STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE: April 5, 2023

FROM: Joshua Brown
Wetlands Program Analyst

AT (OFFICE): Department of Transportation
Bureau of Environment

SUBJECT Dredge & Fill Application
Jaffrey, 16307

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 project is located along US Route 202, NH Route 124 and NH Route 137 in the Town of Jaffrey, NH. NHDOT proposes to reconfigure the existing signalized five-way intersection into a five-leg roundabout and construct a new US 202 connector road from this roundabout across the Contoocook River to a new three-leg roundabout at its proposed intersection with River Street. The goal of this Project is to move traffic more effectively through this inefficient and highly congested area in downtown Jaffrey and address identified safety deficiencies. Various improvements are also proposed along the approach roadways and other minor work/improvements along the Contoocook River (including repairs to the existing Main Street bridge and Mill Race).

This project was reviewed at the Natural Resource Agency Coordination Meeting on October 20, 2021, January 19, 2022 and January 18, 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: http://www.nh.gov/dot/org/projectdevelopment/environment/units/program-management/wetland-applications.htm.

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 was determined to not be required as the proposed work was determined to be self-mitigating.

The lead people to contact for this project are Tobey Reynolds, Bureau of Highway Design (6032717421or tobey.l.reynolds@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 # 715141) in the amount of $4,989.20.

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
Town of Jaffrey (4 copies via certified mail)
Contoocook River LAC (1 copy via certified mail)
David Trubey, NHDHR (Cultural Review Within)
Mike Dionne & Kevin Newton, NHF&G (via electronic notification)
Maria Tur, US Fish & Wildlife (via electronic notification)
Jeanie Brochi, USEPA(via electronic notification)
Michael Hicks & Rick Kristoff, US Army Corp of Engineers (via electronic notification)
Kevin Nyhan, BOE (via electronic notification)

US 202 / NH 124 / NH 137 Intersection Improvements

Jaffrey, New Hampshire

PREPARED FOR
NH Department of Transportation
PO Box 483; 7 Hazen Drive
Concord, NH 03302-0483
603.271.3226

PREPARED BY
VHB
2 Bedford Farms Drive, Suite 200
Bedford, NH 03110
603.391.3900

March 2023

Table of Contents

Appendices

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:** Jaffrey

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): N/A ○ NHB Project ID #: NHB22-3543	☐ 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): **Contoocook and North Branch Rivers** • 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, no dredging proposed.	☐ 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): ~19,100 acres	

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 NHDOT proposes to permanently impact 2,540 sq ft (225 lin ft) within the bed and 1,504 sq ft (240 lin ft) within the banks of the Contoocook River to construct a new bridge with associated riprap stabilization and simulated streambed material, and to fill 4,517 sq ft of palustrine wetlands to construct a new connector road, stormwater infrastructure, and relocated parking. Temporary impacts include 3,372 sq ft (442 lin ft) within the bed and 296 sq ft (114 lin ft) within the banks of the Contoocook River, along with 244 sq ft within a palustrine wetland (Wetland 1) to install proposed erosion controls (i.e., steel sheet pile cofferdams, sandbag cofferdams, silt fence/sock, etc.).

NHDOT proposes to reconfigure the existing signalized five-way intersection into a five-leg roundabout and construct a new US 202 connector road from this roundabout across the Contoocook River to a new three-leg roundabout at its proposed intersection with River Street ("the Project"). The goal of this Project is to move traffic more effectively through this inefficient and highly congested area in downtown Jaffrey and address identified safety deficiencies. Various improvements are also proposed along the approach roadways and other minor work/improvements along the Contoocook River (including repairs to the existing Main Street bridge and Mill Race). Refer to the **Application Narrative** for more detailed information.

SECTION 3 - PROJECT LOCATION

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

ADDRESS: US 202 / NH 124 / NH 137

TOWN/CITY: Jaffrey

TAX MAP/BLOCK/LOT/UNIT: N/A - roadway rights-of-way and easements

US GEOLOGICAL SURVEY (USGS) TOPO MAP WATERBODY NAME: Contoocook River
☐ N/A

(Optional) LATITUDE/LONGITUDE in decimal degrees (to five decimal places): 42.813462° North
-72.023439° 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: NH Department of Transportation (NHDOT) c/o Tobey Reynolds		
MAILING ADDRESS: 7 Hazen Drive		
TOWN/CITY: Concord	STATE: NH	ZIP CODE: 03301
EMAIL ADDRESS: Tobey.L.Reynolds@dot.nh.gov		
FAX:	PHONE: (603) 271-7421	

ELECTRONIC COMMUNICATION: By initialing here: TR, 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.: Walker, Peter, J.		
COMPANY NAME: VHB		
MAILING ADDRESS: 2 Bedford Farms Drive (Suite 200)		
TOWN/CITY: Bedford	STATE: NH	ZIP CODE: 03110
EMAIL ADDRESS: pwalker@vhb.com		
FAX:	PHONE: (603) 391-3942	

ELECTRONIC COMMUNICATION: By initialing here PW, 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 , 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):

All jurisdictional areas were delineated and classified by a VHB NH Certified Wetlands Scientist in accordance with the requirements of Env-Wt 400. The project complies with the bank stabilization measures outlined in Env-Wt 514 (refer to the worksheet provided in ***Appendix F***) and public highway requirements outlined in Env-Wt 527 (refer to the **Application Narrative** for details). Env Wt 600 and Env-Wt 700 are not applicable to the proposed project, as there are no coastal lands/tidal waters/tidal wetlands or prime wetlands within or near the project area. Env-Wt 900 is applicable to the proposed project, as both the proposed new bridge construction and repairs to the existing Main Street bridge are regulated tier 3 stream crossings. Refer to the **Application Narrative** which details the project's compliance with this chapter of the rules.

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: 01 Day: 18 Year: 2023

(☐ N/A - Mitigation is not required)

*This project was present at numerous Natural Resource Agency Coordination Meetings, detailed in the Application Narrative.

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			☐			☐
	Scrub-shrub Wetland	1,016		☐	0		☐
	Emergent Wetland	3,501		☐	244		☐
	Wet Meadow			☐			☐
	Vernal Pool			☐			☐
	Designated Prime Wetland			☐			☐
	Duly-established 100-foot Prime Wetland Buffer			☐			☐
Surface Water	Intermittent / Ephemeral Stream			☐			☐
	Perennial Stream or River	2,540	225	☐	3,372	442	☐
	Lake / Pond			☐			☐
	Docking - Lake / Pond			☐			☐
	Docking - River			☐			☐
Banks	Bank - Intermittent Stream			☐			☐
	Bank - Perennial Stream / River	1,504	240	☐	296	114	☐
	Bank / Shoreline - Lake / Pond			☐			☐
Tidal	Tidal Waters			☐			☐
	Tidal Marsh			☐			☐
	Sand Dune			☐			☐
	Undeveloped Tidal Buffer Zone (TBZ)			☐			☐
	Previously-developed TBZ			☐			☐
	Docking - Tidal Water			☐			☐
TOTAL		8,561	465		3,912	556	

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):	**12,473** SF	× $0.40 =	$ **4,989.20**
Seasonal docking structure:	0 SF	× $2.00 =	$ 0
Permanent docking structure:	0 SF	× $4.00 =	$ 0
Projects proposing shoreline structures (including docks) add $400 =			$ N/A
		Total =	$ **4,989.20**

The application fee for minor or major impact is the above calculated total or $400, whichever is greater = $ **4,989.20**

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: TR	To the best of the signer's knowledge and belief, all required notifications have been provided.
Initials: TR	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: TR	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: TR	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): Tobey Reynolds	PRINT NAME LEGIBLY: Tobey Reynolds (NHDOT)	DATE: 4/3/2023
SIGNATURE (APPLICANT, IF DIFFERENT FROM OWNER):	PRINT NAME LEGIBLY: N/A (Same as owner)	DATE:
SIGNATURE (AGENT, IF APPLICABLE):	PRINT NAME LEGIBLY: Peter J. Walker (VHB)	DATE: 03/23/23

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, NHDOT is exempt from this requirement per RSA 482-A:3(I)(a)(1).
TOWN/CITY:	DATE: (Application filed with clerk at same time.)

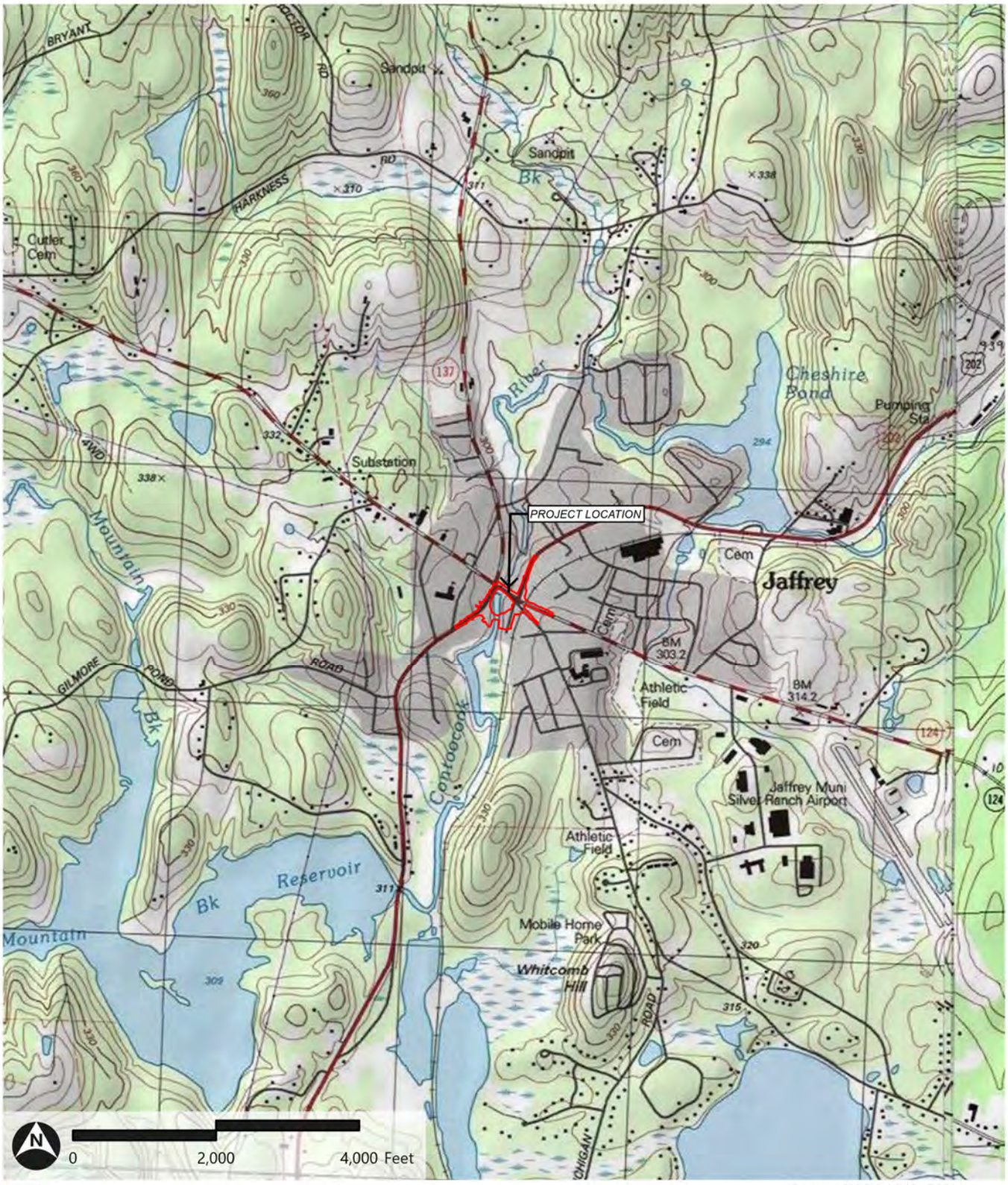
DIRECTIONS FOR TOWN/CITY CLERK:
Per RSA 482-A:3, I(a)(1)

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”.

Figure 1: USGS Overview Map

Jaffrey Wetlands Permit Application | Jaffrey, NH



Project Footprint

Source: USGS, VHB, ESRI

Path: \\vhb.com\gis\proj\Bedford\52457.00\GIS\Project\Jaffrey Wetlands Permit Application\Jaffrey Wetlands Permit Application\Jaffrey Wetlands Permit

Figure 2: Aerial Overview Map

Jaffrey Wetlands Permit Application | Jaffrey, NH

Source: USGS, VHB, ESRI

Path: \\vhb.com\gis\proj\Bedford\52457.00\GIS\Project\Jaffrey Wetlands Permit Application\Jaffrey Wetlands Permit Application\Jaffrey Wetlands Permit

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:** Jaffrey

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.

NHDOT proposes to reconfigure the existing signalized five-way intersection into a five-leg roundabout and construct a new US 202 connector road from this roundabout across the Contoocook River to a new three-leg roundabout at its proposed intersection with River Street ("the Project") to address identified traffic and safety deficiencies in this congested area in downtown Jaffrey. The various components of this Project are detailed in **Section 3** of the **Application Narrative**. However, the portions of this Project that will result in jurisdictional natural resource impacts include the proposed new bridge construction and repairs to existing infrastructure (i.e., Main Street Bridge and Mill Race).

Since the objective of this Project is to improve traffic and safety issues identified in this specific area, consideration of alternative new connector road alignments were limited. However, an alternatives analysis was conducted during the NEPA phase of this Project where two additional connector road alignments were assessed that would have crossed the Contoocook River farther upstream. Since those alternatives would have increased natural resource impacts (including the addition of in-stream piers to support longer bridge spans), rare/threatened/ endangered species habitat impacts, floodplain impacts, and cultural resource impacts, the current design was selected as the preferred alternative.

Furthermore, the Site is located with a highly developed urban setting, which limits the areas where the Project components can be placed. However, the proposed limits of disturbance have been reduced to the maximum extent practical while still accomplishing the Project objectives and providing sufficient space (i.e., temporary work areas) for construction feasibility. Impacts to the river were minimized through the design of a bridge that will span the channel (and can convey the Q100 flows, has wildlife shelves, etc.); however, riprap stabilization around the abutments was deemed necessary for the long term structural stability of the bridge to prevent erosion and scour (as justified in the **Application Narrative** and **Hydraulic Analysis Memo** provided in ***Appendix E***). However, the proposed riprap will be embedded with simulated streambed material below the OHW elevation to mimic the natural benthic habitat. Additionally, the highly developed Site made avoidance of palustrine wetland impacts not feasible, but the proposed impacts to Wetland 1 (a Priority Resource Area) were minimized, allowing a portion of this wetland to remain post-construction.

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.

This section is not applicable to the proposed Project, as there are no known tidal or non-tidal marshes within or near the Site.

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

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

The hydrologic connection between adjacent wetland and stream systems will be maintained post-construction. The proposed new bridge will span the stream channel and is sized sufficiently to convey the 100-year (Q100) design storm flows with >3 feet of freeboard (space between the water surface elevation and bottom of the bridge).

Similarly, the proposed work on the existing Main Street bridge is limited to concrete patch repairs that will be conducted from scaffolding set up under the bridge under drawdown conditions (behind the dam/spillway). The proposed work to the adjacent Mill Race (a box culvert that is blocked with trash/debris and no longer conveys active flow) is limited to concrete repairs and installation of a new trash rack. This work will also occur under drawdown conditions (likely behind a sandbag cofferdam). The limited work to these structures will not change their size, so the hydrologic connections post-construction will match the existing conditions.

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.

As previously mentioned, the overall limits of disturbance were minimized to the extent practical to reduce and avoid natural resource impacts, where practical, while accomplishing the Project objectives within the constraints of this highly developed Site. No vernal pools were observed within the Site during the delineation field work.

A Natural Heritage Bureau (NHB) DataCheck Report (NHB22-3543) indicated that NHB has no recorded occurrences for sensitive species near the Site. Consequently, coordination with NHB or the NH Fish and Game Department was not required. The US Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) report identified the potential presence of the endangered northern long-eared bat (NLEB) and candidate species monarch butterfly within the vicinity of the Site. No habitat or reproduction areas for species of concern were identified. Coordination with the USFWS for the NLEB is on hold, pending further guidance from USFWS regarding the proposed relisting of the species to endangered. The effective date of the final rule was pushed to March 31, 2023. There is no suitable habitat for the monarch butterfly within the Site and no consultation is required because the candidate status of this species does not provide protection under the Endangered Species Act. Refer to **Section 6** of the **Application Narrative** for more information.

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 Project avoids and minimizes impacts to public commerce through the proposed improvements to the traffic flow and motorist/pedestrian safety within the Site. The Project objective of eliminating traffic congestion within the Site will improve public commerce. Upon coordination with the US Coast Guard (provided in ***Appendix P***), the Contoocook River within the Site is navigable by law but not actually navigated. This is due to the series of dams located along this river, including the one located within the Site just south of the existing Main Street bridge that impounds the river and impedes human passage. However, the hydrologic connections and hydraulic capacity of the river will not be adversely impacted by the proposed work. There will also be no impact to recreation (i.e., kayaking and fishing) in this area, aside from the temporary duration of construction.

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.

According to the NHDES Wetlands Permit Planning Tool (WPPT), there are no mapped Priority Resource Areas (PRAs) within the Site. However, there are some mapped PRAs (Floodplain Wetlands Adjacent to Tier 3 Streams) along the Contoocook River upstream of the Site that overlap the National Wetland Inventory-mapped wetlands. Similarly, Wetland 1 is a floodplain wetland adjacent/contiguous to a Tier 3 stream that is also located in the FEMA-mapped 100-year floodplain. Consequently, Wetland 1 meets the definition of a PRA per Env-Wt Env-Wt 103.66(c). Wetland 2 is also located with the FEMA-mapped 100-year floodplain but is not contiguous to the river and, therefore, is not a PRA.

Although the proposed work will directly impact the floodplain through the addition of fill materials, the proposed impacts to the floodplain (including the proposed 92-foot-span bridge) are not expected to substantially increase the base flood elevation nor cause the loss of property due to increased flooding. The floodplain impacts were calculated to be negligible (less than 0.1 feet). Refer to **Section 5** of the **Application Narrative** and the **Hydraulic Analysis Memo** provided in ***Appendix E*** for more information.

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.

There are no scrub-shrub-marsh complexes or riverine forested wetland systems within the Site; however, these communities are present along the Contoocook River farther upstream. The delineated wetlands within the Site include Wetland 1, which is classified as Palustrine, Emergent, Persistent, Seasonally Flooded/Saturated (PEM1E) and Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded/Saturated (PSS1E) to the west, and Wetland 2 which is classified entirely as PSS1E.

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.

The proposed Project activities will not impact drinking water supply or groundwater aquifer levels. According to NH GRANIT View data, the Site is underlain by an aquifer with a transmissivity of less than 2,000 feet sq./day. Nevertheless, the implementation of soil erosion and sediment controls will help to preserve water quality throughout construction.

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.

The proposed construction of the new bridge crossing will not adversely impact the ability of the Contoocook River to handle runoff water, as the bridge will span the stream channel and be able to convey the 100-year design storm flows with freeboard. Furthermore, the limited nature of the proposed work to the existing Main Street bridge and Mill Race (mainly concrete repairs) will not affect the hydraulic capacity of either structure post-construction. The intent of the proposed repairs are to extend the service life of the existing infrastructure.

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.

The Shoreline Structures sections of this form are not applicable to the proposed Project, as no shoreline structures consistent with the guidance in the *Wetlands Best Management Practices Techniques for Avoidance and Minimization Manual* dated 2019 and published by NEIWPCC (i.e., docks, seating for dining establishments, etc.) are proposed. In accordance with that manual, this Project best fits into the Stream and Wetland Crossings section (Chapter 7) as opposed to the Non-Tidal Shoreline Structure section (Chapter 12) referenced in the rules.

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.

This section is not applicable to the proposed Project.

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.

This section is not applicable to the proposed Project.

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.

This section is not applicable to the proposed Project.

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.

This section is not applicable to the proposed Project.

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.

This section is not applicable to the proposed Project.

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: **USACE Highway Methodology Workbook, dated 1993, together with the USACE New England District Highway Method Workbook Supplement, dated 1999.**
NAME OF CERTIFIED WETLAND SCIENTIST (FOR NON-TIDAL PROJECTS) OR QUALIFIED COASTAL PROFESSIONAL (FOR TIDAL PROJECTS) WHO COMPLETED THE ASSESSMENT: **Nicole Martin (NH CWS #316)**
DATE OF ASSESSMENT: **October 2021**
Check this box to confirm that the application includes a NARRATIVE ON FUNCTIONAL ASSESSMENT: [X]
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: [X] Note: The Wetlands Functional Assessment worksheet can be used to compile the information needed to meet functional assessment requirements.

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 (NHDOT) c/o Reynolds, Tobey	
PROJECT STREET ADDRESS: US 202 / NH 124 / NH 137	PROJECT TOWN: Jaffrey
TAX MAP/LOT NUMBER: N/A, roadway rights-of-way and easements	

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 this project is to address identified transportation deficiencies at the subject "dog-leg" intersections through the construction of two roundabouts and a new bridge crossing of the Contoocook River to enhance public safety, improve pedestrian mobility, and support the quality of life and economic vitality of downtown Jaffrey. Additionally, various improvements are proposed along the existing road corridors and reparis to the existing Main Street bridge and Mill Race are proposed to preserve that existing infrastructure (i.e., concrete patching, trash rack replacement, etc.).

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

Application Narrative

1. Introduction

On behalf of the New Hampshire Department of Transportation (NHDOT or "the Applicant"), this Wetlands Permit Application was prepared by VHB pursuant to the New Hampshire Revised Statutes Annotated (RSA) Chapter 482-A, Fill and Dredge in Wetlands, and Wetland Bureau Code of Administrative Rules, Chapters Env-Wt 100 through Env-Wt 900.

NHDOT proposes to reconfigure the existing signalized five-way intersection into a five-leg roundabout and construct a new US 202 connector road from this roundabout across the Contoocook River to a new three-leg roundabout at its proposed intersection with River Street ("the Project"). The goal of this Project is to move traffic more effectively through this inefficient and highly congested area in downtown Jaffrey, as further detailed below. Various improvements are also proposed along the approach roadways and other minor work/improvements along the Contoocook River (including repairs to the existing Main Street bridge and Mill Race, as further described in **Section 3** of this **Application Narrative** below). The limits of all this work comprise the extent of the "Site," as depicted on the **USGS Site Location Map** and referenced throughout this application.

2. Site Description and Existing Conditions

Brief Background

The existing five-way signalized intersection of US 202 (Main Street/Peterborough Street) with Turnpike Road (NH 124), Blake Street, and Stratton Road is in the center of downtown Jaffrey located east of the existing Main Street Bridge crossing of the Contoocook River. West of the Main Steet Bridge is a four-way signalized intersection of US 202 (Main Street/River Street) with Main Street (NH 124) and North Street (NH 137). Traffic flow through this area is highly inefficient and congested, prompting the need for this Project.

The main land use within the vicinity of the US 202/NH 124 intersections is a mix of commercial and residential. The Town of Jaffrey is most densely populated within the vicinity of the Site with little undeveloped space. The Contoocook River flows under Main Street between the two US 202/NH 124 intersections. A dam is located within the Contoocook River directly south of Main Street, which impounds the river in the southern portion of the Site.

NHDES Wetlands Permit Planning Tool (WPPT) Review

The following information was obtained from the NHDES WPPT mapper.

Priority Resource Areas (PRAs): There are no mapped PRAs within the Site; however, there are some mapped PRAs (Floodplain Wetlands Adjacent to Tier 3 Streams) along the Contoocook River upstream of the Site that overlap the National Wetland Inventory-mapped wetlands. Similarly, Wetland 1 is a floodplain wetland adjacent/contiguous to a Tier 3 stream that is also located in the FEMA-mapped 100-year floodplain. Consequently, Wetland 1 meets the definition of a PRA per Env-Wt 103.66(c), and permanent impacts to this wetland will require mitigation, as detailed in **Section 7.2** of this **Application Narrative** below.

Impairments: The Contoocook River impoundment within the Site (NH AUID NHIMP700030101-02) is listed as impaired for dissolved oxygen saturation, dissolved oxygen concentration, and non-native plants. Downstream of the site, the Contoocook River (NH AUID NHIMP700030101-03) is impaired for dissolved oxygen saturation, dissolved oxygen concentration, and pH. However, the proposed work will not contribute to this impairment.

Other Water Types: There are no Class A waters or outstanding resource watersheds within the vicinity of the Site. Furthermore, there are no National Wild and Scenic Rivers within the Site.

Designated Rivers: The Contoocook River is a Designated River; therefore, a complete copy of this application will be submitted to the Contoocook and North Branch Rivers Local Advisory Committee (LAC) concurrently with the NHDES submission to provide them with the opportunity to review and comment.

Fisheries: There are no fisheries identified within the Site. A discussion regarding Essential Fish Habitat (EFH) is provided in **Section 6.3** of this **Application Narrative** below.

Shoreland: The Contoocook River is a 4th Order watercourse and subject to the NHDES Shoreland Water Quality Protection Act (RSA 483-B). Therefore, this Project will require separate authorization from the NHDES Shoreland Program (likely via a Shoreland Permit-by-Notification) for the proposed impacts with the 250-foot Protected Shoreland of the Contoocook River.

3. Proposed Project Description

The NHDOT proposes to permanently impact 2,540 sq ft (225 lin ft) within the bed and 1,504 sq ft (240 lin ft) within the banks of the Contoocook River to construct a new bridge with associated riprap stabilization and simulated streambed material, and to fill 4,517 sq ft of palustrine wetlands to construct a new connector road, stormwater infrastructure, and relocated parking. Temporary impacts include 3,372 sq ft (442 lin ft) within the bed and 296 sq ft (114 lin ft) within the banks of the Contoocook River, along with 244 sq ft within a palustrine wetland (Wetland 1) to install proposed erosion controls (i.e., steel sheet pile cofferdams, sandbag cofferdams, silt fence/sock, etc.).

The purpose of this Project is to address the traffic congestion and safety deficiencies associated with the current configuration of the US 202 "dog-leg" intersections of Main Street with Peterborough Street (five-way signalized intersection) and Main Street with River Street (four-way signalized intersection), while enhancing pedestrian mobility and supporting the quality of life and economic vitality of downtown Jaffrey.

The need for the Project relates to the high-volume US 202 movement (between Peterborough Street and River Street) that must travel through both intersections. Since both traffic signal-controlled intersections are separated by only about 300 feet, there is not enough storage length to accommodate the left-turn movements. As a result, vehicles in the left-turn lanes queue back into the adjacent signalized intersection creating a gridlock condition. This gridlock condition, which occurs sporadically (at least eight to ten times during the peak hour) produces an unstable flow that is frustrating to both motorists and pedestrians. The condition is also potentially hazardous as motorists move from one lane to another to maneuver around blocked vehicles. This queueing problem was confirmed with a Sim Traffic simulation model as well as with actual observations including monitoring the interaction between the intersections with a drone. Additionally, large trucks (WB-50 or longer) traveling along US 202 have difficulty turning right onto Main Street from both Peterborough Street and River Street. Large trucks have been observed crossing into the opposing travel lane to complete the turn.

The proposed Project elements are detailed below. All Project activities will occur within the existing roadway rights-of-way (ROW) and newly acquired ROW, easements, and parcel acquisitions that will be in place prior to the start of construction. The existing and proposed ROW and easement lines are included in the **Wetland Impact Plans** provided in ***Appendix Q***.

All work associated within the Contoocook River will occur during low flow periods, and much of it will also occur under drawdown conditions. The Town of Jaffrey routinely draws down the Contoocook River

impoundment within the Site in coordination with the New Hampshire Fish and Game Department (NHF&G) to perform infrastructure maintenance and inspections by raising the two gates at either side of the dam and drawing the water down slowly (at a rate specified by NHF&G) to minimize disturbance to aquatic fauna. The Site during drawdown is visible in Photos 15-19 and 21-23 of the **Photo Log** provided in ***Appendix L.***

Roundabouts and New Bridge: The Project proposes to reconfigure the US 202 and NH 124 intersection (east of the river) into a single lane 5-leg roundabout configuration and construct a new section of US 202 over the Contoocook River. The new section of US 202 between Blake Street and River Street will remove the signalized US 202 dogleg configuration, thereby improving traffic flow. The new intersection with US 202 and River Street (west of the river) will be a 3-leg roundabout. The dual roundabout configuration serves to enhance the safe and efficient movement of all travel modes, including pedestrians and bicycles, while maintaining low vehicle speeds within the town center.

- Single Lane, Five-Leg Roundabout: The proposed Project calls for the existing five-way traffic signal controlled Main Street/Peterborough Street/Turnpike Road/Stratton Road/Blake Street intersection to be reconstructed to form a five-way single-lane roundabout. The proposed roundabout would have an inscribed diameter (approximate outside curb-to-curb edge) of approximately 125 feet. Each approach to the roundabout would consist of only a single lane except for the northbound approach from the new connector road that would also provide a channelized right-turn lane that will accommodate buses, large trucks, fire engines, and similar large vehicle turns onto Stratton Road. This roundabout will provide pedestrian crosswalks and pedestrian refuge islands on each approach to the roundabout. No jurisdictional impacts are proposed in this vicinity.

- Connector Road/New Bridge Crossing: Along with reconstructing the five-way intersection at Main Street, the proposed Project will realign US 202 by constructing a new 92-foot-long clear span bridge crossing the Contoocook River approximately 375 feet south/upstream of the Main Street bridge. The new segment of US 202 would extend south and west from the five-way roundabout using portions of the current Blake Street alignment to cross the river to River Street. Subsurface micropiles are proposed to connect the abutment footings to the bedrock. Riprap is also proposed around the abutments and in the stream channel that will extend below the calculated scour elevation of approximately 1002.9 feet to further protect the infrastructure. The riprap below the ordinary high-water elevation (1005.9 feet) will be embedded with 6 to 8 inches of simulated streambed material. Refer to the **Hydraulic Analysis Memo** provided in ***Appendix E*** and the **Bridge Section** and **Simulated Streambed Material Special Provision** provided in ***Appendix S*** for more information. The proposed connector roadway and bridge crossing the Contoocook River will also provide a 5.5-foot-wide sidewalk and a 5- to 7-foot-wide shoulder/bike lane on each side of the roadway. There will also be a 5-foot-wide terrestrial wildlife shelf along each bank beneath the bridge.

- Single Lane, Three-Leg Roundabout: The new segment of US 202 would intersect River Street at a second proposed roundabout. The River Street roundabout would be a three-way single-lane roundabout with an inscribed diameter (approximate outside curb-to-curb edge) of approximately 125 feet. This roundabout will provide pedestrian crosswalks and pedestrian refuge islands on each approach to the roundabout.

Main Street/River Street/North Street Intersection: The proposed Project also removes the traffic signal at the Main Street/River Street/North Street intersection, replacing it with all-way stop-sign control. No jurisdictional impacts are proposed in this vicinity.

Parking Lot Relocation and Stormwater Management: The existing parking lot between the Contoocook River and Blake Street (east of the river) is proposed to be relocated farther south to accommodate the proposed alignment of the new connector roadway. A stormwater basin to treat the increased impervious area is also proposed in close vicinity to the parking lot on the east side of the Contoocook River and would drain to the Contoocook River.

US 202 and NH 124 Mill Race Inlet Box Culvert (Bridge #154/084) Repairs: The existing US 202 and NH 124 (Main Street) over Mill Race Inlet structure is a cast-in-place concrete box culvert constructed in 1900 with a clear span of approximately 11'-8" and a measured vertical opening of 6'-2". There is approximately 3 to 4 feet of cover/fill above the culvert crown including the sidewalk above it. The concrete headwall extends from the crown of the culvert to the sidewalk at the inlet. Based on the latest NHDOT-prepared bridge inspection report dated 9/14/2021, the culvert is in Satisfactory condition. The culvert is oriented at a 30-degree skew under the roadway and includes two 90-degree bends. It passes directly under the old mill building currently containing the Jaffrey Mills Apartments. The outlet is located at the north end of the building after which the flow rejoins the Contoocook River. It has previously been assumed that the box culvert was blocked or has a weir at the downstream end, but this has not been confirmed. Recent field observations suggest that the culvert is clogged with debris and not intentionally blocked. The outlet has a large accumulation of debris, but it appears that water flows through.

This structure is located along the west riverbank between a 24-inch reinforced concrete pipe and the dam. There are remnants of a deteriorated trash rack and accumulated sediment in front of the inlet (likely from the adjacent stormwater outfall). The sediment is proposed to be removed to replace the trash rack. Concrete repairs include refacing the existing deteriorated concrete headwall and inside walls adjacent to the culvert inlet. The proposed work will be conducted under drawdown conditions behind a small sandbag cofferdam.

US 202 and NH 124/Main Street Bridge (Bridge #155/084) Repairs: This Project proposes to repair the deteriorated portions of the existing masonry wall along the artificial western riverbank north/downstream of the Main Street bridge, conduct concrete patch repairs as needed along the structure including to the roof slab of the bridge below the road, plug the various drainage pipes within the bridge walls with concrete upon confirmation that pipes are abandoned, and repair/reconstruct the existing sidewalks. Although the proposed work will be conducted under drawdown conditions, sandbag cofferdams may be installed along the bridge abutments. Crews and scaffolding will be lowered from the bridge and the limited extent of proposed concrete patching will allow the required concrete to be pumped from the roadway to avoid the need for heavy equipment or vehicles in the riverbed.

Roadway Corridor Improvements: Additional roadway corridor improvements are proposed along the approach roadways (Peterborough St, NH 124, Stratton Road, Blake Road, and River Street) that will not result in natural resource impacts; these improvements include sidewalks, bike lanes, lighting, and utility relocations.

Retaining Wall Removal: There is an existing wall that retains the backyard of a residential property at 15 River Street (NHDOT Parcel #11) that has been acquired as part of this Project between the Jaffrey War Memorial parcel to the north and the proposed new bridge crossing to the south. This retaining wall is proposed to be

removed to allow this area to be regraded to support the bridge abutment installation, eliminate any future maintenance requirements for this wall if it were left in place, and provide a relatively flat, usable area for potential expansion of the adjacent War Memorial Park use.

Refer to the **Construction Sequence Narrative** provided in ***Appendix M*** for additional project implementation details.

4. Wetland & Surface Water Resources

VHB Senior Environmental Scientist Kristopher Wilkes (NH CWS #288) and VHB Environmental Scientist Nicole Martin re-delineated wetland and surface water boundaries within the Site on October 7, 2021, that were originally delineated on September 7, 2017. Wetland delineation work was performed in accordance with the procedures and standards outlined in the *1987 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) using alpha-numerically coded pink flagging tape. Wetland delineation also relied upon the *Field Indicators for Identifying Hydric Soils in the United States, Version 8.2,* published by the Natural Resource Conservation Service and the *Field Indicators for Identifying Hydric Soils in New England, Version 4.0,* published by the New England Interstate Water Pollution Control Commission in June 2020. Dominant wetland vegetation was assessed using the *2018 National Wetland Plant List* published by the US Army Corps of Engineers. Wetlands were classified using the USFWS methodology *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979, revised 1985). Wetland function and values were assessed using the Wetland Function-Value Evaluation Forms in accordance with the *Highway Methodology Workbook Supplement* (USACE, 1999) and principal functions are summarized for each natural resource listed below.

The top of bank of the Contoocook River was identified and delineated within the Site in accordance with *Env-Wt 102.15* using alpha-numerically coded blue flagging tape. Wetland and top of bank flags were collected in the field at the time of delineation with a GPS Trimble unit capable of sub-meter accuracy and later picked up via traditional survey methods. The ordinary high-water line of the Contoocook River was not delineated in the field due to environmental conditions (presence of an impoundment). Rather, the ordinary high-water line within the Site was established at a contour elevation of approximately 1005.9 feet NGVD29 based on the NHDES 2009 Dam Bureau report information and hydraulic modelling.

An assessment for potential vernal pool habitat was conducted within the Site in accordance with *Identifying and Documenting Vernal Pools in New Hampshire – Third Edition*, 2016, published by the New Hampshire Fish and Game Department, Nongame and Endangered Wildlife Program. No potential vernal pools were identified.

Finally, notes regarding the presence and distribution of invasive species within the Site were collected in the field and digitized for inclusion on the plans. Invasive species polygons were classified as Type I or Type II based on the NHDOT's *Best Management Practices for the Control of Invasive and Noxious Plant Species* (dated 2018). Type I species readily spread by seeds but do not reproduce by vegetative means (i.e., root or stem fragments), while Type II species can reproduce by seeds and vegetative means which makes them more difficult to eradicate. Type I species observed include glossy buckthorn (*Frangula alnus*), multiflora rose (*Rosa multiflora*), autumn olive (*Elaeagnus umbellata*), oriental bittersweet (*Celastrus orbiculatus*), common buckthorn (*Rhamnus cathartica*), Japanese barberry (*Berberis thunbergii*), and Norway maple (*Acer platanoides*). Type II species observed include purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Reynoutria japonica*).

The Contoocook River and two wetlands were identified within the Site and are further described below in terms of location, vegetative cover class, hydrological regime, soil characteristics, and landscape form. Refer to the **Photo Log** and **Delineated Natural Resources Figure** provided in ***Appendix L***.

4.1 Contoocook River

The Contoocook River flows for 71 miles from its origin in Poole Pond in Rindge, NH north to the Merrimack River in Concord, NH with a total drainage area of approximately 486,400 acres (760 square miles). The river flows south to north through the Site between Blake Street and River Street and beneath Main Street. The Contoocook River is impounded by the Contoocook River Dam located just south of the bridge that carries Main Street (US 202) over the river.

The bank of the Contoocook River near the dam is composed of a concrete retaining wall and sidewalk, which transitions to a built stone wall bordering a paved sidewalk for approximately 85 feet along the eastern bank of the river. From there the eastern bank transitions to a more natural bank near the northern edge of the public parking lot off Blake Street. The concrete retaining wall near the bridge transitions to a mixed stone and concrete retaining wall for approximately 340 feet along the western bank from the dam, after which the bank transitions to a more natural bank. The field top of bank delineations along each bank began in the naturalized areas where the constructed walls end.

The delineated top of bank of the Contoocook River was completed from the end of the constructed walls to approximately 100 feet south of the southern limits of disturbance associated within the proposed new bridge crossing along the eastern bank and approximately 50 feet south of the southern limits of disturbance along the western bank due to private property constraints. The remaining distance of the top of bank line along the western bank was approximated and digitized to approximately 100 feet south of the southern limits of disturbance to match the extent of the eastern bank delineation. The Contoocook River is classified as Riverine, Lower Perennial, Unconsolidated, Mud, dike/impounded (R2UB3h). The average bank height within this portion of the river was observed to be approximately 4 to 8 feet high. The eastern and western banks of the river through the Site are densely vegetated with trees, shrubs, and invasive plant species and were observed to be relatively stable with no significant erosion or undercutting present. Little to no disturbance was noted along the natural riverbanks.

Functions and Values

As a major Tier 3 surface water draining a watershed of approximately 19,100 acres at the Site, the Contoocook River plays an important part in the water cycle and provides a multitude of functions and values often associated with large river systems. Refer to the **Wetland Function-Value Evaluation Form** provided in ***Appendix C***. Principal functions and values of the Contoocook River include:

- Groundwater Recharge/Drinking Water - The Contoocook River provides opportunity for groundwater recharge and influences the drinking water supply in the region as water often penetrates groundwater through wetlands and the beds of rivers and streams. According to NH GRANIT data, the Site is underlain by a stratified drift aquifer with a transmissivity of less than 2,000 square feet per day. Jaffrey Water Works draws from this aquifer to supply town residents.

- Flood and Erosion Protection - The Contoocook River provides a level of flood and erosion protection by receiving precipitation, surface water, groundwater, and other sources of runoff/discharge associated with the surrounding natural and urban areas. The river's storage ability plays an important role in reducing erosion and flood damage to communities along the river corridor and downstream.

- Sediment & Toxicant Retention/Nutrient Removal - The Contoocook River functions like other surface waters in reducing pollution that flows downstream to the Merrimack River, New Hampshire ponds and lakes, and ultimately coastal waters. The river retains sediments, pollutants, and excess nutrients, and plays a role in reducing carbon to the atmosphere.

- Wildlife/Fish Habitat - The Contoocook River provides habitat for a diverse assemblage of plant, fish, amphibian, bird, and mammal species. Rivers are often vital for spawning and nursery habitats, provide feeding opportunities and refuge, and act as travel corridors.

- Recreation – Like many other large rivers in New Hampshire, the Contoocook River provides opportunity for recreation including boating, paddling, fishing, and sight-seeing.

The proposed Project will not have an adverse impact on the functions and values of the Contoocook River. The proposed work on the existing Main Street Bridge and Mill Race structures will be limited to repairs and only result in temporary impacts to the river, while the permanent and temporary jurisdictional impacts associated with the abutments of the new connector road bridge have been minimized to the extent practical while providing sufficient support (via riprap) to the new infrastructure that extends below the scour elevation. Refer to **Section 7.1** of this **Application Narrative** below for more information regarding the design details and proposed impacts. Furthermore, wildlife shelves are proposed along both banks beneath the new bridge to further offset potential impacts in this area. Standard best management practices (BMPs) will be implemented throughout construction to reduce the risk of erosion and sedimentation within the river, as discussed below in **Section 7.2** of this **Application Narrative** below.

The Project construction may have some impact to wildlife and river recreation due to enhanced noise and activity in the area; however, these impacts are temporary in nature and any temporary noise resulting from construction is not likely to cause a large disruption given the noise levels associated with high traffic volumes common in this area. Also, the location of the proposed work in a highly developed setting reduces the likelihood that the river provides essential wildlife and recreation opportunity at this location.

Finally, it should be noted that since the purpose and need of the proposed Project are specific to the traffic deficiencies identified in this location within a highly developed area in downtown Jaffrey, limiting impacts based on the results of the functional assessments were not applicable in this case. However, all impacts were avoided and minimized to the maximum extent practical throughout the design while still accomplishing the Project objectives.

4.2 Palustrine Wetlands

Wetland 1

Wetland 1 originates in a relatively flat vegetated and disturbed area containing tire ruts and exposed soils surrounded by a parking lot to the north, Blake Street to the east, and a residential building and parking area to the south. Wetland 1 extends west from this flat area to a small depression abutting the Contoocook River before draining directly to the river in two locations along the river's eastern bank. The eastern half of Wetland

1 is classified as Palustrine, Emergent, Persistent, Seasonally Flooded/Saturated (PEM1E) and receives hydrology from surface water run-off from surrounding developed areas. The western depressional portion of Wetland 1 is classified as Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded/Saturated (PSS1E) and is fed by a culvert that conveys flow from the adjacent parking lot to the north.

Wetland 1 vegetation is dominated by grass-leaved goldenrod (*Euthamia graminifolia*), New England aster (*Symphyotrichum novae-angliae*), reed canary grass (*Phalaris arundinacea*), woolgrass (*Scirpus cyperinus*), sensitive fern (*Onoclea sensibilis*), bittersweet nightshade (*Solanum dulcamara*), narrowleaf cattail (*Typha angustifolia*), white meadowsweet (*Spiraea alba*), green ash saplings (*Fraxinus pennsylvanica*), tall meadow-rue (*Thalictrum pubescens*), soft rush (*Juncus effusus*), path rush (*Juncus tenuis*), deer-tongue grass (*Dichanthelium clandestinum*), calico aster (*Symphyotrichum lateriflorum*), joe pye weed (*Eutrochium purpureum*), devil's beggartick (*Bidens frondosa*), and blue joint grass (*Calamagrostis canadensis*), along with the invasive purple loosestrife, glossy buckthorn, multiflora rose, autumn olive, and oriental bittersweet. Wetland hydrology indicators include surface water (A1), saturation (A3), water-stained leaves (B9), and drainage patterns (B10). Soils sampled within Wetland 1 were observed to meet Hydric Soil Indicators F3: Depleted Matrix and F6: Redox Dark Surface. Refer to the **Wetland Determination Data Forms** provided in ***Appendix K***.

Functions and Values

The position of Wetland 1, being that it directly abuts and connects to the eastern bank of the Contoocook River, combined with the dense vegetation within the wetland help to stabilize the riverbank and prevent erosion. Wetland 1 also functions to slow and retain flood flows and surface runoff from surrounding upland and developed areas. The presence of dense vegetation within Wetland 1 makes it potentially suitable for sediment/toxicant retention and nutrient removal as it filters runoff water before draining directly into the Contoocook River, thus aiding the river's overall water quality and fish habitat suitability. Although these functions are present, they are considered minimal contributions within the context of the greater landscape due to the wetland's small size. Refer to the **Wetland Function-Value Evaluation Form** provided in ***Appendix C***.

