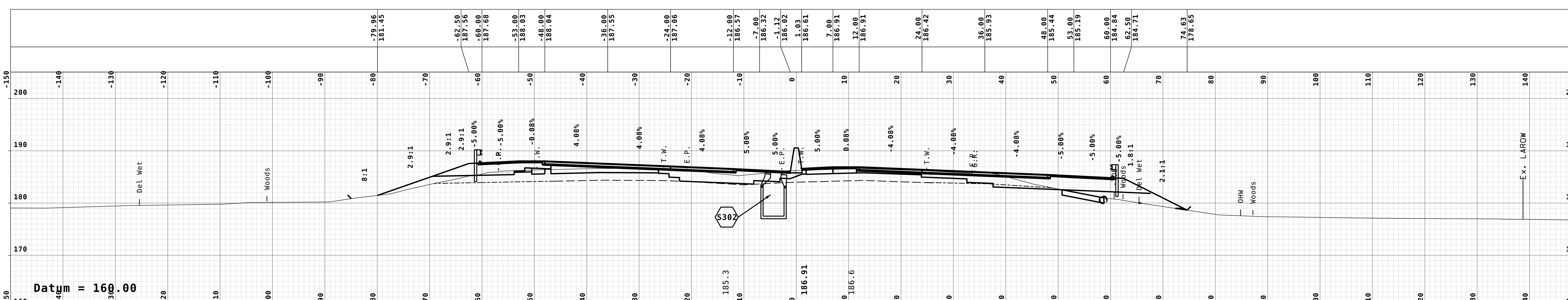

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NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE	11/10/2023
AS BUILT DETAILS		DATE	

NASHUA & MERRIMACK

DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
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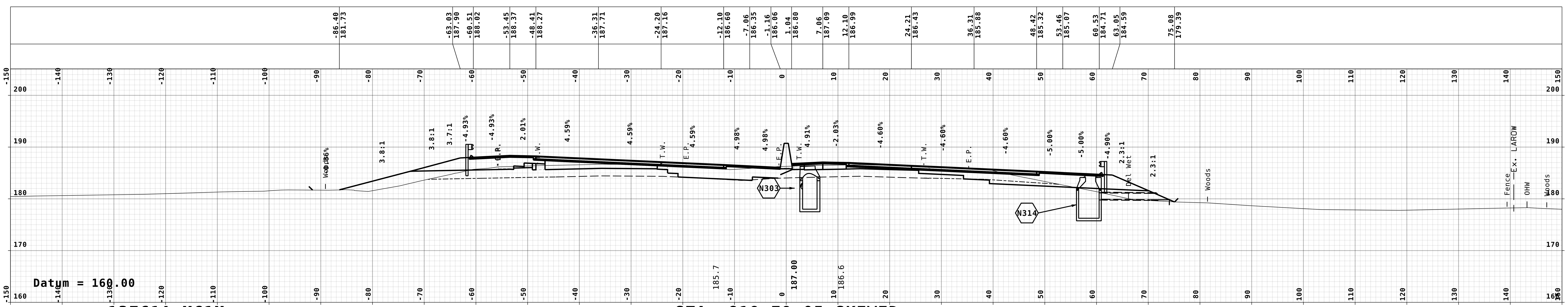
13761A_mc1m - 819+44.98 [Sheet]

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 7/2021
NEW DESIGN	VHB TEAM	DATE 11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE 11/10/2023
AS BUILT DETAILS		DATE



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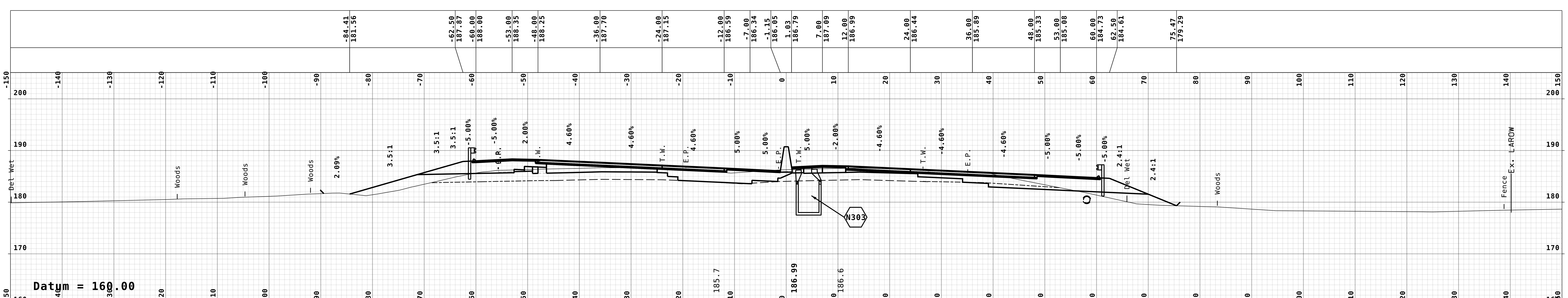

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NASHUA & MERRIMACK

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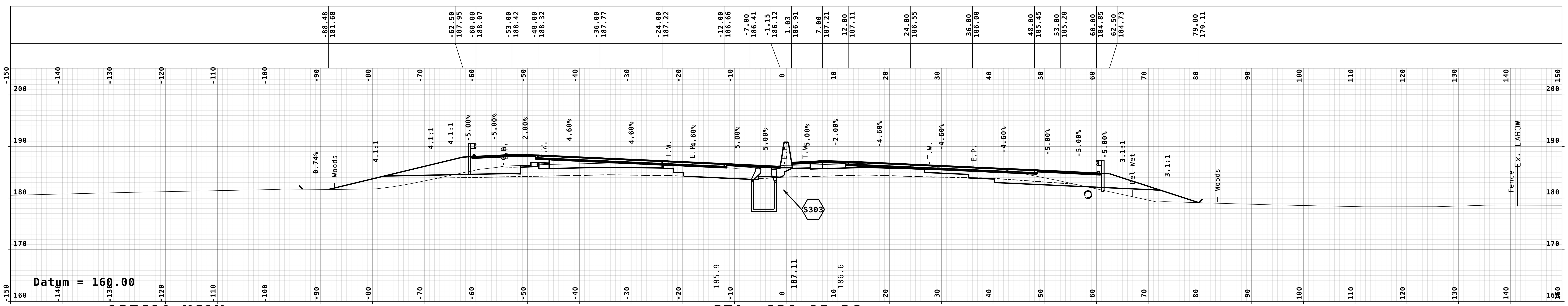

13761A_MC1M

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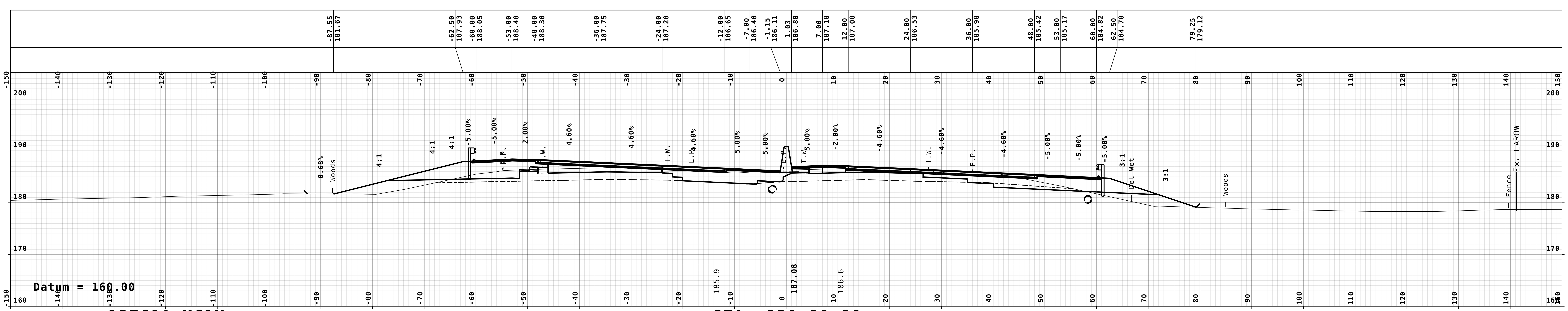