Wetland 2

Wetland 2 is a small circular natural depression located within the northeastern corner of a residential back yard near the Contoocook River's western bank. Disturbance (rutting, exposed soils, and depressed vegetation) was noted within the wetland at the time of the delineation and appeared to be the result of recent geotechnical boring work. Wetland 2 is classified as PEM1E and receives hydrology from groundwater breakout and surface runoff from the surrounding residential properties upslope to the north and west. Wetland vegetation is dominated by sensitive fern, white meadowsweet, New England aster, rough-stemmed goldenrod (*Solidago rugosa*), giant goldenrod (*Solidago gigantea*), silky dogwood (*Cornus amomum*), red maple (*Acer rubrum*), and some eastern white pine (*Pinus strobus*) and Norway maple along the edges, along with the invasive glossy buckthorn, common buckthorn, and oriental bittersweet. Wetland hydrology indicators include saturation (A3) and geomorphic position (D2). Soils sampled within Wetland 2 were observed to meet Hydric Soil Indicators A11: Depleted Below Dark Surface and F3: Depleted Matrix. Refer to the **Wetland Determination Data Forms** provided in ***Appendix K***.

Functions and Values

The depressional topography within Wetland 2 makes it potentially suitable for sediment/toxicant retention and nutrient removal as it receives and holds runoff from surrounding upland areas. However, its small size and isolated nature significantly limits these functions within the context of the greater landscape. Refer to the **Wetland Function-Value Evaluation Form** provided in ***Appendix C***.

5. Watersheds, Floodplains, and Hydraulics

The size of the contributing watershed of the Contoocook River at the proposed crossing location was calculated to be approximately 29.85 square miles or 19,100 acres. Refer to the **USGS Watershed Map** provided in ***Appendix D.***

The proposed work is located within the Federal Emergency Management Agency's (FEMA)-mapped 100-year floodplain Special Flood Hazard Area (SFHA) Zone AE of the Contoocook River. Zone AE is defined as a one-percent annual chance flood hazard that is determined in the Flood Insurance Study (FIS) by detailed methods of hydraulic analysis. Refer to the **FEMA Floodplain Map** provided in ***Appendix D.*** It should be noted that the FEMA floodplain mapping is based on low-resolution topographic data and floodplain delineation was adjusted to fit the site-specific topography on the **Wetland Impacts Plans** provided in ***Appendix Q.*** The location of the proposed new stream crossing will be approximately 375 feet upstream of the dam at the floodplain's narrowest point, where the Base Flood Elevation (BFE) is elev. 1011.8 feet NAVD88. According to the FIS completed for Cheshire County, New Hampshire, no floodway was computed for the Contoocook River. Since this river does not have a regulatory floodway, the National Flood Insurance Program (NFIP) regulations for floodway development set forth in 44 CFR 60.3(d)(3) do not apply and a "No Rise" Floodway Encroachment Assessment is not required.

While the proposed work will directly impact the floodplain through the addition of fill materials, hydraulic modeling completed to date indicates that the hydraulic effects of the project are negligible. The proposed impacts to the floodplain (including the proposed 92-foot-span bridge) are not expected to substantially increase flood elevations nor cause the loss of property due to increased flooding. Refer to **Table 1** below (an excerpt from the **Hydraulic Analysis Memo** provided in ***Appendix E***), which shows no substantial change in flood elevations between the existing and proposed conditions. Please note that the Hydraulic Analysis Memo uses a New Hampshire-specific USGS hydrologic regression to estimate flow for the 1% annual exceedance probability (AEP), or "100-year" flood discharge. This method differs from the FEMA FIS but is considered more appropriate for this site-specific design analysis. As a result, the modeled flood elevations in **Table 1** differ from the FEMA regulatory BFE.

Table 1 NH Route 202 – Contoocook River Hydraulic Analysis Results

	Existing Conditions	Proposed 92-ft span Bridge
Drainage Area (mi^2)	29.85	
Bridge Waterway Opening (sf)	N/A	960
1% AEP Design Flood Discharge (cfs)	1,740	
1% AEP Design Flood Elevation (ft)	1010.1	1010.1
1% AEP Design Flood Velocity (fps)	3.2	3.1
1% AEP Design Flood Freeboard (ft)	N/A	3.5

Source: VHB HEC-RAS model. All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29). Headwater measured at model station 683 (75 ft upstream of culvert), velocity measured in main channel at internal bridge model station 606 BRU. Freeboard is measured as the difference between the headwater elevation and the lowest elevation of the bridge low chord.

6. Rare, Threatened, and Endangered Species

The following is a discussion of rare, threatened, and endangered species identified within the vicinity of the Site by the NH Natural Heritage Bureau (NHB) DataCheck tool and US Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IPaC) system.

6.1 Natural Heritage Bureau

A search for the occurrence of rare plant, animal, or natural communities within the vicinity of the proposed Project was completed using the NHB online DataCheck tool. A report provided by NHB, dated November 7, 2022, indicated that NHB has no recorded occurrences for sensitive species near the Site. Therefore, no coordination with NHB or the NH Fish and Game Department is required for this Project. Refer to the **NHB DataCheck Report** provided in ***Appendix G***.

6.2 US Fish and Wildlife Service

The Project was reviewed for the presence of federally listed or proposed, threatened, or endangered species, designated critical habitat, or other natural resources concerning the USFWS IPaC System. Results dated January 25, 2023, indicated the potential presence of two species within the vicinity of the Site: northern long-eared bat (*Myotis septentrionalis*, "NLEB") and monarch butterfly (*Danaus plexippus*). Refer to the **USFWS IPaC Report** provided in ***Appendix H***.

Northern Long-Eared Bat

The proposed Project is located within the federally protected range of the NLEB, which is a federally endangered species (as of the recent USFWS reclassification decision, further detailed below). Tree clearing activities are one of the largest threats to the NLEB. Based on the current plans, approximately 0.5 acre of woody vegetation/tree clearing are proposed and will occur within 300 feet of existing road corridors. No known hibernacula or roost trees currently exist in the Town of Jaffrey. As such, the proposed Project is not within 150 feet of known occupied maternity roost trees, nor within a ¼ mile of known hibernaculum. However, the adjacent town of Peterborough has known NLEB sites.

Additional considerations regarding potential impacts the Project may have on NLEB species is the removal of two buildings (4 Stratton Road and 15 River Street). A separate demolition contract (Jaffrey, 16307A) has been awarded by NHDOT. These buildings are scheduled for demolition in 2023. Assessments of these structures to

determine their use by bats were conducted in July 2022, in accordance with the USFWS Bridge/Structure Bat Assessment Form procedures. No evidence of uses by bats were identified, as such it was determined that the Proposed Action will have no effect on Northern long-eared bat and no further consultation with the USFWS is required as the proposed demolition of these buildings is consistent with the February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

Section 7 consultation for the NLEB was previously completed for this Project during the NEPA phase using the online determination key on March 6, 2019, which found that the Project adhered to the criteria of the *Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat* (revised February 5, 2018), and therefore satisfied the requirements under Section 7(a)(2) of the Endangered Species Act (ESA). Refer to the **Consistency Letter** provided in ***Appendix H***. The official effect determination of "may affect – likely to adversely affect" resulted, along with some Avoidance and Minimization Measures (AMMs), listed below.

- The Northern Long-Eared Bat Flyer shall be shared with all operators, employees, and contractors working on the project, and operators, employees, and contractors shall be aware of all environmental commitments, including all applicable AMMs.
- Direct temporary lighting away from suitable habitat during the active season.
- When installing new or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting).
- Modify all phases/aspects of the project (e.g., temporary work areas, alignments) to avoid tree removal.
- Ensure tree removal is limited to that specified in project plans and ensure that all contractors understand clearing limits and how they are marked in the field.
- All sightings of dead or sick bats in the project area shall be immediately reported to the Bureau of Environment.

However, the USFWS announced a final rule to reclassify the NLEB as endangered under the ESA on November 29, 2022. This new rule was originally planned to go into effect on January 30, 2023, but that date was recently extended to March 31, 2023. Once effective, this final rule will revoke the 4(d) rule (which is only applicable to threatened species), and require an update of the *FHWA, FRA, FTA Programmatic Consultation for Transportation Projects affecting NLEB or Indiana Bats*. Therefore, this consultation will be renewed for this Project. We will monitor the evolving consultation requirements to ensure this Project remains in compliance.

<u>Monarch Butterfly</u>

Since the monarch butterfly is a candidate species but is not listed as threatened or endangered, conservation measures are not required but should be implemented when feasible to demonstrate environmental stewardship. This species can be found anywhere where nectar producing plants are present, especially in open fields or meadows. Monarch butterflies will only breed in places with milkweed since that is the primary food source for their larva. Given the urban setting of this Site, lack of observed milkweed, and forested area with maintained lawns where the new stream crossing is proposed, suitable habitat for this species is considered absent from the Site. The candidate status of this species does not provide protection under the Endangered Species Act, and no further coordination with the USFWS is required at this time.

6.3 Wildlife & Fisheries

Wildlife Action Plan

The NH Fish & Game Department (NHF&G) has developed the New Hampshire Wildlife Action Plan (WAP) to assist with conserving and protecting wildlife species and habitat types throughout the State. The WAP identifies ranked habitat tiers that recognize the highest quality habitats in the state. Habitat tiers were created by the NHF&G Department using biological data, landscape data, and human influence information. Habitat tiers are separated into three rankings, which are 1) *Highest Ranked Habitat in the State*, 2) *Highest Ranked Habitat in Biological Region*, and 3) *Supporting Landscape*. No ranked habitat is mapped within the Site but a small tract of land with the Supporting Landscape ranking is located greater than half a mile upstream. Refer to the **NHF&G WAP Ranked Habitat Map** provided in ***Appendix N***.

The Site and surrounding area are primarily urbanized, with the dominant habitat types being Developed Impervious and Developed or Barren Land. A narrow strip of open water habitat with additional island habitats of marsh/shrub wetland and hemlock-hardwood-pine cover types extend south of the dam along the Contoocook River. Refer to the **NHF&G WAP Habitat Type Map** provided in ***Appendix N.***

Upon field review it was confirmed that the wet meadow/shrub wetland habitat types are limited to the small wetland located east of the Contoocook River near the end of Blake Street (Wetland 1) and a small wetland west of the Contoocook River in a residential backyard (Wetland 2). The Project will have temporary and permanent impacts within the open water habitat of the Contoocook River to construct the new bridge crossing and conduct maintenance on the Main Street Bridge and Mill Race. The Project will also impact a large portion of Wetland 1 and fully impact Wetland 2 to construct the new bridge crossing between the two proposed roundabouts. Due to the relatively small size of these wetlands and their location in an urbanized setting, the proposed impacts to these wetlands are not anticipated to negatively impact wildlife habitats given the current limited potential of this area to provide suitable wildlife habitat.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) established a requirement to describe and identify "essential fish habitat" (EFH) in each federal fishery management plan. The Magnuson-Stevens Act defines EFH as "those waters and substrates necessary for fish for spawning, breeding, feeding, or growth to maturity." The Magnuson-Stevens Act can be found in federal regulations under Wildlife and Fisheries (50 CFR 600.920). Under these regulations (Subpart K), FHWA is required to notify the National Oceanic and Atmospheric Administration (NOAA; also known as the National Marine Fisheries Service, NMFS) of the proposed Project.

The only EFH species that is known to occur within inland areas in New Hampshire is Atlantic salmon (*Salmo salar*). Atlantic salmon designated EFH in New Hampshire, other than coastal areas, includes the Merrimack River and Connecticut River as well as all rivers, streams, tributaries, and bays that are located within their watersheds. Information regarding the location of EFH for Atlantic salmon can be found on the NOAA EFH mapper within a document titled "Atlantic salmon EFH." Based on this document, the Contoocook River is included in Atlantic salmon EFH downstream of the Site and, therefore, consultation with NOAA is required. Consultation with NOAA was initiated through the completion of the EFH Worksheet (provided in ***Appendix O***). This worksheet assesses potential impact to EFH habitat that may occur from the proposed Project by assessing impacts to the habitat's benthic community, presence or absence of certain community types, changes in flow or sedimentation rates, or anticipated impacts to water quality or noise levels, among other factors. NOAA concluded that while the proposed Project would have an adverse effect to EFH, the adverse effect is not

substantial, and no conservation recommendations were requested (in accordance with the communication with Mike Johnson in June 2019 provided in ***Appendix O***).

7. Impact Analysis, Best Management Practices, and Mitigation

7.1 Proposed Impacts

This Project will result in a total of approximately 8,561 square feet (sq ft) and 465 linear feet (lin ft) of permanent impact to natural resources, along with approximately 3,912 sq ft and 556 lin ft of temporary impact to natural resources, further detailed below.

Permanent Impacts

The Project will have permanent impacts within the bed (2,540 sq ft/225 lin ft) and the banks (1,504 sq ft /240 lin ft) of the Contoocook River to construct the new bridge abutments and riprap protection, embedded with 6 to 8 inches of simulated streambed material to mimic the natural benthic habitat. There will also be approximately 4,517 sq ft of permanent impact to palustrine wetlands to construct the new connector road, as well as associated stormwater features and a relocated parking area. Refer to the **Env-Wt 514 Bank/Shoreline Stabilization Project-Specific Worksheet** provided in ***Appendix F*** for more information regarding riprap details.

Temporary Impacts

The Project will have limited temporary impacts within the bed (3,372 sq ft /442 lin ft) and banks (296 sq ft /114 lin ft) of the Contoocook River resulting from the in-stream turbidity control measures around the new bridge abutments, in front of the Mill Race, and below the existing Main Street Bridge to facilitate access for the concrete patch work. The Project also proposes some temporary impacts within Wetland 1 (244 sq ft) associated with land-based erosion controls.

<u>Cofferdams/Water Diversion</u>

New Connector Road Bridge: Steel sheet pile cofferdams are proposed around each abutment of the new connector road bridge to facilitate excavation and construction of the abutments and footings. These cofferdams may be dewatered if needed to remove any groundwater that seeps beneath the cofferdams. Turbid discharge will be directed to filter bags or stabilized above-grade temporary sediment basins/traps located on site in uplands. Once the abutments are constructed, the steel sheet pile cofferdams will be removed, and sandbag cofferdams or a turbidity curtain will be installed during the installation of the proposed riprap. The proposed riprap installation will occur during drawdown conditions. Given the low flow conditions expected during the drawdown, work along both banks may occur simultaneously as the streamflow under drawdown will not occupy the full channel width. However, if necessary to maintain stream flow and continued aquatic organism passage throughout construction, the riprap will be installed one side at a time using staged stream diversions.

Bridge Preservation Work: The proposed work on the existing Main Street Bridge (No. 155/084) and Mill Race (No. 154/084) will occur during drawdown conditions behind sandbag cofferdams.

Temporary Workspace/Access

The 1,710 sq ft (168 lin ft) of bed impact below the existing Main Street bridge is proposed to provide workspace for the limited bridge repair activities behind the sandbag cofferdams during drawdown conditions. As detailed further in **Section 3** of this **Application Narrative** above, no heavy machinery will be required within the riverbed, just scaffolding and crews on foot that will access from off the existing bridge. Sandbag cofferdams will be constructed around the scaffolding in case there is minimal water flow during construction, as shown on the **Erosion Control Plans** provided in ***Appendix R.*** Similarly, 267 sq ft/32 lin ft of temporary impact is proposed around the Mill Race to allow for the accumulated sediment removal, trash rack installation, and concrete repairs.

7.2 Mitigation and Best Management Practices

Mitigation Applicability

This Project as a whole does not trigger mitigation since the proposed permanent impacts are less than the 10,000 sq ft threshold per Env-Wt 313.04(a)(2). However, the following separate elements of the Project do independently trigger mitigation:

- PRA: As described in **Section 2** of this **Application Narrative** above, Wetland 1 is a PRA, so all permanent impacts to this wetland must be mitigated in accordance with Env-Wt 313.04(a)(1).
- Tier 3 ADR: In accordance with Env-Wt 904.05(f)(1)(a), mitigation is triggered for the proposed new Tier 3 stream crossing if it does not meet the tier-specific criteria of Env-Wt 904.07, which includes compliance with the *NH Stream Crossing Guidelines* (May 2009). This was confirmed by Lori Sommer at the Natural Resource Agency Coordination Meeting (NRAM) held on January 19, 2022. Ms. Sommer also concurred that any impacts that are required to construct the wildlife shelves would not require mitigation, which Karl Benedict confirmed at the NRAM held on January 18, 2023. Refer to the **Natural Resource Agency Coordination Meeting Minutes** provided in ***Appendix A***.

Therefore, of the total proposed impacts discussed in **Section 7.1** of this **Application Narrative** above, only the permanent impacts to Wetland 1 (3,300 sq ft) and the permanent impacts associated with the construction of the new bridge minus the wildlife shelves (258 lin ft) are subject to mitigation. Since the impacts to the riverbank are quantified by linear footage for mitigation, we used the following approach to deduct the wildlife shelves:

- We calculated the square footage of impacts along each bank that were the result of the proposed wildlife shelves (99 sq ft along the left bank associated with Impact D and 221 sq ft along the right bank associated with Impact G, totaling 320 sq ft).
- This area was used to calculate the percent of each proposed bank impact area that is attributed to the proposed wildlife shelves.
- These percentages were applied to the linear footage of the bank impacts to adjust the length that is subject to mitigation in the ARM Fund Stream Calculator.

Refer to the **Mitigation Documentation** provided in ***Appendix B*** for more information.

Mitigation Considerations

In accordance with Env-Wt 801.03(a), NHDOT contacted the Jaffrey Conservation Commission on November 8, 2021, to see if they maintain a list of local mitigation projects that could be considered as potential permittee-responsible mitigation (if the available projects are an appropriate scale relative to the proposed impacts and

that the resources have similar functions and values to those proposed to be impacted). No response was received.

Additionally, onsite mitigation via the preservation of an aquatic resource buffer is not practical given the Site constraints (within a highly developed area in downtown Jaffrey) and abutting private small residential properties, in accordance with Env-Wt 801.03(b & c)(1) and (2). Furthermore, the Contoocook River is highly modified due to the presence of numerous dams that have altered the natural geometry of the river over time, further described in **Section 11.2** of this **Application Narrative** below. However, stream restoration/enhancement via dam removal is beyond the scope of this Project.

Finally, the NH Aquatic Restoration Mapper was reviewed to assess deficient stream crossings (in terms of structural condition, aquatic organism passage, geomorphic compatibility, hydraulic vulnerability, etc.) in the vicinity of the Site within the same HUC-12 watershed for potential suitability for permittee-responsible mitigation. However, none of the stream crossings stood out as being practical options for mitigation commensurate to the scope of the proposed Project.

Mitigation Proposal

Therefore, mitigation via an in-lieu fee payment to the Aquatic Resource Mitigation (ARM) Fund in the amount of $93,494.35 is proposed in accordance with Env-Wt 801.03(b)(3). Refer to the supporting mitigation documentation provided in ***Appendix B.***

Best Management Practices

Standard BMPs will be applied throughout construction in accordance with applicable NHDES and NHDOT BMP Manuals to reduce the risk of erosion and sediment-laden run-off from entering the Contoocook River and adjacent wetlands. Perimeter controls such as silt fence and/or silt sock will be installed upslope of the wetlands and river to ensure that surface water run-off from un-stabilized areas does not carry silt, sediment, and other debris outside of the limits of work. Temporary diversion BMPs (i.e., a sandbag cofferdam, steel sheet piles, and/or clean water bypass pumps) may be required to isolate dry work areas and minimize the risk of sedimentation downstream. All installed temporary erosion control measures shall be inspected daily and repaired/replaced as necessary.

In accordance with the *New Hampshire Stormwater Manual, Volume 3, Erosion and Sediment Controls During Construction* dated December 2008, areas remaining un-stabilized for a period of more than 30 days shall be temporarily seeded and mulched. Erosion control blankets shall be installed on all slopes that are greater than 3 feet horizontal and 1 foot vertical (3:1). Upon the completion of the proposed work, all disturbed and graded areas located upslope of the erosion control measures will be seeded and mulched as needed. Disturbed areas that have been seeded and mulched will be considered stable once 85-percent vegetative growth has been achieved. Refer to the **Erosion Control Plans** included as ***Appendix R*** for further details.

Since invasive plants are known to occur within the Site, all work including daily removal of plant material from construction equipment, shall be constructed in accordance with NHDOT's *Best Management Practices for Roadside Invasive Plants Manual* (2008) and *Best Management Practices for the Control of Invasive and Noxious Plant Species* (2018). The Contractor will be required to provide an Invasive Species Management Plan specific to their means and methods of construction for review and approval by NHDOT. Only clean equipment that is free of plant material and debris shall be delivered to the Site and utilized during construction. All machinery entering and leaving any area containing invasive plants will be inspected for foreign plant matter (i.e., stems, flowers, and roots) and soil embedded in the tracks or wheels. If foreign plant matter or soil is present, the operator shall remove the plant material and soil from the machine using hand tools.

In accordance with Env-Wt 904.02, work will be conducted during low flow periods or in dry conditions using BMPs to maintain normal flows and prevent water quality degradation during construction.

8. Cultural Resources

In March 2018, a Request for Project Review (RPR) was submitted to NH Division of Historical Resources (NHDHR) for the proposed Project. NHDHR reviewed the RPR on April 18, 2018, with subsequent meetings held on July 11, 2019, and September 12, 2019, to discuss the proposed impacts on the National Register-Listed Downtown Jaffrey Historic District including a National Register-eligible Boundary Increase and the National Register-Listed Jaffrey Mills.

An **Adverse Effect Memo** was executed in September 2019 (refer to ***Appendix I***) to document the unavoidable adverse impacts to the Downtown Jaffrey Historic District and Boundary Increase Area, including impacts to 4 Stratton Road, and 15, 19, 21 and 23 River Street which are all contributing properties to the District that would result from the two proposed roundabouts and the new bridge crossing of the Contoocook River. The Section 106 consultation with FHWA, NHDOT, NHDHR and a Consulting Party identified the specific measures to mitigate this adverse effect to the District, detailed in a **Memorandum of Agreement (MOA)** executed on August 20, 2020 (refer to ***Appendix I***). An **amendment to the MOA** was executed on June 29, 2022, and filled with the Advisory Council on Historic Preservation (ACHP) on August 10, 2022 (refer to ***Appendix I***) as part of the NEPA CE and Section 4(f) Reevaluation regarding the full acquisition of the 19 River Street and 21 River Street properties where partial acquisitions were originally proposed. The US Department of the Interior (DOI) reviewed the signed MOA and concurred that the agreed mitigation is appropriate to offset the impacts to these Section 4(f) resources.

Since this coordination, the Project scope expanded to include some work on the existing Main Street Bridge and Mill Race, along with the removal of a stone retaining on the acquired property at 15 River Street. The proposed bridge and Mill Race work qualifies for approval under Appendix B of the NHDOT/FHWA/NHDHR Section 106 Programmatic Agreement. Furthermore, since the 15 River Street property contributes to the Downtown Jaffrey Historic District, further coordination with NHDHR will be initiated to document the proposed retaining wall removal.

9. Federal and Local Coordination

United States Army Corps of Engineers

The proposed Project would have impacts below ordinary high-water, including permanent impacts of 2,540 sq ft (225 lin ft) and temporary impacts of 3,372 sq ft (442 lin ft). The Project would also impact palustrine wetlands, including permanent impact of 4,517 sq ft and temporarily impact 244 sq ft. These impacts fall under the US Army Corps of Engineers (USACE) Section 404 jurisdiction through the New Hampshire State Programmatic General Permit No. NAE-2022-00849. As such, Appendix B – Corps Secondary Impacts Checklist has been completed. Refer to the **ACOE Appendix B** checklist provided in ***Appendix J.***

United States Coast Guard

Based a letter from the US Coast Guard (USCG) dated January 12, 2022, the proposed new bridge over the Contoocook River does not require a bridge permit, although other areas of USCG jurisdiction apply. For example, they stipulated that the lowest portion of the superstructure should clear high water pursuant to 33 CFR 115.70, which applies to bridges constructed across reaches of waterways navigable in law, but not actually navigated (in this case due to a series of dams along the river). Refer to the **USCG Correspondence** provided in

Appendix P. Additionally, Gary Croot from the USCG indicated that there is no Coast Guard jurisdiction within the Site at the NRAM held on January 18, 2023 (refer to the **Meeting Minutes** provided in ***Appendix A***).

Conservation Commission

As mentioned in **Section 7.2** of this **Application Narrative** above, NHDOT reached out to the Jaffrey Conservation Commission on November 8, 2021, to see if they maintain a list of local projects that may be appropriate to mitigate impacts associated with this Project pursuant to Env-Wt 801.03(a). No response was received.

Local River Advisory Committee

Since the Contoocook River is a Designated River, a complete copy of this application will be submitted to the Contoocook and North Branch Rivers Local Advisory Committee (LAC) concurrently with the NHDES submission to provide them with the opportunity to review and comment. LAC comments during the NEPA analysis recommended wildlife corridors on both banks, sidewalks on bridge, and sediment and erosion controls – all of which have been incorporated into the project design.

Natural Resource Agency Coordination Meeting (NRAM)

This Project was presented at the following NRAMs: September 19, 2018, October 20, 2021, January 19, 2022, and January 18, 2023. Relevant information from these meetings are referenced throughout this Application Narrative, where applicable. Refer to the **Meeting Minutes** provided in ***Appendix A***.

NEPA Public Involvement

A summary of the meetings and public outreach conducted during the NEPA phase for this Project is provided in **Table 2** below. Notes for many of these meetings can be accessed online at https://www.nh.gov/dot/projects/jaffrey_16307/index.htm.

Table 2 Project Meetings

Date	Topic
05/09/2017	Technical Advisory Committee Meeting
06/27/2017	Technical Advisory Committee Meeting
09/12/2017	Technical Advisory Committee Meeting
10/17/2017	Public Informational Meeting #1
10/24/2017	Technical Advisory Committee Meeting
02/13/2018	Technical Advisory Committee Meeting
02/20/2018	Public Informational Meeting #2 – Public Workshop
05/29/2018	Technical Advisory Committee Meeting
07/10/2018	Technical Advisory Committee Meeting
09/19/2018	NHDOT Natural Resource Agency Coordination Meeting
10/16/2018	Technical Advisory Committee Meeting
11/15/2018	Public Informational Meeting #3
04/11/2019	Cultural Resources Agency Meeting
06/25/2019	Technical Advisory Committee Meeting
07/11/2019	Cultural Resources Agency Meeting
09/12/2019	Cultural Resources Agency Meeting
10/02/2019	Public Hearing
07/16/2020	Finding of Necessity

10. Project-Specific Requirements (Env-Wt 500)

Since the Project involves the rehabilitation of the existing Main Street and construction of a new bridge that will convey a public highway over jurisdictional areas, the standards outlined in New Hampshire Administrative Rule Env-Wt 527 must be addressed.

In accordance with RSA 482-A:3, I-a, this NHDOT project is subject to the rebuttable presumption that for applications "proposed, sponsored, or administered by the department of transportation", NHDOT "has exercised appropriate engineering judgement in the project's design."

10.1 Env-Wt 527.02: Approval Criteria for Public Highways

(a) The project meets the design criteria specified in Env-Wt 527.04;
Refer to the applicable discussion in Section 10.3 of this Application Narrative below.

(b) The project is consistent with RSA 482-A:1, RSA 483, RSA 483-B, RSA 485-A, and RSA 212-A;
The proposed Project is consistent with all above referenced statutes. In accordance with RSA 482-A:1 "Finding of Public Purpose," the interests of the general public regarding preservation of natural resources is in line with the proposed activities; the proposed impacts have been avoided and minimized to the extent feasible while still accomplishing the Project objectives. No substantial adverse impacts to the functions and values of stream channel hydraulic capacity, groundwater recharge, *etc*. will result from the proposed activities. In accordance with RSA 483 "NH Rivers Management and Protection Program," the characteristics and functions of Contoocook River will be preserved. Furthermore, the Project complies with RSA 483-B "Shoreland Water Quality Protection Act"; a shoreland permit application (likely a PBN) will be prepared for review and approval by the NHDES Shoreland Program. Finally, coordination with NHB was conducted to ensure all appropriate conservation measures are followed to avoid adverse impacts to identified species, thereby, complying with RSA 212-A "Endangered Species Conservation Act."

(c) The purpose of the project is to improve or maintain public safety, consistent with federal and state safety standards;
The purpose of this Project is to address the traffic congestion and safety deficiencies associated with the current configuration of the US 202 "dog-leg" intersections of Main Street with Peterborough Street (five-way signalized intersection) and Main Street with River Street (four-way signalized intersection) through the construction of two roundabouts and a new bridge crossing over the Contoocook River, as detailed in Section 3 of this Application Narrative above. Other smaller components of the Project (such as concrete repairs to the existing Main Street Bridge) will extend the service life (and safety) of the existing infrastructure.

d) The project will not cause displacement of flood storage wetlands or cause diversion of stream flow impacting abutting landowner property; and
The Project will not cause displacement of flood storage or cause diversion of stream flows impacting abutting landowner property. BMPs (i.e., cofferdams) will be implemented throughout construction and all work will occur during low flow conditions. Additionally, portions of the work are planned to occur during scheduled drawdown conditions (including the proposed activities associated with the existing Main Street bridge, Mill Race, and riprap installation around the new bridge abutments). The Town of Jaffrey is familiar with conducting dam drawdowns in coordination with NHF&G to facilitate inspection and maintenance activities. Therefore, no lasting adverse effects to the Contoocook River are expected as a result from this Project.

(e) For a project in the 100-year floodplain, the project will not increase flood stages off-site.
The Project will not increase flood stages off-site. The post-construction hydraulic capacity of the stream crossing will match the existing conditions. Refer to Section 5 of this Application Narrative above for a more detailed discussion.

10.2 Env-Wt 527.03: Application Requirements for Public Highway Projects

(a) A description of the scope of the project, the size of the impacts to aquatic resources, and the purpose of the project;
Please refer to the preceding sections of this Application Narrative.

(b) An accurate drawing with existing and proposed structure dimensions clearly annotated to:
(1) Document existing site conditions;
(2) Detail the precise location of the project and show the impact of the proposed activity on jurisdictional areas;
(3) Show existing and proposed contours at 2-foot intervals;
(4) Show existing and proposed structure invert elevations on the plans; and
(5) Use a scale based on standard measures of whole units, such as an engineering rule of one to 10, provided that if plans are not printed at full scale, a secondary scale shall be noted on the plans that identifies the half scale unit of measurement;
The project plans appended to this application meet these specifications.

(c) All easements and right-of-way acquisition area outlines in relation to the project;
The proposed work will occur within the limits of the existing roadway rights-of-way (ROW), acquired ROW, acquired easements (both permanent and temporary), and acquired parcels. All existing and proposed ROW and easements lines are depicted on the Wetland Impact Plans provided in *Appendix Q*.

(d) The name of the professional engineer who developed the plans, whether an employee of the applicant or at a consulting firm; and
Mr. Chuck Gregory, VHB, NH Professional Engineer #13833, is the engineer of record for the overall project design including roadway and stormwater components.

Mr. Gregory Goodrich, VHB, NH Professional Engineer #12284, developed the project plans for the new bridge.

Ms. Julie Whitmore, VHB, NH Professional Engineer #13861, developed the project plans for the bridge preservation work (Main Street Bridge and Mill Race).

(e) An erosion control plan that shows:
(1) Existing and proposed contours at 2-foot intervals, with existing contours shown with a lighter line weight and proposed contours shown with a heavier line weight such as a bold font; and
(2) The outermost limit of all work areas, including temporary phasing work, with perimeter controls.
Refer to the Erosion Control Plans provided in *Appendix R*.

10.3 Env-Wt 527.04: Design Requirements for Public Highway Projects

(a) Protect significant function wetlands, watercourses, and PRAs;
Wetland 1 along the eastern bank of the Contoocook River meets the definition of a PRA as a floodplain wetland adjacent/contiguous to a Tier 3 stream. Through careful consideration, impacts to this wetland could not be entirely avoided given the Site constraints and the need to construct a stormwater basin (which will push the parking area farther south). The Project has been designed to minimize impacts to the Contoocook River.

(b) Minimize impacts to wetland and riparian function;
All proposed impacts have been minimized to the maximum extent practicable while still accomplishing the Project objectives (i.e., public safety). This is also in compliance with Env-Wt 311.07(a).

(c) Maintain wetland and stream hydrology and function to the remaining aquatic resources;
The overall hydrology and function of Contoocook River to the remaining aquatic resources will not be adversely impacted. Post-construction conditions will closely match existing conditions as the new stream crossing will be able to convey the 100-year design storm flows.

(d) Use on-site measures to compensate for any loss of flood storage where the project proposes:
(1) Filling or placement of structures in a 100-year floodplain; or
(2) Greater than 0.5 acre-feet of fill volume or a road crossing that affects floodplain conveyance;
Based upon VHB's detailed study of this proposed crossing using the US Army Corps of Engineers (USACE) Hydraulic Engineering Center River Analysis System (HEC-RAS) software, the proposed impacts to the floodplain (including the proposed 92-foot-span bridge and associated grading) are not expected to increase the base flood elevation nor cause the loss of property due to increased flooding. The floodplain impacts were calculated to be negligible (less than 0.1 feet) and there are no federal NFIP or FEMA requirements to mitigate for floodplain impacts. Refer to Section 5 of this Application Narrative above for a more detailed discussion.

(e) Use on-site minimization and water quality protection measures to prevent direct discharge to surface waters and wetlands, including retention of vegetated filter strips between the construction area and the aquatic resource areas to disperse runoff with no direct discharge to natural wetlands or surface waters; and
Temporary erosion controls (i.e., steel sheet piles, sandbags/turbidity curtain, and silt sock) will be implemented throughout construction to prevent construction site sediment-laden discharge from entering the surrounding habitat areas. Refer to the Erosion Control Plans provided in *Appendix R*. This Project will also involve retrofitting an extension of an existing closed drainage system and the construction of a bioretention basin.

(f) Where temporary impacts will occur, include re-establishment of a similar ecosystem using vegetative species and spacing that are as similar as practicable to what was removed unless the applicant shows that the proposed vegetative composition will provide higher functions and values.
The only wetland that is temporarily impacted is Wetland 1, a narrow area of 244 sq ft. Upon completion of the proposed work, all temporary erosion control measures will be removed, and the Site will be reseeded and stabilized with a seed mix that compliments the Site and will perform similar functions and values to the existing vegetation, such as Scrub/Shrub Wetland Seed Mix, Item 644.21.

10.4 Env-Wt 527.05: Construction Requirements for Public Highway Projects

(a) The permit shall be contingent on review and approval by the department of final stream diversion and erosion control plans that detail the timing and method of stream flow diversion during construction and show temporary siltation, erosion, and turbidity control measures to be implemented; and

As previously mentioned, temporary erosion controls (i.e., steel sheet piles, sandbags/turbidity curtain, and silt sock) will be implemented throughout construction to protect the surrounding habitat areas. Open channel space/clean water bypass will be maintained between the riverbanks during the construction of the new bridge, to allow for continued flow between the cofferdams that will run parallel to the banks to allow for continued passage of aquatic fauna during construction. The construction of the bridge abutments will occur during low flow conditions, while the installation of the proposed riprap will occur under drawdown conditions. Although the cofferdams associated with the riprap installation will extend farther into the channel, the active streamflow at that time (under drawdown conditions) will not occupy the full channel width. Flow conditions will be assessed at the time of construction to determine if the riprap should only be installed along one side of the river at a time to avoid obstructing aquatic organism passage or creating erosion. Refer to the Erosion Control Plans provided in *Appendix R*.

As previously mentioned in this application, the limited proposed work to the existing Main Street Bridge and Mill Race (along with the installation of riprap around the new bridge abutments) will occur under drawdown conditions. Therefore, no signification erosion controls or water diversion methods are expected to be required. However, simple cofferdams (e.g., sandbags) are included on the impact plans and Erosion Control Plans in case site conditions at the time of work require stream diversion in those locations.

(b) The contractor responsible for completion of the work shall use techniques described in Env-Wq 1504.06, Env-Wq 1504.16, Env-Wq 1505.02, Env-Wq 1506, and Env-Wq 1508.

The contractor responsible for the completion of the proposed work will comply with the techniques described in Env-Wq 1504.06 "Plan Information," Env-Wq 1504.16 "Erosion Control Notes," Env-Wq 1505.02 "Required Construction Practices," Env-Wq 1506 "Methods for Erosion and Sediment Control During Terrain Alteration Activities," and Env-Wq 1508 "Permanent Methods for Protecting Water Quality," as applicable.

11. Stream Crossings (Env-Wt 900)

Since the Project proposes to construct a new stream crossing and repair an existing stream crossing over a Tier 3 watercourse, the stream crossing standards as outlined in New Hampshire Administrative Rule Env-Wt 900 must be addressed as further outlined below.

However, this chapter of the rules does not apply to the minimal proposed work on the Mill Race. The proposed work on the Mill Race is limited to concrete patching of the headwall and installation of a new trash rack. This Mill Race only receives passive flow and is partially blocked by accumulated sediment and debris; in the absence of true conveyance, this structure is not considered to be a stream crossing.

11.1 Env-Wt 903.04(d) – Information Required for All Stream Crossing Standard Permit Applications

Although VHB has provided the likely stream diversion and dewatering strategy, the means and methods of installing and maintaining cofferdams, clean water bypass, and sediment control measures are determined by the contractor as outlined in NHDOT Standard Specification Sections 503 and 645. However, VHB provides the

information specified in Env-Wt 903.04(d) below and on the **Erosion Control Plans** provided in ***Appendix R***. Cofferdams (e.g., steel sheet piling) will be installed parallel to each riverbank to allow for the construction of the new bridge abutments. Once the abutment construction is complete, those cofferdams will be removed and additional cofferdams (e.g., sandbags or turbidity curtains) will be installed within the channel to facilitate the proposed riprap installation. The riprap installation will occur under drawdown conditions. If necessitated by flow conditions at the time of construction, the cofferdams associated with the riprap installation may be phased with one installed at a time to keep most of the open water space in the channel open to support maintenance of stream flow and aquatic organism passage.

(*d) The dewatering system, as follows:*

(1) Estimates of the maximum flow anticipated during construction, including any summer storm estimates;

VHB estimates the 2-year flood frequency discharge or 50% Annual Exceedance Probability (AEP) of 467 cubic feet per second (cfs) for the Contoocook River, in accordance with the USGS SIR 2008-5206 Regression Peak Discharge.

(2) The hydraulic calculation for the bypass pipe or channel size, length, and gradient;

Although water diversion will require cofferdams, there is no active bypass pipe or channel.

(3) Location, height, and width of the diversion dam;

The anticipated locations of the proposed cofferdams for each stream crossing are noted on the Erosion Control Plans provided in *Appendix R*, while the dimensions of these structures will be determined by the contractor based on the flow conditions at the time of construction. Based on experience from similar projects, the contractor will likely install steel sheet piles as the water diversion structures along the riverbanks near the new bridge abutments and then install sandbag cofferdams farther out into the channel during drawdown conditions to install the proposed riprap stabilization. Water diversion system geometry will be dependent upon the system selected by the contractor, with a recommended minimum top elevation of the system above the OHW elevation noted in the plans (elevation 1005.9).

(4) Sump locations, including estimate of necessary flow and sump capacity;

Sump would be for construction area dewatering only if groundwater were to seep in behind the proposed steel sheet pile cofferdams. The sumps would need to be field-fitted by the contractor depending on actual conditions, but it is safe to assume that it would be a standard dewatering trash pump size and sump.

(5) Backwater prevention method; and

The water diversion structures will extend along the banks to prevent backwater from entering the dewatered area.

(6) Sediment treatment plan with methods, release point, and extent;

Construction area dewatering, if applicable, would be discharged into a filter bag or similar before allowing the filtered water to sheet flow through a vegetated buffer in uplands in advance of entering the river.

11.2 Env-Wt 903.04(j) – Stream Geomorphic Assessments

VHB completed a desktop review of the crossing location, as well as downstream and upstream profiles. A substantial challenge has been identifying an appropriate reference reach to determine the appropriate estimate of bankfull width (BFW) of the Contoocook River. A primary source of this challenge is due to human activity (i.e., Contoocook Lake Dam, Mountain Brook Reservoir Dam, Contoocook River Dam, and the Mill Race through downtown) that has altered the natural geometry of the river. The width of water at the proposed new crossing is not representative of BFW as it is impounded by the downstream dam. In addition, neither the upstream nor downstream channel have a good reference reach characterized by a low level of human modifications. The upstream reach is characterized by dams and impoundments, and the reach immediately downstream is generally heavily incised, sediment-starved, and characterized by bare bedrock.

The desktop review identified a relatively undisturbed downstream reach of channel where a stream geomorphic assessment might be conducted. This reach is located between the two downstream crossings of Nutting Road. Although this reach might be an appropriate reference reach, VHB noted that due to the distance downstream (approximately 2,800 feet) and difference in valley form it may not be representative of the river at the crossing location. Refer to the documentation provided in ***Appendix E.***

In accordance with Env-Wt 903.04(j) and the agency concurrence at the NRAM held on October 20, 2021 (notes provided in ***Appendix A***), VHB collected data in the field on November 1, 2021, along the selected reference reach of the Contoocook River downstream of the stream crossings. Field measurable geomorphic variables including bankfull width, bankfull depth, and flood prone width were collected at each transect and later utilized to calculate bankfull cross-sectional area, mean bankfull depth, width to depth ratio, entrenchment ratio, and sinuosity. This data is available numerically and graphically in ***Appendix E.***

Based on the data collected and subsequent desktop calculations for entrenchment ratio, width/depth ratio, and sinuosity, VHB has classified the stream type at the reference reach according to *the Key to the Rosgen Classification of Natural Rivers* (Rosgen, 1996). In accordance with the NHDES Stream Crossing Worksheet (provided in ***Appendix E***), the stream type of this Tier 3 stream is C5. The average entrenchment ratio for the reference reach cross sections was calculated to be about 7.5 which is consistent with the slightly entrenched Type C classification. According to the *New Hampshire Stream Crossing Guidelines*:

> *"Type C channels have high entrenchment ratios and therefore commonly access well developed floodplains to accommodate high flow stages. Channels are typically sinuous with low slopes, less than 2%, and commonly consist of riffle/pool sequences… Channel stability and lateral movement is highly dependent on the adjacent stability of the natural riverbank. If existing bank stability is impacted, this channel type can quickly become unstable. To compensate for possible channel instability and wider bankfull flows, larger crossing structures and/or flood plain drainage structures should be considered."*

Since a stream geomorphic assessment isn't appropriate to represent the impounded reach of the river where the bridge is proposed, the reference reach stream type (C5) should be interpreted cautiously. The topography and morphology of the crossing location is different from the reference reach, as the effective floodplain at the proposed crossing is narrower and steeper. Hydraulic Engineering Center River Analysis System (HEC-RAS) hydraulic modeling shows the impounded bankfull width (BFW) is ±65 feet at bankfull stage (50% AEP, 2-year flood), but the floodplain width (2% AEP, 50-year flood) is only ±90 feet, resulting in an approximate entrenchment ratio of 1.38 (90/65); that entrenchment differs from the entrenchment ratio of the downstream reference reach (which was calculated to be 7.5).

Span Requirement – Bankfull width (BFW) measurements were collected along the three transects of the selected reference reach. The three bankfull width measurements were then averaged and the bankfull width criteria of the minimum entrenchment ratio of the range for the selected stream type (2.2 for Stream Type C) times the average bankfull width was applied. Based on the average bankfull width calculated at the reference reach at 54 feet, a minimum span length of about 118.8 feet (rounded to about 120 feet) would be required for the proposed new crossing. Despite the entrenchment ratio difference between the reference and project reaches of the river, we believe that a BFW of 54 feet is appropriate for the crossing location since it aligns with regional geometry regressions.

Crossing Compatibility Conclusion – This Project proposes a bridge with a clear span (distance between the inside abutment wall faces) of 92 feet which does not meet the required span length. The proposed 92-foot clear span better aligns with the current channel geometry, while the 120-foot span would push the abutments far back into the existing embankments west and east of the river. However, the proposed bridge design will be a span structure (in accordance with Env-Wt 904.05(d)) that can accommodate the 100-year/Q100 design storm flows and will have a five-foot-wide terrestrial wildlife shelf along each bank. The 92-foot span allows for a shallower beam depth, increasing clearance below the dam by about 1.5 feet compared to the 120-foot span alternative (totaling 5.5 feet tall) for wildlife, ice/debris, and maintenance.