13761A_MC1M

STA. 820+00.00

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE	7/2021
NEW DESIGN	VHB TEAM	DATE	11/10/2023
SHEET CHECKED	C. GREGORY/B. MARTIN	DATE	11/10/2023
AS BUILT DETAILS		DATE	

NASHUA & MERRIMACK

DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
13761A_XS_ML_03	13761A	55	55

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Bank/Shoreline Stabilization Project Specific Worksheet

BANK/SHORELINE STABILIZATION PROJECT-SPECIFIC WORKSHEET FOR STANDARD APPLICATION

Water Division/Land Resources Management
Wetlands Bureau
Check the Status of your Application

RSA/Rule: RSA 482/ Env-Wt 514

APPLICANT LAST NAME, FIRST NAME, M.I.: NH DEPARTMENT OF TRANSPORTATION

This worksheet summarizes the criteria and requirements for a Standard Permit for all types of "bank/shoreline stabilization" projects, as outlined in Chapter Env-Wt 500. In addition to the project-specific criteria and requirements on this worksheet, all Standard Applications must meet the criteria and requirements listed in the Standard Dredge and Fill Wetlands Permit Application form (NHDES-W-06-012).

Do **not** use this worksheet if the project is located in a coastal (tidal) area (Env-Wt 509.02(b)).

SECTION 1 - APPROVAL CRITERIA (Env-Wt 514.02)

An application for bank/shoreline stabilization must meet the following approval criteria:

☒ The project must meet the applicable conditions established in Env-Wt 300.

☒ For a hard-scape stabilization proposal, such as rip-rap or a retaining wall, the applicant must demonstrate that the bank or shoreline in that location cannot be stabilized by preserving natural vegetation, landscaping, or bioengineering.

☒ Bank/shoreline stabilization must be designed to be the least intrusive practicable method in accordance with Chapter 8 of the Wetlands Best Management Practice Techniques for Avoidance and Minimization (A/M BMPs).

☒ Bank/shoreline stabilization must conform to the natural alignment of the bank/shoreline.

☒ Bank/shoreline stabilization must not adversely affect the stream course such that water flow will be transported by the stream channel in a manner that the stream maintains it dimensions, general pattern, and slope with no unnatural raising or lowering of the channel bed elevation along the stream bed profile.

☒ Bank/shoreline stabilization must not adversely affect the physical stream forms or alter the local channel hydraulics, natural stream bank stability, or floodplain connectivity.

☒ Bank/shoreline stabilization must avoid and minimize impacts to shoreline resource functions as described in Env-Wt 514.01 and Chapter 8 of the A/M BMPs.

☒ If the project is a wall on a great pond or other surface water where the state holds fee simple ownership of the bed, bank/shoreline stabilization must locate the wall on the shoreward side of the normal high water line.

☒ If the project is to install rip-rap, bank/shoreline stabilization must locate the rip-rap shoreward of the normal high water line, where practicable, and extend it not more than two feet lakeward of that line at any point.

☒ The hierarchy of bank stabilization practices must be as follows:

(1) Soft vegetative bank stabilization, including regrading and replanting of slopes, in which all work occurs above ordinary high water or normal high water,

(2) Bioengineered bank stabilization or naturalized design techniques that uses a combination of live vegetation, woody material, or geotextile matting and may include regrading and replanting of slopes,

(3) Semi-natural form design shall be allowed only where the applicant demonstrates that anticipated turbulence, flows, restricted space, or similar factors, render vegetative or soft stabilization methods, bioengineering, and natural process design stabilization methods physically impractical,

(4) Hard-scape or rip-rap design shall be allowed only where anticipated turbulence, flows, restricted space, or similar factors render vegetative, bio-engineering, semi-natural form design and diversion methods physically impractical and where necessary to protect existing infrastructure, and

(5) Wall construction shall be allowed as the last available option, only where lack of space or other limitations of the site make alternative stabilization methods of bioengineering, seminatural, and rip-rap impractical. Wherever sufficient room exists, slopes shall be cut back to eliminate the requirement for a wall.