Alternative Design Request (ADR)

An ADR has been prepared for the proposed new stream crossing (provided in ***Appendix E***) since, based on the application of the data collected at the best available reference reach, the design will not meet the minimum span requirement nor does the proposed entrenchment ratio meet the minimum ratio for a Type C stream (as specified in Section 10 of the NHDES Stream Crossing Worksheet).

11.3 Env-Wt 904.01: General Design Considerations

Although this section applies to both the proposed new stream crossing and the proposed repairs to the existing Main Street bridge, only the proposed new bridge is discussed in detail below. This is because the limited proposed repairs to the existing Main Street bridge (i.e., concrete repairs) will not alter any of the factors below.

(a) All stream crossings, whether over tidal or non-tidal waters, shall be designed and constructed so as to:

(1) Not be a barrier to sediment transport;

The proposed bridge crossing will not be a barrier to sediment transport. The proposed bridge has been designed to minimize bank and bed impacts to the extent practical through the span structure with an open/natural stream bottom and no in-water piers. The stream channel is not proposed to be reshaped, the existing channel slope will remain, there will be no impact to the ordinary water volume, and the proposed riprap will be embedded with 6 to 8 inches of simulated streambed material to mimic the natural benthic habitat. Therefore, the ability of the Contoocook River to transport sediment post-construction will match the existing conditions.

(2) Not restrict high flows and maintain existing low flows;

The proposed bridge crossing will not restrict high flows and will maintain existing low flows as it will span the existing stream channel and be able to convey the 100-year design storm flows, which were determined to be approximately 1,740 cfs at elevation 1010.1 feet NGVD29.

(3) *Not obstruct or otherwise substantially disrupt the movement of aquatic organisms indigenous to the waterbody beyond the actual duration of construction;*
Aside from temporary obstructions or disruptions resulting from the construction activities (i.e., in-stream cofferdams along the banks that will maintain a zone of passage within the existing channel), the existing capacity of the Contoocook River at the proposed crossing for aquatic organism passage will be maintained, as the bridge will span the existing stream channel.

(4) *Not cause an increase in the frequency of flooding or overtopping of banks;*
As previously mentioned, the proposed bridge will span the channel and be able to convey the 100-year design storm flows and, therefore, will not increase the frequency of flooding or overtopping of banks.

(5) *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;
The proposed bridge crossing will maintain the existing geomorphic compatibility of the Contoocook River as no stream channel realignment is proposed. Since the proposed bridge will span the channel with no in-stream piers, the potential for channel obstruction is minimized through the exclusion of in-stream components for dead wood or other river debris to get hung up on. Furthermore, the vertical clearance between the wildlife shelves and bridge bottom was increased by 1.5 feet (for a total clearance height of 5.5 feet) through the selection of the 92-foot span as opposed to the 120-foot span alternative based on the reduction in girder depth. As always, all temporarily disturbed areas will be restored to pre-construction condition following project completion.

(6) *Preserve watercourse connectivity where it currently exists;*
The hydrologic connectivity of the Contoocook River will be preserved through the implementation of a bridge design that can accommodate the 100-year design storm flows.

(7) *Restore watercourse connectivity where:*

a. Connectivity previously was disrupted as a result of human activity(ies); and
b. Restoration of connectivity will benefit aquatic organisms upstream or downstream of the crossing, or both;
This section is not applicable to the proposed Project since a new bridge crossing is proposed (as opposed to replacing an existing undersized crossing). Furthermore, removal of the dam is beyond the scope and budget of this Project.

(8) *Not cause erosion, aggradation, or scouring upstream or downstream of the crossing; and*
The proposed bridge crossing will not cause erosion, aggradation, or scouring upstream or downstream of the crossing, as it will span the channel at a sufficient length to accommodate the 100-year design storm flows. The proposed bridge abutments will be stabilized with riprap within the riverbank and bed to prevent erosion and scour.

(9) *Not cause water quality degradation.*
The proposed bridge crossing will not cause water quality degradation post-construction and erosion controls will be implemented throughout the duration of construction to preserve water quality.

11.4 Env-Wt 904.07: Design Criteria for Tier 2, Tier 3, and Tier 3 Stream Crossings

Note: This section only applies to the proposed new bridge crossing.

(c) Tier 2, tier 3, and tier 4 stream crossings shall be designed:

(1) To meet the general design considerations specified in Env-Wt 904.01;

The Project's compliance with Env-Wt 904.01 is detailed in Section 11.3 of this Application Narrative above.

(2) Of sufficient size to accommodate the greater of:

a. The 100-year 24-hour design storm;

b. Flows sufficient to:

1. Prevent an increase in flooding on upstream and downstream properties; and

2. Not affect flows and sediment transport characteristics in a way that could adversely affect channel stability; or

c. Applicable federal, state, or local requirements;

As previously mentioned, the proposed new bridge will span the stream channel and be able to convey the 100-year design storm flows, which were determined to be approximately 1,740 cfs at elevation 1010.1 feet NGVD29.

(3) With the bed forms and streambed characteristics necessary to cause water depths and velocities within the crossing structure at a variety of flows to be comparable to those found in the natural channel upstream and downstream of the stream crossing;

Since the proposed bridge crossing will span the channel, a large portion of the natural streambed within the center of the channel will remain intact beyond the limits of proposed riprap on either side. Furthermore, the proposed riprap below the ordinary high-water elevation (1005.9 feet) will be embedded with 6 to 8 inches of simulated streambed material to mimic the natural benthic habitat. Water depths and flow velocities at this crossing will be comparable to pre-construction conditions. Comparison to upstream and downstream characteristics isn't applicable given that the new bridge will be constructed over an impounded reach of the river.

(4) To provide a vegetated bank on both sides of the watercourse or to provide a wildlife shelf of suitable substrate and access to allow for wildlife passage;

Given the space constraints of the selected span length and water elevations/velocity along this slightly entrenched portion of the river that require riprap stabilization around the abutments, it is not practical to provide vegetated banks on both sides of the river. Refer to the Env-Wt 514 Bank/Shoreline Stabilization Project-Specific Worksheet provided in *Appendix F* for more information regarding the riprap justification. However, the design incorporates 5-foot-wide terrestrial wildlife shelves beneath the bridge on both sides of the river. Theses shelves are located approximately 2 feet above the ordinary high-water elevation (1005.9 feet) to allow use during most flow conditions; but it should be noted that the shelves will be submerged under approximately 2 feet of water during the infrequent 100-year design storm flows.

(5) To preserve the natural alignment and gradient of the stream channel, so as to accommodate natural flow regimes and the functioning of the natural floodplain;

The natural alignment and channel gradient of the Contoocook River will be preserved to accommodate natural flow regimes and floodplain function. As previously mentioned, the location of the proposed bridge crossing is at a natural constriction point in the floodplain width, making the proposed 92-foot span compatible with the existing river geometry and floodplain topography.

(6) To simulate a natural stream channel;

Since the proposed bridge crossing will span the channel, a large portion of the natural streambed within the center of the channel will remain intact beyond the limits of proposed riprap on either side. The proposed riprap below the ordinary high-water elevation (1005.9 feet) will be embedded with 6 to 8 inches of simulated streambed material to mimic the natural benthic habitat.

(7) So as not to alter sediment transport competence; and

The proposed new bridge will not alter the sediment transport competence of the Contoocook River. Refer to the response to Env-Wt 904.01(a) in Section 11.3 of this Application Narrative above for more information.

(8) To avoid and minimize impacts to the stream in accordance with Env-Wt 313.03.

Overall impacts the Contoocook River (and the delineated palustrine wetlands) have been minimized to the extent practical while still accomplishing the Project objective of constructing the proposed bridge crossing between the proposed roundabouts to address the traffic congestion and safety deficiencies associated with the current configuration of the US 202 "dog-leg" intersections of Main Street with Peterborough Street and Main Street with River Street. Some previously mentioned impact minimization components of the proposed bridge crossing design include, but are not limited to, that it will span the channel, convey the 100-year design storm flows, contain terrestrial wildlife shelves along both banks of the river, and the abutments will be located partially outside of the jurisdictional banks.

11.5 Env-Wt 904.05: Tier 3 Stream Crossings

(a) Subject to (b), below, a tier 3 stream crossing shall be a crossing located:

- *(1) On a watercourse where the contributing watershed is 640 acres or greater;*
- *(2) Within a designated river corridor, unless:*
  - a. *The crossing would be a tier 1 stream based on the 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;*
- *(3) Within a 100-year flood plain;*
- *(4) In a jurisdictional area having any protected species or habitat; or*
- *(5) In a prime wetlands 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.*

The proposed new bridge and existing Main Street bridge over the Contoocook River are classified as Tier 3 stream crossings in accordance with (a)-(c) above. The watershed of the Contoocook River at the proposed new crossing location is approximately 19,100 acres in size. Refer to the Watershed Map provided in *Appendix D*. The Contoocook River is a Designated River and has a FEMA-mapped 100-year floodplain. There are no prime wetlands or jurisdictional area having protected species or habitat within the Site.

(b) The applicant for a project in which a stream crossing is categorized as tier 3 based solely on being in a 100-year floodplain may request that the crossing be categorized as a tier 1 or tier 2 stream crossing, as applicable based on watershed size, if the impacts to the floodplain are specifically mitigated in accordance with Env-Wt 800.
Not applicable. The subject stream crossings are also categorized as Tier 3 based on the contributing watershed size and location within a designated river corridor.

(c) If an applicant for a project in which a stream crossing is categorized as tier 3 based solely in a jurisdictional area having any protected species or habitat may request that the crossing be categorized as tier 1 or tier 2 based on watershed size, provided:

(1) The applicant consults with NHB to determine whether any protected plant species or habitat would be impacted;

(2) The applicant consults with NHF&G to determine whether any protected species or habitat is impacted; and

(3) The NHB, NHF&G, or both, as applicable, recommend(s) such a downgrade to the department in writing.

Not applicable. The stream crossings are not located in a jurisdictional area having any protected species or habitat, according to the NHB DataCheck Report provided in *Appendix G*.

(d) A tier 3 stream crossing shall be a span structure or an open-bottomed culvert with stream simulation, not a closed-bottom culvert or pipe arch.
The proposed stream crossing will be an open-bottomed span bridge and the existing Main Street crossing is an open-bottomed span bridge. Additionally, the proposed riprap below the ordinary high-water elevation will be embedded with 6 to 8 inches of simulated streambed material to mimic the natural benthic habitat.

(e) The applicant shall use an alternative design by submitting a request as specified in Env-Wt 904.10.
An Alternative Design Request (ADR) has been prepared in accordance with Env-Wt 904.10 and is provided in *Appendix E* since the design of the proposed new stream crossing will not meet the minimum span requirement, nor will the proposed entrenchment ratio meet the minimum ratio for a Type C stream (as specified in Section 10 of the NHDES Stream Crossing Worksheet).

(f) Compensatory mitigation shall not be required for:

(1) Any new tier 3 stream crossing that:

a. Meets the general design criteria in Env-Wt 904.01 and the tier-specific criteria of Env-Wt 904.07;

b. Is self-mitigating; and

c. Improves aquatic organism passage, connectivity, and hydraulics; or

(2) Any replacement of a crossing that met all applicable requirements when originally installed but is in a location that results in the crossing being classified as tier 3 under these rules, provided the proposed stream crossing meets the requirements of Env-Wt 904.09.

As detailed in Section 7.2 of this Application Narrative above, this Project requires mitigation for the proposed permanent impacts to the PRA (Wetland 1) and the proposed new bridge that does not fully comply with the stream crossing rules, necessitating an ADR. The remaining components of the Project do not trigger mitigation since the Project as a whole remains below the 10,000 square foot threshold specified in Env-Wt 313.04(a)(2).

(g) Plans for a tier 3 stream crossing shall be dated and bear the signature of the professional engineer who prepared or had responsibility for and approved them, as required by RSA 310-A:18.
Refer to *Appendix Q* for a copy of the Wetland Impact Plans and *Appendix R* for a copy of the Erosion Control Plan which have been stamped and signed by a licensed NH professional engineer.

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

Note: This section only applies to the proposed repair work on the existing Main Street 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 localized flooding events and this will not change post-construction. The proposed work to the bridge is minimal and mainly limited to concrete patching.

(2) The proposed stream crossing will:

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

The existing capacity of the Main Street bridge to meet the criteria specific in Env-Wt 904.01 will be maintained post-construction due to the limited nature of the proposed bridge repairs that will extend the service life of the existing infrastructure.

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

The proposed work on the Main Street bridge will maintain the hydraulic capacity of the stream crossing post-construction.

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

The proposed work on the Main Street bridge will maintain the existing aquatic organism passage capacity of the stream crossing post-construction.

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

The proposed work on the Main Street bridge will maintain the existing connectivity of stream reaches upstream and downstream of the crossing post-construction.

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 work on the Main Street bridge will not contribute to the increase in frequency of flooding or overtopping of banks upstream or downstream of the crossing post-construction. The existing stream crossing size will not be altered.

The signature and stamp below certify that the existing crossing of the Contoocook River meets the criteria listed in Env-Wt 904.09(c)(1) and (2), as detailed above.

_____

Julie Whitmore, PE

Appendix A – Natural Resource Agency Coordination Meeting Minutes

This appendix includes the following:

- 10/20/2021 NRAM Minutes
- 01/19/2022 NRAM Minutes
- 01/18/2023 NRAM Minutes

BUREAU OF ENVIRONMENT
CONFERENCE REPORT

SUBJECT: NHDOT Monthly Natural Resource Agency Coordination Meeting
DATE OF CONFERENCE: October 20, 2021
LOCATION OF CONFERENCE: Virtual meeting held via Zoom

ATTENDED BY:

NHDOT
Andrew O'Sullivan
Matt Urban
Mark Hemmerlein
Rebecca Martin
Marc Lauren
Tobey Reynolds

ACOE
Mike Hicks

EPA
Jeanie Brochi

NHDES
Lori Sommer
Karl Benedict

NHB
Jessica Bouchard

NH Fish & Game
Carol Henderson

Federal Highway
Absent

The Nature Conservancy
Pete Steckler

Consultants/ Public Participants
Gregory Goodrich
Jason Hilton
Hannah Beato
Peter Walker
Dave Cloutier
Sam White
Joshua Lund
John Stockton
Anna Giraldi
Jim Bouchard
Sam Cheney
Ron Kleiner
Kyle Fox
Chris Fournier
Trevor Ricker
Tucker Gordon
Bob Landry

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

NOTES ON CONFERENCE:

Finalize Meeting Minutes
Finalized and approved the September 15, 2021 meeting minutes.

Jaffrey #16307, (X-A001(234)).

The project proposes improvements to the five-way intersection of US 202 (Main Street/Peterborough Street) with NH 124 (Turnpike Road), Stratton Road, and Blake Street in the Town of Jaffrey. The goal of the meeting was to discuss issues related to the stream geomorphic assessment (SGA) of the Contoocook River since the project proposes a new crossing over an impounded section of the river. This meeting also included discussion of the proposed new bridge and the recommended approaches to conducting the geomorphic assessment.

Prior to the start of the presentation, Bob Landry (VHB) shared that Tobey Reynolds is the NHDOT Project Manager, and that Mr. Landry's role is to assist Mr. Reynolds with project management. This process of a consultant providing direct support to a NHDOT Project Manager is new for NHDOT.

Pete Walker (VHB) started the presentation by briefly reviewing the need for the project, which are related to the existing geometric issues of the downtown transportation network. The purpose of this Project is to address the traffic congestion and safety deficiencies associated with the current configuration of the US 202 “dog-leg” intersections of Main Street with Peterborough Street and Main Street with River Street. The proposed action involves construction of a new 140-foot span bridge over the Contoocook River to connect two roundabouts on the west and east sides of the river.

Mr. Walker noted that a Public Hearing was held in October 2019. In September 2020, the Federal Highway Administration (FHWA) issued approval of the National Environmental Policy Act (NEPA) Categorical Exclusion (CE) and Final Section 4(f) Evaluation. Permit applications are anticipated to be submitted in the fall of 2022.

Although the proposed crossing is in an urbanized area, the river does have a narrow riparian buffer at the proposed bridge crossing location. VHB intends to follow the procedures in Env-Wt 900 to advance the design of the new bridge, but conducting an SGA has proved challenging since the river at the crossing is impounded, and since an appropriate reference reach may not be present. He turned the presentation to Dave Cloutier to provide more detail.

Dave Cloutier (VHB) completed a desktop review of the crossing location, as well as downstream and upstream profiles. A substantial challenge has been identifying an appropriate reference reach to determine the appropriate estimate of bankfull width (BFW) of the Contoocook River. A primary source of this challenge is due to human activity (i.e., Contoocook Lake Dam, Mountain Brook Reservoir Dam, Contoocook River Dam, and the mill race through downtown) that has altered the natural geometry of the river. The width of water at the proposed new crossing is not representative of BFW as it is impounded by the downstream dam. In addition, neither the upstream nor downstream channel have a good reference point for an area of low human activity. The upstream reach is characterized by dams and impoundments, and the downstream reach is heavily incised, sediment-starved and characterized by bare bedrock.

The desktop review identified a relatively undisturbed downstream reach of channel where a stream geomorphic assessment might be conducted. This reach is located between the two downstream crossings of Nutting Road. Although this reach *might* be an appropriate reference reach, VHB noted that due to the distance downstream (approximately 1,700 feet) and difference in valley form VHB believes that it may not be representative of the river at the crossing location. Based on desktop review, the BFW estimates at this downstream reach are approximately 45 to 75 feet. Top of bank (TOB) at the crossing location was delineated during the NEPA phase of the project, and the bank-to-bank width at the crossing location ranges from 83 to 98 feet. (Mr. Walker noted that TOB-to-TOB width per the NHDES definition is not the same measurement as BFW but rather an approximation which can overestimate the BFW.)
Mr. Cloutier also calculated BFW for the crossing location using regional regression equations from Massachusetts, Maine and Vermont (New Hampshire does not have a published regression equation). The range of these estimates is 45 to 60 feet.
Mr. Walker summarized the issues related to the SGA. While most of the data required by the NHDES stream crossing rules can be provided, the challenge lies in the fact that SGA is not appropriate for an impounded reach, and that identifying an appropriate reference reach in this case is difficult or perhaps impossible. A full stream geomorphic assessment may therefore not be possible. Based on the analysis to date, VHB believes the BFW at the crossing (if unimpounded) would be expected to be approximately 45 to 60 feet. Therefore, even if the stream type were determined to be a Rosgen E or C channel, the compatible width would be no more than 132 ft. The proposed conceptual design with 140 foot span seems to be an appropriate crossing structure even in the absence of additional SGA data, consistent with Env-Wt 900, and would protect river and floodplain hydraulics, sediment transport integrity, and wildlife connectivity. The new bridge would be designed to allow space for terrestrial wildlife to cross.

Questions and Comments:

Karl Benedict (NHDES) commented that he concurred with the identified issues to establishing a reference reach approach. Mr. Benedict recommended that the team consider submitting the proposed bridge as an Alternative Design. The Alternative Design Report could include a summary of the reference reach characteristics and issues to justify the approach taken for the crossing structure.
Mr. Walker responded that the project is not technically in an Alternative Design because with the 140-foot span the design would be fully compliant. The method to get the span length was different than how it would normally be calculated.
Mr. Benedict clarified that waivers are generally not issued for Env-Wt 900 rules. If there is a different approach, it goes into Alternative Design. He suggested proceeding with Alternative Design and to summarize existing conditions (i.e., history of flooding, dam controlled elevations, organism passage, etc.) and the reference reach approach - covering hydrologic capacity, geomorphic compatibility, and organism passage. Mr. Benedict also requested that VHB verify in the field BFW, ordinary high water (OHW) and TOB.
Andrew O'Sullivan (NHDOT) questioned whether an Alternative Design would be appropriate for this scenario. He agreed with Mr. Walker, and believes that the design as proposed is compliant, although not all of the geomorphic data can be developed given the restrictions of the site and physical limitations.

Mr. Benedict suggested that a memorandum be provided to NHDES explaining why the span is compliant with the known information and to justify why the span is an appropriate crossing structure. Lori Sommer (NHDES) agreed with Mr. Benedict and asked to review a write-up of the justification prior to submission of the stream crossing worksheet. VHB will develop a summary memo to NHDOT and others to review. Mr. Walker noted that a Type, Span and Location Study (TS&L) is due to NHDOT in mid-November 2021.

Mr. Benedict asked about local river management advisory committee (LAC) or shoreland considerations. Mr. Walker responded that LAC issued comments during the NEPA phase. Comments pertained to establishing erosion control and wildlife benches on both sides of the river, which smaller mammals may use.

Ms. Sommer will be looking forward to hearing more details on the project and will be looking into mitigation. Priority resources areas (i.e., 100-year floodplain) will need to be identified. Ms. Sommer asked if there would be any flood storage loss. Mr. Walker responded yes, and that floodplain and hydraulics will be assessed.

Ms. Sommer also mentioned that VHB should check for any new NHB hits in the project area. She also asked whether there would be a need for sediment/contaminated soils analysis with this impoundment. Mr. Walker responded that VHB is tasked with studying soil and groundwater contamination issues in the project location, including one site adjacent to the proposed bridge. But, there is no plan for unconfined dredging; the bank will be stabilized with traditional rip-rap which may require some removal of native soils, but that would typically occur behind a cofferdam.

Carol Henderson (NHF&G) did not have any comments on the stream assessment and appreciates the passage under the bridge for wildlife. A bench would not be necessary, just flat areas under the bridge that animals could utilize. Ms. Henderson shared that there were no NHB records for this project.

Mike Hicks (USACE) agreed with Ms. Sommer's comments and asked whether historical issues have been discussed. Mr. Walker responded that there is an executed Section 106 Memorandum of Agreement and the stipulations will be completed during final design.

Ms. Henderson asked about the size of the existing bridge. Mr. Cloutier answered that the downstream Main Street Bridge is 33 feet long and was built in 1929.

Jessica Bouchard (NHB) stated that although the NHB data check letter indicated no records in vicinity, the existing data check is expired. VHB will need to conduct a new search to provide with the application in case new NHB records are present.

Peter Steckler (TNC) stated that he does not see terrestrial wildlife passage as a priority for this bridge, due to the limited downstream habitat, which is within the 300 feet of the downtown area of Jaffrey.

Action Items:

- VHB to field verify impounded BFW, OHW, and TOB.
- VHB to submit summary memo to NHDOT with the Type, Span and Location Study (TS&L) due November 2021.
- VHB to conduct a new NHB search to provide with the permit application.

BUREAU OF ENVIRONMENT
CONFERENCE REPORT

SUBJECT: NHDOT Monthly Natural Resource Agency Coordination Meeting
DATE OF CONFERENCE: January 19, 2022
LOCATION OF CONFERENCE: Virtual meeting held via Zoom

ATTENDED BY:

NHDOT
Andrew O'Sullivan
Joshua Brown
Matt Urban
Jon Evans
Mark Hemmerlein
Arin Mills
Marc Laurin
Kerry Ryan
Leah Savage
Jonathan Hebert
Margarete Baldwin
Tobey Reynolds
Rebecca Martin

ACOE
Mike Hicks

EPA
Absent

NHDES
Karl Benedict
Lori Sommer
Cheryl Bondi
Mary Ann Tilton
Eben Lewis

NHB
Jessica Bouchard

NH Fish & Game
Absent

Federal Highway
Absent

The Nature Conservancy
Pete Steckler

Consultants/ Public Participants
Liviu Sfintescu
Stephanie Camay
Pete Walker
Dave Cloutier
Jason Hilton
Greg Goodrich
Bob Landry
Nicole Martin
Frank Koczalka
Mike McCrory
Nancy Merrill

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

Table of Contents:

- ≠ Jessica Bouchard – the Heritage Program request for the project was received January 6 and is pending. The team can expect to receive a response soon.
- ≠ Peter Steckler – presence of American eel in Messer Brook (upstream and downstream of the culvert). Messer Brook is also an important wildlife corridor.
- ≠ Mark Hemmerlein – stormwater management will be a challenge for this project, especially if the 5-lane alternative is the preferred alternative. The team should focus on identifying where point source water is going, particularly for the larger neighborhoods west of Mammoth Road (by Zachary Drive/Embassy Avenue) and follow where it leaves the project area to a Water of the US. Drainage likely goes to Messer Brook and/or adjacent wetlands.
- ≠ Liviu confirmed that there are no bridges in the project area and that the project will return to another NRACM when a preferred alternative and impacts have been identified.

Jaffrey, #16307 (X-A001(234)):

Pete Walker (VHB) introduced the project, which proposes a new traffic connection with a river crossing south (400' upstream) of the existing Main Street bridge. This portion of the river is impounded due to the Contoocook River Dam located near Main Street. At the October 20, 2021 NRAM, we discussed the challenges associated with the stream geomorphic assessment since the crossing is proposed over an impounded reach of the river. Therefore, the reference reach stream type (C5) should be interpreted cautiously as the reach type may differ at the impounded crossing location. However, VHB believes that a bankfull width (BFW) of 54 feet is appropriate for the crossing location since it aligns with regional geometry regressions. We also have surveyed bathymetry data at the proposed crossing location that can help us estimate appropriate BFW and bankfull depth since field measurements are not practical in this impounded reach. If we assume that the stream type at the crossing location is the same as the downstream reference reach, then the minimum Entrenchment Ratio for the C-type stream would be 2.2, making a fully compliant bridge span ~120 feet. As this analysis was used to advance the design of the proposed new bridge, the design team began to realize a 120-foot clear span bridge does not appear to appropriately fit the topography of the crossing location.

Greg Goodrich (VHB) described the 120-foot and 92-foot clear span alternatives. The 120-foot clear span would push the abutments far back into the existing embankments west and east of the river. Therefore, a 92-foot clear span would better align with the current channel bank geometry but would require the submission of an Alternative Design Request (ADR) in accordance with the Stream Crossing Rules. There is a negligible difference in hydrology between the 92-foot clear span and the 120-foot clear span, as both can accommodate the 100-year (Q100) design storm flows. The proposed crossing is located at a natural constriction point of the channel which explains why the water levels match between the two span alternatives. The 92-foot clear span still pushes back into the western embankment but better fits the existing grades along the eastern embankment. Furthermore, both span alternatives allow for the construction of a 5-foot-wide terrestrial wildlife shelf located approximately 2 feet above the ordinary high-water (OHW) elevation. The OHW elevation is approximately 1005.9 which correlates to the water stains

observed on downstream dam abutments. The 92-foot clear span also provides an additional 1.5 feet of vertical clearance to the wildlife shelf (totaling 5.5 feet tall) compared to the 120-foot clear span alternative.

Karl Benedict (NHDES) reiterated that the project will likely require an ADR due to the geomorphic incompatibility caused by the dam. He suggested that we compare the reference reach BFW with the on-site BFW, along with the operating levels of dam in the ADR narrative in support of the 92-foot clear span. He acknowledged that the 92-foot clear span design is appropriate for the proposed location given the altered stream reach. The ADR should show that the design meets all design criteria at the crossing location geomorphically, hydraulically, and regarding aquatic organism passage. P. Walker added that we can only estimate the BFW at the impoundment because it is below the impounded water level.

Lori Sommer (NHDES) and K. Benedict concurred that a compliant crossing that fully spans the jurisdictional banks of the river would not require mitigation in accordance with Env-Wt 904.05(f)(1), as long as there are no Priority Resource Area (PRA) impacts.

L. Sommer concurred that any impacts below the proposed bridge and within the riverbank to construct the wildlife shelf would not require mitigation. She also commented on the riprap extension beyond the crossing along the banks. G. Goodrich stated that this aspect of the design is not yet final, that the riprap limits will be adjusted to better match in with existing banks and will be designed to not inhibit wildlife passage. Finally, she mentioned that removal of the Contoocook River Dam could be a mitigation strategy if mitigation was triggered. P. Walker stated that dam removal would be beyond the scope of the project.

Lori asked about coordination with the Contoocook and North Branch Rivers Local Advisory Committee (LAC). Pete responded that the LAC commented during the National Environmental Policy Act (NEPA) phase. Nevertheless, that coordination will be renewed, as will coordination with the Jaffrey Conservation Commission during the permitting phase.

Mike Hicks (USACE) stated that the Contoocook River is Essential Fish Habitat (EFH), so coordination with the National Marine Fisheries Service (NMFS) would be needed. P. Walker stated that the Federal Highway Administration (FHWA) is the lead federal agency for this project and replied that EFH coordination was completed during the NEPA phase. The US Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) is done (although NLEB survey of buildings to be demolished will need to occur), Division of Historical Resources (DHR) coordination is ongoing, and floodplain impacts will be further evaluated to determine if they would require compensation. Bob Landry indicated that FHWA has already coordinated with the US Coast Guard (USCG) who deemed the project location non-navigable. VHB will include USCG documentation in the wetlands permit application.

Pete Steckler (TNC) had no comments.

Jessica Bouchard (NHB) did not attend the meeting since the Datacheck Letter (NHB19-0664) indicated that there are no rare, threatened, or endangered (RTE) species within the project vicinity at the time the letter was issued (per her email on 1/18/22). However, prior to the

meeting, she recommended updating the Datacheck Letter because new occurrences are continuously being documented. This will occur during the permitting phase.

Claremont, #13248:

Pete Walker (VHB) introduced the project, which seeks to address transportation deficiencies at the intersection of NH 12/103 and North Street and the adjacent roadway approaches. The key items are the replacement of the undersized Stevens Brook culvert, raising the profile of NH 12/103 that is in the Sugar River floodplain to attenuate flooding concerns, and the proposed impacts to the Stevens Brook Conservation Easement located between NH 12/103 and Sugar River. This easement was initially created to mitigate impacts associated with the adjacent commercial development (Tractor Supply). The City will be requesting an Alternative Design Request (ADR) for the proposed box culvert as it does not fully comply with the Stream Crossing Rules. We propose unavoidable impacts to the bed and banks of Stevens Brook required to replace and extend the existing culvert. The replaced culvert will be able to convey the 100-year design storm flows, will have a shallower grade, and will be more suitable for aquatic organism passage since it will not have an overhanging outlet as the existing culvert does. Impacts to Sugar River are limited to the upper limits of the bank (no bed impacts are proposed) and have been minimized to the extent practical through the design of steep slopes for the raised portion of NH 12/103 to minimize encroachment into the bank. No change to the base flood elevation of Sugar River will result from the limited extent of the proposed impacts. Finally, there is a National Environmental Policy Act (NEPA) commitment for the project to offset any impacts to the existing 0.83-acre conservation easement. We currently propose approximately 0.32 acre of impact to this easement. The project will impact approximately 0.4 acre of wetlands and about 792 lin ft of stream resource. Mitigation is therefore required. The City is proposing to mitigate by preservation of lands adjacent to the Whitewater Reservoir water supply.

Mike McCrory (City of Claremont) discussed the permittee-responsible mitigation proposal of conserving three parcels (totaling approximately 44 acres) surrounding the Whitewater Reservoir along the northern border of Claremont. This reservoir provides greater than two thirds of the City's drinking water and is surrounded by parcels that contain the NH Wildlife Action Plan Highest Ranked Habitat and are contiguous with a large area of unfragmented forested land. The City prefers to have a third party steward of the conservation easement and the Upper Valley Land Trust (UVLT) may serve that role.

Following the presentation, Andy O'Sullivan opened the meeting to questions.

Karl Benedict (NHDES) inquired about the alternatives considered to avoid and minimize natural resource impacts. P. Walker described the proposed realignment and steep slopes associated with the profile raise of NH 12/103 to attenuate flooding concerns within the Sugar River floodplain. However, alternatives are limited due to its proximity to Sugar River to the west and bordering palustrine wetlands to the northeast. An alternative discussion will be incorporated into the permit application.

BUREAU OF ENVIRONMENT
CONFERENCE REPORT

Final

SUBJECT: NHDOT Monthly Natural Resource Agency Coordination Meeting
DATE OF CONFERENCE: January 18, 2023
LOCATION OF CONFERENCE: Virtual meeting held via Zoom

ATTENDED BY:

NHDOT
Matt Urban
Andrew O'Sullivan
Jon Evans
Marc Laurin
Rebecca Martin
Dillan Schmidt
Chris Carucci
Dillan Schmidt
John Sargent
Meli Dube

ACOE
Mike Hicks

USCG
Gary Croot

EPA
Jean Brochi

NHDES
Karl Benedict
Mary Ann Tilton

NHB
Absent

NH Fish & Game
Mike Dionne
Kevin Newton

Federal Highway
Absent

US Fish & Wildlife
Absent

The Nature Conservancy
Absent

NH Transportation & Wildlife Workgroup
Absent

Consultants/ Public Participants
Brooke Stubbs
Michael Leach
Gerard Fortin
Alanna Gerton
Peter Walker
Stephen Hoffmann
Christine Perron
Sam White

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

Table of Contents:

• Will provide simulated stream bottom material.
• Will pass 100-year storm for Brown Brook with more than 1 foot freeboard.
• Reduces 100-year floodplain elevation by approximately 1.5 feet of the bridge.
• Maintains approximately 2 foot depth of water through opening under normal flow conditions to promote aquatic passage.
• A waiver will be requested for the impacts to the Prime Wetland and 100-foot buffer.

Mike noted the results of the NH Natural Heritage Bureau data check received in December of 2022 were the American Eel and Blanding's Turtle. At this point, the presentation was opened to questions.
Karl Benedict of NHDES stated this project should be reviewed for compliance with the alternative design requirements. Since the project is in a priority resource area, mitigation would be required. Karl asked if the existing water velocities necessitated the extensive riprap layout, and if the limit of the proposed riprap could be minimized or revegetated. In response, Jerry noted the average stream velocities at both the upstream and downstream face of the proposed 22-ft span box culvert are nearly half the existing values. Additionally, the proposed riprap layout helps mitigate the existing unsuitable material that will need to be over-excavated and improves scour protection. Jerry said Stantec will review the riprap layout and minimize the limits of construction where possible.
Karl noted the 48" diversion pipe should be designed for a 2-year storm; Jerry acknowledged and will confirm the pipe size is adequate.
Karl noted the length of the stream work was not noted. He suggested that a mitigation worksheet be prepared for the project.
Mary Ann Tilton of NHDES said for the Department to process the prime wetland waiver, Stantec will need to provide evidence the proposed culvert design does not impact the functions and values of the prime wetland as established by the Town of Fremont. Stantec will reach out to the Town for their prime wetland report. Mary Ann asked if the proposed culvert design meets AOT floodplain requirements; Jerry responded the proposed design lowers the floodplain as established in our hydraulic study.
Michael Dionne of NH F&G reiterated the request to review and minimize the proposed riprap layout.
Kevin Newton of NH F&G noted the angular surface of the riprap makes it difficult for species migrating through the area, and asked Stantec to review the extent of the riprap layout.
Michael Hicks of USACE had no comment on the presentation.
Jean Brochi of the EPA had no comments on the presentation.
Gary Croot of the USCG had no comments on the presentation since Brown Brook is not a navigable waterway so the USCG has no jurisdiction.

Jaffrey, #16307 (X-A001(234))

Pete Walker presented VHB's current design plans for Jaffrey downtown. Main traffic movement through downtown is from north to south on US 202 through a "dog-leg" intersection. This project proposes a new bridge spanning the Contoocook River to improve traffic flow and safety, with minor repairs to the existing Main Street bridge. An NHDES Wetland Application will be filed shortly. The project proposes permanent impacts to two small wetlands, one of which is a Priority Resource Area as it is within the floodplain of the river, as well as impacts to the bed and banks of the Contoocook River. Permanent wetland impacts are currently estimated

to be about 4,500 sq ft, with about 4,000 sq ft/470 ln ft of impact within the river. The revised bridge design proposes to place rip-rap within the river to ensure that the new bridge is protected from scour. Because this reach is impounded, the river impoundment will be drawn down for installation of the rip-rap with a turbidity curtain or sand bag type cofferdams installed. At the Main Street bridge, temporary impacts include sediment removal to reinstall a trash rack at an existing mill race, as well as impacts beneath the bridge for temporary staging for concrete repairs. No permittee responsible mitigation was suggested by the Town of Jaffrey and furthermore there are no suitable potential sites due to the urban nature of the project area. As such an ARM fund mitigation payment for the permanent impacts is proposed.

Comment Period

Andy O'Sullivan (NHDOT) questioned whether an Alternative Design Report is required, due to the challenge of finding an appropriate reference reach. Andy believes the 92-ft span complies with the stream rules. Karl Benedict (NHDES) agreed with the methodology used by VHB for estimating bankfull width, and believes that the ADR process is the appropriate method to present the required stream crossing design information.

Pete Walker explained that geomorphic assessment completed in 2022 found that the downstream reference reach was classified as a Rosgen C5 channel, which would have a minimum entrenchment ratio of 2.2. The current design provides a entrenchment ratio of 1.7. The design complies with all stream rule requirements except that minimum ratio. Andy added that the ratio was calculated at a reference reach far downstream of the actual project area and therefore is not a representative reference reach. Karl responded that the project can be approved under the ADR process, the ADR narrative would need to explain that there is not a chance for a representative reference reach in the immediate project vicinity.

Karl Benedict NHDES agrees the Department would classify Wetland 1 as a Priority Resource Area. The design should also meet standards for stormwater under AoT rules and shoreland protection requirements. Karl believes an ARM Fund payment would be appropriate mitigation.

Pete Walker mentioned that one issue needing resolution is how to calculate the mitigation credit for the wildlife shelves below the proposed bridge. Prior indication from NHDES was that mitigation is not necessary for these impacts but VHB needs further guidance on how to partition the impacts, since there does not appear to be a clear way to separate these impacts in the ARM Fund calculator. Pete suggested a working meeting with Andy O'Sullivan and Karl Benedict. Karl suggested it may be worthwhile including NHDES mitigation staff if needed.

Mary Ann Tilton (NHDES) commented that NHDOT should review and consider the DES self-mitigation rule for the wildlife shelves.

Mike Dionne (NHFGD) asked whether a mussel survey had been completed in the area. Pete confirmed that the NHNHB database search did not identify endangered mussels, no survey had been requested and therefore no survey has been conducted. Mike suggested that even common mussels should be relocated during the drawdown, regardless of whether they are identified by NHB. Further, drawdown should be completed at a rate of no more than 6 inches per day and completed before cold weather, approximately by mid-October.

Mike further asked whether it is known where the mill race leads. Greg Goodrich replied that the missing trash rack has allowed accumulation of debris further down the mill race channel, although it is unknown whether a weir or other structure is located within the mill race at its outlet to the channel. Water is flowing into the mill race, and some may get through it, but is not free flowing. In response, Mike expressed concern that fish could become entrained within the trash rack and suggested the mill race could be entirely blocked off at its face if no downstream water rights are being exercised.

Kevin Newton (NHFGD) had no further comments.
Mike Hicks (USACE) requested that floodplain impacts should be addressed.
Jean Brochi (USEPA) emphasized earlier comment by Karl Benedict that if there will be a change in the plan there may need to be a second mitigation discussion.
Gary Croot (USCG) indicated that there is no Coast Guard jurisdiction in this river segment.

Lee, #41322 (X-A004(593))

Stephen Hoffmann reintroduced the Lee 41322 project involving the replacement of the structure carrying NH Route 125 over the Little River in Lee, NH. The project was previously presented at the October 2019, August 2020, and December 2021 NHDOT Natural Resource Agency Meetings. The purpose of this meeting was to present the selected alternative, provide project updates since the December 2021 meeting, discuss resource area impacts, and obtain concurrence from the resource agencies on the permitting and mitigation approach.

Updates since the prior resource agency meetings included: increasing the span length of the selected alternative from 90 feet to 100 feet; updated NHB DataCheck Results letter now includes spotted turtle and wood turtle in addition to the state listed species identified on prior NHB DataCheck Results Letters; rare plant survey completed in 2022 for American featherfoil and small whorled pogonia (no rare plants documented in the project area); and the advertising date has shifted from June 20223 to June 2024.

The existing structure consists of an 18’ wide x 12’ high corrugated metal pipe (CMP) that was installed in 1972 and was added to the State Red List in 2014. At the location of the crossing, the Little River has a watershed area of approximately 18.4 square miles making this a Tier 3 stream crossing. The Little River is also part of the Lamprey River Watershed and is a NH Designated River. The average bankfull width of the river at this location is 32’ and the design channel bankfull width of the reference reach is 34’. Additional resources located within the project area include wetlands, priority resource areas (PRAs, floodplain wetlands adjacent to Tier 3 stream), 100-year floodplain (Zone A), and rare plants and animals identified by NHB and USFWS. Rare plants identified by NHB and USFWS include tufted yellow loosestrife, American featherfoil, and small whorled pogonia. A rare plant survey was completed in August 2020 and no rare species were identified. Based on coordination with NHB an additional rare plant survey was completed in June 2022 and again no rare species were documented in the project areas. Rare wildlife species include American eel, Blanding’s turtle, spotted turtle, and wood turtle. NHF&G made the following recommendations based on preliminary coordination: 1) Time of year restriction from April 15th through July 1st to protect diadromous fish spawning runs, particularly river herring which has been documented in the Little River downstream from the project area, and American eel; 2) Wildlife friendly erosion control matting; and 3) Limiting riprap in the river channel. The NHDES WPPT was reviewed and the segment of the Little River was identified as a cold water fishery and an eastern brook trout water. However, John Magee at NHFG confirmed that this section of the Little River does not contain eastern brook trout and is not a cold water fishery.

The selected alternative consists of a 100-foot single span bridge structure with a channel realignment originating on the upstream side of the bridge. The proposed project will construct approximately 143 linear feet of “new” stream channel through the proposed structure. The

Appendix B – Mitigation Report / Coordination / ARM Calculators

This appendix includes the following:

- Outreach letter to the Jaffrey Conservation Commission
- Mitigation Calculation Table
- Wetland ARM Fund Calculator
- Stream ARM Fund Calculator

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

Victoria F. Sheehan
Commissioner

William Cass, P.E.
Assistant Commissioner

JAFFREY
16307, X-A001(234)
US 202 / NH 124 / NH 137 Intersection Improvements

November 8, 2021

Carolyn Garretson, Chair
Jaffrey Conservation Commission
10 Goodnow Street
Jaffrey, NH 03452

RE: Local Mitigation Project Inquiry

Dear Ms. Garretson:

As you may know, the New Hampshire Department of Transportation (NHDOT) is currently preparing final design plans and permit applications to construct improvements to the five-way intersection of US 202 (Main Street/Peterborough Street) with NH 124 (Turnpike Road), Stratton Road, and Blake Street in the Town of Jaffrey (project location attached). The project seeks to address the traffic congestion and safety deficiencies associated with the current configuration of the US 202 "dog-leg" intersections of Main Street with Peterborough Street and Main Street with River Street.

This project proposes a new bridge crossing of the Contoocook River between River Street and Blake Street. Preliminary jurisdictional impacts to one wetland and the river are currently estimated at less than 3,000 square feet. Although currently mitigation for wetland and river impacts associated with the project are not expected to be required under NH Department of Environmental Services' wetland regulations, NHDOT is beginning coordination efforts to identify appropriate mitigation measures, if required, in accordance with Env-Wt 801.03(a). We are writing to you to determine whether the Jaffrey Conservation Commission maintains a list of local projects that may be appropriate to mitigate impacts associated with this project.

Please don't hesitate to contact me if you have any questions or require additional information.

Sincerely,

Marc G. Laurin
Senior Environmental Manager
Bureau of Environment
Room 160, Tel: (603) 271-3226
Email: marc.g.laurin@dot.nh.gov

MGL/pjw/nml
cc: Tobey Reynolds, NHDOT
Jason Hilton, VHB
Peter Walker, VHB

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US 202 / NH 124 / NH 137 Intersection Improvements Project
Jaffrey, NH
ARM Fund Mitigation Payement Justification

PERMANENT WETLAND IMPACT SUMMARY									
WETLAND IDENTIFICATION	WETLAND CLASSIFICATION	WETLAND DESIGNATION	PERMANENT					Subject to Mitigation?	Impact Description
			N.H.W.B. (NON-WETLAND) BANK		N.H.W.B. & A.C.O.E. (WETLAND) BED		PALUSTRINE WETLAND		
			SF	LF	SF	LF	SF		
A	PSS1E	1					1016	Yes, Wetland 1 is a PRA.	Wetland 1 (PSS area)
B	PEM1E	1					2284	Yes, Wetland 1 is a PRA.	Wetland 1 (PEM area)
C	PEM1E	2					1217	No, Wetland 2 is not a PRA and total non-PRA wetland impacts are under 10,000 sq. ft.	Wetland 2 (entire area)
D	BANK	S-1	762	107				Yes, non-compliant bridge.	Left bank under new bridge
E	R2UB3h	S-1			1143	110		Yes, non-compliant bridge.	Left bed under new bridge
F	R2UB3h	S-1			1397	115		Yes, non-compliant bridge.	Right bed under new bridge
G	BANK	S-1	652	76				Yes, non-compliant bridge.	Right bank under new bridge
H	BANK	S-1	90	57				No, grading associated with retaining wall removal.	Left bank near retaining wall removal
TOTALS			1504	240	2540	225	4517		

ARM Fund Calculations			
Wetlands Calculator	3300	SF	$14,890.01
Stream Calculator	258	LF	$78,604.34
TOTAL PAYMENT			$93,494.35

KEY
Subject to Mitigation (Stream Calculator)
Subject to Mitigation (Wetlands Calculator)
Not included in stream calculator to not double count the bed impacts.