☒ Stream bank-stabilization project plans must be developed in accordance with the following techniques, as applicable:

- Naturalized and semi-natural design techniques where practicable in accordance with the Guidelines for Naturalized River Channel Design and Bank Stabilization dated February 2007; R. Schiff, J.G. MacBroom, and J. Armstrong Bonin.
- For bioengineering projects, National Engineering Handbook Part 654 (NEH 654), Technical Supplement 141, Streambank Soil Bioengineering, dated August 2007, USDA NRCS.
- For stream restoration projects, NEH 654, Stream Restoration Design, dated August 2007, USDA NRCS.

SECTION 2 - APPLICATION REQUIREMENTS FOR ALL BANK/SHORELINE STABILIZATION PROJECTS (Env-Wt 514.03)

An application for any bank/shoreline stabilization project must include:

☒ A narrative and photos that:

- Describe and illustrate existing conditions and locations where shoreline vegetation currently exists.

  The existing causeway banks consist of manmade fill installed as part of the original construction of the F.E. Everett Turnpike crossing structure over Pennichuck Brook. The causeways consist of stone fill material. Over the past 70+ years the causeways have accumulated soil material and support herbaceous vegetation as well as small to medium sized trees. Tree species along the causeways consist primarily red maple and white pine. Exposed stone is apparent under the bridge structures in front of both abutments, and along the ordinary highwater in places. Photos of the existing banks are included in the attached photo log included with the wetlands permit application.

- Identify all known causes of erosion to the bank/shoreline in that location.

  Water velocities in Pennichuck Brook through the structure are relatively low due to the impounded condition of the reservoir. Erosion from wave action is one potential cause of erosion at the Pennichuck Brook crossing location.

- Identify information and, for minor and major projects, engineering standards used to determine the appropriateness of the proposed bank stabilization treatment or practice.

  Stone fill is required to widen the existing causeways on the eastern side in order to accommodate the proposed highway widening. The proposed stone material is required in order to resist erosion and support the proposed highway infrastructure.

- Explain the design elements that have been incorporated to address erosion, by eliminating or minimizing the causes therefor.

  The proposed stone fill will reduce erosion by providing a stable, armored bank that extends below of the ordinary high water. In order to improve terrestrial wildlife passage at the crossing location, riprap above the ordinary high water will be top dressed with humus and seeded in order to provide vegetated 2:1 slopes.

- For minor and major bank/shoreline stabilization projects or minimum impact bioengineering stream bank projects, identify the flood risk tolerance of the proposed treatment or practice using the appropriate technical guidance or national engineering handbook.

  Water levels in Pennichuck Brook are controlled by a series of upstream and downstream dams. The proposed roadway surface is approximately 11 feet higher than the ordinary high water of Pennichuck Brook. Additional information on the hydraulics is included in the attached Hydraulic Report.

A cross-section plan that shows:

☒ The difference in elevation between the lowest point of the bank/shoreline slope to be impacted by the construction and the highest point of the bank/shoreline slope to be impacted.

☒ The linear distance across the proposed project area as measured along a straight line between the highest and lowest point of the bank/shoreline slope to be impacted.

☒ The existing and proposed slope of the bank/shoreline.

☒ The normal high water line or ordinary high water mark, as applicable.

Hard-scape, rip-rap, or unnatural design plans that must include:

☒ Designation of minimum and maximum stone size.

☒ Gradation.

☒ Minimum rip-rap thickness.

☒ Type of bedding for stone.

☒ Cross-section and plan views of the proposed installation.

☒ A description of anticipated turbulence, flows, restricted space, or similar factors that would render vegetation and bioengineering stabilization methods physically impracticable.

☒ Engineering plans for rip-rap in excess of 100 linear feet along the bank or bed of a stream or river, including in-stream revetments, stamped by a professional engineer.

☒ If the project proposes rip-rap adjacent to great ponds or other surface waters where the state holds fee simple ownership to the bed, a stamped surveyed plan showing the location of the normal high water line and the footprint of the proposed project.

Design plans for a wall in non-tidal waters must include:

☐ Cross-section and plan views of the proposed installation and sufficient plans to clearly indicate the relationship of the project to fixed points of reference, abutting properties, and features of the natural shoreline.