Wildlife Shelf Impacts			
Impact ID	Bank Impact (SF)	Portion of Bank Impact Resulting from the Wildlife Shelves (SF)	Percentage of Impact Resulting from the Wildlife Shelves
D	762	99	13%
G	652	221	34%

Wildlife Shelf Impact Adjustment for Mitigation Calculation			
Impact ID	Bank Impact (LF)	Percentage of Impact Subject to Mitigation	Bank Impact Subject to Mitigation (LF)
D	107	87%	93
G	76	66%	50

US 202 / NH 124 / NH 137 Intersection Improvements Project
Jaffrey, NH
Mitigation Calculation - Wetland Impacts

2022 VALUES

TOWN	LAND VALUE
Acworth	2015
Albany	1166
Alexandria	3283
Allenstown	11545
Alstead	3107
Alton	28465
Amherst	33150
Andover	5187
Antrim	5186
Ashland	17888
Atkinson	53267
Auburn	25811
Barnstead	10183
Barrington	14071
Bartlett	10785
Bath	2148
Bean's Grant	494
Bean's Purchase	494
Bedford	53267
Belmont	16815
Bennington	5777
Benton	494
Berlin	2091
Bethlehem	1170
Boscawen	8475
Bow	22793
Bradford	5543
Brentwood	25013
Bridgewater	21888
Bristol	19371
Brookfield	3208
Brookline	24118
Cambridge	494
Campton	6327
Canaan	5832
Candia	13335
Canterbury	4856
Carroll	4102
Center Harbor	43396
Chandler's Purchase	494
Charlestown	3287
Chatham	742
Chester	16676
Chesterfield	9817
Chichester	10581
Claremont	5788
Clarksville	681
Colebrook	1771
Columbia	684
Concord	37684
Conway	17622
Cornish	2954
Crawford's Purchase	494
Croydon	1878
Cutt's Grant	494
Dalton	1912
Danbury	2798
Danville	25564
Deerfield	9596
Deering	6106
Derry	53267
Dix's Grant	494
Dixville	494
Dorchester	869
Dover	53267
Dublin	6403
Dummer	494
Dunbarton	7038
Durham	35249
East Kingston	26497
Easton	1943
Eaton	3515
Effingham	4109
Ellsworth	655
Enfield	12084
Epping	22559
Epsom	10218
Errol	1110
Erving's Location	494
Exeter	53267
Farmington	9882
Fitzwilliam	4939
Francestown	5172
Franconia	4017
Franklin	15980
Freedom	16133
Fremont	18506
Gilford	30949
Gilmanton	7638
Gilsum	2184
Goffstown	38305
Gorham	3104
Goshen	2880
Grafton	2877
Grantham	8993
Greenfield	4216
Greenland	53267

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: 3300.00
43560.00
Acres of impact = 0.0758

2 Determine acreage of wetland construction:

Forested wetlands:	0.1136
Tidal wetlands:	0.2273
All other areas:	0.1136

3 Wetland construction cost:

Forested wetlands:	$11,642.55
Tidal Wetlands:	$23,285.10
All other areas:	$11,642.55

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:	6739
Forested wetlands:	$765.80
Tidal wetlands:	$1,531.59
All other areas:	$765.80

5 Construction + land costs:

Forested wetland:	$12,408.35
Tidal wetlands:	$24,816.69
All other areas:	$12,408.35

6 NHDES Administrative cost:

Forested wetlands:	$2,481.67
Tidal wetlands:	$4,963.34
All other areas:	$2,481.67

********** **TOTAL ARM PAYMENT**********

Forested wetlands:	$14,890.01
Tidal wetlands:	$29,780.03
All other areas:	$14,890.01

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

US 202 / NH 124 / NH 137 Intersection Improvements Project

Jaffrey, NH

Mitigation Calculation - Stream Impacts

NHDES AQUATIC RESOURCE MITIGATION FUND STREAM PAYMENT CALCULATION		
INSERT LINEAR FEET OF IMPACT on BOTH BANKS AND CHANNEL	Right Bank	50.00
	Left Bank	93.0000
	Channel	115.0000
	TOTAL IMPACT	258.0000
	Stream Impact Cost:	$65,503.62
	NHDES Administrative cost:	
		$13,100.72
********* TOTAL ARM FUND STREAM PAYMENT********		
		$78,604.34

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Appendix C – Wetlands Function-Value Evaluation Forms

Wetland Function-Value Evaluation Form

Total area of wetland ~4,180 SF Human made? Partially Is wetland part of a wildlife corridor? No or a "habitat island"? No

Adjacent land use Parking lot, public roadway, businesses Distance to nearest roadway or other development adjacent

Dominant wetland systems present PSS1E/PEM1E 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? Mid

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

Wetland I.D. W-1

Latitude 42.81314757 Longitude -72.02311823

Prepared by: NLM Date 10/18/2021

Wetland Impact:
Type Fill Area Refer to plans

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	2, 3, 4, 7		This wetland contains depressional topography and is connected to the Contoocook River.
Floodflow Alteration	Y	3, 5, 6, 7, 8, 9, 10, 11, 13, 18	X	This concave wetland receives and retains runoff from surrounding developed areas and culvert. Contained standing water at time of observation.
Fish and Shellfish Habitat	Y	4, 6, 7, 8, 14, 16, 17		Large impounded perennial watercourse connected to floodplain wetland.
Sediment/Toxicant Retention	Y	2, 4, 9, 10, 13, 16		Dense vegetation present. Surrounding development provides potential toxicant/sediment sources.
Nutrient Removal	Y	3, 5, 7, 8, 9, 10, 11, 13		No nearby nutrient sources were identified. Dense vegetation and fine grained soils present in wetland.
Production Export	N	1, 7, 8, 12		No particularly high level of production or signs of export observed. Wetland connects to river bank.
Sediment/Shoreline Stabilization	Y	6, 7, 12, 13, 14, 15	X	Dense bank vegetation with extensive root systems. Scrub shrub along river and emergent near parking lot and road.
Wildlife Habitat	N	6, 7, 8, 13		Dense vegetation and adjacent stream provide suitable habitat but proximity to development diminishes its value.
Recreation	N	6, 9, 12		Wetland is adjacent to parking lot but its small size and dense vegetation makes it less suitable for recreation/access.
Educational/Scientific Value	N			Small, disturbed wetland with tire ruts in the emergent portion and a culvert in the scrub-shrub area.
Uniqueness/Heritage	N	1, 2, 11		Disturbed, small wetland area surrounded by development.
Visual Quality/Aesthetics	N	9		Disturbed small wetland, but visible from road/parking lot and associated with perennial stream.
ES Endangered Species Habitat	N			The 2019 NHB report (NHB-19-0664) did not result in any recorded occurrences for sensitive species near the Site.
Other				

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland ~1,250 SF Human made? No Is wetland part of a wildlife corridor? No or a "habitat island"? No

Adjacent land use Residential homes and nearby public road Distance to nearest roadway or other development adjacent homes

Dominant wetland systems present PEM1E 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? Mid

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. W-2

Latitude 42.81356333 Longitude -72.02375331

Prepared by: NLM Date 10/18/2021

Wetland Impact:
Type Fill Area Refer to plans

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	2, 3, 4		This wetland is located within a natural depression.
Floodflow Alteration	N	5, 6, 8		This concave wetland receives and retains runoff from surrounding upland areas.
Fish and Shellfish Habitat	N			This wetland is not associated with a perennial watercourse.
Sediment/Toxicant Retention	Y	2, 4, 9		Dense vegetation present. Surrounding development provides potential toxicant/sediment sources.
Nutrient Removal	Y	3, 7, 8, 9, 10, 11		No nearby nutrient sources were identified. Dense vegetation and fine grained soils present in wetland.
Production Export	N	1, 7, 12		No particularly high level of production or signs of export observed.
Sediment/Shoreline Stabilization	N			This wetland is not associated with a perennial watercourse.
Wildlife Habitat	N	7, 8, 13		Dense vegetation and nearby stream provide suitable habitat but proximity to development and small size diminishes its value.
Recreation	N			Wetland is on private property so no good access. Not connected to river.
Educational/Scientific Value	N			Small, disturbed wetland with tire ruts in the emergent portion surrounded by residential properties.
Uniqueness/Heritage	N	1, 2		Disturbed, small wetland area surrounded by development.
Visual Quality/Aesthetics	N			Disturbed small wetland on private property. No good access or viewing locations.
ES Endangered Species Habitat	N			The 2019 NHB report (NHB-19-0664) did not result in any recorded occurrences for sensitive species near the Site.
Other				

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland ~1.36 ac delineated Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Parking lots, public roadways, businesses Distance to nearest roadway or other development adjacent

Dominant wetland systems present R2UB3h 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? Mid

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

Wetland I.D. Contoocook River

Latitude 42.814090 Longitude -72.023453

Prepared by: NLM Date 10/18/2021

Wetland Impact:
Type Fill Area Refer to plans

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, 3, 4, 7, 11, 15	X	This project involves an impounded reach of the Contoocook River, underlain by a stratified drift aquifer.
Floodflow Alteration	Y	1, 5, 6, 7, 8, 9, 10, 11, 13, 15	X	This river receives runoff from surrounding developed areas. Impounded by dam/spillway.
Fish and Shellfish Habitat	Y	1, 3, 4, 5, 6, 7, 8, 9, 10, 14, 15, 16, 17	X	River is large and perennial. Dam is a barrier to anadromous fish.
Sediment/Toxicant Retention	Y	2, 3, 4, 6, 8, 9, 10, 12	X	Slow water velocity allows particulates to settle.
Nutrient Removal	Y	2, 3, 4, 7, 10, 13	X	Slow water velocity allows for potential nutrient removal.
Production Export	Y	1, 6, 7, 10		Dense vegetation along the banks. River has a permanent outlet for potential export.
Sediment/Shoreline Stabilization	N			Specific to wetlands located along stream banks.
Wildlife Habitat	Y	6, 7, 8, 9, 18, 19, 20	X	River provides habitat for many species and acts as a travel corridor.
Recreation	Y	2, 5, 6, 8, 9, 10, 12	X	Fishing, boating, paddling, and passive sight-seeing recreational opportunities along the river are restricted in the Site by dam.
Educational/Scientific Value	N			River within the Site is surrounded by development. Not easy to access.
Uniqueness/Heritage	Y	1, 2, 14, 19, 21		Can view the river from the surrounding roads, especially the US 202 bridge crossing.
Visual Quality/Aesthetics	N	8		Can view the river from the dam/bridge along public road.
ES Endangered Species Habitat	N			The 2019 NHB report (NHB-19-0664) did not result in any recorded occurrences for sensitive species near the Site.
Other				

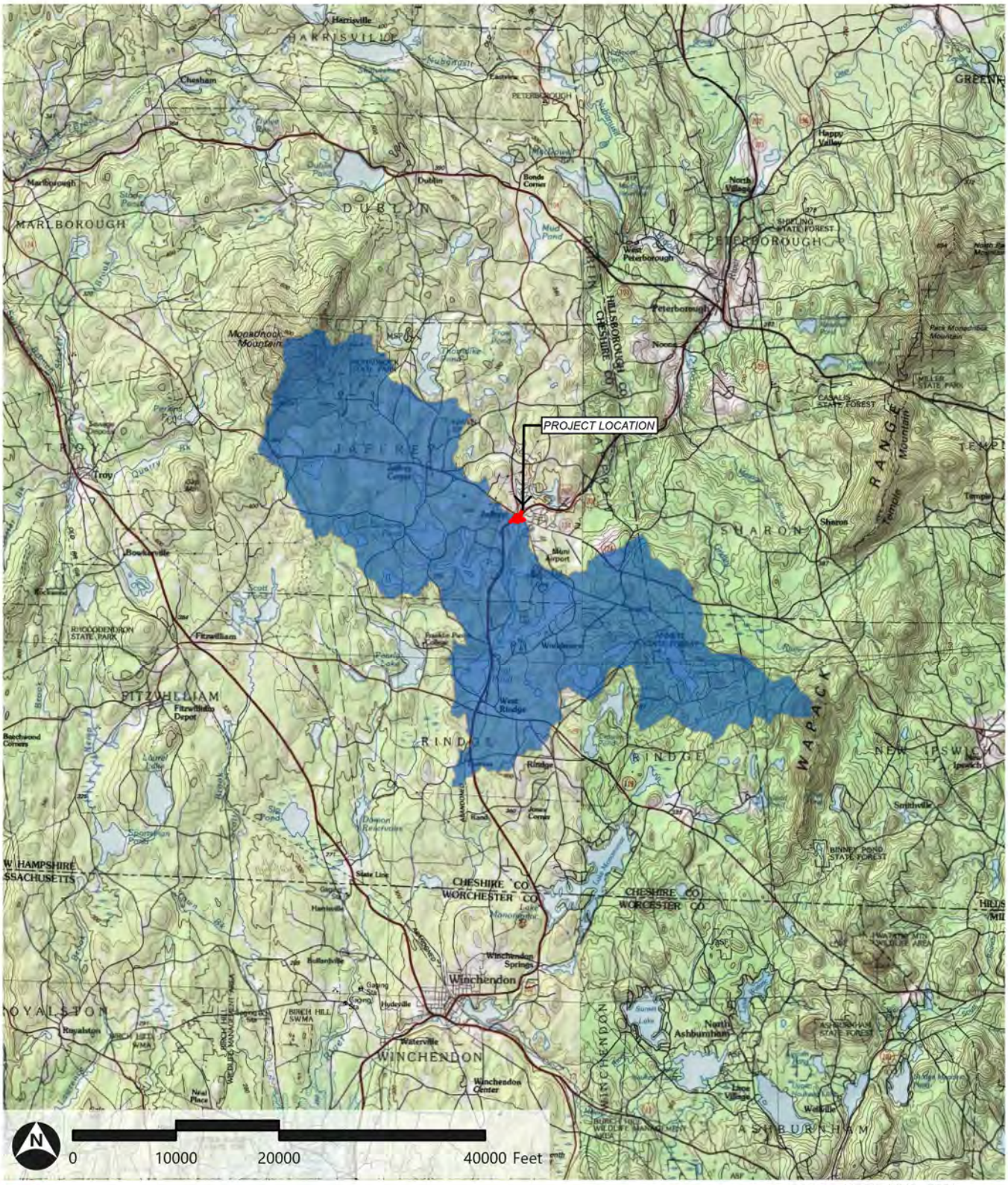
Notes:

* Refer to backup list of numbered considerations.

Appendix D – Watershed Map and Floodplain Map

Figure 3: USGS Watershed Map

Jaffrey Wetlands Permit Application | Jaffrey, NH



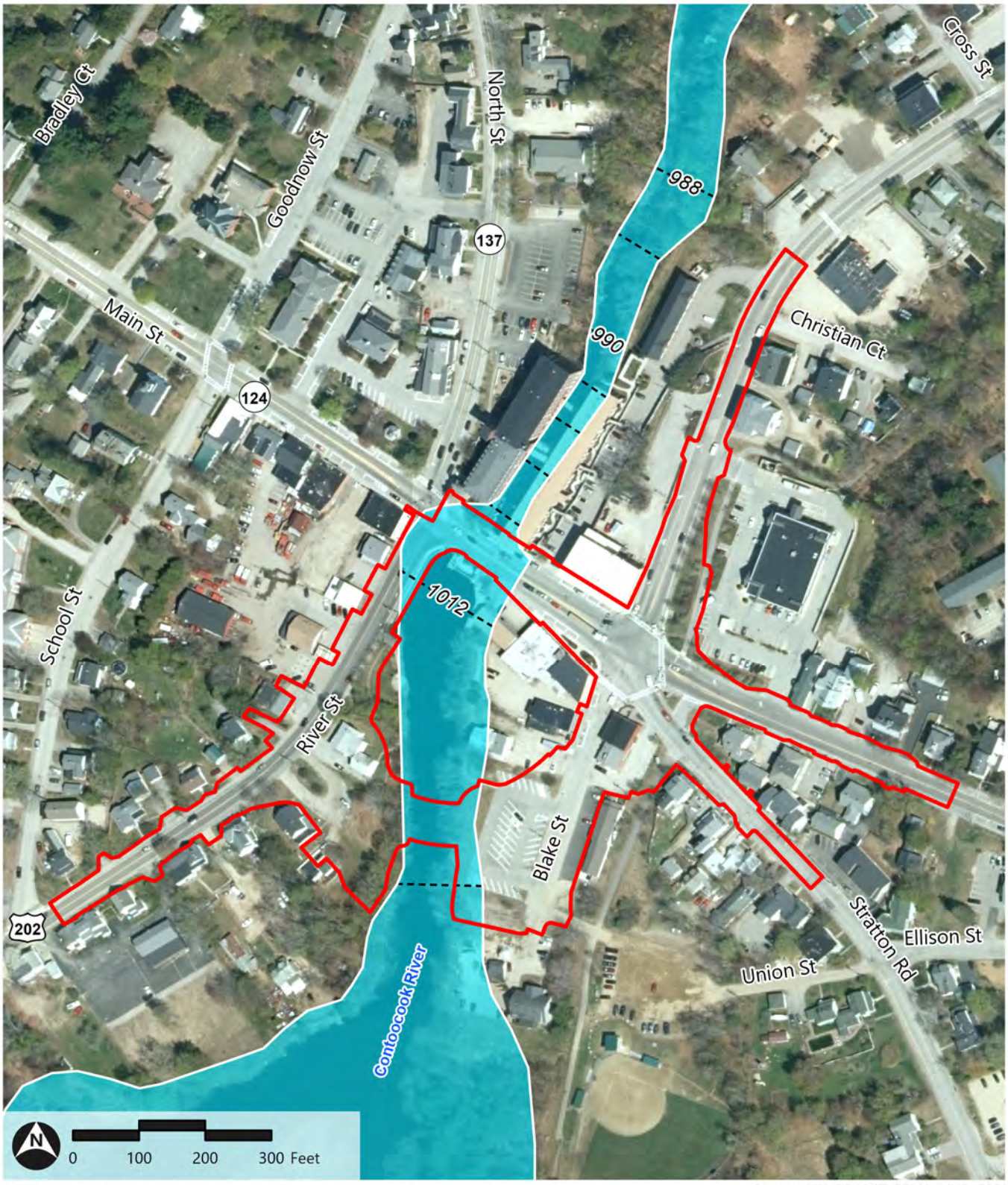
Source: USGS, VHB, ESRI

Project Site

Watershed Boundary
Approx. 19,100 acres

Figure 4: FEMA Floodplain Map

Jaffrey Wetlands Permit Application | Jaffrey, NH



Source: NH GRANIT, FEMA, VHB, ESRI

Path: \\vhb.com\gis\proj\Bedford\52457.00\GIS\Project\Jaffrey Wetlands Permit Application\Jaffrey Wetlands Permit Application\Jaffrey Wetlands Permit

Appendix E – Stream Crossing Data

This appendix includes:

- NHDES Stream Crossing Worksheet for the New Bridge
- NHDES Stream Crossing Worksheet for the Main Street Bridge
- Stream Geomorphic Assessment Data and Graphs
- Hydraulic Analysis Memo
- Alternative Design Request

New Bridge

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: 19,100 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 = 1011.8

Elevation of the 100-year floodplain at the inlet: 1010.1 feet (FEMA El. or Modeled El.)

SECTION 3 - CALCULATING PEAK DISCHARGE

Existing 100-year peak discharge (Q) calculated in cubic feet per second (CFS): 1,740 CFS	Calculation method: USGS Regression
Estimated bankfull discharge at the crossing location: 467 CFS	Calculation method: USGS Regression

⟶ ***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: 55 feet	Mean Bankfull Depth: 2.9 feet
Bankfull Cross Sectional Area: 190 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: 2,800 ft downstream of crossing
Reference reach watershed size: 19,300 acres

Parameter	**Cross Section 1** Describe bed form Glide (*e.g. pool, riffle, glide*)	**Cross Section 2** Describe bed form Glide (*e.g. pool, riffle, glide*)	**Cross Section 3** Describe bed form Glide (*e.g. pool, riffle, glide*)	**Range**
Bankfull Width	55 feet	54 feet	54 feet	54 feet
Bankfull Cross Sectional Area	153 SF	205 SF	169 SF	175 SF
Mean Bankfull Depth	2.8 feet	3.8 feet	3.1 feet	3.2 feet
Width to Depth Ratio	19.8	14.2	17.3	17.1
Max Bankfull Depth	3.8 feet	4.8 feet	4.3 feet	4.3 feet
Flood Prone Width	423 feet	391 feet	414 feet	410 feet
Entrenchment Ratio	7.7	7.2	7.7	7.5

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

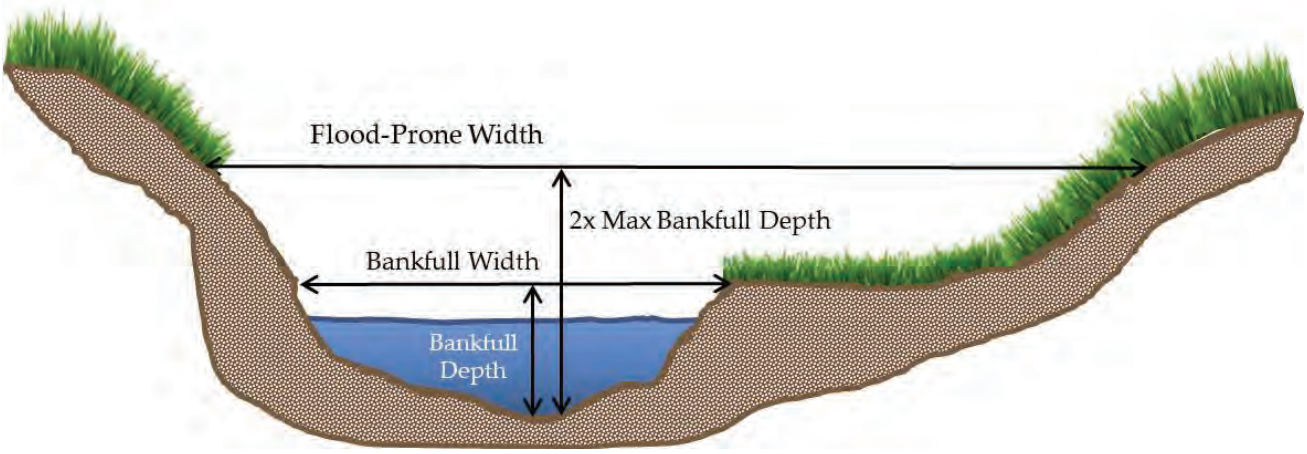


Figure 1: Determining the Reference Reach Attributes.

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: .0015
Average Channel Slope at the Crossing Location: .0005

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: 1.28
Sinuosity of the Crossing Location: 1.17

SECTION 8 - SUBSTRATE CLASSIFICATION BASED ON FIELD OBSERVATIONS *For **tier 2, tier 3** and **tier 4** crossings only.*	
% of reach that is bedrock:	**0** %
% of reach that is boulder:	**5** %
% of reach that is cobble:	**5** %
% of reach that is gravel:	**25** %
% of reach that is sand:	**45** %
% of reach that is silt:	**20** %
SECTION 9 - STREAM TYPE OF REFERENCE REACH *For **tier 2, tier 3** and **tier 4** crossings only.*	
Stream Type of Reference Reach:	C5

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

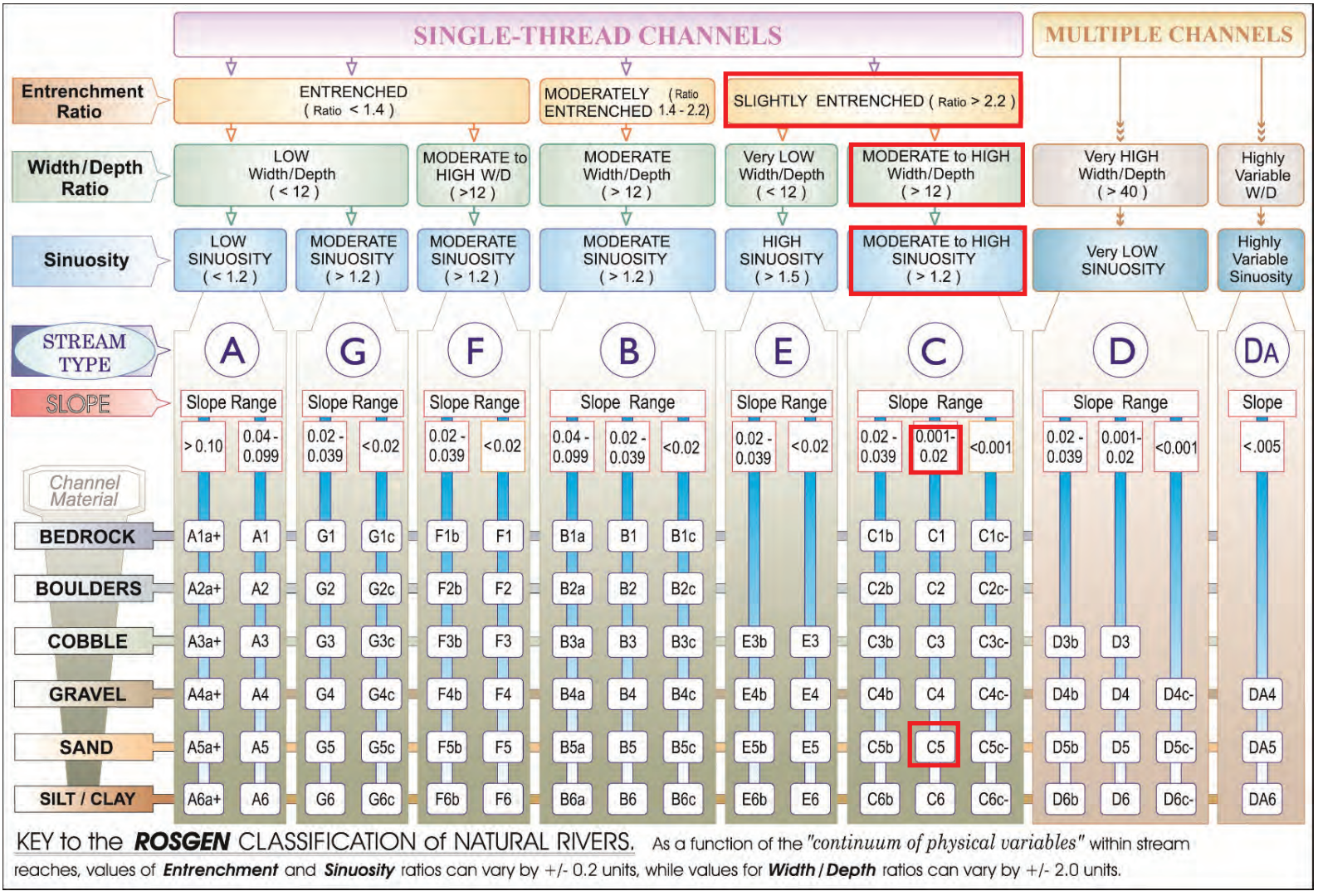


Figure 2: Reference from Applied River Morphology, Rosgen, 1996.

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: None

Existing Crossing Span: *(perpendicular to flow)*	feet
Existing Crossing Length: *(parallel to flow)*	feet
Culvert Diameter:	feet
Inlet Elevation: El.	feet
Outlet Elevation: El.	feet
Culvert Slope:	

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: *(perpendicular to flow)*	92-foot clear span
Proposed Structure Length: *(parallel to flow)*	62 feet
Culvert Diameter:	feet
Inlet Elevation: El.	feet
Outlet Elevation: El.	feet
Culvert Slope:	

Proposed Entrenchment Ratio:* 1.70 = 92 (proposed span) / 54 (average BFW)

*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.*

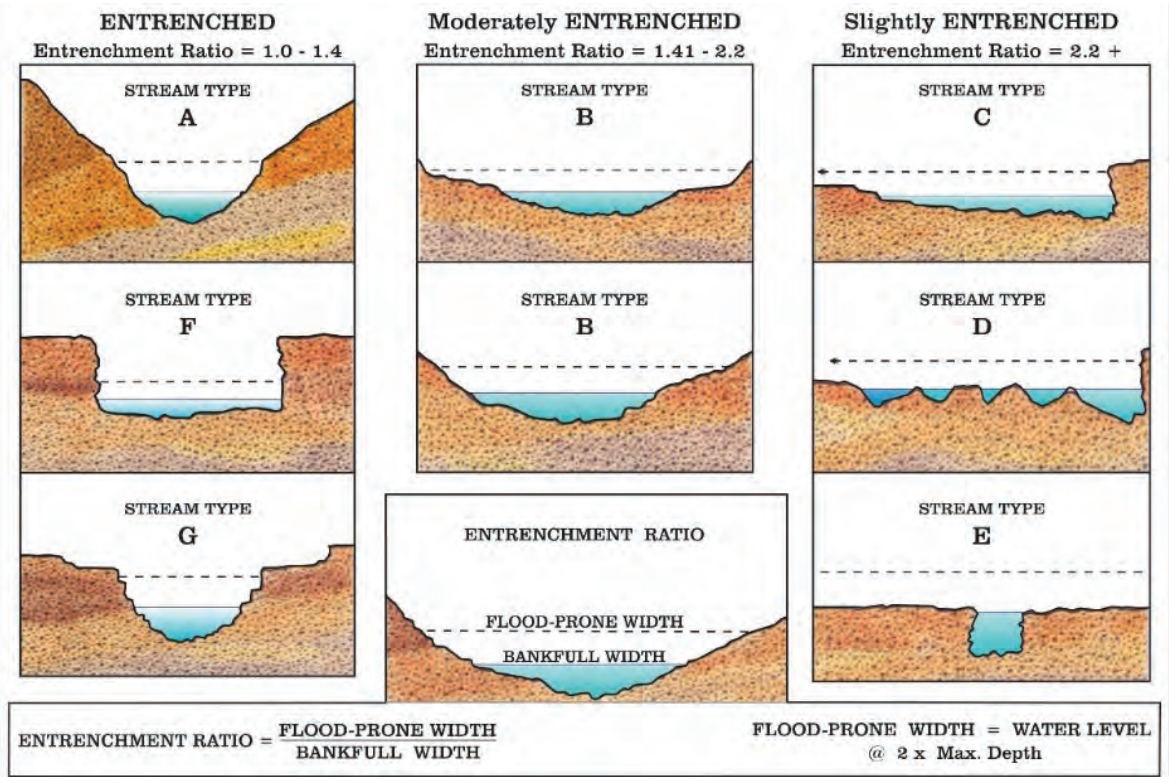


Figure 3: Reference from Applied River Morphology, Rosgen, 1996.

SECTION 11 - CROSSING STRUCTURE HYDRAULICS		
	Existing	**Proposed**
100 year flood stage elevation at inlet:	1010.1	1010.1
Flow velocity at outlet in feet per second (FPS):	3.2	3.2
Calculated 100 year peak discharge (Q) for the *proposed* structure in CFS:		1,740
Calculated 50 year peak discharge (Q) for the *proposed* structure in CFS:		1,460

SECTION 12 - CROSSING STRUCTURE OPENNESS RATIO

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

Crossing Structure Openness Ratio* = 15.5 = 960 sq ft (hydraulic opening) /62 (deck width)

* 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.

N/A ☐ 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.

Main Street Bridge Repair

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: 19,100 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: 1001.1 feet (FEMA El. or Modeled El.)

SECTION 3 - CALCULATING PEAK DISCHARGE

Existing 100-year peak discharge (Q) calculated in cubic feet per second (CFS): 1,740 CFS	Calculation method: USGS Regression
Estimated bankfull discharge at the crossing location: 467 CFS	Calculation method: USGS Regression

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: 55 feet	Mean Bankfull Depth: 2.9 feet
Bankfull Cross Sectional Area: 190 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: 2,800 ft downstream of crossing
Reference reach watershed size: 19,300 acres

Parameter	**Cross Section 1** Describe bed form Glide (*e.g. pool, riffle, glide*)	**Cross Section 2** Describe bed form Glide (*e.g. pool, riffle, glide*)	**Cross Section 3** Describe bed form Glide (*e.g. pool, riffle, glide*)	**Range**
Bankfull Width	55 feet	54 feet	54 feet	54 feet
Bankfull Cross Sectional Area	153 SF	205 SF	169 SF	175 SF
Mean Bankfull Depth	2.8 feet	3.8 feet	3.1 feet	3.2 feet
Width to Depth Ratio	19.8	14.2	17.3	17.1
Max Bankfull Depth	3.8 feet	4.8 feet	4.3 feet	4.3 feet
Flood Prone Width	423 feet	391 feet	414 feet	410 feet
Entrenchment Ratio	7.7	7.2	7.7	7.5

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

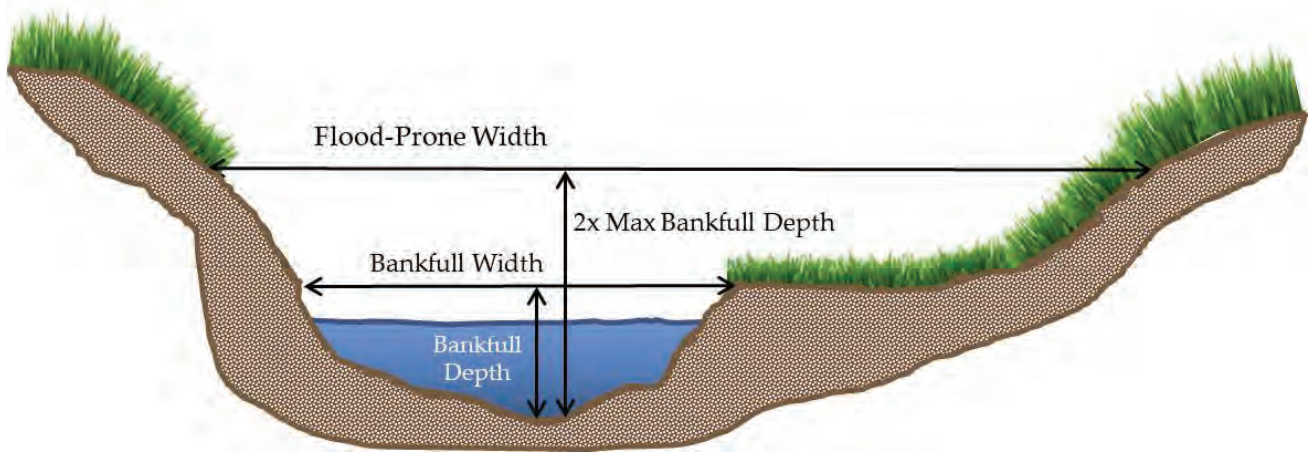


Figure 1: Determining the Reference Reach Attributes.

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: 0.0015
Average Channel Slope at the Crossing Location: 0.0405

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: 1.28
Sinuosity of the Crossing Location: 1.00

SECTION 8 - SUBSTRATE CLASSIFICATION BASED ON FIELD OBSERVATIONS *For **tier 2, tier 3** and **tier 4** crossings only.*	
% of reach that is bedrock:	**0** %
% of reach that is boulder:	**5** %
% of reach that is cobble:	**5** %
% of reach that is gravel:	**25** %
% of reach that is sand:	**45** %
% of reach that is silt:	**20** %
SECTION 9 - STREAM TYPE OF REFERENCE REACH *For **tier 2, tier 3** and **tier 4** crossings only.*	
Stream Type of Reference Reach:	C5

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

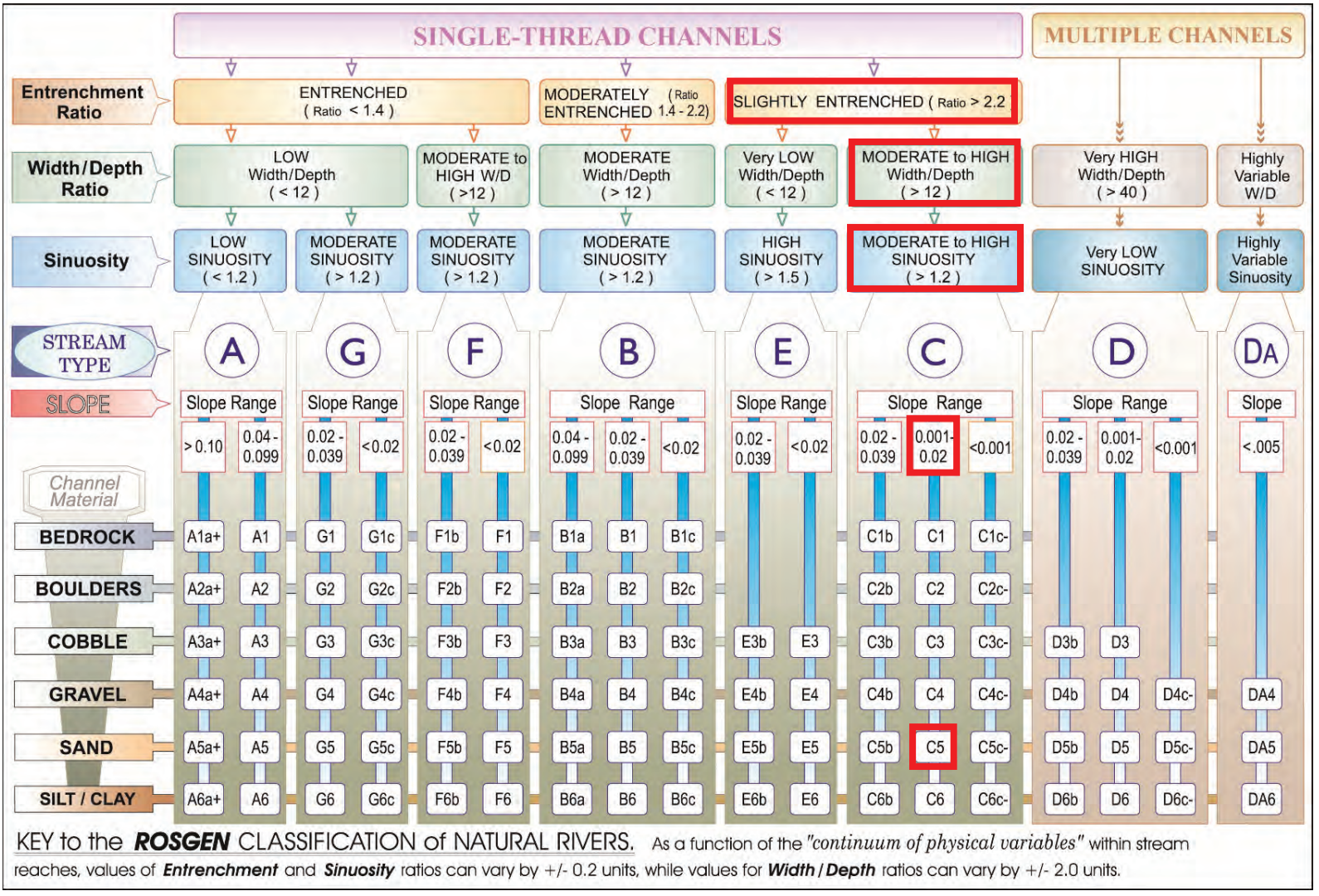


Figure 2: Reference from Applied River Morphology, Rosgen, 1996.

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:

Existing Crossing Span: *(perpendicular to flow)*	38 feet	**Culvert Diameter:**	feet
		Inlet Elevation: El.	feet
Existing Crossing Length: *(parallel to flow)*	65 feet	**Outlet Elevation:** El.	feet
		Culvert Slope:	

Proposed Conditions

Proposed Structure Type:	Tier 1	Tier 2	Tier 3	Alternative Design
Bridge Span — Limited repair of existing structure.	☐	☐	☒	☐
Pipe Arch	☐	☐		☐
Closed-bottom Culvert	☐	☐		☐
Open-bottom Culvert	☐	☐	☐	☐
Closed-bottom Culvert with stream simulation	☐	☐	☐	☐

Proposed Structure Span: *(perpendicular to flow)*	(same as existing) feet	**Culvert Diameter:**	feet
		Inlet Elevation: El.	feet
Proposed Structure Length: *(parallel to flow)*	(same as existing) feet	**Outlet Elevation:** El.	feet
		Culvert Slope:	

Proposed Entrenchment Ratio:* 0.70 = 38 (bridge span)/54 (avg. BFW)

*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.*

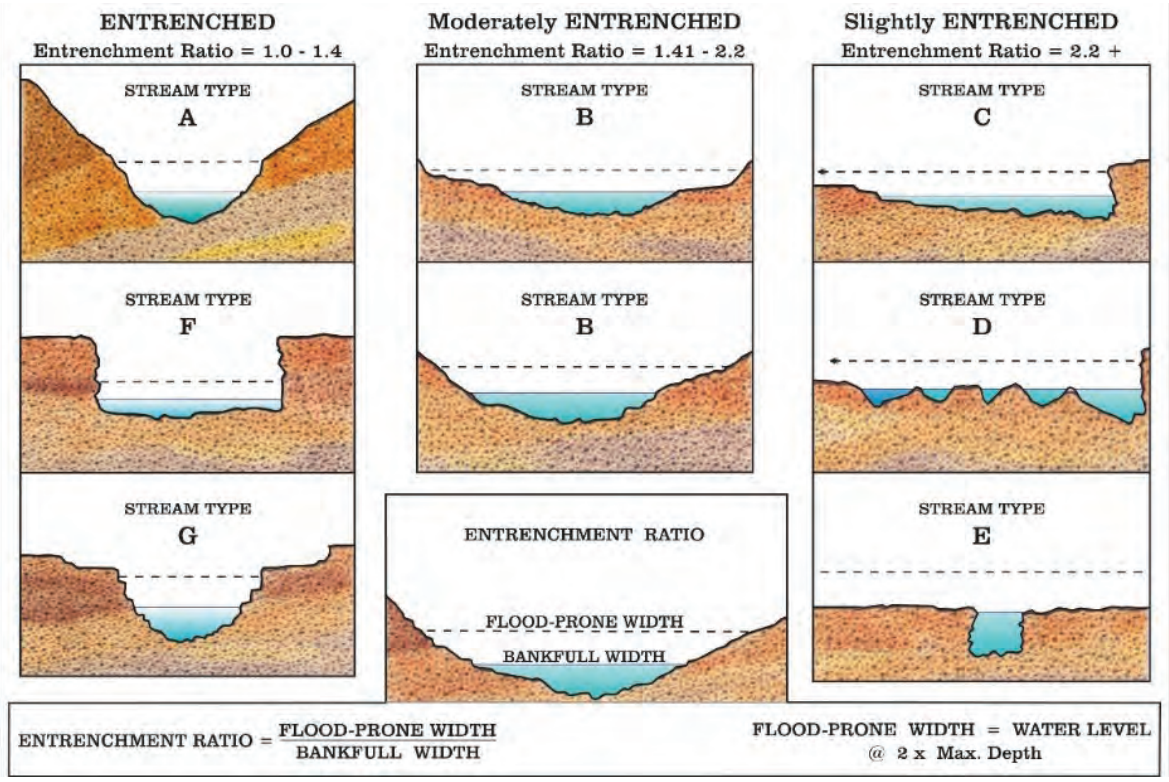


Figure 3: Reference from Applied River Morphology, Rosgen, 1996.

SECTION 11 - CROSSING STRUCTURE HYDRAULICS		
	Existing	**Proposed**
100 year flood stage elevation at inlet:	1001.3	1001.3
Flow velocity at outlet in feet per second (FPS):	9.2	9.2
Calculated 100 year peak discharge (Q) for the *proposed* structure in CFS:		1,740
Calculated 50 year peak discharge (Q) for the *proposed* structure in CFS:		1,460

SECTION 12 - CROSSING STRUCTURE OPENNESS RATIO

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

Crossing Structure Openness Ratio* = 6.2

* 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.

N/A ☐ 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.

**Note that no ADR is required for the proposed repairs to this stream crossing despite the proposed entrenchment ratio in Section 10 since the limited scope of the proposed tier 3 repair complies with the Env-Wt 904.09 criteria.*

Computations

Project:	**Jaffrey 16307, X-A001(234), Part B**	**Project #:**	**52792.00**
Location:	**Jaffrey, NH**	**Sheet:**	**1 of 5**
Calculated by:	**DWC**	**Date:**	**9/28/2021**
Checked by:	**PJW**	**Date:**	**10/5/2021**
Title:	**Contoocook River Bankfull Width Evaluation**		

Bankfull Width (BFW) Estimation - Review of Available Data

Goal: determine appropriate estimate of bankfull width (BFW) of Contoocook River at Jaffrey

Challenges:

1) The Contoocook River Dam ±200 ft downstream of the crossing creates an impoundment, so width of water at crossing is not indicative of BFW
2) The Mountain Brook Reservoir and Contoocook Lake Dams ±4,500 ft upstream prevent natural sediment transport downstream and therefore river morphology is artificially influenced by these reservoirs; upstream of these dams there is no defined river channel.
3) The reach upstream of the crossing is characterized by a channel flowing through a wetland and is not represented by Rosgen stream classification system; the Contoocook River Dam impoundment extends to Contoocook Lake and there is no upstream un-impounded reach
4) The reach downstream of Contoocook River Dam is channelized by mill buildings and is starved of sediment transport by dam; and therefore river morphology is again artificially influenced.
5) The reach near the second crossing of Nutting Road ±4,000 ft downstream of crossing is influenced by confluence of Tyler Brook (tributary to Contoocook River) and therefore watershed hydrology is not appropriate for a reference reach. Downstream of Nutting Road, the river is impounded by the Cheshire Dam and there is no defined river channel.
6) The only potential reference reach location that is not dominated by anthropomorphic factors is the downstream reach ±1,200-4,000 ft downstream between the first and second crossings of the Contoocook River with Nutting Road.
7) Regression equations are an appropriate check for BFW estimation. There are no New Hampshire-specific BFW regression equations available, but equations are available for the neighboring states of Maine, Massachusetts, and Vermont

Bankfull Estimates:

BFW (ft) **Location**

(site-specific measurements)

- **45** Nutting Road downstream reach - minimum measurement (aerial orthophoto estimate)
- **50** Nutting Road downstream reach - average measurement (aerial orthophoto estimate)
- **75** Nutting Road downstream reach - maximum measurement (aerial orthophoto estimate)
- **85** Crossing location - minimum measurement (aerial orthophoto estimate)
- **95** Crossing location - maximum measurement (aerial orthophoto estimate)
- **83** Crossing location - minimum measurement - March 2019 stream crossing assessment
- **98** Crossing location - maximum measurement - March 2019 stream crossing assessment
- **89.8** Crossing location - average measurement - March 2019 stream crossing assessment

(regression estiamtes)

- **59.3** SIR 2013-5155 Massachusetts BFW regression - simple regression equation (Bent, 2013)
- **58.3** SIR 2013-5155 Massachusetts BFW regression - multiple regression equation (Bent, 2013)
- **44.9** SIR 2004-5042 Maine BFW regression (Dudley, 2004)
- **58.4** Vermont Stream Geomorphic Assessment (VT ANR, 2006)

Given that the Contoocook River morphology in the vicinity of the crossing is heavily influenced by dams, bridges, and channelization, and based on review of available literature, a BFW estimate of 45 to 60 ft is reasonable to assume for the crossing location

Note: the FEMA floodplain width is approximately 145 ft at the crossing location.

Regression equation inputs (determined by USGS StreamStats v.4.6, accessed September 2021)

- 29.85 Watershed Area (mi^2)
- 7.9140 Mean Basin Slope (%)

Bankfull Width (BFW) Estimation - Review of Available Data

SIR 2013-5155:

Table 6. Statistical summary of simple and multiple regression equations for estimating bankfull stream width, mean depth, cross-sectional area, and discharge for streams in and near Massachusetts.

[n, number; R^2, coefficient of determination; S_e, standard error of the estimate; S_p, standard error of the prediction; ft, foot; mi^2, square miles; ft^2, square foot; ft^3/s, cubic foot per second; log, base-10 logarithm; %, percent]

Equation number	Equation	n	R^2	Adjusted R^2	Predicted R^2	S_e (log)	S_e (%)	S_p (log)	S_p (%)
	Simple regression equation								
8	Bankfull width (ft) = 15.0418 [Drainage area (mi^2)]$^{0.4038}$	33	0.877	0.873	0.8635	0.0903	21.02	0.0950	22.14
9	Bankfull mean depth (ft) = 0.9502 [Drainage area (mi^2)]$^{0.2960}$	33	0.820	0.814	0.7995	0.0826	19.19	0.0873	20.30
10	Bankfull cross-sectional area (ft^2) = 14.1156 [Drainage area (mi^2)]$^{0.7026}$	33	0.911	0.908	0.9028	0.1308	30.81	0.1369	32.31
11	Bankfull discharge (ft^3/s) = 37.1364 [Drainage area (mi^2)]$^{0.7996}$	33	0.770	0.762	0.7428	0.2608	65.89	0.2757	70.43
	Multiple regression equation								
12	Bankfull width (ft) = 10.6640 [Drainage area (mi^2)]$^{0.3935}$ [Mean basin slope (%)]$^{0.1751}$	33	0.900	0.894	0.8780	0.0825	19.17	0.0913	21.26
13	Bankfull mean depth (ft) = 0.7295 [Drainage area (mi^2)]$^{0.2880}$ [Mean basin slope (%)]$^{0.1346}$	33	0.845	0.834	0.8159	0.0781	18.13	0.0850	19.76
14	Bankfull cross-sectional area (ft^2) = 7.6711 [Drainage area (mi^2)]$^{0.6842}$ [Mean basin slope (%)]$^{0.3105}$	33	0.937	0.932	0.9320	0.1123	26.30	0.1234	29.00
15	Bankfull discharge (ft^3/s) = 8.2490 [Drainage area (mi^2)]$^{0.7545}$ [Mean basin slope (%)]$^{0.7659}$	33	0.871	0.862	0.8366	0.1986	48.23	0.2234	55.02

Table 6. Regional regression equations for estimating bankfull streamflow, channel width, channel depth, and channel cross-sectional area as functions of drainage area for rivers in coastal and central Maine.

[Q_{bkf}, bankfull streamflow in cubic feet per second; w_{bkf}, bankfull channel width, in feet; d_{bkf}, bankfull mean channel depth, in feet; A_{bkf}, bankfull cross-sectional area, in square feet ; DA, drainage area in square miles; R^2, fraction of variance explained by regression]

Regression equation	Average standard error of estimate	R^2
$Q_{bkf} = 5.19DA^{1.05}$	+66.0 to -39.8	0.88
$w_{bkf} = 7.67DA^{0.52}$	+37.9 to -27.5	0.82
$d_{bkf} = 0.594DA^{0.34}$	+29.4 to -22.7	0.76
$A_{bkf} = 4.55DA^{0.86}$	+70.5 to -41.3	0.82

Computations

Project:	**Jaffrey 16307, X-A001(234), Part B**	**Project #:**	**52792.00**
Location:	**Jaffrey, NH**	**Sheet:**	**3 of 5**
Calculated by:	**DWC**	**Date:**	**9/28/2021**
Checked by:	**PJW**	**Date:**	**10/5/2021**
Title:	**Contoocook River Bankfull Width Evaluation**		

Bankfull Width (BFW) Estimation - Review of Available Data

VT ANR 2006:

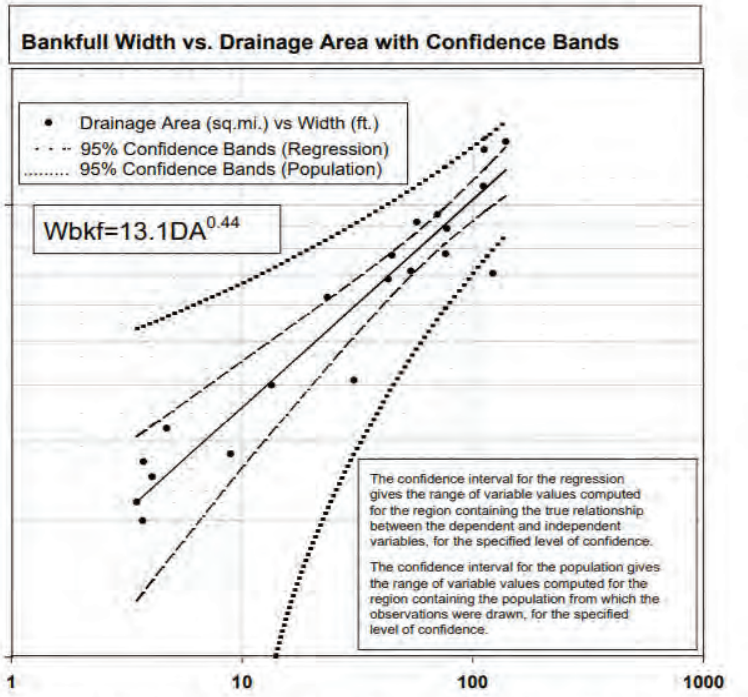


Figure 3. Width vs. drainage area data and regression lines with confidence

Computations

Project:	**Jaffrey 16307, X-A001(234), Part B**	**Project #:**	**52792.00**
Location:	**Jaffrey, NH**	**Sheet:**	**4 of 5**
Calculated by:	**DWC**	**Date:**	**9/28/2021**
Checked by:	**PJW**	**Date:**	**10/5/2021**
Title:	**Contoocook River Bankfull Width Evaluation**		

Rosgen Channel Classification - Review of Available Data

Goal: determine Rosgen stream classification of Contoocook River at Jaffrey

Challenges:

1) Impoundment from Contoocook River Dam ±200 ft downstream of crossing prevents classification of channel within crossing reach
2) Bankfull width, width/depth ratio, and entrenchment ratio cannot be measured in an impounded reach
3) Alternative is to assume similar conditions for the "reference reach" between the Nutting Rd crossings ±1,700-4,000 ft downstream

Reference Reach

0.0015	Channel Slope (ft/ft)	Estimated from FEMA flood profile
1.28	Approx sinuosity	Estimated from aerial photos

Crossing Reach

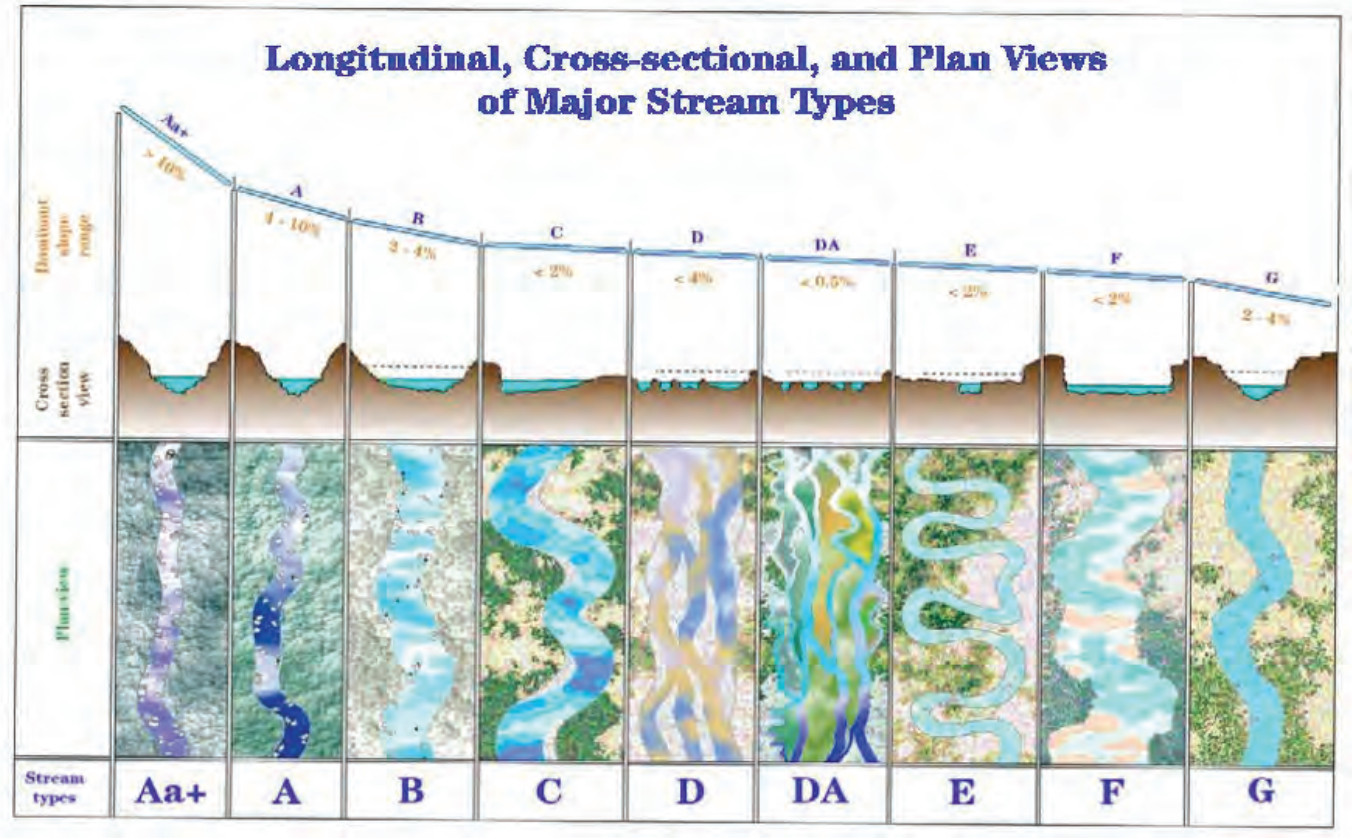
0.0005	Channel Slope (ft/ft)	Estimated from FEMA flood profile
1.17	Approx sinuosity	Estimated from aerial photos

Classification:

Based on stream gradient, sinuosity, and overall topography, could potentially be Type C, E, or F stream.

Actual classification would depend on estimation of entrenchment and width/depth ratios - not possible in impounded reach.

Figure 11–2 Broad-level stream classification delineation showing longitudinal, cross-sectional, and plan views of major stream types

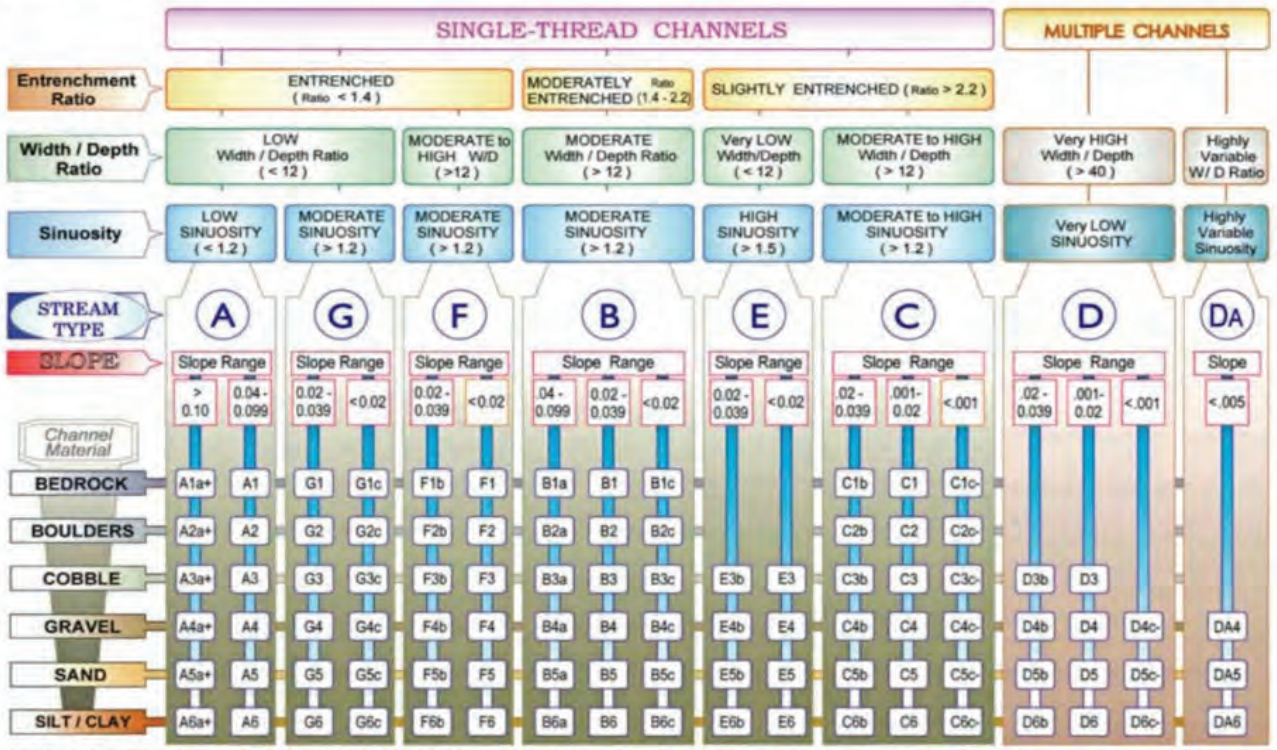


Computations

Project:	Jaffrey 16307, X-A001(234), Part B	**Project #:**	52792.00
Location:	Jaffrey, NH	**Sheet:**	5 of 5
Calculated by:	DWC	**Date:**	9/28/2021
Checked by:	PJW	**Date:**	10/5/2021
Title:	Contoocook River Bankfull Width Evaluation		

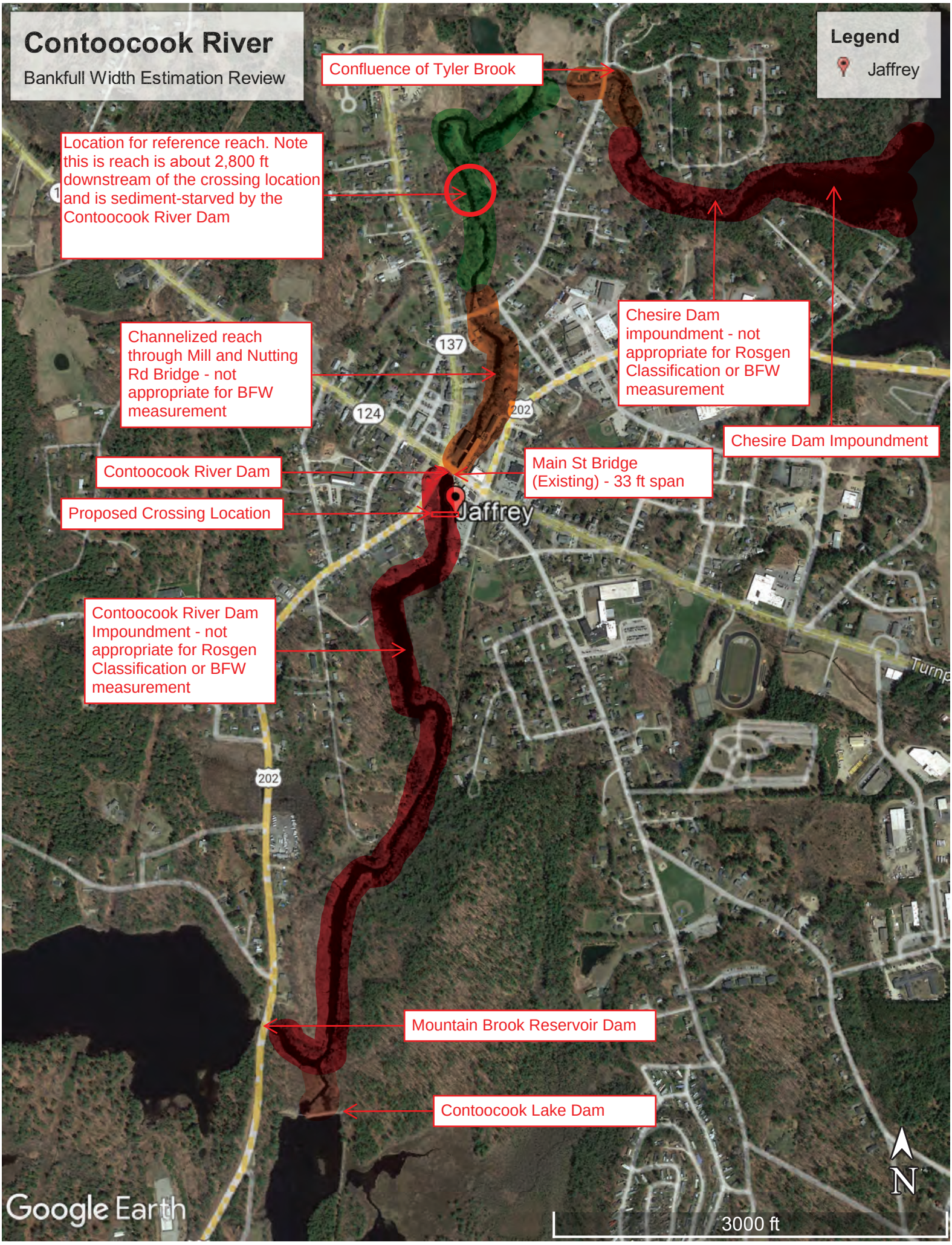
Rosgen Channel Classification - Review of Available Data

Figure 11–3 Classification key for natural rivers



KEY to the ROSGEN CLASSIFICATION of NATURAL RIVERS. As a function of the *"continuum of physical variables"* within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

(210-VI-NEH, August 2007)

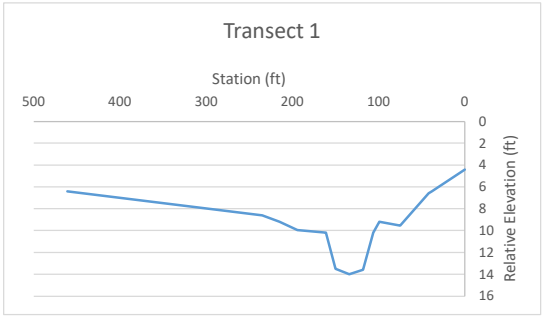

Contoocook River
Bankfull Width Estimation Review
Legend
Jaffrey
Confluence of Tyler Brook
Location for reference reach. Note this is reach is about 2,800 ft downstream of the crossing location and is sediment-starved by the Contoocook River Dam
Channelized reach through Mill and Nutting Rd Bridge - not appropriate for BFW measurement
Chesire Dam impoundment - not appropriate for Rosgen Classification or BFW measurement
Chesire Dam Impoundment
Contoocook River Dam
Main St Bridge (Existing) - 33 ft span
Proposed Crossing Location
Jaffrey
Contoocook River Dam Impoundment - not appropriate for Rosgen Classification or BFW measurement
Mountain Brook Reservoir Dam
Contoocook Lake Dam
137
124
202
202
N
3000 ft
Google Earth

Contoocook River Reference Reach Transect Data

Transect 1	
Bankfull Width	55.0
Bankfull Area	153.0
Mean Bankfull Depth	2.8
Width to Depth Ratio	19.8
Max Bankfull Depth	3.8
Flood Prone Width	422.8
Entrenchment Ratio	7.7

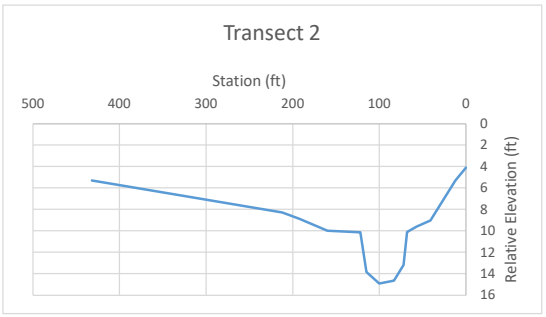
Description	Station (ft)	Height[1] (ft)	Bankfull XS Area
Floodplain	0	4.4	
(interpolated)	38.2	6.4	
Floodplain	42	6.6	
Floodplain	75	9.55	
Stone Wall	99	9.2	
Bank	106	10.2	
Toe of Bank	118	13.6	20.4
Center Channel	134	14	57.6
Toe of Bank	150	13.5	56.8
Bank	161	10.2	18.15
Floodplain	194	9.95	
Floodplain	215	9.2	
Floodplain	235	8.6	
Floodplain (approx)	461	6.4	

[1] Height above ground from the survey tripod/relative elevation.



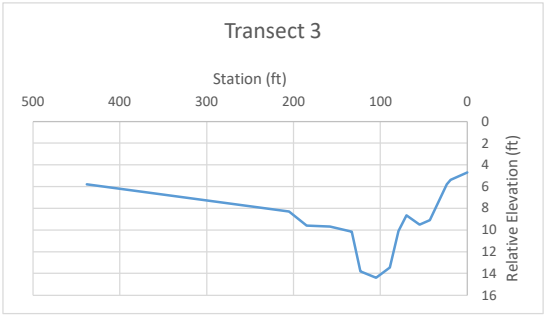
Transect 2	
Bankfull Width	54.0
Bankfull Area	205.2
Mean Bankfull Depth	3.8
Width to Depth Ratio	14.2
Max Bankfull Depth	4.8
Flood Prone Width	391.0
Entrenchment Ratio	7.2

Description	Station (ft)	Height[1] (ft)	Bankfull XS Area
Floodplain	0	4.1	
Floodplain	12	5.3	
Floodplain	41	9.05	
Stone Wall	57	9.6	
Bank	68	10.1	
Toe of Bank	72	13.2	6.2
Center Channel	83	14.65	42.075
Thalweg (approx)	100	14.9	79.475
Toe of Bank	115	13.85	64.125
Bank	122	10.15	13.3
Floodplain	160	10	
Floodplain	192	8.9	
Floodplain	212	8.3	
Floodplain (approx)	432	5.3	



Transect 3	
Bankfull Width	54.0
Bankfull Area	168.7
Mean Bankfull Depth	3.1
Width to Depth Ratio	17.3
Max Bankfull Depth	4.3
Flood Prone Width	414.4
Entrenchment Ratio	7.7

Description	Station (ft)	Height[1] (ft)	Bankfull XS Area
Floodplain	0	4.7	
Floodplain	19	5.4	
(interpolated)	23.6	5.8	
Floodplain	43	9.1	
Floodplain	55	9.5	
Stone Wall	70	8.65	
Bank	79	10.1	
Toe of Bank	89	13.45	16.75
Center Channel	105	14.4	61.2
Toe of Bank	123	13.8	72
Bank	133	10.15	18.75
Floodplain	158	9.7	
Floodplain	185	9.6	
Floodplain	205	8.3	
Floodplain (approx)	438	5.8	



Average
54.3
175.6
3.2
17.1
4.3
409.4
7.5

Ref: 52792.00
March 18, 2022

Memorandum

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

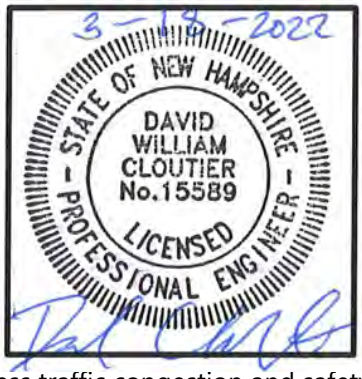
Date: March 18, 2022

Project #: 52501.06

From: David Cloutier, P.E.
Water Resources Engineer

Re: US Route 202 – Jaffrey NH (State Project #16307)
Proposed Contoocook River Bridge Final Hydraulic Analysis

This memorandum updates the previous DRAFT Hydrologic and Hydraulic analysis dated November 10, 2021.



This memorandum provides a summary of hydrologic and hydraulic analysis completed by VHB to support the design of the proposed new bridge carrying US Route 202 over the Contoocook River in Jaffrey, NH (the Crossing). All elevations listed in this memorandum are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29), consistent with project design plans, unless noted otherwise.

Project Background

The proposed Jaffrey-US Route 202 (US 202) improvement project is intended to address traffic congestion and safety related deficiencies associated with the current configuration of the US 202 intersections of Main Street with Peterborough Street and River Street, achieved by reconfiguring US 202 along a new section crossing the Contoocook River south of Main Street connecting River Street and Peterborough Street. As part of the overall US 202 improvement project, US 202 will be carried over the Contoocook River by a new curved 92-foot (clear span) single-span steel girder bridge (the Crossing). The proposed design revises initial draft designs to balance freeboard, river geomorphology, hydraulic capacity, scour, and cost considerations.

The National Flood Insurance Program (NFIP) Flood Insurance Rate Map (FIRM) Panel 33005C0459R (Effective Date June 6, 2006) shows the Crossing to be located within the Special Flood Hazard Area (SFHA) Zone AE associated with the Contoocook River, with a Base Flood Elevation (BFE) of elevation 1011.8 ft. There is no regulatory floodway defined for the Contoocook River; because there is no floodway, the NFIP regulations for floodway development set forth in 44CFR 60.3(d)(3) do not apply for this project and a "No Rise" Floodway Encroachment Assessment is not required.

The Contoocook River flows in a generally northeasterly direction, from Contoocook Lake on the Jaffrey-Rindge town line, to its confluence with the Merrimack River in Penacook. In Jaffrey, the river is fed by lakes and streams between the western slopes of Monadnock Mountain and the eastern slopes of New Ipswich Mountain. There are three (3) dams along the Contoocook River and its tributaries within the vicinity of the Crossing:

- Contoocook Lake Dam (D124.002)
- Contoocook River Dam (D124.003)
- Mountain Brook Reservoir Dam (D124.017)

The Mountain Brook Reservoir and Contoocook Lake dams are located upstream of the Crossing and impact Contoocook River hydrology; the Contoocook River Dam is located approximately 300 feet downstream of the

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proposed crossing and backwater from this dam impacts river hydraulics at the Crossing. The proposed crossing is located within the approximately 1-mile-long impoundment of the Contoocook River Dam (D124.003), a 15-foot-tall run-of-the-river concrete dam with 33-foot-wide ogee spillway and two 6.5-foot-tall-by-7.5-foot-wide gates. The dam was built in 1861 and reconstructed in 1939 following damage from the floods of 1936 and 1938. Reconstruction plans of the dam and downstream Main Street bridge from 1938 are available.

Because the hydraulic performance of the proposed crossing is influenced by tailwater from the Contoocook River Dam (D124.003), hydraulic modeling extends downstream to include the dam.

Hydrology

VHB calculated the contributing watershed of the Contoocook River at the Crossing location using USGS StreamStats 4.6 hydrologic software to be 29.85 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. To supplement this analysis, VHB reviewed available hydrologic data and studies for the Contoocook River:

- There is no historic stream gage data for the Contoocook River in Jaffrey; the nearest gage on the river, located approximately 5 miles downstream on the Contoocook in Peterborough (USGS Gage 01082000), has a contributing watershed of 67.4 square miles (227% of the watershed area at the Crossing location). The difference in size between the watersheds is outside of the 50%-150% range appropriate for gage transfer. However, flood-discharge estimates computed from statistical analysis of the 73-year stream gage record are within 2% of the estimated computed by regression for the gage location, indicating that the SIR 2008-5206 regression equations are well-suited to the Contoocook River. The flood of record at Gage 01082000 (4,110 cfs in April 2007) corresponds to a 1% Annual Exceedance Probability (AEP) discharge, or "100-year" event.
- The May 23, 2006 Effective Flood Insurance Study (FIS) for Cheshire County, New Hampshire only estimates flood discharges for the Contoocook River associated with the 1% AEP, based on USGS regression equations from a 1978 study. This study was based on a significantly shorter period of record than SIR 2008-5206 and therefore has a larger margin of error. The FIS also notes that the flood of record at the Contoocook River Dam (D124.003) was measured to be 2,580 cfs, corresponding to a 1% AEP discharge; however, the construction of the upstream Mountain Brook Reservoir Dam (D124.017) since 1936 has increased storage and reduced flood discharges at the Crossing location.
- The contributing watershed of the Contoocook River at the Crossing location is 29.85 square miles, split evenly between the watersheds of Contoocook Lake to the east and Mountain Brook Reservoir to the west. Discharges from these lakes are controlled by the Contoocook Lake Dam (D124.002; built in 1885) and the Mountain Brook Reservoir Dam (D124.017; built in 1948), respectively. Neither dam was constructed for flood attenuation purposes and both reservoirs provide only limited storage. Emergency Action Plan (EAP) documents provided by the NHDES Dam Bureau indicate that no original design calculations are available for these dams, but provide estimates of 1% AEP discharges; the combined estimate for the two dams is approximately 1,870 cfs.

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- Documents provided by the NHDES Dam Bureau for the Contoocook River Dam (D124.003), located immediately downstream of the Crossing, indicate a 1% AEP discharge of 2,206 cfs in a 2007 inspection report and 1,504 cfs in a 2020 data sheet.

Based on the quality of available data, VHB selected USGS SIR 2008-5026 regression calculations as the most appropriate estimate for flood discharges at the Crossing location. As a check on this estimate, the downstream USGS gage data (adjusted for drainage area) and NHDES Dam Bureau hydrologic data provide comparable results within the range of standard error for SIR 2008-5026 regression. However, the FIS 1% AEP discharge is a clear outlier and is outside of the range of standard error. As noted above, this discrepancy could be due to the shorter period of record from the original 1978 study used for the FIS, or due to poor input data; if using the same methodology as indicated by the FIS (USGS WRI 78-47) but with the watershed parameters determined using StreamStats, calculated discharges are much closer to the selected method.

As a Tier 2 highway, the design flood for NH Route 202 is the 1% Annual Exceedance Probability (AEP), or "100-year" event. **Table 1** presents a summary of hydrology; detailed hydrologic calculations are included in **Appendix A. Figure 1** (attached) shows the contributing watershed of the Contoocook River for the study area.

Table 1 Hydrology: Contoocook River at Contoocook River Dam (Main Street)

Flood Annual Exceedance Probability (AEP)	USGS SIR 2008-5026 Regression Peak Discharge (cfs)	Gage Transfer from USGS Gage 01082000 (cfs)	NHDES Dam Bureau Dam 124.03 Records (cfs)	FIS Peak Discharge (cfs)
50% AEP (2-year flood)	**467**	*560*		
20% AEP (5-year flood)	**736**	*844*		
10% AEP (10-year flood)	**953**	*1,064*		
40% AEP (25-year flood)	**1,230**	*1,358*		
2% AEP (50-year flood)	**1,460**	*1,599*	2,060	
1% AEP (100-year flood)	**1,740**	*1,873*	1,506/2,206	2,970
0.2% AEP (500-year flood)	**2,390**	*2,551*		

Source: USGS Streamstats 4.6, USGS SIR 2008-5206, USGS Gage 01082000, 2006 Chesire County FIS
1. USGS gage 01082000 watershed is 64.7 mi^2, 227% of watershed at Crossing location

Hydraulic Analysis Methodology

Using bathymetric survey of the Contoocook River collected by VHB in September 2021, supplemented by 2015 NH GRANIT LiDAR digital terrain model, and 1938 NHDOT design plans of the Route 202/Main Street bridge and adjacent Contoocook River Dam (D124.003), VHB developed a hydraulic model of the Contoocook River using the US Army Corps of Engineers (USACE) Hydraulic Engineering Center River Analysis System (HEC-RAS) software. The model extends approximately 500 feet downstream (FIS Published Cross-Section AN) and 600 feet upstream of the proposed crossing and includes the downstream Dam D124.003 and Main Street Bridge structures to quantify tailwater impacts

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of the dam on the hydraulics of the proposed crossing. The Contoocook River Dam (D124.003) includes a 33-foot-wide spillway and two 7.5-foot-wide by 6.5-foot-tall gates; these gates are normally closed and the model assumes a closed gate condition with all flow passing the dam via the spillway or overtopping the dam abutments. The geometry of the dam and attached Main Street Bridge are modeled from 1938 plan geometry with elevations verified by VHB field survey. It should be noted that the surveyed spillway elevation crest is approximately 0.3 feet lower than the elevation depicted in the Cheshire County FIS flood profile; the dam headwater elevation is similarly calculated to be 0.3 feet higher for the 1% AEP FIS discharge flow.

No hydraulic design data for the dam is available; the spillway of the dam is similar to an ogee-shape, but the spillway curve is more semicircular than parabolic in shape. Additionally, there are steel pipes embedded at regular intervals along the crest of the spillway for the purpose of securing flashboards. NHDES Dam Bureau records and the Cheshire County FIS both assume a lower spillway discharge coefficient (3.3) instead of an ogee coefficient (3.9). Given the lack of spillway design data and suboptimal spillway geometry, this analysis retains the 3.3 spillway discharge coefficient of earlier studies. This assumption predicts a design (1% AEP) dam headwater approximately 0.6 feet higher than for a true ogee spillway.

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 inline structures 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 Contoocook River channel is clean and straight with no significant pools, brush, or stones. Values for paved roadways and parking lots assumes some debris from cars. 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
Contoocook River Channel	0.03
Roadways/Parking Lots	0.025
Wooded Areas	0.09
Grassed Areas	0.04
Emergent Wetlands	0.06

Source: Chow (1959), aerial imagery

The Contoocook River Dam (D124.003) is a "run-of-the-river" dam and does not provide appreciable flood storage; the 13-acre dam impoundment extends approximately 5,800 feet upstream to the Contoocook Lake Dam (D124.002) and is limited to the river channel and adjacent bank areas. NHDES Dam Bureau records for the Contoocook River Dam (D124.003) estimate impoundment storage to be 15 acre-feet at normal pool elevation and 60 acre-feet at the top of the dam; this storage volume corresponds to less than 30 minutes of flow at peak 1% flood flow rates.

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Therefore, flood storage effects are not expected to be significant and a steady-state model assumption is appropriate for this crossing.

Using the existing conditions model geometry as a base, VHB developed an additional model representing the proposed 92-foot single-span bridge. **Figure 2** (attached) shows the domain of the HEC-RAS model; detailed HEC-RAS model outputs are included in **Appendix B.**

Hydraulic Analysis Results

Hydraulic model results indicate that the proposed 92-foot span bridge would result in no noticeable change in flood elevations in the Contoocook River upstream (south) of the crossing compared to existing conditions. Model results also indicate that tailwater effects from the Contoocook River Dam (D124.003) are the primary factor influencing water elevations at the crossing. The proposed structure has been designed to provide a minimum 3.5 foot of freeboard during the 100-year storm event at the lowest elevation of the bridge low chord: 1013.6 ft at the right (east) abutment face.

The proposed structure spans the entire channel and nearly the entire 1% AEP floodplain with no proposed impacts within the channel. A maximum increase of 0.02 feet is identified when using the HEC-RAS bridge crossing contraction/expansion coefficients of 0.3/0.5 for bounding bridge cross-sections instead of standard 0.1/0.3; if these higher coefficients are not used model results show no change in design flood elevation. Given that the proposed structure does not contract the river channel or floodplain these 0.3/0.5 coefficients are conservatively high for the proposed crossing. **Table 3** below provides a summary of model results for the design 1% AEP flood event and 0.2% AEP scour check flood event:

Table 3 NH Route 202 – Contoocook River Hydraulic Analysis Results

	Existing Conditions	Proposed 92-ft span Bridge
Drainage Area (mi^2)	29.85	
Bridge Waterway Opening (sf)	N/A	960
1% AEP Design Flood Discharge (cfs)	1,740	
1% AEP Design Flood Elevation (ft)	1010.1	1010.1
1% AEP Design Flood Velocity (fps)	3.2	3.1
1% AEP Design Flood Freeboard (ft)	N/A	3.5
0.2% AEP Check Flood Discharge (cfs)	2,390	
0.2% AEP Check Flood Elevation (ft)	1011.1	1011.1
0.2% AEP Check Flood Velocity (fps)	3.8	3.8

Source: VHB HEC-RAS model. Headwater measured at model station 683 (75 ft upstream of culvert), velocity measured in main channel at internal bridge model station 606 BRU. Freeboard is measured as the difference between the headwater elevation and the lowest elevation of the bridge low chord.

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Scour Analysis

As a Tier 2 highway, the design scour and check scour events for the proposed NH Route 202 crossing are the 1% AEP and 0.2% AEP, respectively. As there is no existing structure at the crossing location, there is no history of scour. Historic aerial photographs show no change in channel alignment dating to 1998 and historic USGS maps show no noticeable change in channel alignment to 1936, the oldest available map after downstream dam was constructed. 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 September 2021 indicate alluvial sand deposits over glacial till underlain by bedrock. There is no boring data available within the channel but the streambed material is assumed to be similar to that of overbank areas. VHB evaluated scour for a range of D_{50} values corresponding to sand (0.075 to 4.75 mm); the values presented below assume the minimum particle size for sand.

The proposed bridge span is slightly wider than the upstream bankfull channel, with abutments set back approximately 10 ft from the ordinary high water (OHW) of the Contoocook River. Given the historic stability of the river channel and this high setback distance, 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 above the bottom of proposed footings, assumed to be elevation 1000.0 ft. The finish grade around proposed bridge abutments will be protected with Class III riprap armoring. VHB evaluated predicted design and check scour events based on FHWA HEC-23 methodology, confirming Class III riprap sizing is appropriate. **Table 4** provides a summary of scour calculations; detailed HEC-18 scour calculations and HEC-23 riprap sizing calculations are provided in **Appendix C.**

Table 4 NH Route 202 – Contoocook River Scour Analysis Results

	Channel	Left (West) Abutment	Right (East) Abutment
1% AEP Design Scour Depth (ft)	1.1	5.1	5.1
1% AEP Design Scour Elevation (ft)	1000.7	1002.9	1002.9
0.2% AEP Check Scour Depth (ft)	1.2	5.1	5.1
0.2% AEP Check Scour Elevation (ft)	1000.6	1002.9	1002.9

Source: VHB HEC-18 calculations. Channel scour depths are from general contraction scour equations, abutment scour depths are from NCHRP 24-20 scour equations. Contraction scour depth is measured at the channel thalweg; abutment scour depths are measured from finish grade at the face of abutments, assumed to be elevation 1008.0 ft. Bottom of abutment footing elevation assumed to be 1000.0 ft at both abutments.