☐ If the application is for a wall adjacent to a great pond or other surface water where the state holds fee simple ownership to the bed, a surveyed plan, stamped by a licensed land surveyor, showing the location of the normal high water line and the footprint of the proposed project.

SECTION 3 - DESIGN REQUIREMENTS FOR ALL BANK/SHORELINE STABILIZATION PROJECTS (Env-Wt 514.04)

In addition to meeting all applicable requirements in Env-Wt 300, bank/shoreline stabilization must be designed to:

☒ Incorporate stormwater diversion and retention to minimize erosion.

☒ Retain natural vegetation to the maximum extent possible.

☐ If space and soil conditions allow, cut back unstable banks to a flatter slope and then plant with native, non-invasive trees, shrubs, and groundcover.

☒ Avoid and minimize impacts to adjacent properties and infrastructure.

☒ Avoid and minimize impacts to water quality.

☒ Avoid and minimize impacts to priority resource areas, avian nesting areas, fish spawning locations, and other wildlife habitat to meet the requirements of Env-Wt 514.02.

☐ Incorporate naturalized and semi-natural design techniques where practicable in accordance with Guidelines for Naturalized River Channel Design and Bank Stabilization dated February 2007, R. Schiff, J.G. MacBroom, and J. Armstrong Bonin.

☐ For bioengineering projects, be in accordance with NEH 654, Technical Supplement 141, Streambank Soil Bioengineering, dated August 2007, USDA NRCS.

☐ For stream restoration projects, be in accordance with NEH 654, Stream Restoration Design, dated August, 2007, USDA NRCS.

SECTION 4 - CONSTRUCTION REQUIREMENTS FOR ALL BANK/SHORELINE STABILIZATION PROJECTS (Env-Wt 514.05)

In addition to all applicable construction standards specified in Env-Wt 300, the following apply to all bank/ shoreline stabilization projects:

☒ Materials used to emulate a natural channel bottom must:

- Be consistent with materials identified in the reference reach, and
- Not include any angular rip-rap or gravel unless specifically identified on the approved plan.

☒ Bank restoration must be constructed, landscaped, and monitored in a manner that will create a healthy riparian or lacustrine shoreline system.

☒ Bank/shoreline stabilization areas must:

(1) Have at least 75% successful establishment of vegetation after two growing seasons, or
(2) Be replanted and re-established until a functional lacustrine, wetland, or riparian system has been reestablished in accordance with the approved plans.

☒ Unless otherwise approved, construction must be performed during low flow or dry conditions.

☐ Where there is documented occurrence of a cold water fishery or protected species or habitat, unless a waiver of this condition is issued in writing by the department in consultation with the New Hampshire Fish and Game Department, work must occur:

- During low-flow or dry conditions during the growing season, and
- Prior to October 1.

☒ Work authorized must be carried out in accordance with Env-Wt 307 such that there are no discharges in or to spawning or nursery areas during spawning seasons.

☒ Work authorized must be carried out in accordance with Env-Wt 307 such that controls are in place to protect water quality and appropriate turbidity controls such that no turbidity escape the immediate dredge area and must remain until suspended particles have settled and water at the work site has returned to normal clarity.

☒ Within 60 days of completion of construction, the applicant must submit a post-construction report that:

- Has been prepared by a professional engineer, certified wetland scientist, or qualified professional, as applicable, and
- Contains a narrative, exhibits, and photographs, as necessary to report the status of the project area and restored jurisdictional area.

SECTION 5 - ON-GOING REQUIREMENTS FOR ALL BANK/SHORELINE STABILIZATION PROJECTS (Env-Wt 514.06)

The owner must monitor the project and take corrective measures if the area is inadequately stabilized or restored by:

(a) Replacing fallen or displaced materials without a permit, where no machinery in the channel is required,

(b) Identifying corrective actions and follow-up plans in accordance with Env-Wt 307, and

(c) Filing appropriate application and plans where work exceeds (a), above.

SECTION 6 - BANK STABILIZATION CONSTRUCTION PROJECT CLASSIFICATION (Env-Wt 514.07)

Refer to Env-Wt 514.07 for project classification.