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Hydraulic Data Table for Bridge General Plan:

HYDRAULIC DATA	
Drainage Area	29.85 sq. mi.
Design Flood Discharge (100-yr)	1,740 cfs
Design Flood Elevation (100-yr)	1010.1 feet
Design Flood Velocity (100-yr)	3.1 fps
Scour Check Discharge (500-yr)	2,390
Anticipated Depth of Scour (100-yr)	5.1 ft at Right (East) Abutment Face
Anticipated Depth of Scour (500-yr)	5.1 ft at Right (East) Abutment Face
Bridge Full Waterway Opening	960 sf

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Figures

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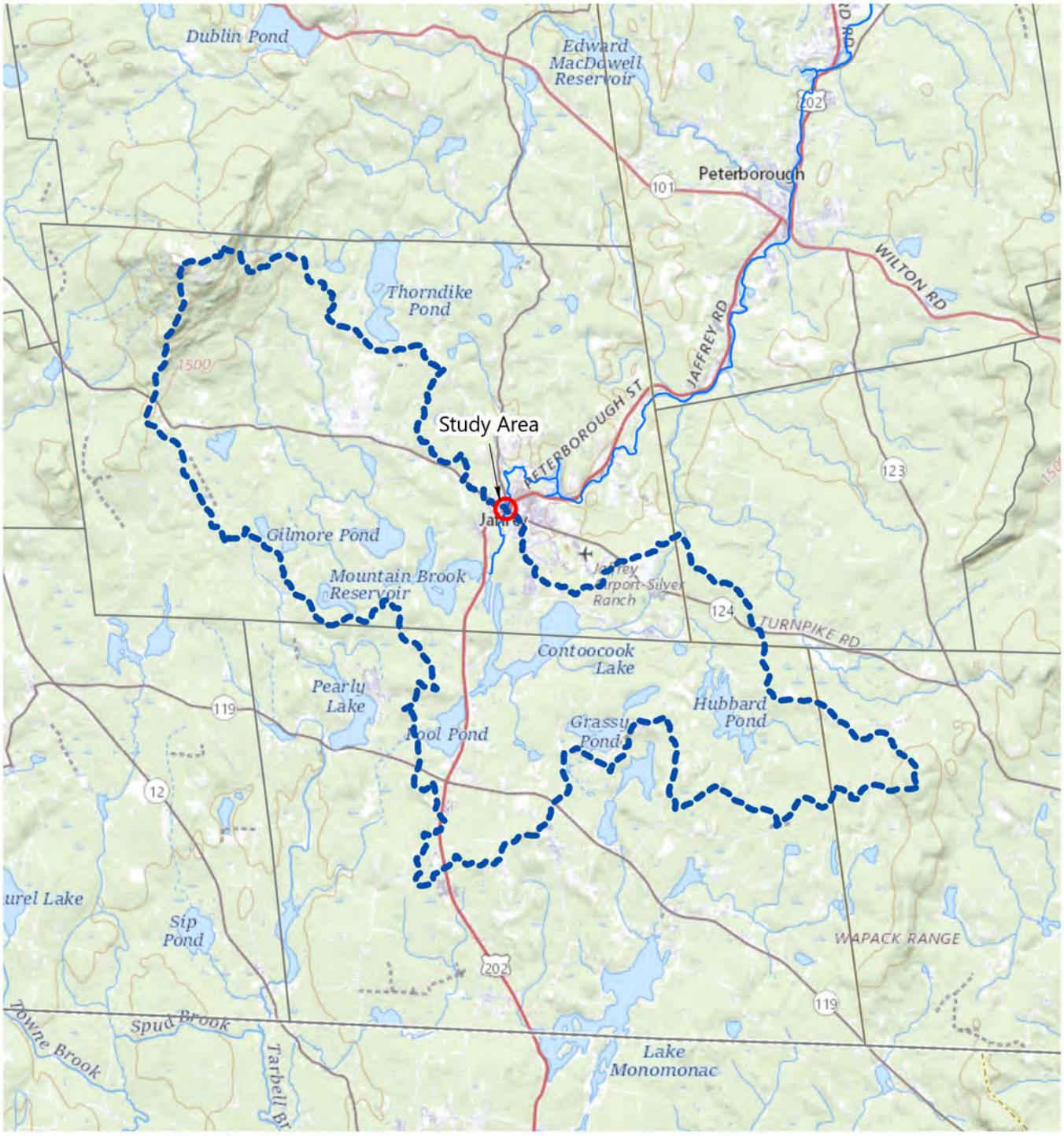
Figure 1: Watershed

Route 202 Bridge over the Contoocook River | Jaffrey, NH



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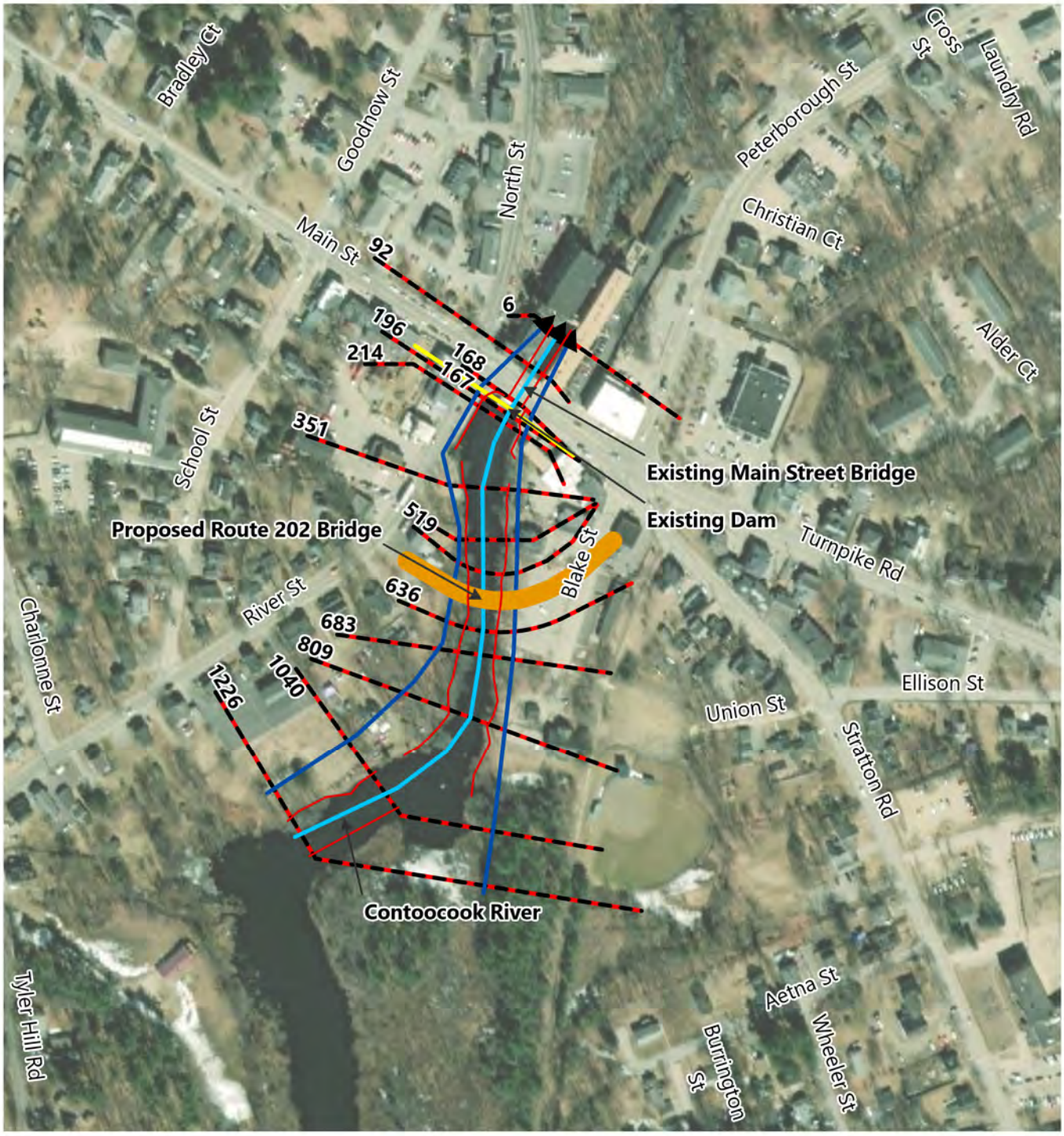
Source: USGS National Map, StreamStats, National Hydrography Dataset

Figure 2: HEC-RAS Model Framework

Route 202 Bridge over the Contoocook River | Jaffrey, NH



Source: ESRI, FEMA, USGS, VHB

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Appendix A: Hydrologic Calculations

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Computations

Project:	**Jaffrey 16307, X-A001(234), Part B**	**Project #:**	**52792.00**
Location:	**Jaffrey, NH**	**Sheet:**	**11 of 1**
Calculated by:	**DWC**	**Date:**	**9/28/2021**
Checked by:	**JSA**	**Date:**	**11/8/2021**
Title:	**Contoocook River Hydrology Calculations**		

Hydrologic Calculations - USGS SIR 2008-5206, Estimation of Flood Discharges at Selected Recurrence Intervals for Streams in New Hampshire

Goal: estimate flood flow discharges for Contoocook River at proposed Rt 202 crossing by area-adjusted transfer of downstream USGS Streamgage 01082000

Hydrology at Rt 202 Crossing calculated by regression:

Flood Frequency Event		Flow (cfs)
Q2	50% AEP	467
Q5	20% AEP	736
Q10	10% AEP	953
Q25	4% AEP	1230
Q50	2% AEP	1460
Q100	1% AEP	1740
Q500	0.2% AEP	2390

$$Q_2 = 2.60A^{0.958}P^{1.50}10^{-0.0245(W)}S^{0.205}, \quad (3)$$

$$Q_5 = 3.23A^{0.929}P^{1.73}10^{-0.0245(W)}S^{0.211}, \quad (4)$$

$$Q_{10} = 3.88A^{0.912}P^{1.83}10^{-0.0247(W)}S^{0.211}, \quad (5)$$

$$Q_{25} = 4.99A^{0.892}P^{1.90}10^{-0.0250(W)}S^{0.207}, \quad (6)$$

$$Q_{50} = 5.96A^{0.879}P^{1.94}10^{-0.0252(W)}S^{0.203}, \quad (7)$$

$$Q_{100} = 7.13A^{0.867}P^{1.98}10^{-0.0254(W)}S^{0.198}, \text{ and} \quad (8)$$

$$Q_{500} = 10.6A^{0.841}P^{2.03}10^{-0.0259(W)}S^{0.183}, \quad (9)$$

where

Q_T is the estimated flood discharge, in cubic feet per second, at a T-year recurrence interval;

A is the drainage area of the basin, in square miles, computed using the ArcHydro software (Environmental Systems Research Institute, Inc., 2008) (boundaries were from the Watershed Boundary Dataset (Natural Resources Conservation Service, 2001) or digitized manually when a basin boundary was not defined by this GIS coverage);

P is the basinwide mean of the average April precipitation, in inches, determined with the PRISM 1971–2000 April precipitation dataset (PRISM Group, Oregon State University, 2006c) resampled with bilinear interpolation to a 180-ft-cell resolution;

W is the percentage of the basin with land cover categorized as wetland from the National Land Cover Data (Multi-Resolution Land Characteristics Consortium, 2003) using a GIS. Waterbody areas from the National Hydrography Dataset (U.S. Geological Survey, 2007b), which include lakes, ponds, and swamps, were used in areas north of the New Hampshire-Quebec border where the National Land Cover Data does not extend; and

S is the slope of the main channel, in feet per mile, determined between points 10- and 85-percent up the main channel from the selected stream site extended to the drainage divide using the ArcHydro software (Environmental Systems Research Institute, Inc., 2008) and elevation datasets derived from the National Elevation Dataset (U.S. Geological Survey, 2007a).

Watershed parameters at Streamgage 01082000:

Au	(mi2)	29.85	
Ag	(mi2)	67.40	
a		**0.44**	**OUTSIDE OF 0.5-1.5 RANGE;**
P	(in)	3.97	**USE ONLY AS A CHECK**
W	%	10.20	
S	(ft/mi)	21.80	
N	(years)	59	
E	(years)	59	

Area-Adjusted hydrology (gage transfer) at Rt 202 grossing from weighted Streamgage 01082000 hydrology using USGS SIR 2008-5206 methodology:

Flood Frequency Event		QT,s(g)	QT,r(g)	Delta (%)	QT,r(w)	QT,r(u)	m	c	QT,u	**Q transfer**
Q2	50% AEP	1300	1229	94.53%	1264	467	0.1486249	0.183178777	1089	**560**
Q5	20% AEP	1920	1890	98.43%	1905	736	0.1448719	0.154557283	1680	**844**
Q10	10% AEP	2390	2415	101.03%	2402	953	0.1428083	0.136542505	2149	**1064**
Q25	4% AEP	3050	3083	101.09%	3067	1230	0.1411758	0.134492805	2748	**1358**
Q50	2% AEP	3600	3622	100.61%	3611	1460	0.1395782	0.135823665	3233	**1599**
Q100	1% AEP	4190	4267	101.83%	4228	1740	0.1377821	0.126666933	3814	**1873**
Q500	0.2% AEP	5770	5748	99.62%	5759	2390	0.1348057	0.137158844	5150	**2551**

$$Q_{T,u} = Q_{T,w}\left[\frac{A_u}{A_g}\right]^c. \quad (19)$$

$$c = m + \frac{\log_{10}\left(Q_{T,r(g)} / Q_{T,w}\right)}{\log_{10}(a)}, \quad (18)$$

$$\log_{10}Q_{T,w} = \frac{(N)\log_{10}Q_{T,s} + (E)\log_{10}Q_{T,r(g)}}{N+E}, \quad (16)$$

$$m = \frac{\log_{10}\left(Q_{T,r(u)} / Q_{T,r(g)}\right)}{\log_{10}\left(A_u / A_g\right)}, \quad (17)$$

where

$Q_{T,r(u)}$ is the flood-discharge estimate at the T-year recurrence interval generated using the regression equation for the ungaged site,

$Q_{T,r(g)}$ is the flood-discharge estimate at the T-year recurrence interval generated using the regression equation for the streamgage,

A_u is the drainage area of the ungaged site, and

A_g is the drainage area at the streamgage.

Computations

Project:	Jaffrey 16307, X-A001(234), Part B	**Project #:**	52792.00
Location:	Jaffrey, NH	**Sheet:**	2
Calculated by:	DWC	**Date:**	9/28/2021
Checked by:	JSA	**Date:**	11/8/2021
Title:	Contoocook River Hydrology Calculations		

Hydrologic Calculations - USGS SIR 2008-5206, Estimation of Flood Discharges at Selected Recurrence Intervals for Streams in New Hampshire

Goal: determine appropriate flood flow discharges for Contoocook River at proposed Rt 202 crossing

$$Q_2 = 2.60A^{0.958}P^{1.50}10^{-0.0245(W)}S^{0.205}, \quad (3)$$

$$Q_5 = 3.23A^{0.929}P^{1.73}10^{-0.0245(W)}S^{0.211}, \quad (4)$$

$$Q_{10} = 3.88A^{0.912}P^{1.83}10^{-0.0247(W)}S^{0.211}, \quad (5)$$

$$Q_{25} = 4.99A^{0.892}P^{1.90}10^{-0.0250(W)}S^{0.207}, \quad (6)$$

$$Q_{50} = 5.96A^{0.879}P^{1.94}10^{-0.0252(W)}S^{0.203}, \quad (7)$$

$$Q_{100} = 7.13A^{0.867}P^{1.98}10^{-0.0254(W)}S^{0.198}, \text{ and} \quad (8)$$

$$Q_{500} = 10.6A^{0.841}P^{2.03}10^{-0.0259(W)}S^{0.183}, \quad (9)$$

where

Q_T is the estimated flood discharge, in cubic feet per second, at a T-year recurrence interval;

A is the drainage area of the basin, in square miles, computed using the ArcHydro software (Environmental Systems Research Institute, Inc., 2008) (boundaries were from the Watershed Boundary Dataset (Natural Resources Conservation Service, 2001) or digitized manually when a basin boundary was not defined by this GIS coverage);

P is the basinwide mean of the average April precipitation, in inches, determined with the PRISM 1971–2000 April precipitation dataset (PRISM Group, Oregon State University, 2006c) resampled with bilinear interpolation to a 180-ft-cell resolution;

W is the percentage of the basin with land cover categorized as wetland from the National Land Cover Data (Multi-Resolution Land Characteristics Consortium, 2003) using a GIS. Waterbody areas from the National Hydrography Dataset (U.S. Geological Survey, 2007b), which include lakes, ponds, and swamps, were used in areas north of the New Hampshire-Quebec border where the National Land Cover Data does not extend; and

S is the slope of the main channel, in feet per mile, determined between points 10- and 85-percent up the main channel from the selected stream site extended to the drainage divide using the ArcHydro software (Environmental Systems Research Institute, Inc., 2008) and elevation datasets derived from the National Elevation Dataset (U.S. Geological Survey, 2007a).

Values from StreamStats:

A (mi2)	29.85
p (in)	3.995
W (%)	13.4987
S (ft/ft)	20.7

Calculate regression flows, including low- and high- estimates for Standard Error (68% confidence) and Prediction Interval (90% confidence) ranges

Flood Frequency Event		Flow (cfs)	PI Lower (90% confidence)	PI Upper (90% Confidence)	Standard Error (%)	Standard Error (log)	S_{neg} (%)	S_{pos} (%)	SE Lower (68% Confidence)	SE Upper (68% Confidence)
Q2	50% AEP	467	287	759	30.10%	0.114277297	-23.14%	30.10%	359	608
Q5	20% AEP	736	448	1210	31.10%	0.117602692	-23.72%	31.10%	561	965
Q10	10% AEP	953	569	1600	32.30%	0.121559844	-24.41%	32.30%	720	1261
Q25	4% AEP	1230	711	2130	34.30%	0.128076013	-25.54%	34.30%	916	1652
Q50	2% AEP	1460	819	2600	36.40%	0.13481437	-26.69%	36.40%	1070	1991
Q100	1% AEP	1740	944	3210	38.60%	0.14176323	-27.85%	38.60%	1255	2412
Q500	0.2% AEP	2390	1200	4770	44.10%	0.158663981	-30.60%	44.10%	1659	3444

$$S_{pos} = 100\left(10^{SE_{pred}} - 1\right), \text{ and} \quad (11)$$

$$S_{neg} = 100\left(10^{-SE_{pred}} - 1\right), \quad (12)$$

where

S_{pos} is the positive percent error of prediction,

SE_{pred} is the standard error of prediction in logarithmic units, and

S_{neg} is the negative percent error of prediction.

Computations

Project:	Jaffrey 16307, X-A001(234), Part B	**Project #:**	52792.00
Location:	Jaffrey, NH	**Sheet:**	2
Calculated by:	DWC	**Date:**	9/28/2021
Checked by:	JSA	**Date:**	11/8/2021
Title:	Contoocook River Hydrology Calculations		

Hydrologic Calculations - USGS SIR 2008-5206, Estimation of Flood Discharges at Selected Recurrence Intervals for Streams in New Hampshire

Re-calculate hydrology from FEMA FIS using 1978 methodology and 2021 watershed data:

USGS WRI 78-47 (source of data from FEMA FIS)

A (mi2)	29.85	2021 StreamStats
S (ft/mi)	20.7	2021 StreamStats
I (in)	2.92	2021 NOAA Atlas 14

Event		Flow (cfs)
Q2	50% AEP	568
Q5	20% AEP	849
Q10	10% AEP	1034
Q25	4% AEP	1393
Q50	2% AEP	1641
Q100	1% AEP	1958

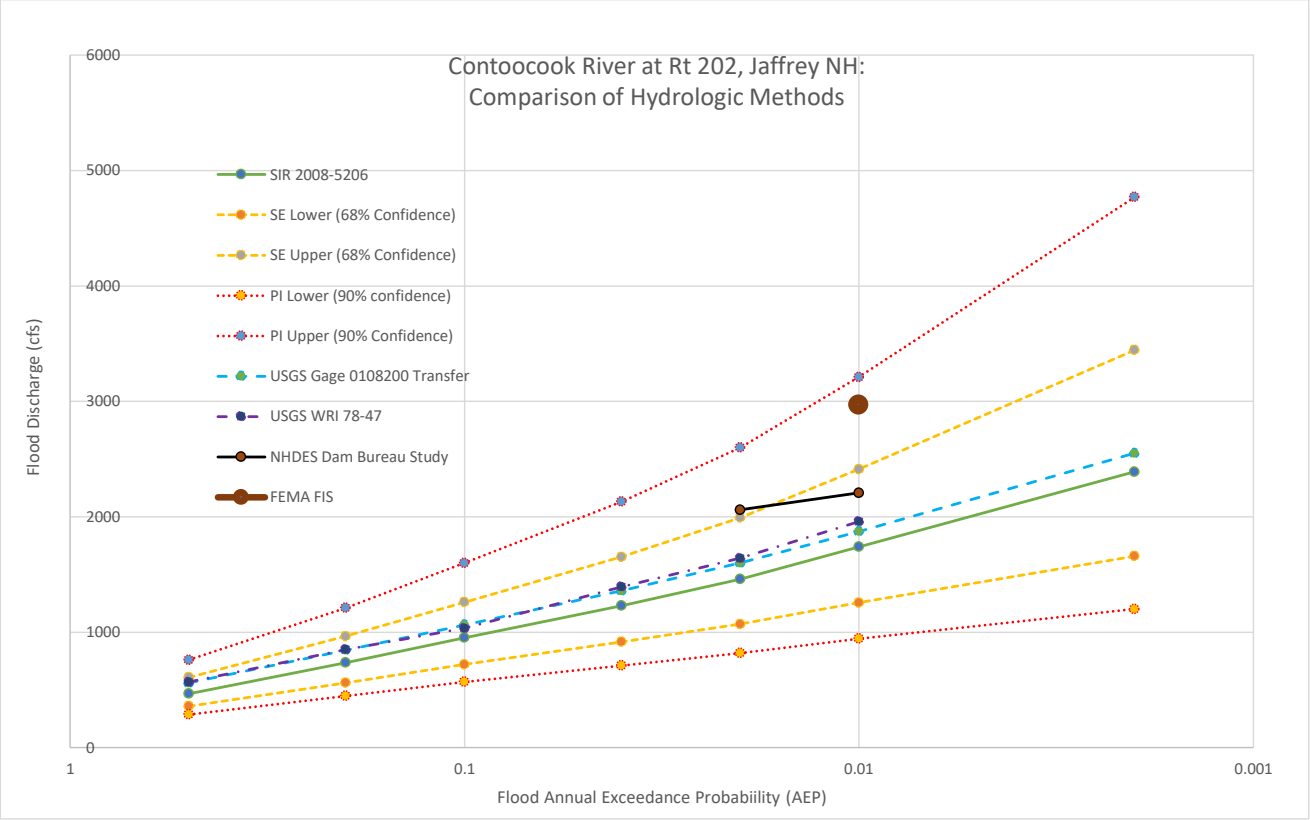
$$P_2 = 1.34A^{1.06}S^{0.37}I^{1.24},$$
$$P_5 = 1.00A^{1.06}S^{0.44}I^{1.69},$$
$$P_{10} = 0.84A^{1.06}S^{0.46}I^{1.98},$$
$$P_{25} = 0.70A^{1.05}S^{0.52}I^{2.29},$$
$$P_{50} = 0.62A^{1.05}S^{0.54}I^{2.50},$$
$$P_{100} = 0.55A^{1.05}S^{0.56}I^{2.72},$$

where

P_t is the peak discharge, in cubic feet per second, for the specified recurrence interval t, in years,
A is the drainage area, in square miles,
S is the main-channel slope, in feet per mile, and
I is the maximum 24-hour precipitation having a recurrence interval of 2 years, expressed in inches.

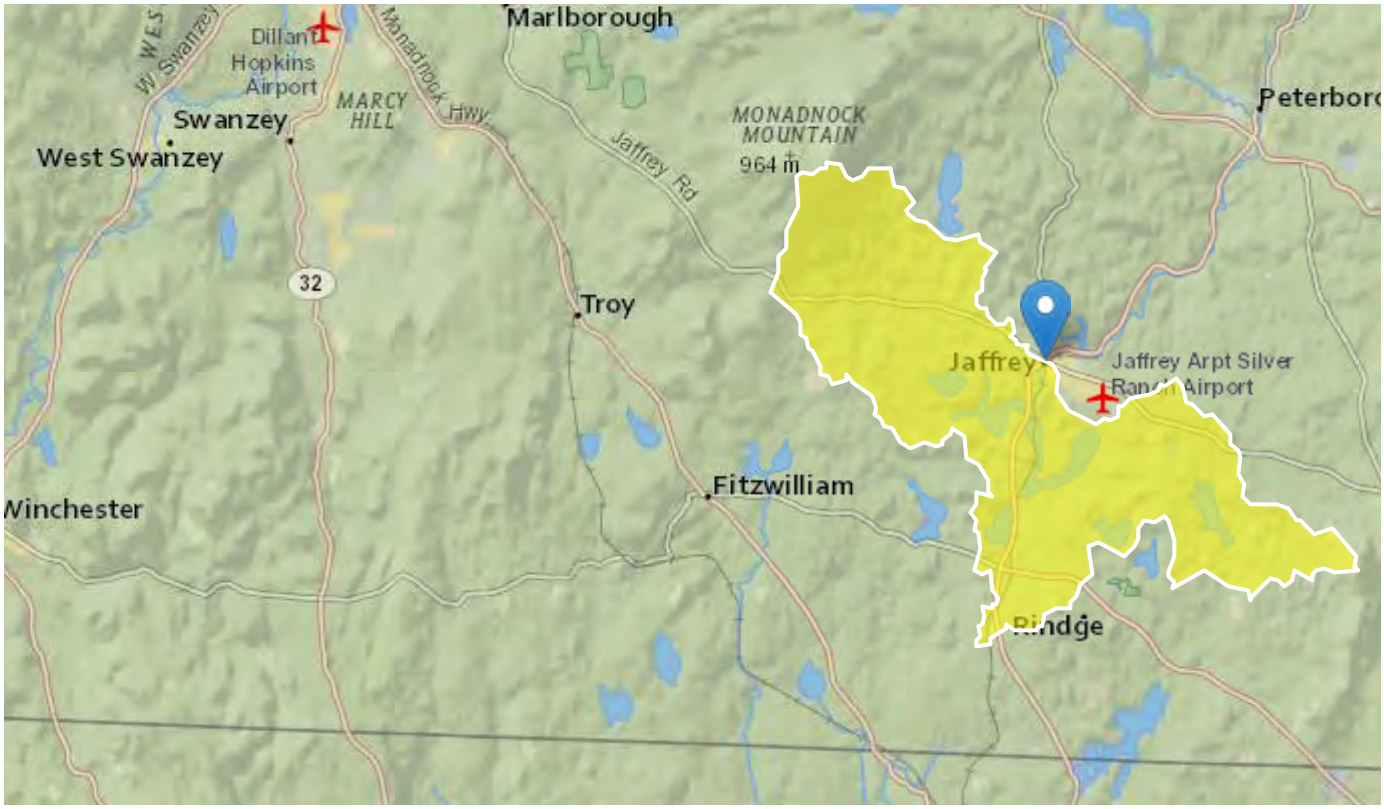
Comparison of Flows for Selected and Check Methods:

Flood Frequency Event		SIR 2008-5206	SE Lower (68% Confidence)	SE Upper (68% Confidence)	PI Lower (90% confidence)	PI Upper (90% Confidence)	USGS Gage 0108200 Transfer	USGS WRI 78-47	NHDES Dam Bureau Study	FEMA FIS
Q2	50% AEP	**467**	*359*	*608*	*287*	*759*	560	568		
Q5	20% AEP	**736**	*561*	*965*	*448*	*1210*	844	849		
Q10	10% AEP	**953**	*720*	*1261*	*569*	*1600*	1064	1034		
Q25	4% AEP	**1230**	*916*	*1652*	*711*	*2130*	1358	1393		
Q50	2% AEP	**1460**	*1070*	*1991*	*819*	*2600*	1599	1641	2060	
Q100	1% AEP	**1740**	*1255*	*2412*	*944*	*3210*	1873	1958	2206	2970
Q500	0.2% AEP	**2390**	*1659*	*3444*	*1200*	*4770*	2551			



StreamStats Report - Contoocook River at Contoocook River Dam (Main St), Jaffrey New Hampshire

Region ID: NH
Workspace ID: NH20210909192326934000
Clicked Point (Latitude, Longitude): 42.81470, -72.02319
Time: 2021-09-09 15:23:46 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	29.85	square miles
APRAVPRE	Mean April Precipitation	3.995	inches
WETLAND	Percentage of Wetlands	13.4987	percent

Parameter Code	Parameter Description	Value	Unit
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	20.7	feet per mi
BSLDEM30M	Mean basin slope computed from 30 m DEM	7.914	percent
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	886323.2	meters
CENTROIDY	Basin centroid vertical (y) location in state plane units	109967.2	meters
CONIF	Percentaqe of land surface covered by coniferous forest	18.4609	percent
ELEVMAX	Maximum basin elevation	3122.591	feet
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	8.35	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	1.45	percent
MINTEMP_W	Mean winter minimum air temperature over basin surface area	13.733	degrees F
MIXFOR	Percentage of land area covered by mixed deciduous and coniferous forest	25.8193	percent
OUTLETX	Basin outlet horizontal (x) location in state plane coordinates	888585	feet
OUTLETY	Basin outlet vertical (y) location in state plane coordinates	114885	feet
PREBC0103	Mean annual precipitation of basin centroid for January 1 to March 15 winter period	8.31	inches
PREBC_1112	Mean annual precipitation of basin centroid for November 1 to December 31 period	7.95	inches
PRECIPCENT	Mean Annual Precip at Basin Centroid	44.1	inches
PRECIPOUT	Mean annual precip at the stream outlet (based on annual PRISM precip data in inches from 1971-2000)	44.9	inches
PREG_03_05	Mean precipitation at gaging station location for March 16 to May 31 spring period	9.4	inches
PREG_06_10	Mean precipitation at gaging station location for June to October summer period	18.7	inches
SNOFALL	Mean Annual Snowfall	74.156	inches
TEMP	Mean Annual Temperature	44.059	degrees F

Parameter Code	Parameter Description	Value	Unit
TEMP_06_10	Basinwide average temperature for June to October summer period	59.719	degrees F

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

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	29.85	square miles	0.7	1290
APRAVPRE	Mean April Precipitation	3.995	inches	2.79	6.23
WETLAND	Percent Wetlands	13.4987	percent	0	21.8
CSL10_85	Stream Slope 10 and 85 Method	20.7	feet per mi	5.43	543

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

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

Statistic	Value	Unit	PIl	PIu	ASEp	Equiv. Yrs.
50-percent AEP flood	467	ft^3/s	287	759	30.1	3.2
20-percent AEP flood	736	ft^3/s	448	1210	31.1	4.7
10-percent AEP flood	953	ft^3/s	569	1600	32.3	6.2
4-percent AEP flood	1230	ft^3/s	711	2130	34.3	8
2-percent AEP flood	1460	ft^3/s	819	2600	36.4	9
1-percent AEP flood	1740	ft^3/s	944	3210	38.6	9.8
0.2-percent AEP flood	2390	ft^3/s	1200	4770	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/)

Bankfull Statistics Parameters [Appalachian Highlands D Bieger 2015]

StreamStats Data-Collection Station Report

USGS Station Number	**01082000**
Station Name	**CONTOOCOOK RIVER AT PETERBOROUGH, NH**

Click here to link to available data on NWIS-Web for this site.

Descriptive Information

Station Type	Streamgage, continuous record
Location	Lat 42°51'45", long 71°57'35" referenced to North American Datum of 1927, Hillsborough County, NH, Hydrologic Unit 01070003, on left bank, 1,200 ft downstream from Noone falls mill dam, 0.3 mi northeast of Noone, NH, 1.2 mi south of Town Hall in Peterborough, and 1.3 mi upstream from Nubanusit Brook.
Gage	Water-stage recorder. The datum of gage is 731.25 ft above North American Vertical Datum of 1988.
Regulation and Diversions	The normal flow is regulated by Noones Mills 1,200 ft upstream which had been operated by Ken King ((603) 924-7275) but which is now being operated by Cobbs ((603) 924-9980).
Regulated?	True
Period of Record	1946-1977, 2001-2013
Remarks	Flow regulated by mill and reservoirs upstream regulation greater prior to 1965.
Latitude (degrees NAD83)	42.86258
Longitude (degrees NAD83)	-71.95924
Hydrologic unit code	01070003
County	011-Hillsborough
HCDN2009	No

Physical Characteristics

Characteristic Name	Value	Units	Citation Number
Descriptive Information			
Datum_of_Latitude_Longitude	NAD83	dimensionless	30
District_Code	33	dimensionless	30
Begin_date_of_record	7/7/1945	days	41
End_date_of_record	9/30/2003	days	41
Number_of_days_of_record	12504	days	41
Number_of_days_GT_0	12504	days	41
Precipitation Statistics			
24_Hour_2_Year_Precipitation	3.2000	inches	31
Mean_Annual_Precipitation	46.000	inches	31
Mean_April_Precipitation	3.973405	inches	89
Mean_Annual_Precip_PRISM_1981_2010	48.3	inches	262
Climate Characteristics			
Mean_Annual_Snowfall	70.000	inches	31
Temperature Statistics			
Mean_Min_January_Temperature	11.000	degrees F	31
Topographical Characteristics			
Mean_Basin_Elevation	1170.00	feet	31
Land Cover Characteristics			
Percent_Forest	93.000	percent	31
Percent_Lakes_and_Ponds	2.8000	percent	31
Percent_Storage	8.8100	percent	31
Percent_Storage_from_NLCD2006	10.3	percent	262
Percentage_of_Storage_from_NWI	10.2	percent	89
Soil Properties			
Soil_Infiltration	6.0000	inches	31
Stream Channel Properties			
Main_Channel_Length	14.000	miles	31
Stream_Slope_10_and_85_Method	33.900	feet per mi	31
Stream_Slope_10_and_85_Method_ft_per_mi	21.8	feet per mi	89

Basin Dimensional Characteristics

Contributing_Drainage_Area	68.100	square miles	31
Drainage_Area	67.4	square miles	262

Streamflow Statistics

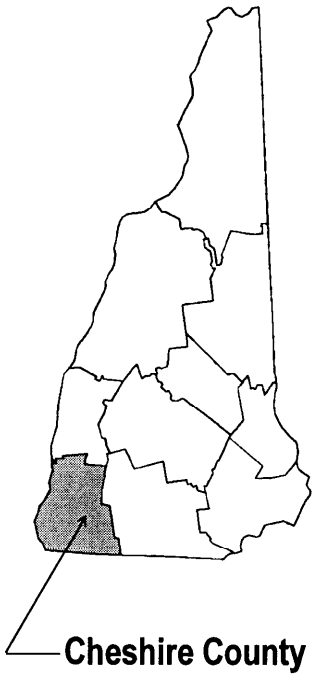
Statistic Name	Value	Units	Citation Number	Preferred?	Years of Record	Standard Error, percent	Variance log-10	Lower 95% Confidence Interval	Upper 95% Confidence Interval	Start Date	End
Peak-Flow Statistics											
42_9_percent_AEP_flood	833.000	cubic feet per second	31	Y							
50_percent_AEP_flood	1320	cubic feet per second	262	Y	63		0.0007				
20_percent_AEP_flood	2000	cubic feet per second	262	Y	63		0.0011				
10_percent_AEP_flood	2530	cubic feet per second	262	Y	63		0.0016				
4_percent_AEP_flood	3300	cubic feet per second	262	Y	63		0.0026				
2_percent_AEP_flood	3950	cubic feet per second	262	Y	63		0.0036				
1_percent_AEP_flood	4670	cubic feet per second	262	Y	63		0.0049				
0_5_percent_AEP_flood	5470	cubic feet per second	262	Y	63		0.0065				
0_2_percent_AEP_flood	6660	cubic feet per second	262	Y	63		0.009				
Regression_est_50_Percent_AEP_flood	1450	cubic feet per second	262	Y		34.8	0.0216				
Regression_est_20_Percent_AEP_flood	2200	cubic feet per second	262	Y		36.1	0.0231				
Regression_est_10_Percent_AEP_flood	2760	cubic feet per second	262	Y		38.6	0.0262				
Regression_est_4_Percent_AEP_flood	3570	cubic feet per second	262	Y		42.5	0.0313				
Regression_est_2_Percent_AEP_flood	4250	cubic feet per second	262	Y		44.9	0.0346				
Regression_est_1_Percent_AEP_flood	4950	cubic feet per second	262	Y		47.3	0.0381				
Regression_est_0_5_Percent_AEP_flood	5740	cubic feet per second	262	Y		50.8	0.0433				
Regression_est_0_2_Percent_AEP_flood	6880	cubic feet per second	262	Y		55.2	0.0502				
Weighted_20_percent_AEP_flood	2010	cubic feet per second	262	Y			0.00105				
Weighted_10_percent_AEP_flood	2540	cubic feet per second	262	Y			1.50791366906475E-03				
Weighted_4_percent_AEP_flood	3320	cubic feet per second	262	Y			2.40058997050148E-03				
Weighted_2_percent_AEP_flood	3980	cubic feet per second	262	Y			3.26073298429319E-03				
Weighted_1_percent_AEP_flood	4700	cubic feet per second	262	Y			4.34162790697674E-03				
Weighted_0_5_percent_AEP_flood	5500	cubic feet per second	262	Y			5.65160642570281E-03				
Weighted_0_2_percent_AEP_flood	6690	cubic feet per second	262	Y			7.63175675675676E-03				
Log_Mean_of_Annual_Peaks	3.0730	Log base 10	31	Y							
Log_STD_of_Annual_Peaks	0.1780	Log base 10	31	Y							
Log_Skew_of_Annual_Peaks	-0.2050	Log base 10	31	Y							
WRC_Mean	3.0730	Log base 10	31	Y							
WRC_STD	0.1780	Log base 10	31	Y							
WRC_Skew	0.4620	Log base 10	31	Y							
Weighted_50_percent_AEP_flood	1320	cubic feet per second	262	Y			6.78026905829596E-04				
Maximum_Peak_Flood	4110	cubic feet per second	262	Y							
Year_of_Maximum_Flood	2007	years	262	Y							

FLOOD INSURANCE STUDY

VOLUME 1 OF 2

CHESHIRE COUNTY, NEW HAMPSHIRE
(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
ALSTEAD, TOWN OF	330020
CHESTERFIELD, TOWN OF	330183
FITZWILLIAM, TOWN OF	330207
GILSUM, TOWN OF	330021
HARRISVILLE, TOWN OF	330212
HINSDALE, TOWN OF	330022
JAFFREY, TOWN OF	330215
KEENE, CITY OF	330023
MARLBOROUGH, TOWN OF	330024
MARLOW, TOWN OF	330025
RICHMOND, TOWN OF	330188
RINDGE, TOWN OF	330189
ROXBURY, TOWN OF	330172
STODDARD, TOWN OF	330195
SULLIVAN, TOWN OF	330233
SURRY, TOWN OF	330170
SWANZEY, TOWN OF	330026
TROY, TOWN OF	330173
WALPOLE, TOWN OF	330027
WESTMORELAND, TOWN OF	330238
WINCHESTER, TOWN OF	330028



MAY 23, 2006

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
33005CV001A

In the other model, peak discharges from the uncontrolled areas were assumed to be 60 percent of the calculated peak discharges. Discharges from Surry Mountain Lake Reservoir were assumed to be zero.

For the Branch River, Beaver Brook, and Ash Swamp Brook, one of the models used peak flood discharges from the uncontrolled drainage areas, and the other used flood discharges at 60 percent of peak discharges. For both conditions, no outflow from Otter Brook Lake was assumed.

Due to the steep gradient at Otter Brook, only one condition was investigated. Peak flood discharges from the uncontrolled drainage area below the confluence of Roaring Brook were used in the analysis. For the reach above Roaring Brook, maximum release rates from Otter Brook were used.

In the September 17, 1997, revision for City of Keene, Black Brook discharges were developed using the hydrologic analysis from the February 1, 1985, FIS and a TR-20 hydrologic analysis for the watershed upstream of West Street, which was developed by the SCS. In the October 5, 2001, FIS, Beaver Brook discharges were developed using TR-20 hydrologic analysis along with hydrologic calculations, using a drainage area-peak discharge relationship.

The flood flow frequency data for Blanchard Brook, Hayward Brook, Mirey Brook, Pauchaug Brook, Rixford Brook, Roaring Brook, Snow Brook, and Wheelock Brook were determined from a method developed by Manuel A. Benson (U.S. Department of the Interior, 1962). This method uses multiple-regression equations to determine peak discharges of 1.2- to 300-year recurrence intervals.

For the Town of Hinsdale, portions of streams studied by detailed methods, the area-ratio technique was applied, based on the assumption that flows along a stream increase or decrease according to the ratio of the drainage area with unknown flows to the drainage area with known flows.

To establish flows on the Minnewawa Brook, Robbins Brook, ungaged Sprauge Brook, and the South Branch Ashuelot River, the SCS method was used (U.S. Department of Agriculture, 1975).

For the Town of Jaffrey, discharge-frequency data for Contoocook River, Mountain Brook, Mead Brook, and Black Reservoir outlet stream studied in detail were determined from equations based on multiple-regression analyses of data from USGS gaged sites in New Hampshire and adjacent areas of bordering states (U.S. Department of the Interior, Geological Survey, 1978). The equations contain the independent variables basin drainage area, main-channel slope, and a precipitation intensity index.

The equation was applied to compute the 100-year flood discharge for the Contoocook River at the corporate limits and for Black Reservoir Outlet Stream at the mouth. Peak discharges for sites upstream from the Contoocook River at the corporate limits and Black Reservoir Outlet Stream at mouth were computed

using the following drainage area adjustment formula (U.S. Geological Survey, A Technique for Estimating the Magnitude and Frequency of Floods in Maine):

$$Q = Q_g (A/A_g)^{0.8}$$

Where Q is the discharge at the upstream site, Q_g is the discharge computed using the regression equations, and A and A_g are the drainage areas at the upstream site and at the site where the regression equation was applied, respectively. The use of this equation assumes that all reservoirs are full prior to flooding and have no significant storage capacity.

For the Town of Rindge, an independent hydrologic analysis was performed for Pool Pond (total drainage area 2.69 square miles) to determine if the 100-year flood stillwater elevation developed for Contoocook Lake is in fact valid for Pool Pond. Pool Pond is hydraulically connected to Contoocook Lake; however, there is a control weir just upstream of the culvert of State Route 202 which controls the normal elevation of the lake. Under normal flow control, Pool Pond is at a higher elevation than Contoocook Lake.

To determine the 100-year flood stillwater elevation of Pool Pond, the USACE HEC-1 computer program (USACE, 1990) was used to develop a rainfall-runoff hydrograph for a 100-year flood event which was then routed through the natural flood storage of the lake using the Modified Puls Method. In order to perform the flood routing analysis in HEC-1, a stage vs. discharge rating curve was developed for the outlet of Pool Pond by analyzing the hydraulic performance of the control weir and a CMP arch culvert under State Route 202 as one steady state backwater system. The hydraulic analysis was done using the USACE HEC-RAS computer program (USACE, 1998).

Based on the independent HEC-1 analysis of Pool Pond, the 100-year flood elevation caused by the inflow into Pool Pond is 1,011.45 feet NAVD; however, Contoocook Lake has a much larger drainage area than Pool Pond and will rise above elevation 1,011.45 at some time after the peak flow occurs in Pool Pond. Peak flooding in Contoocook Lake will result in a backwater condition on Pool Pond where the flood elevation will be approximately equal to that of Contoocook Lake. Therefore, the elevation in the 1998 FIS of 1,012.5 is valid.

For the North Branch Millers River, peak discharges were calculated using regional equations based on multiple regression analysis of data from USGS gaged streams in the Central Region of Massachusetts. The USGS NFF program (U.S. Geological Survey, 1993) was used to perform the actual calculations.

For the Town of Roxbury, discharges on Otter Brook may be caused by backwater from the Branch River or by runoff from the uncontrolled watershed below Otter Brook Reservoir. Due to the steep gradient of Otter Brook, it was determined that backwater from the Branch River would have minimal flooding effects on Otter Brook. Therefore, the peak discharges for the uncontrolled watershed below Otter Brook were used. These discharges were determined from a regional analysis performed by the USACE (USACE, 1955).

TABLE 3 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
BLANCHARD BROOK					
At confluence with Connecticut River	5.1	550	1,270	1,540	2,750
BRANCH RIVER					
Downstream of Beaver Brook	54.3	2,675	4,650	5,800	9,575
Downstream of Otter Brook	42.9	2,270	3,965	4,965	8,290
COLD RIVER					
At confluence with Connecticut River	102	4,260	6,780	8,080	11,710
CONNECTICUT RIVER					
At Hinsdale-Northfield Boundary	6,765	91,300	126,000	144,200	191,700
Vernon Gage (No. 01156500)	6,266	95,700	115,600	122,900	138,100
Confluence of Whestone Brook (Windham, VT)	6,180	94,700	114,500	121,900	137,200
Confluence of West River (Windham, VT)	6,151	94,400	114,200	121,500	137,000
Confluence of Sacketts Brook (Windam, VT)	5,685	89,200	108,400	116,000	132,500
Confluence with Saxtons and Cold Rivers (Windham, VT)	5,555	87,800	106,800	114,400	131,300
Bellows Gage (No. 01154500)	5,493	87,100	106,100	113,700	130,700
CONTOOCOOK RIVER					
At the corporate limits of the Town of Jaffrey	36.6	*	*	3,500	*
Upstream from Tyler Brook	29.8	*	*	2,970	*
At outlet of Contoocook Lake	15.00	*	*	1,710	*
HAYWARD BROOK					
At the confluence with Ashuelot River	2.2	220	580	710	1,400

*Data not available

Initials SW Date 8/10/07

07-010
- LOD -

INSPECTION REPORT

To: Steve N. Doyon, P.E.
Administrator Dam Bureau

Subject: Scheduled Inspection of Contoocook River Dam in Jaffrey
Dam# 124.03

From: Brian A. Desfosses, P.E. BAD
Dam Safety Engineer

Classification: Low Hazard **(Proposed change to "Significant")**

Date: June 13, 2007; Revised August 2, 2007 following downstream review of mill buildings.

PREV YES 1994 our corresp dtd Sept 29 94 advises owner that DES was satisfied w/ response to LOD THIS LOD IS CONSIDERED addressed

OK TO ISSUE NEW LOD?

Pertinent Data:	**(from ACC report dated 12/19/2001)**
Date Inspected:	June 11, 2007
Town:	Jaffrey
Waterbody:	Contoocook River
Maximum Height:	15 ft
Overall Length:	98 ft
Pond Area:	5 ac
Drainage Area:	21.7 mi^2
Storage:	15 ac-ft (normal); 60 ac-ft (top of dam)
50-Year Storm:	2060 cfs
100-Year Storm:	2206 cfs
Discharge Capacity:	2017 cfs (spillway only) w/ 0' FBD
	1600 cfs (spillway only) w/ 1' FBD
	3500 cfs (gates open full) w/ 0' FBD
	3013 cfs (gates open full) w/ 1' FBD
Type of Construction:	Concrete Gravity
Construction Date:	1861 - washed out during the flood of 1938 and reconstructed complete by April 1939
Outlet Works:	Two – 7'w x 6.5'h gates (inverts at elevation 85')
	33' wide spillway with 12" high flashboards (invert of permanent crest at elevation 93')
	(Outlet confirmed 6/11/07 BAD)

Owner/Operator:
Town of Jaffrey
Public Works Department
10 Goodnow Street
Jaffrey, NH 03452
(603) 532 – 6521

Hydrology/Hydraulics: **(from ACC report dated 12/19/2001)**

The discharge capacity of the 33' wide spillway when the water is to the top of the dam (no freeboard) is **2,017 cfs.** An additional 1,480 cfs comes from the two 7' wide by 6.5' high gates when open full. With one foot of freeboard the discharge capacity becomes **1,600 cfs** for the spillway with an additional 1,413 cfs when the two gates are open full.

D124003 CONTOOCOOK RVR DAM 1922-20

The drainage area for this watershed is 21.7 mi^2. Based on a HEC-1 analysis for Mountain Brook Dam, which lies about 1mile upstream of Contoocook River Dam and has a drainage area of 12.2 mi^2, the 100-year flow is 1,270 cfs. Using a weighted average of the drainage areas, this produces a 100-year storm for Contoocook River Dam of **2,206 cfs**.

Analyzing similar watersheds in this area and comparing their 50 and 100 year storms it was found that the 50 year storm is about 93 percent of the 100-year storm. Thus, 93% of the computed 100-year storm of 2,206 cfs, results in a 50-year storm of **2,060 cfs**.

Classification Justification & Downstream Review: "S" (Significant Hazard) – Previously labeled as a Low-Hazard "A"

Failure of the dam during the 50-year storm (4' over the spillway crest) would create a flow of 3,400 cfs, an increase of 1,200 cfs above the base flow. Approximately 200' downstream of the dam, a pedestrian bridge between two old mill structures spans the river. The bridge is supported by a concrete pier, and is about 10' above the riverbed. A breach flow would be about 5' deep in this area.

Further downstream, the river is restricted immediately upstream of Old Peterborough Road. A small parking area was built 8' above the streambed, on a concrete block retaining wall. The depth of flow in this area would be about 6'. The Old Peterborough Road Bridge can safely pass a breach flow.

The calculations for this analysis are included in the file, July 27, 1994.

The Jaffrey Mill is now being converted to Apartments, directly downstream of the dam (within 100' or so). The foundation of this mill structure is a mix of ledge and mortar rubble construction. In the event of a breach flow, these foundations could be subject to scour and pressure on a large scale. Additionally, there is an old stone arch built through the downstream left building, which allows for a free surface under the second basement of the structure. This arch culvert was the outflow for the turbine that served the mill (now removed).

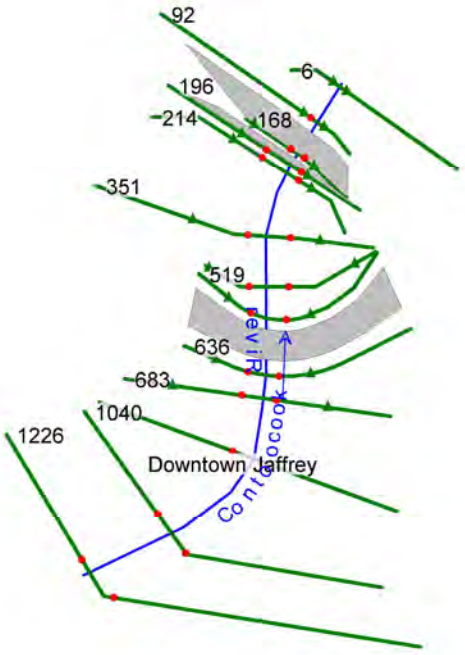
It may be noted that this dam is at the intersection of two NHDOT roads, Route 202 and Route 124. Although it seems as though a breach of the dam would safely pass without incident, the dam is located at a very important intersection.

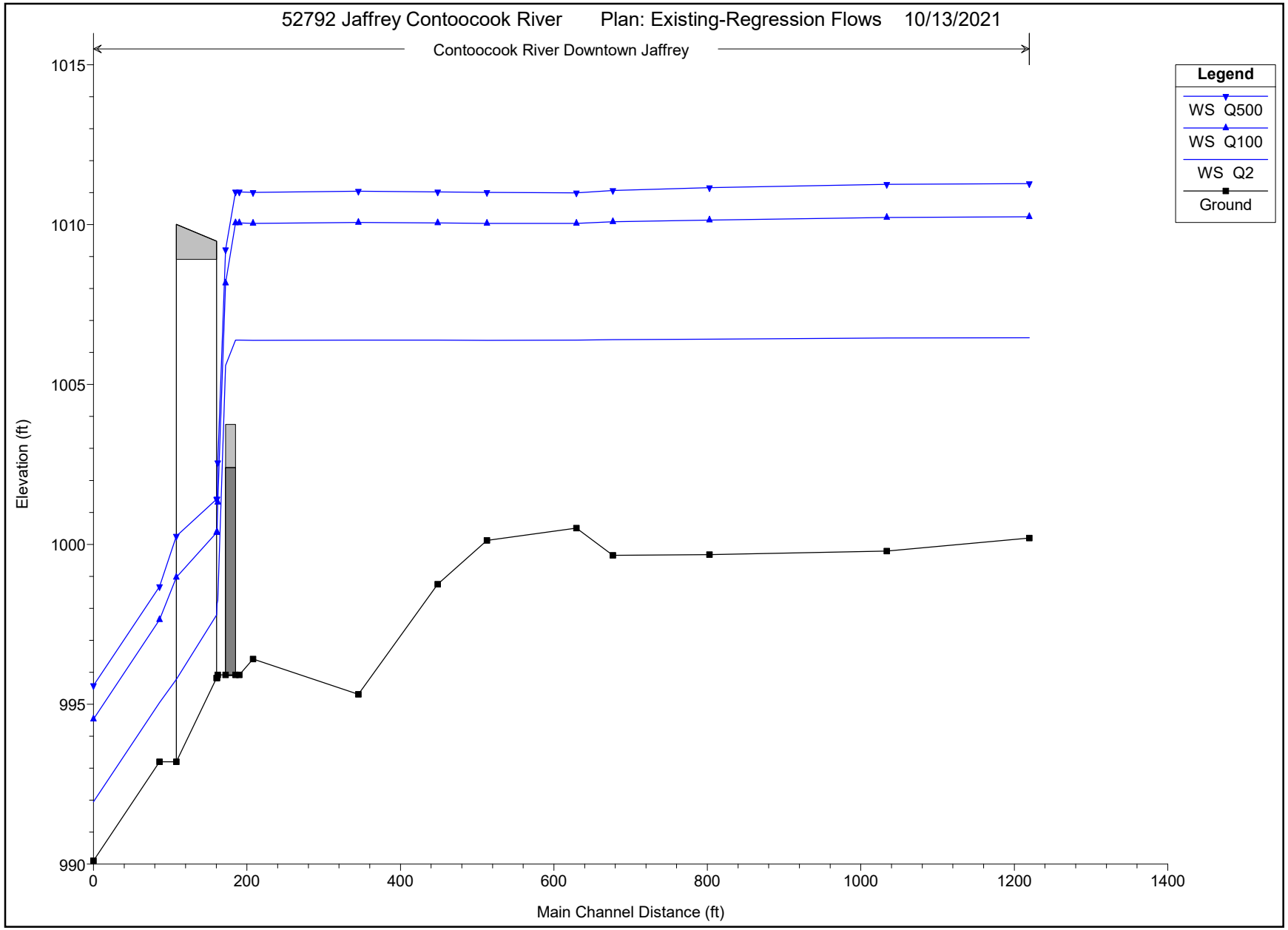
A thorough file review reveals that a dam breach calculation was done in 1994. Failure in the 50-year storm would result in a flow 4' over the spillway crest of 3400 cfs, which is 1200 cfs over the base flow. The breach flow would be about 5' deep in the area of the mills and below the 10' high pedestrian bridge. This flow could significantly undermine and scour both mills and the downstream bridge.

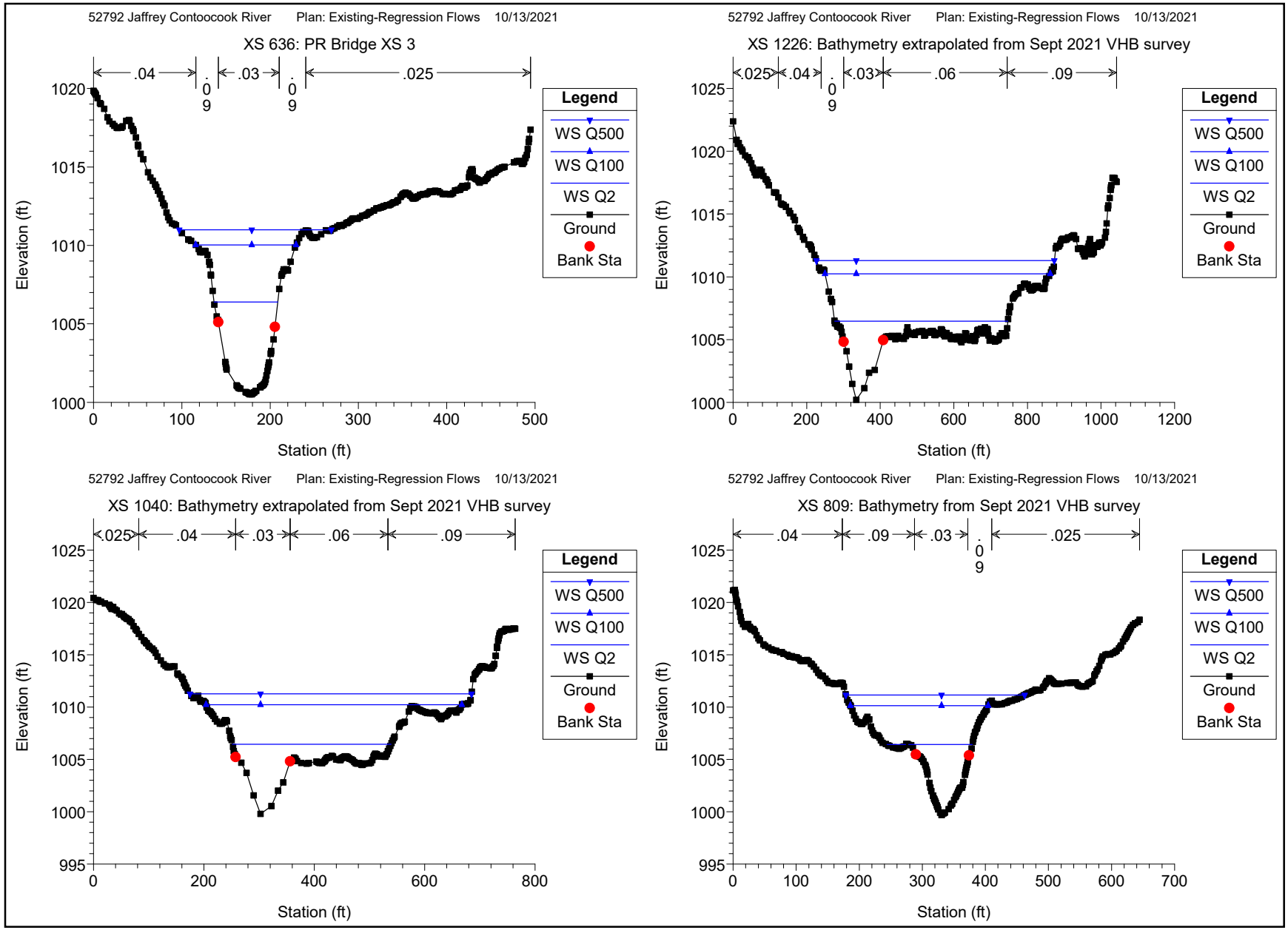
Memorandum

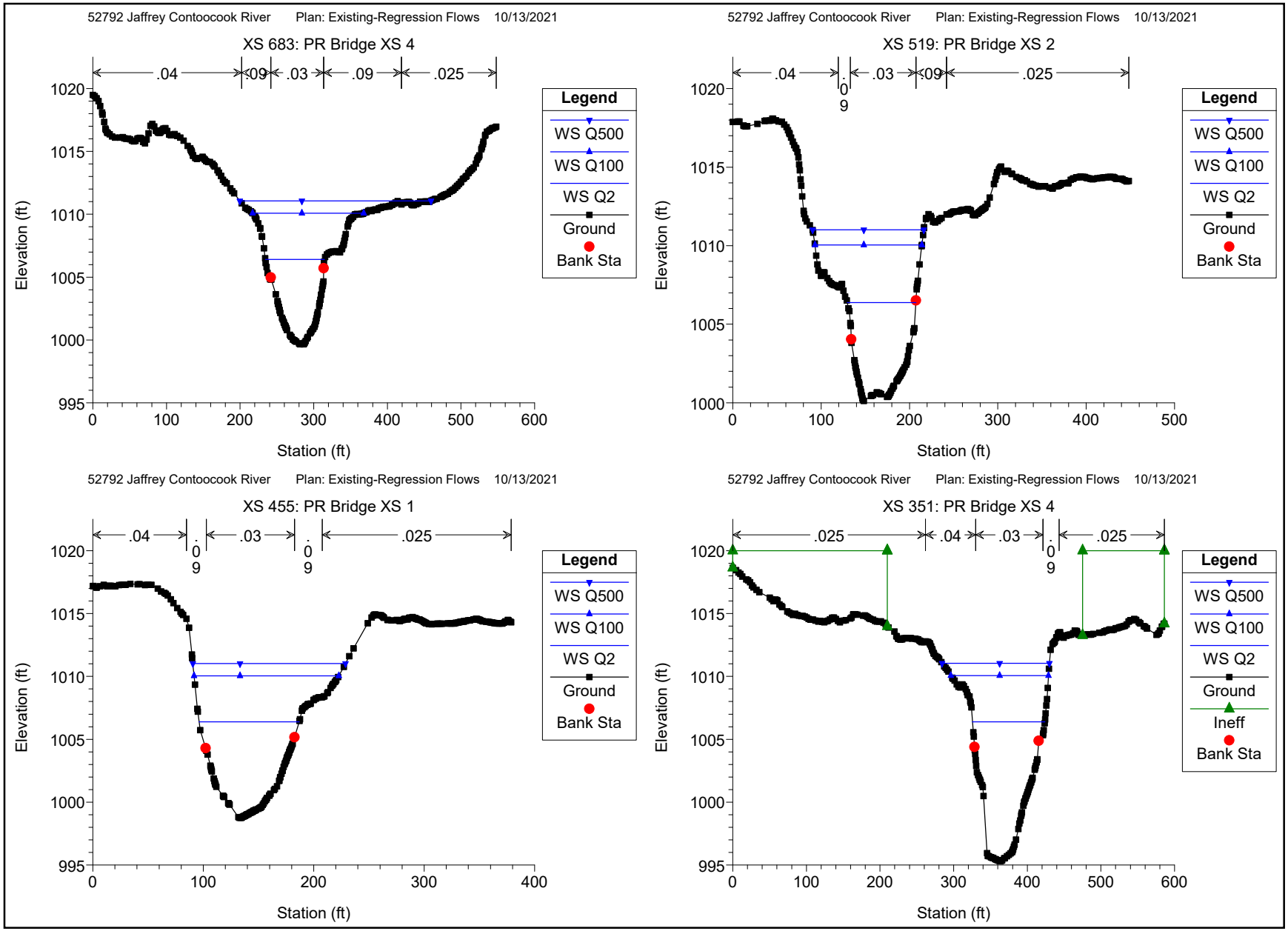
Appendix B: HEC-RAS Hydraulic Model Results

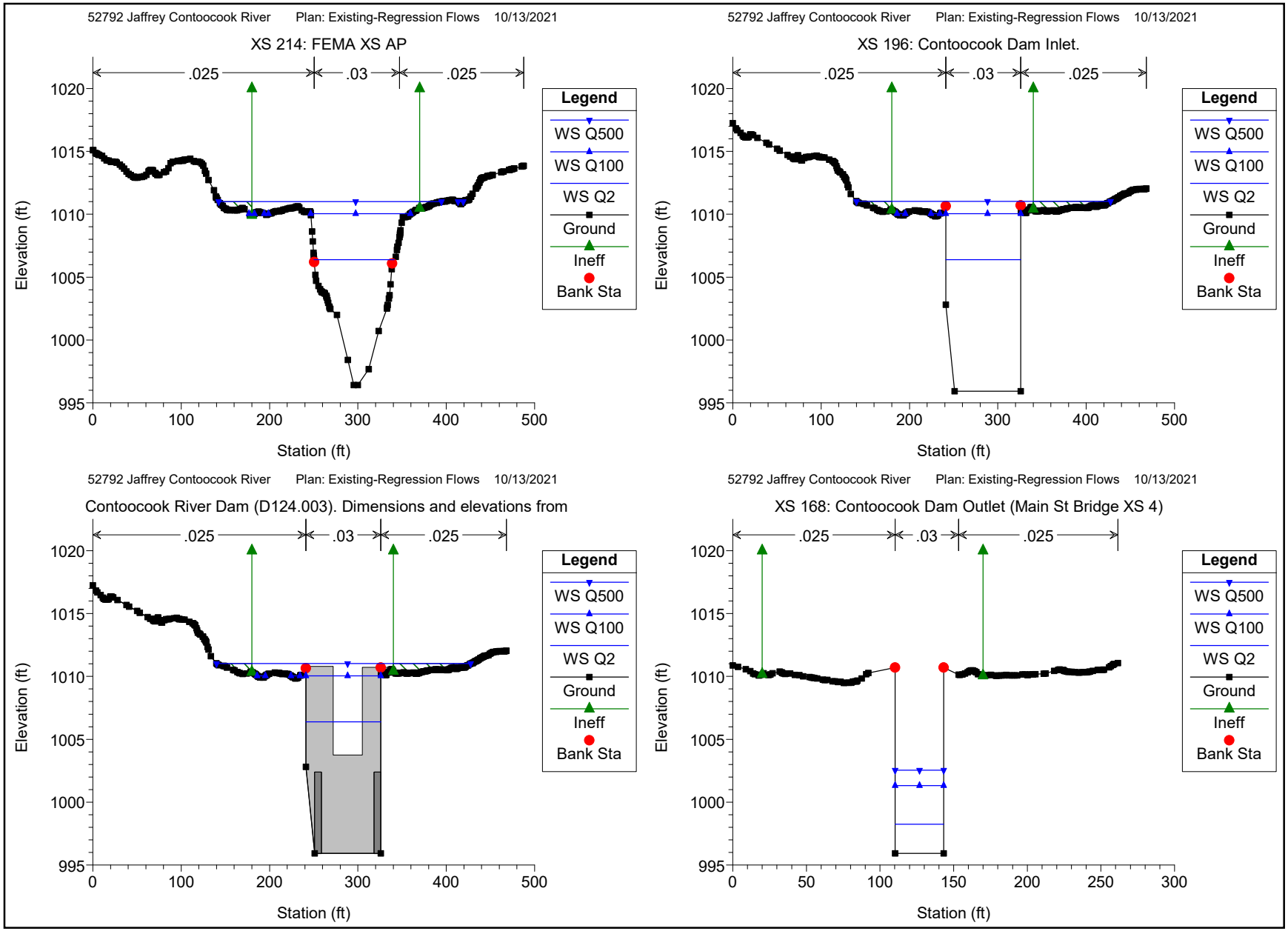
2 Bedford Farms Drive
Suite 200
Bedford, NH 03110-6532
P 603.391.3900


92
6
196
214
168
351
519
636
683
1040
1226
Downtown Jaffrey
Contoocook R
Contoocook


52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
Contoocook River Downtown Jaffrey
Legend
WS Q500
WS Q100
WS Q2
Ground
Elevation (ft)
1015
1010
1005
1000
995
990
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

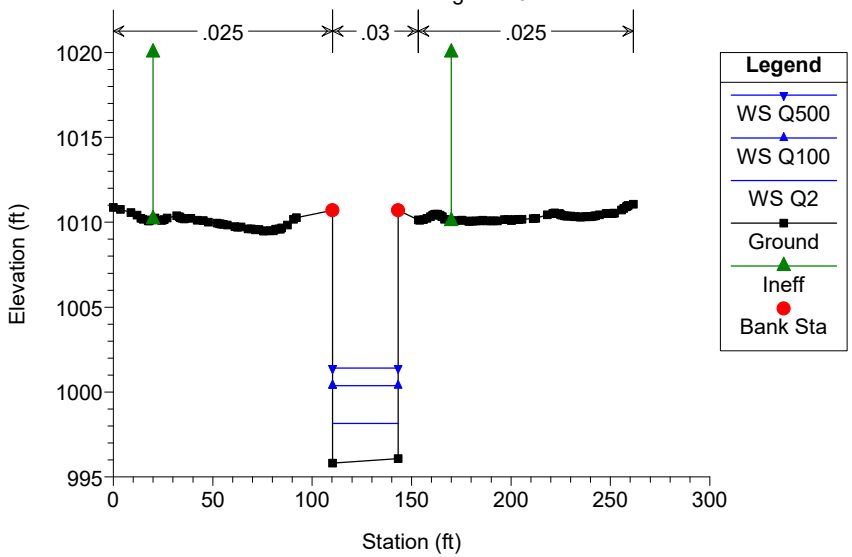

52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 636: PR Bridge XS 3
.04
.09
.03
.09
.025
Legend
WS Q500
WS Q100
WS Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 1226: Bathymetry extrapolated from Sept 2021 VHB survey
.025
.04
.09
.03
.06
.09
Legend
WS Q500
WS Q100
WS Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 1040: Bathymetry extrapolated from Sept 2021 VHB survey
.025
.04
.03
.06
.09
Legend
WS Q500
WS Q100
WS Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 809: Bathymetry from Sept 2021 VHB survey
.04
.09
.03
.09
.025
Legend
WS Q500
WS Q100
WS Q2
Ground
Bank Sta
Elevation (ft)
Station (ft)


52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 683: PR Bridge XS 4
.04
.09
.03
.09
.025
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q2
Ground
Bank Sta
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 519: PR Bridge XS 2
.04
.09
.03
.09
.025
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q2
Ground
Bank Sta
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 455: PR Bridge XS 1
.04
.09
.03
.09
.025
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q2
Ground
Bank Sta
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 351: PR Bridge XS 4
.025
.04
.03
.09
.025
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q2
Ground
Ineff
Bank Sta


52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 214: FEMA XS AP
.025
.03
.025
Legend
WS Q500
WS Q100
WS Q2
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 196: Contoocook Dam Inlet.
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
Contoocook River Dam (D124.003). Dimensions and elevations from
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021
XS 168: Contoocook Dam Outlet (Main St Bridge XS 4)

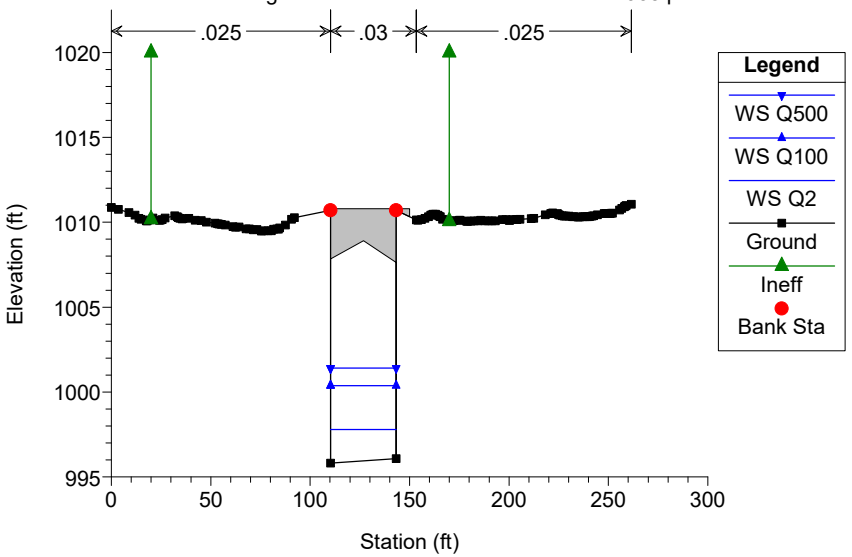
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021

Main St Bridge XS 3



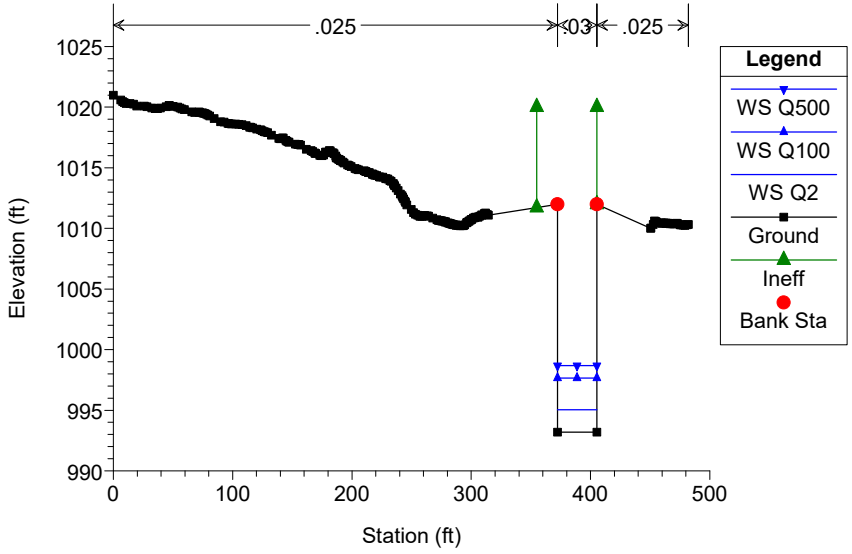
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021

Main Street Bridge. Dimensions and elevations from 1938 plans an



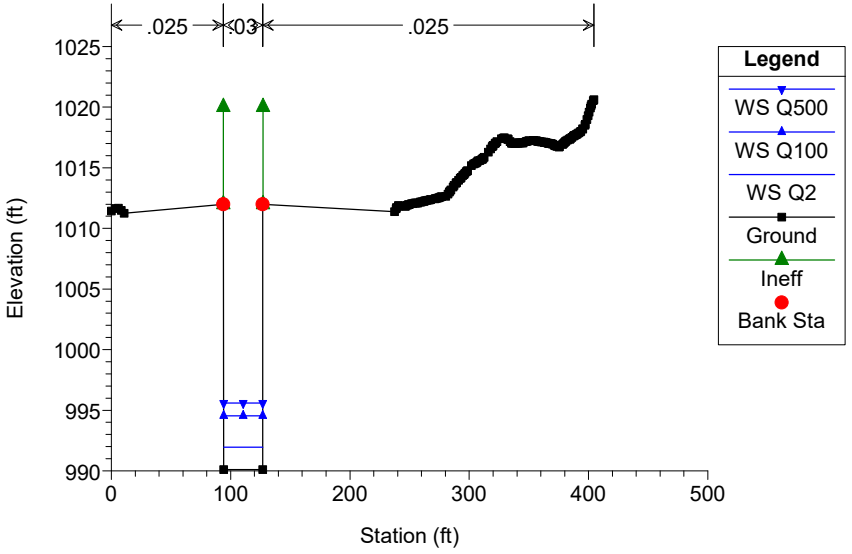
52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021

FEMA XS AO (Main St Bridge XS 2)



52792 Jaffrey Contoocook River Plan: Existing-Regression Flows 10/13/2021

FEMA XS AN (Main St Bridge XS 1)

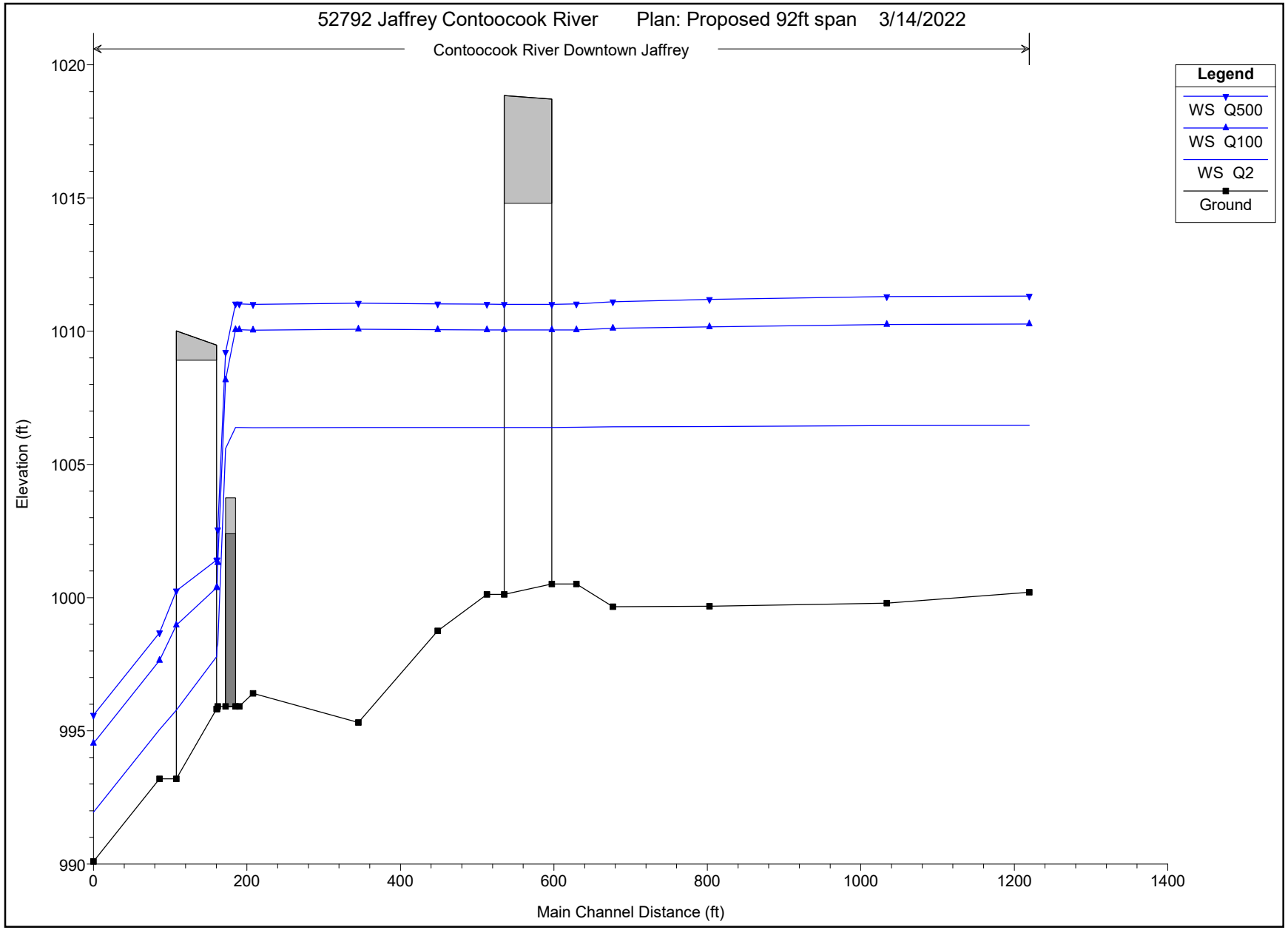


HEC-RAS Plan: Ex-regression River: Contoocook River Reach: Downtown Jaffrey

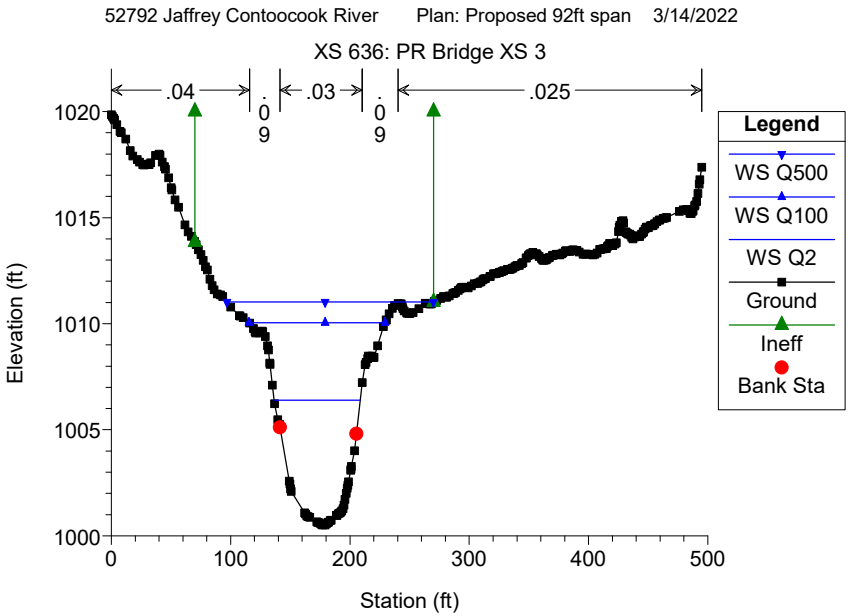
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Downtown Jaffrey	1226	Q2	467.00	1000.20	1006.46		1006.47	0.000049	0.89	838.43	471.06	0.08
Downtown Jaffrey	1226	Q100	1740.00	1000.20	1010.24		1010.26	0.000035	1.17	2807.66	612.02	0.07
Downtown Jaffrey	1226	Q500	2390.00	1000.20	1011.28		1011.30	0.000039	1.33	3466.96	646.47	0.08
Downtown Jaffrey	1040	Q2	467.00	999.79	1006.45		1006.46	0.000056	0.96	689.35	287.40	0.08
Downtown Jaffrey	1040	Q100	1740.00	999.79	1010.23		1010.25	0.000055	1.46	1982.81	463.66	0.09
Downtown Jaffrey	1040	Q500	2390.00	999.79	1011.26		1011.29	0.000062	1.68	2491.91	510.22	0.10
Downtown Jaffrey	809	Q2	467.00	999.68	1006.42		1006.44	0.000123	1.33	365.27	130.66	0.11
Downtown Jaffrey	809	Q100	1740.00	999.68	1010.14		1010.22	0.000168	2.37	1028.33	218.29	0.15
Downtown Jaffrey	809	Q500	2390.00	999.68	1011.16		1011.26	0.000197	2.78	1288.12	283.59	0.16
Downtown Jaffrey	683	Q2	467.00	999.66	1006.41		1006.43	0.000082	1.29	367.66	80.40	0.10
Downtown Jaffrey	683	Q100	1740.00	999.66	1010.09		1010.20	0.000172	2.70	780.47	150.70	0.16
Downtown Jaffrey	683	Q500	2390.00	999.66	1011.07		1011.23	0.000222	3.29	970.56	259.92	0.19
Downtown Jaffrey	636	Q2	467.00	1000.51	1006.39		1006.43	0.000129	1.55	305.73	72.18	0.13
Downtown Jaffrey	636	Q100	1740.00	1000.51	1010.04		1010.19	0.000246	3.15	619.12	113.61	0.19
Downtown Jaffrey	636	Q500	2390.00	1000.51	1011.00		1011.21	0.000312	3.82	749.58	172.09	0.22
Downtown Jaffrey	519	Q2	467.00	1000.12	1006.38		1006.41	0.000087	1.31	360.29	77.65	0.10
Downtown Jaffrey	519	Q100	1740.00	1000.12	1010.04		1010.15	0.000172	2.67	738.08	120.99	0.16
Downtown Jaffrey	519	Q500	2390.00	1000.12	1011.01		1011.16	0.000219	3.24	857.31	125.87	0.19
Downtown Jaffrey	455	Q2	467.00	998.75	1006.39		1006.40	0.000048	1.04	456.76	90.72	0.08
Downtown Jaffrey	455	Q100	1740.00	998.75	1010.05		1010.13	0.000118	2.28	858.53	131.12	0.13
Downtown Jaffrey	455	Q500	2390.00	998.75	1011.02		1011.14	0.000155	2.80	989.38	138.25	0.15
Downtown Jaffrey	351	Q2	467.00	995.31	1006.39	997.35	1006.40	0.000013	0.68	700.35	98.33	0.04
Downtown Jaffrey	351	Q100	1740.00	995.31	1010.07	999.57	1010.11	0.000047	1.68	1102.68	132.44	0.09
Downtown Jaffrey	351	Q500	2390.00	995.31	1011.05	1000.43	1011.12	0.000066	2.10	1238.52	145.86	0.10
Downtown Jaffrey	214	Q2	467.00	996.41	1006.38	999.31	1006.39	0.000034	0.91	514.32	90.75	0.07
Downtown Jaffrey	214	Q100	1740.00	996.41	1010.04	1001.91	1010.10	0.000089	2.04	875.91	123.62	0.12
Downtown Jaffrey	214	Q500	2390.00	996.41	1011.01	1002.85	1011.10	0.000116	2.49	1042.75	257.92	0.14
Downtown Jaffrey	196	Q2	467.00	995.92	1006.39	996.98	1006.39	0.000007	0.55	853.15	84.82	0.03
Downtown Jaffrey	196	Q100	1740.00	995.92	1010.05	998.47	1010.09	0.000038	1.49	1166.56	104.55	0.07
Downtown Jaffrey	196	Q500	2390.00	995.92	1011.03	999.06	1011.08	0.000057	1.90	1311.43	287.77	0.09
Downtown Jaffrey	191		Inl Struct									

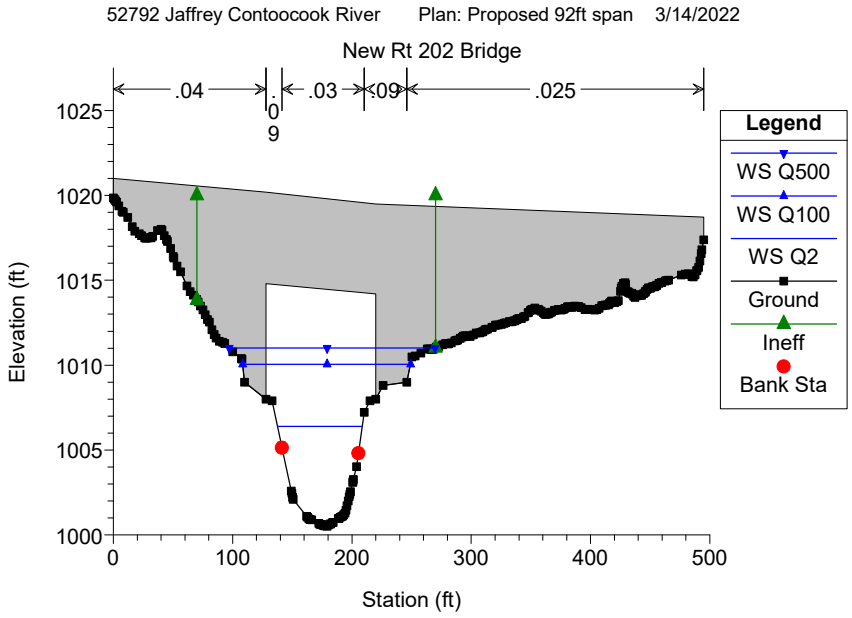
HEC-RAS Plan: Ex-regression River: Contoocook River Reach: Downtown Jaffrey (Continued)

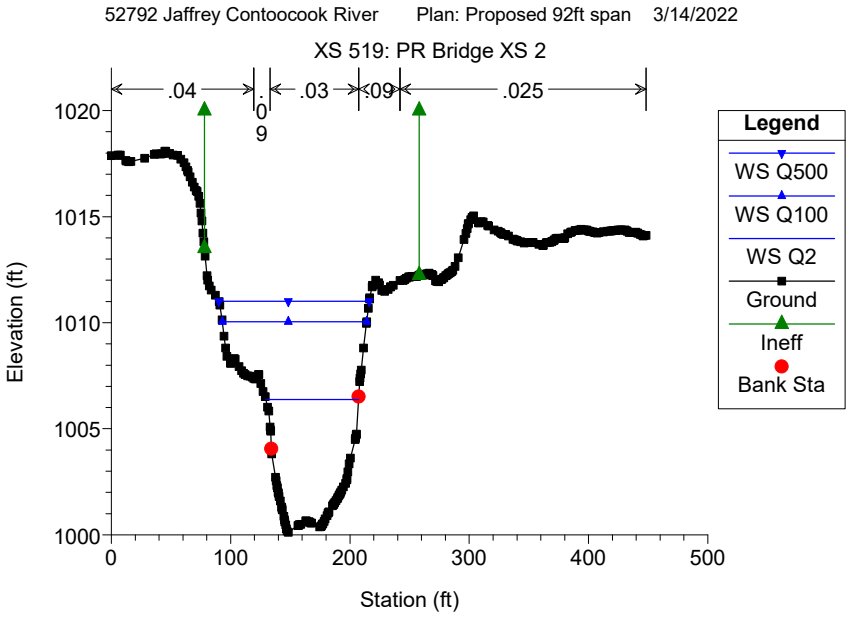
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Downtown Jaffrey	168	Q2	467.00	995.92	998.24	997.75	998.82	0.005895	6.10	76.52	33.00	0.71
Downtown Jaffrey	168	Q100	1740.00	995.92	1001.31	1000.34	1002.80	0.006006	9.78	177.97	33.01	0.74
Downtown Jaffrey	168	Q500	2390.00	995.92	1002.55	1001.38	1004.40	0.006125	10.92	218.80	33.01	0.75
Downtown Jaffrey	167	Q2	467.00	995.82	998.14	997.79	998.79	0.006968	6.43	72.59	33.00	0.76
Downtown Jaffrey	167	Q100	1740.00	995.82	1000.38	1000.37	1002.58	0.010851	11.89	146.39	33.01	1.00
Downtown Jaffrey	167	Q500	2390.00	995.82	1001.42	1001.41	1004.14	0.010835	13.23	180.66	33.01	1.00
Downtown Jaffrey	166		Bridge									
Downtown Jaffrey	92	Q2	467.00	993.20	995.05	995.05	995.97	0.012255	7.70	60.68	32.82	1.00
Downtown Jaffrey	92	Q100	1740.00	993.20	997.64	997.64	999.86	0.010920	11.93	145.86	32.85	1.00
Downtown Jaffrey	92	Q500	2390.00	993.20	998.68	998.68	1001.42	0.010912	13.28	179.96	32.86	1.00
Downtown Jaffrey	6	Q2	467.00	990.10	991.95	991.95	992.87	0.012322	7.71	60.58	32.82	1.00
Downtown Jaffrey	6	Q100	1740.00	990.10	994.54	994.54	996.76	0.010990	11.95	145.56	32.84	1.00
Downtown Jaffrey	6	Q500	2390.00	990.10	995.59	995.59	998.32	0.010888	13.27	180.10	32.85	1.00


52792 Jaffrey Contoocook River Plan: Proposed 92ft span 3/14/2022
Contoocook River Downtown Jaffrey
Legend
WS Q500
WS Q100
WS Q2
Ground
Elevation (ft)
1020
1015
1010
1005
1000
995
990
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

No Data for Plot







HEC-RAS Plan: Ex-regression River: Contoocook River Reach: Downtown Jaffrey

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)	
Downtown Jaffrey	1226	Q2	467.00	1000.20	1006.46		1006.48	0.000049	0.89	839.18	471.08	0.08
Downtown Jaffrey	1226	Q100	1740.00	1000.20	1010.25		1010.26	0.000035	1.17	2809.23	612.08	0.07
Downtown Jaffrey	1226	Q500	2390.00	1000.20	1011.29		1011.30	0.000039	1.33	3469.45	646.53	0.08
Downtown Jaffrey	1040	Q2	467.00	999.79	1006.45		1006.47	0.000056	0.96	689.80	287.42	0.08
Downtown Jaffrey	1040	Q100	1740.00	999.79	1010.23		1010.25	0.000055	1.46	1984.00	463.70	0.09
Downtown Jaffrey	1040	Q500	2390.00	999.79	1011.27		1011.30	0.000062	1.68	2493.91	510.28	0.10
Downtown Jaffrey	809	Q2	467.00	999.68	1006.42		1006.45	0.000123	1.33	365.49	130.77	0.11
Downtown Jaffrey	809	Q100	1740.00	999.68	1010.15		1010.23	0.000168	2.37	1028.92	218.33	0.15
Downtown Jaffrey	809	Q500	2390.00	999.68	1011.16		1011.27	0.000196	2.78	1289.28	283.79	0.16
Downtown Jaffrey	683	Q2	467.00	999.66	1006.41		1006.43	0.000082	1.29	367.80	80.42	0.10
Downtown Jaffrey	683	Q100	1740.00	999.66	1010.09		1010.20	0.000172	2.70	780.88	150.81	0.16
Downtown Jaffrey	683	Q500	2390.00	999.66	1011.07		1011.23	0.000221	3.29	971.64	260.09	0.19
Downtown Jaffrey	636	Q2	467.00	1000.51	1006.39		1006.43	0.000129	1.55	305.85	72.19	0.13
Downtown Jaffrey	636	Q100	1740.00	1000.51	1010.04		1010.19	0.000246	3.15	619.44	113.69	0.19
Downtown Jaffrey	636	Q500	2390.00	1000.51	1011.00		1011.22	0.000311	3.82	750.30	172.23	0.22
Downtown Jaffrey	572	Q2	467.00	1001.14	1006.38		1006.42	0.000134	1.53	307.23	72.87	0.13
Downtown Jaffrey	572	Q100	1740.00	1001.14	1010.02		1010.17	0.000248	3.10	608.28	104.98	0.19
Downtown Jaffrey	572	Q500	2390.00	1001.14	1010.98		1011.20	0.000317	3.78	717.62	121.22	0.22
Downtown Jaffrey	519	Q2	467.00	1000.12	1006.38		1006.41	0.000087	1.31	360.29	77.65	0.10
Downtown Jaffrey	519	Q100	1740.00	1000.12	1010.04		1010.15	0.000172	2.67	738.08	120.99	0.16
Downtown Jaffrey	519	Q500	2390.00	1000.12	1011.01		1011.16	0.000219	3.24	857.31	125.87	0.19
Downtown Jaffrey	455	Q2	467.00	998.75	1006.39		1006.40	0.000048	1.04	456.76	90.72	0.08
Downtown Jaffrey	455	Q100	1740.00	998.75	1010.05		1010.13	0.000118	2.28	858.53	131.12	0.13
Downtown Jaffrey	455	Q500	2390.00	998.75	1011.02		1011.14	0.000155	2.80	989.38	138.25	0.15
Downtown Jaffrey	351	Q2	467.00	995.31	1006.39	997.35	1006.40	0.000013	0.68	700.35	98.33	0.04
Downtown Jaffrey	351	Q100	1740.00	995.31	1010.07	999.57	1010.11	0.000047	1.68	1102.68	132.44	0.09
Downtown Jaffrey	351	Q500	2390.00	995.31	1011.05	1000.43	1011.12	0.000066	2.10	1238.52	145.86	0.10
Downtown Jaffrey	214	Q2	467.00	996.41	1006.38	999.31	1006.39	0.000034	0.91	514.32	90.75	0.07
Downtown Jaffrey	214	Q100	1740.00	996.41	1010.04	1001.91	1010.10	0.000089	2.04	875.91	123.62	0.12
Downtown Jaffrey	214	Q500	2390.00	996.41	1011.01	1002.85	1011.10	0.000116	2.49	1042.75	257.92	0.14
Downtown Jaffrey	196	Q2	467.00	995.92	1006.39	996.98	1006.39	0.000007	0.55	853.15	84.82	0.03

HEC-RAS Plan: Ex-regression River: Contoocook River Reach: Downtown Jaffrey (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)	
Downtown Jaffrey	196	Q100	1740.00	995.92	1010.05	998.47	1010.09	0.000038	1.49	1166.56	104.55	0.07
Downtown Jaffrey	196	Q500	2390.00	995.92	1011.03	999.06	1011.08	0.000057	1.90	1311.43	287.77	0.09
Downtown Jaffrey	191		Inl Struct									
Downtown Jaffrey	168	Q2	467.00	995.92	998.24	997.75	998.82	0.005895	6.10	76.52	33.00	0.71
Downtown Jaffrey	168	Q100	1740.00	995.92	1001.31	1000.34	1002.80	0.006006	9.78	177.97	33.01	0.74
Downtown Jaffrey	168	Q500	2390.00	995.92	1002.55	1001.38	1004.40	0.006125	10.92	218.80	33.01	0.75
Downtown Jaffrey	167	Q2	467.00	995.82	998.14	997.79	998.79	0.006968	6.43	72.59	33.00	0.76
Downtown Jaffrey	167	Q100	1740.00	995.82	1000.38	1000.37	1002.58	0.010851	11.89	146.39	33.01	1.00
Downtown Jaffrey	167	Q500	2390.00	995.82	1001.42	1001.41	1004.14	0.010835	13.23	180.66	33.01	1.00
Downtown Jaffrey	166		Bridge									
Downtown Jaffrey	92	Q2	467.00	993.20	995.05	995.05	995.97	0.012255	7.70	60.68	32.82	1.00
Downtown Jaffrey	92	Q100	1740.00	993.20	997.64	997.64	999.86	0.010920	11.93	145.86	32.85	1.00
Downtown Jaffrey	92	Q500	2390.00	993.20	998.68	998.68	1001.42	0.010912	13.28	179.96	32.86	1.00
Downtown Jaffrey	6	Q2	467.00	990.10	991.95	991.95	992.87	0.012322	7.71	60.58	32.82	1.00
Downtown Jaffrey	6	Q100	1740.00	990.10	994.54	994.54	996.76	0.010990	11.95	145.56	32.84	1.00
Downtown Jaffrey	6	Q500	2390.00	990.10	995.59	995.59	998.32	0.010888	13.27	180.10	32.85	1.00

Memorandum

Appendix C: HEC-18 Scour Calculations

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

Scour Computations Worksheet

INPUTS AND ASSUMPTIONS

Project:	Rt 202 over Contoocook River	Project #	52792.00
Location:	Jaffrey, NH	Sheet	Inputs and Assumptions
Calculated by:	DWC	Date:	11/4/2021
Checked by:	NDR	Date:	11/5/2021
Title:	Proposed Route 202 over Contoocook River		

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, Section 2.7.7
Scour Design Discharge = Q100, Check Discharge = Q500 per NHDOT Manual Section 2.7.7

Data Sources: \\vhb.com\gbl\proj\Bedford\52792.00 Jaffrey\cad\st\BRC\000_000\PlanPDFs\WORKING set.pdf

Existing bridge plans: N/A, no existing crossing
Topographic data - VHB field topographic survey collected in October 2021 supplemented by 2015 NH GRANIT Connectut River LiDAR
Design Discharge hydrology: \\vhb.com\gbl\proj\Bedford\52792.00 Jaffrey\tech\Bridge\H&H\Hydrology\

HEC-RAS hydraulic model file: \\vhb.com\gbl\proj\Bedford\52792.00 Jaffrey\tech\Bridge\H&H\HEC-RAS

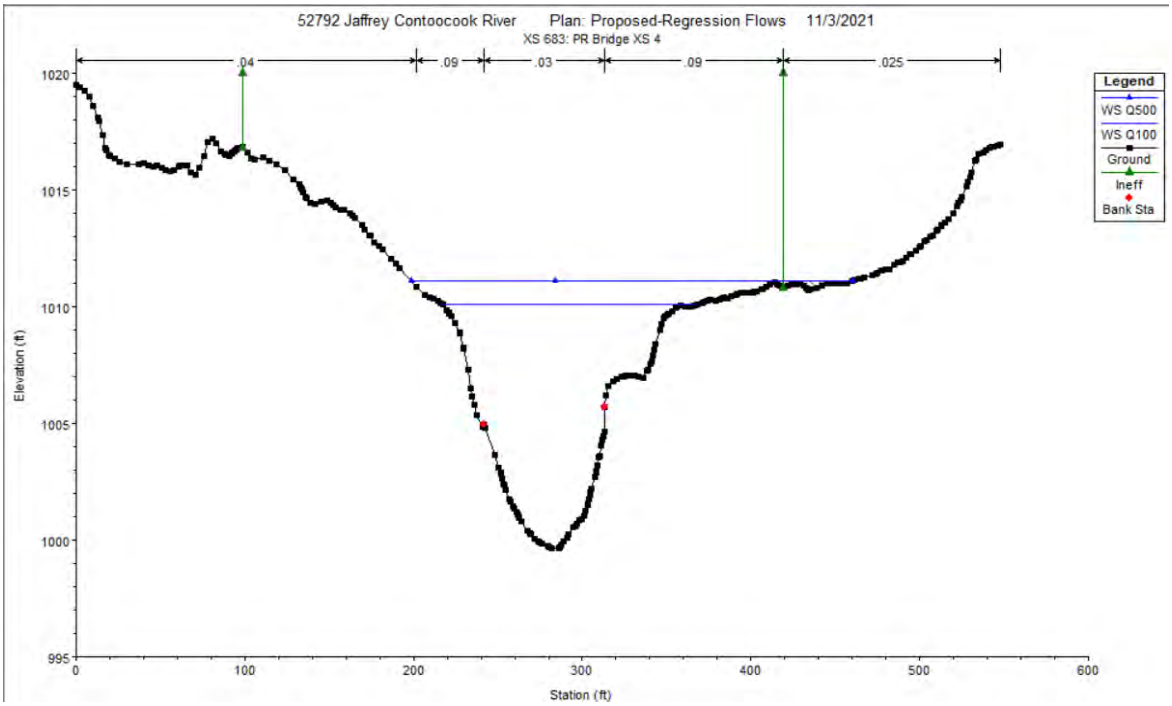
HEC-RAS hydraulic model plan "Proposed-Regression Flows":\\vhb.com\gbl\proj\Bedford\52792.00 Jaffrey\tech\Bridge\H&H\HEC-RAS\52792JaffreyConto.p04

Steady-State Model - HEC-RAS variables for Q100 and Q500 flood profiles
Average Bed Particle Sizes from September 14-30, 2021 SW Cole Draft Geotechnical Boring Logs.

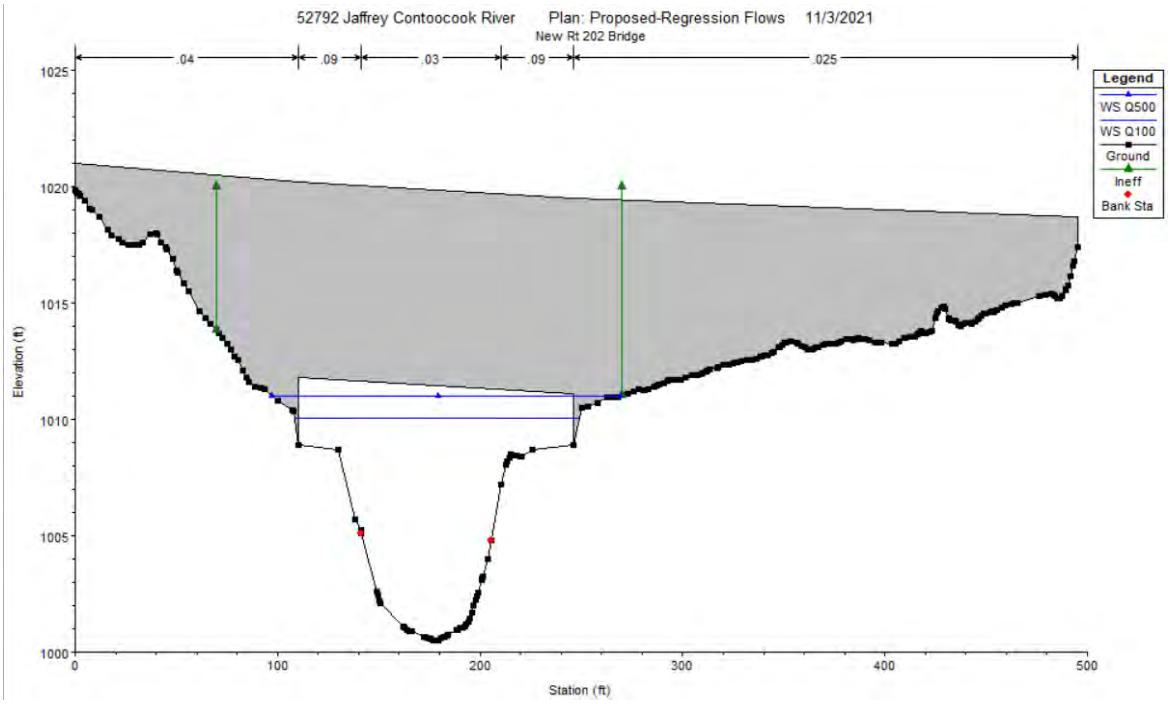
1. HEC-RAS Model Plan View:

2. HEC-RAS Model Cross-Sections:

Approach Section



Contracted/Bridge Section



Scour Computations Worksheet

RESULTS SUMMARY				
	Project:	Rt 202 over Contoocook River	Project #	52792.00
	Location:	Jaffrey, NH	Sheet	Results Summary
	Calculated by:	DWC	Date:	1/31/2022
	Checked by:	NDR	Date:	1/31/2022
	Title:	Proposed Route 202 over Contoocook River		

1. Summary of Scour Calculations

100-Year	500-Year	Scour Conditions
Live Bed	Live Bed	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?

NCHRP 24-20

Left and Right Abutments:

Storm Event	$y_{s\text{-}cont}$ (ft)	$y_{s\text{-}total}$ (ft)	El_{bed} (ft)	El_{ftg} (ft)	El_{scour} (ft)
100-Year	1.05	**5.13**	1008.00	1004.00	**1002.87**
500-Year	1.19	**5.05**	1008.00	1004.00	**1002.95**

Notes:

1. $y_{s\text{-}cont}$ *= general scour depth due to contraction scour*
2. $y_{s\text{-}abut}$ *= local scour depth at abutment*
4. $y_{s\text{-}total}$ *= total scour depth combining local and general scour*
5. El_{bed} *= existing pre-scour minimum bed elevation at the face of substructure*
6. El_{ftg} *= bottom elevation of substructure footing or pile cap*
7. El_{scour} *= elevation of streambed from calculated scour at the face of substructure*

Scour Computations Worksheet

CONTRACTION SCOUR

Project:	Rt 202 over Contoocook River	Project #	52792.00
Location:	Jaffrey, NH	Sheet	Contraction Scour
Calculated by:	DWC	Date:	1/31/2022
Checked by:	NDR	Date:	1/31/2022
Title:	Proposed Route 202 over Contoocook River		

Notes: All hydraulic inputs are taken from the Proposed 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) =	0.008	Clear water contraction scour constant
$D_{50\ bridge}$ =	0.0002	Average particle size in channel bed contracted section (ft)
K_u (Eqn. 6.10) =	0.84	Open Bottom Culvert Scour Coefficient (wingwalls)
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} =	92	Width of bridge opening (ft)
El_{lc} =	1013.9	Average elevation of bridge low chord at upstream fascia (ft)
El_{hc} =	1019.8	Average elevation of bridge high chord at upstream fascia (ft)
El_{bed} =	1001.7	Average elevation of channel bed at upstream fascia
T =	5.9	Bridge superstructure thickness (ft)
h_b =	12.2	Vertical size of bridge opening prior to scour, El_{lc}-El_{bed} (ft)

Approach Section Location: HEC-RAS Model Station 683

Storm Event	Q_1 (cfs)	V_1 (ft/s)	y_1 (ft)	W_1 (ft)	S_1 (ft/ft)	WSE_1 (ft)
100-Year	1687	2.69	8.71	71.90	0.000170	1010.11
500-Year	2287	3.28	9.70	71.90	0.000219	1011.1

Contracted/Bridge Section: HEC-RAS Model Station 606 BR U

Storm Event	Q_2 (cfs)	V_2 (ft/s)	y_0 (ft)	W_2 (ft)
100-Year	1677	3.14	8.33	64.10
500-Year	2283	3.83	9.29	64.10

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 culvert opening (HEC-RAS Variable "Q Barrel" from culvert 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	8.71	1.39
500-Year	9.70	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	2.69	1.39	**Live Bed**
500-Year	3.28	1.42	**Live Bed**

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 1: Live-Bed Scour)

A. Determine mode of bed material transport (k_1 exponent)

k_1 = Exponent determined below

V*/ ω	k_1	Mode of Bed Material Transport
<0.50	0.59	Mostly contact bed material discharge
0.50 to 2.0	0.64	Some suspended bed material discharge
>2.0	0.69	Mostly suspended bed material discharge

Storm Event	y_1 (ft)	S_1 (ft/ft)	V^* (ft/s)	ω (ft/s)	V*/ω	k_1
100-Year	8.71	0.000170	0.22	0.02	13.25	0.69
500-Year	9.70	0.000219	0.26	0.02	15.87	0.69

Notes:

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

2. S_1 = energy slope at the approach section (from HEC-RAS inputs)

3. $V^* = (g * y_1 * S_1)^{1/2}$ shear velocity in the approach section

4. ω (ft/s) fall velocity from Figure 6.8 (HEC-18) for D_{50} particle size.

5. k_1 determined from table above (page 6.10, HEC-18).

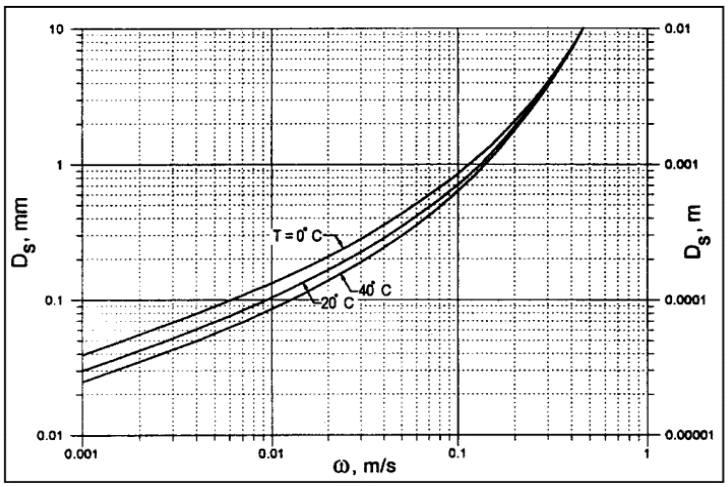


Figure 6.8. Fall velocity of sand-sized particles with specific gravity of 2.65 in metric units.

B. Determine y_2

$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{6/7} \left(\frac{W_1}{W_2}\right)^{k_1} \quad (6.2)$$

Storm Event	Discharge (ft^3/s)		Width (ft)		y_1 (ft)	y_2 (ft)
	Q_1	Q_2	W_1	W_2		
100-Year	1686.90	1677.00	71.90	64.10	8.71	9.38
500-Year	2287.36	2282.95	71.90	64.10	9.70	10.48

Notes:

1. Q_1 is flow in the channel at approach section (from HEC-RAS inputs)

2. W_1 is width of channel at approach section (from HEC-RAS inputs)

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

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

5. y_1 is average channel depth at approach section (from HEC-RAS inputs)

3: Check for Pressure Flow

Storm Event	WSE (ft)	El_{lc} (ft)	Pressure Flow or Free Flow
100-Year	1010.11	1013.9	Free Flow
500-Year	1011.10	1013.9	Free Flow

4. Compute Contraction Scour (no pressure flow)

$$y_s = y_2 - y_o = \text{(average contraction scour depth)} \quad (6.3)$$

3a. Main Channel:

Storm Event	y_2 (ft)	y_0 (ft)	y_s (ft)	Scour El (Ft)
100-Year	9.38	8.33	**1.05**	1000.73
500-Year	10.48	9.29	**1.19**	1000.62

Notes:

1. y_2 = computed equilibrium depth from equation 6.2 or 6.4 (ft)

2. y_0 = average depth in contracted section

3. y_s = calculated contraction scour depth (ft)

Scour Computations Worksheet

ABUTMENT SCOUR

Project:	Rt 202 over Contoocook River	Project #	52792.00
Location:	Jaffrey, NH	Sheet	Abutment Scour
Calculated by:	DWC	Date:	1/31/2022
Checked by:	NDR	Date:	3/15/2022
Title:	Proposed Route 202 over Contoocook River		

Notes: All hydraulic inputs are taken from the Proposed 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} =	92	Width of the bridge opening (ft)
K_1 =	1	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 left abutment, $(\Theta_{rt\ abut}/90)^{0.13}$
El_{bed_lt} =	*1008.00*	Minimum bed elevation at face of Left abutment (ft)
El_{bed_rt} =	*1008.00*	Minimum bed elevation at face of Right abutment (ft)
El_{ftg_lt} =	*1000.00*	Bottom of Left abutment footing (culvert invert) elevation (ft)
El_{ftg_rt} =	*1000.00*	Bottom of Right abutment footing (culvert invert) elevation (ft)
$Sta_{cl\text{-}appr}$ =	277.55	Station of channel centerline, approach section (HEC-RAS Variable "Center Station") (ft)
$Sta_{cl\text{-}contr}$ =	173.45	Station of channel centerline, contracted section (HEC-RAS Variable "Center Station") (ft)
$Sta_{lt\text{-}abut}$ =	128.00	Station of left abutment in contracted section (ft)
$Sta_{rt\text{-}abut}$ =	220.00	Station of right abutment in contracted section (ft)
$Sta_{lt\text{-}bank}$ =	141.40	Station of left bank of channel, contracted section (HEC-RAS Variable "Ch Sta L")
$Sta_{rt\text{-}bank}$ =	205.50	Station of right bank of channel, contracted section (HEC-RAS Variable "Ch Sta R")
$Sta_{lt\text{-}abut\text{-}proj}$ =	232.10	Station of left abutment projected to approach section (ft)
$Sta_{rt\text{-}abut\text{-}proj}$ =	324.10	Station of right abutment projected to approach section (ft)

Left Abutment Approach Section Flow Distribution — 683

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	216.74	YES	15.36	12.85	35.08	10.24	20.79	24.86	1740
500-Year	199.01	YES	33.09	29.71	70.98	22.06	38.24	42.59	2390

Right Abutment Approach Section Flow Distribution — 683

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)	y_{tot} (ft)
100-Year	368.41	YES	44.31	25.81	80.58	28.07	32.31	54.91	5.17
500-Year	460.43	YES	136.33	52.27	160.05	30.44	64.4	146.93	4.42

Contracted Section Flow Distribution

					606 BR U	
Storm Event	**A_{lob} (sf)**	**A_{chnl} (sf)**	**A_{rob} (sf)**	**y_{lob} (ft)**	**y_{chnl} (ft)**	**y_{rob} (ft)**
100-Year	40.15	534.1	41.47	3.00	8.33	2.42
500-Year	53.04	595.7	55.41	3.96	9.29	3.06

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} are 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. ytotal = average depth of total approach section, including overbanks (HEC-RAS Variable "Hydr Depth")

11. $W_{ob\text{-}lt}$ 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)

A: Detailed Approach Section Flow Distribution Outputs for Calculation of L' - Design Discharge

Storm Event	100-Year

Plan: PR Contoocook River Downtown Jaffrey RS: 683 Profile: Q100

Pos		Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	Calculated Incremental Values L	Q	A	L'
1	LOB	194.03	241.6	20.79	56.77	15.36	12.85	35.08	10.24
2	Chan	241.6	255.98	211.23	95.56	0.00	0.00	0.00	0.00
3	Chan	255.98	270.36	365.83	132.06	0.00	0.00	0.00	0.00
4	Chan	270.36	284.74	443.38	147.8	0.00	0.00	0.00	0.00
5						0.00	0.00	0.00	0.00
6						0.00	0.00	0.00	0.00
7						0.00	0.00	0.00	0.00
8						0.00	0.00	0.00	0.00
9						0.00	0.00	0.00	0.00
10						0.00	0.00	0.00	0.00
11						0.00	0.00	0.00	0.00
12						0.00	0.00	0.00	0.00
13						0.00	0.00	0.00	0.00
14						0.00	0.00	0.00	0.00
15						0.00	0.00	0.00	0.00
16						0.00	0.00	0.00	0.00
17						0.00	0.00	0.00	0.00
18						0.00	0.00	0.00	0.00
19						0.00	0.00	0.00	0.00
20						0.00	0.00	0.00	0.00
21						0.00	0.00	0.00	0.00
22						0.00	0.00	0.00	0.00
23						0.00	0.00	0.00	0.00
24						0.00	0.00	0.00	0.00
25						0.00	0.00	0.00	0.00
26						0.00	0.00	0.00	0.00
27						0.00	0.00	0.00	0.00
28						0.00	0.00	0.00	0.00
29						0.00	0.00	0.00	0.00
30						0.00	0.00	0.00	0.00
31						0.00	0.00	0.00	0.00
32						0.00	0.00	0.00	0.00
33	Chan	284.74	299.12	414.72	142.18	0.00	0.00	0.00	0.00
34	Chan	299.12	313.5	251.74	108.82	0.00	0.00	0.00	0.00
35	ROB	313.5	366.2	32.31	100.75	42.10	25.81	80.49	28.07
36	ROB	366.2	418.9	0	0.09	2.21	0.00	0.09	0.00

B: Detailed Approach Section Flow Distribution Outputs for Calculation of L' - Check Discharge

Storm Event	500-Year

Plan: PR	Contoocook River	Downtown Jaffrey	RS: 683	Profile: Q500	Calculated Incremental Values			
	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	L	Q	A	L'
1	LOB	194.03	241.6	38.24	91.36	33.09	29.71	70.98	22.06
2	Chan	241.6	255.98	302.68	109.82	0.00	0.00	0.00	0.00
3	Chan	255.98	270.36	493.23	146.32	0.00	0.00	0.00	0.00
4	Chan	270.36	284.74	587.48	162.07	0.00	0.00	0.00	0.00
5						0.00	0.00	0.00	0.00
6						0.00	0.00	0.00	0.00
7						0.00	0.00	0.00	0.00
8						0.00	0.00	0.00	0.00
9						0.00	0.00	0.00	0.00
10						0.00	0.00	0.00	0.00
11						0.00	0.00	0.00	0.00
12						0.00	0.00	0.00	0.00
13						0.00	0.00	0.00	0.00
14						0.00	0.00	0.00	0.00
15						0.00	0.00	0.00	0.00
16						0.00	0.00	0.00	0.00
17						0.00	0.00	0.00	0.00
18						0.00	0.00	0.00	0.00
19						0.00	0.00	0.00	0.00
20						0.00	0.00	0.00	0.00
21						0.00	0.00	0.00	0.00
22						0.00	0.00	0.00	0.00
23						0.00	0.00	0.00	0.00
24						0.00	0.00	0.00	0.00
25						0.00	0.00	0.00	0.00
26						0.00	0.00	0.00	0.00
27						0.00	0.00	0.00	0.00
28						0.00	0.00	0.00	0.00
29						0.00	0.00	0.00	0.00
30						0.00	0.00	0.00	0.00
31						0.00	0.00	0.00	0.00
32	Chan	284.74	299.12	552.69	156.45	0.00	0.00	0.00	0.00
33	Chan	299.12	313.5	351.27	123.08	0.00	0.00	0.00	0.00
34	ROB	313.5	366.2	60.32	153.02	42.10	48.19	122.24	30.44
35	ROB	366.2	418.9	4.08	30.25	52.70	4.08	30.25	0.00
36	ROB	418.9	461.87	0	7.56	41.53	0.00	7.56	0.00

2. Calculate Abutment Scour Froehlich Equation

NOTE: FHWA recommends NCHRP 24-20 methodology to estimate scour elevations. The Froelich scour calculations are provided here for information only as a check on NCHRP 24-20 calculations, and nor for design.

A. Determine length of embankment blocking live flow, L'

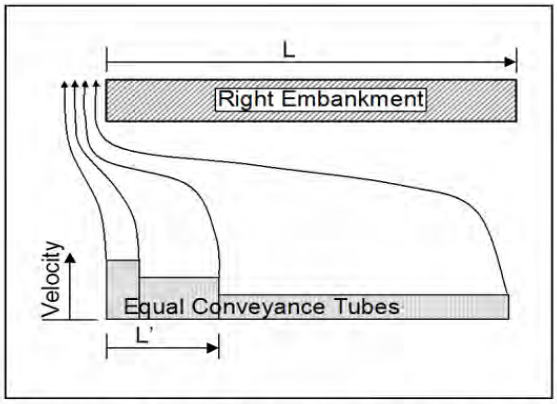


Figure 8.4. Determination of length of embankment blocking live flow for abutment scour estimation.

Left Abutment:

Storm Event	L (ft)	Q_e (sf)	L' (ft)	L'/L Check
100-Year	15.36	12.85	10.24	67%
500-Year	33.09	29.71	22.06	67%

Right Abutment:

Storm Event	L (ft)	Q_e (sf)	L' (ft)	
100-Year	44.31	25.81	28.07	63%
500-Year	136.33	52.27	30.44	22%

Notes:

1. L is the length of flow in the approach section obstructed by the projected abutment (from HEC-RAS inputs)

2. Q_e is the volume of flow in the approach section obstructed the projected abutment (from HEC-RAS inputs)

3. L' is the length of active flow obstructed by the projected abutment, corresponding to the area closest to the channel conveying 2/3 of total obstructed flow, calculated from the HEC-RAS flow distribution tables. In general, L' is expected to be approximately 1/3 of L.

B. Calculate Froude number for flow obstructed by the abutment embankment

g =	32.2	Acceleration due to gravity (from Contraction Scour Inputs) (ft/sec^2)

Left Abutment:

Storm Event	L (ft)	A_e (sf)	Q_e (sf)	y_e (ft)	V_e (fps)	Fr
100-Year	15.36	35.08	12.85	2.28	0.37	0.04
500-Year	33.09	70.98	29.71	2.15	0.42	0.05

Right Abutment:

Storm Event	L (ft)	A_e (sf)	Q_e (sf)	y_e (ft)	V_e (fps)	Fr
100-Year	44.31	80.58	25.81	1.82	0.32	0.04
500-Year	136.33	160.05	52.27	1.17	0.33	0.05

Notes:

1. L is the length of flow in the approach section obstructed by the projected abutment (from HEC-RAS inputs)

2. A_e is the area of flow in the approach section obstructed the projected abutment (from HEC-RAS inputs)

3. Q_e is the volume of flow in the approach section obstructed the projected abutment (from HEC-RAS inputs)

4. y_e is the average depth of flow in the approach section obstructed the projected abutment, A_e/L

5. V_e is the average velocity of flow in the approach section obstructed the projected abutment, Q_e/A_e

6. Fr is the Froude Number in the approach section obstructed by the projected abutment, $V_e/(g*y_e)^{1/2}$

C.1 Calculate Abutment Scour, Froehlich Equation:

$$\frac{y_s}{y_a} = 2.27\, K_1\, K_2 \left(\frac{L'}{y_a}\right)^{0.43} Fr^{0.61} + 1 \qquad (8.1)$$

K_1 =	1	Abutment shape coefficient, dimensionless
$K_{2\text{-lt abut}}$ =	1.00	Left abutment skew coefficient, dimensionless
$K_{2\text{-rt abut}}$ =	1.00	Right abutment skew coefficient, dimensionless

Table 8.1. Abutment Shape Coefficients.

Description	K_1
Vertical-wall abutment	1.00
Vertical-wall abutment with wing walls	0.82
Spill-through abutment	0.55

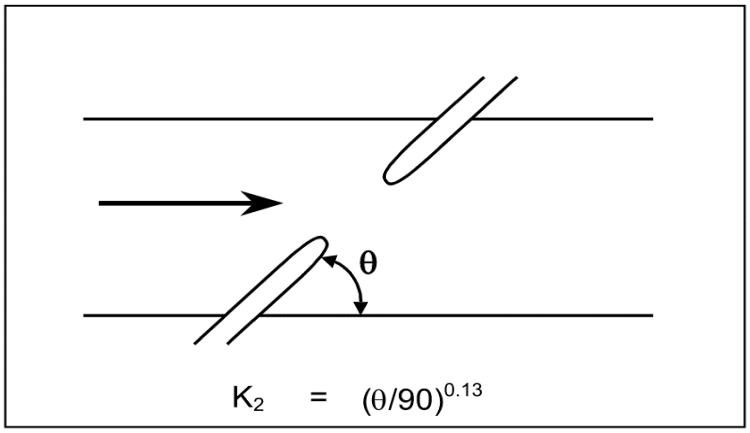


Figure 8.5. Orientation of embankment angle, 2, to the flow.

Left Abutment:

Storm Event	L' (ft)	Fr	y_a (ft)	y_s (ft)
100-Year	10.24	0.04	2.28	**3.73**
500-Year	22.06	0.05	2.15	**4.29**

Right Abutment:

Storm Event	L' (ft)	Fr	y_a (ft)	y_s (ft)
100-Year	28.07	0.04	1.82	**3.75**
500-Year	30.44	0.05	1.17	**2.98**

Notes:

1. L' is the length of active flow obstructed by the projected abutment

2. Fr is the Froude Number in the approach section obstructed by the projected abutment, $V_e/(g*y_e)^{1/2}$

3. $y_a = y_e$, the average depth of flow in the approach section obstructed the projected abutment, A_e/L

4. y_s is the calculated local abutment scour (Equation 8.1)

4. 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	1010.11	1013.9	Free Flow
500-Year	1011.1	1013.9	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

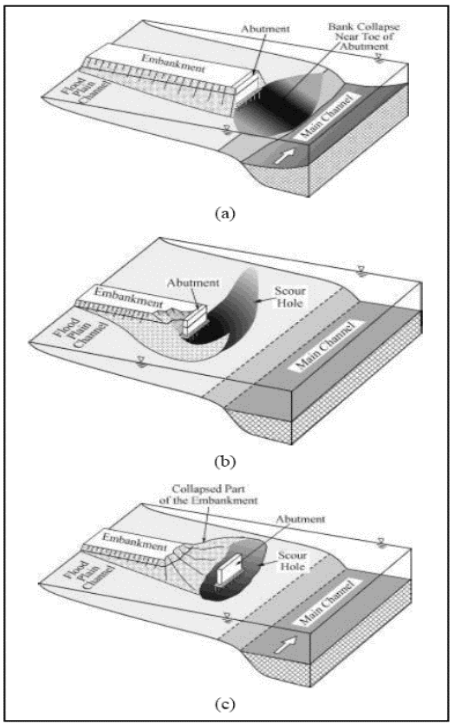


Figure 8.7. Abutment scour conditions (NCHRP 2010b).

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	15.36	24.86	76%	NO	**8.10**
500-Year	33.09	42.59	78%	NO	**8.10**

Right Abutment:

Storm Event	L (ft)	W_{ob-rt} (ft)	L/W (%)	Abut.in channel?	Figure to use:
100-Year	44.31	54.91	81%	NO	**8.10**
500-Year	136.33	146.93	93%	NO	**8.10**

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

3. If there is potential for lateral channel migration to impact abutment, adjust L/W to 76% to account for potential Scour Case A.

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

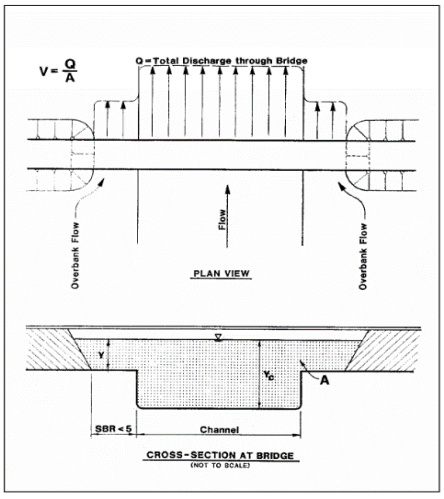


Figure 8.14. Velocity for SBR<5.

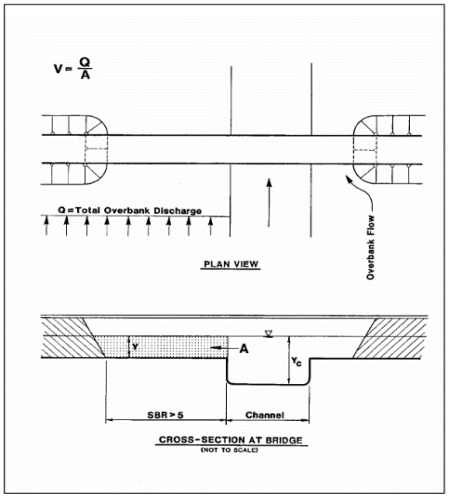


Figure 8.15. Velocity for SBR>5.

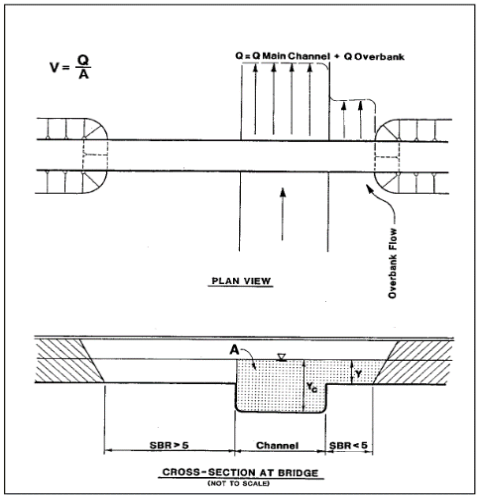


Figure 8.16. Velocity for SBR>5 and SBR<5.

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	128	141.4	205.5	220	5.17	2.59	2.80	8.14
500-Year	128	141.4	205.5	220	4.42	3.03	3.28	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. =	NO	Abutment in channel if $Sta_{lt\text{-}abut} > Sta_{lt\text{-}bank}$
Right Abut. =	NO	Abutment in channel if $Sta_{rt\text{-}abut} < Sta_{rt\text{-}bank}$

Approach Section unit discharge:

Channel

Storm Event	Q_1 (cfs)	W_1 (ft)	q_1 (ft^2/s)
100-Year	1687	71.90	23.46
500-Year	2287	71.90	31.81

Contracted Section unit discharge:

Left and Right Abutments:

Storm Event	Q_2 (cfs)	A_2 (sf)	V (fps)	y_{chan} (ft)	y_{chan} (ft)	q_{2c} (ft^2/s)
100-Year	1740.00	615.68	2.83	8.33	6.69	18.91
500-Year	2390.00	704.19	3.39	9.29	7.65	25.98

Notes:

1. Q_1 = flow in the approach section overbanks

2. W_1 = width of flow in the approach section overbanks

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 overbanks (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	76%	81%
500-Year	78%	93%

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

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

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

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

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)

Left and Right Abutments

Storm Event	y_1 (ft)	q_1 (cfs)	q_2 (cfs)	$y_{c\text{-}lt}$ (ft)
100-Year	8.71	23.46	18.91	7.24
500-Year	9.70	31.81	25.98	8.15

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

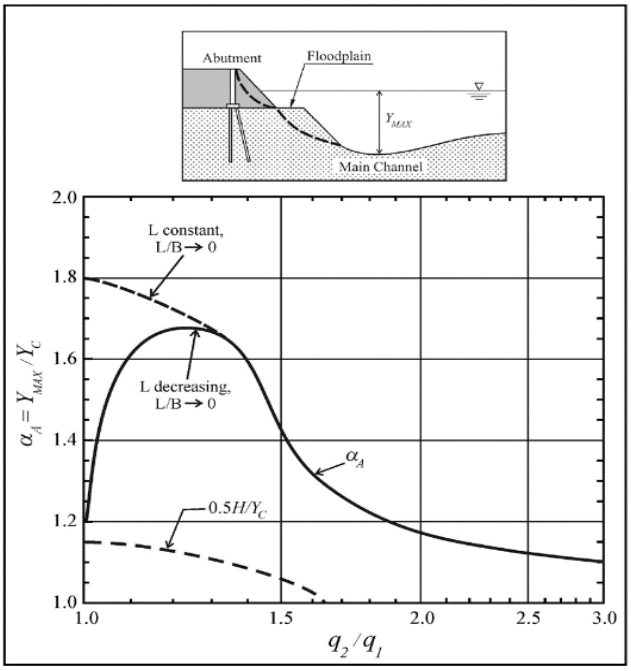


Figure 8.9. Scour amplification factor for spill-through abutments and live-bed conditions (NCHRP 2010b).

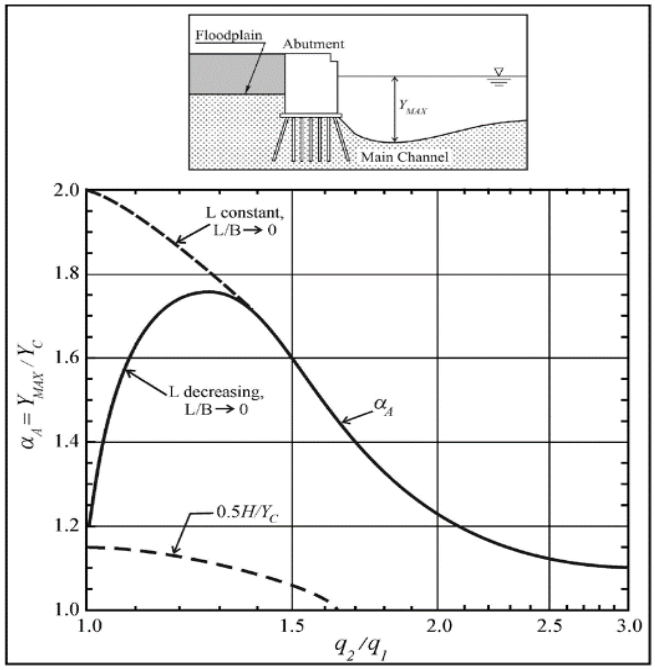


Figure 8.10. Scour amplification factor for wingwall abutments and live-bed conditions (NCHRP 2010b).

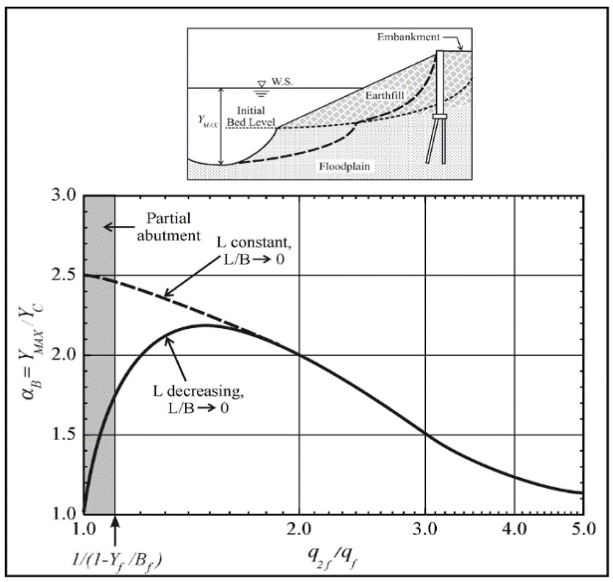


Figure 8.11. Scour amplification factor for spill-through abutments and clear-water conditions (NCHRP 2010b).

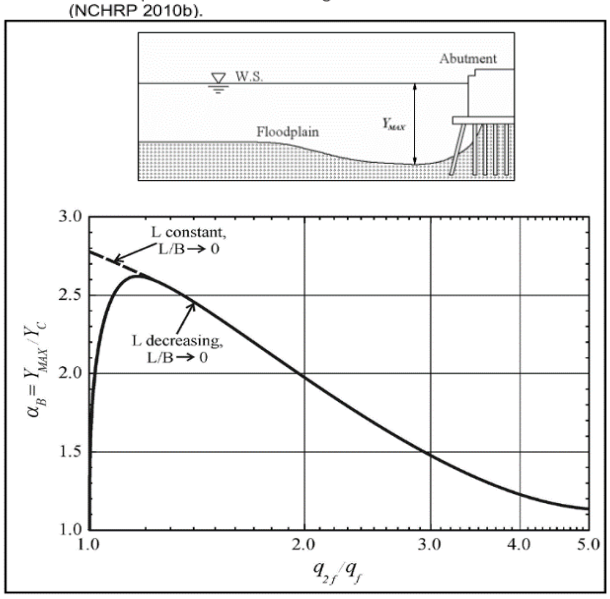


Figure 8.12. Scour amplification factor for wingwall abutments and clear-water conditions (NCHRP 2010b).

Left and Right Abutments:

Storm Event	Use Figure	q_1 (cfs)	q_2 (cfs)	q_2/q_1	α
100-Year	8.10	23.46	18.91	0.81	1.00
500-Year	8.10	31.81	25.98	0.82	1.00

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}

$$y_{max} = \alpha_A\, y_c \text{ or } y_{max} = \alpha_B\, y_c \qquad (8.3)$$

Left and Right Abutments:

Storm Event	y_c (ft)	α	y_{max} (ft)	y_0 (ft)	y_s (ft)	Scour El (Ft)
100-Year	7.24	1.00	**7.24**	2.11	**5.13**	1002.87
500-Year	8.15	1.00	**8.15**	3.10	**5.05**	1002.95

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 = depth of flow at face of abutment, W.S. El - Bed at Abutment face

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

Riprap Sizing Worksheet

Project:	**Proposed Rt 202 over Contoocook River**	**Project #**	**52792.00**
Location:	**Jaffrey, NH**	**Sheet**	**1**
Calculated by:	**DWC**	**Date:**	**3/15/2022**
Checked by:		**Date:**	
Title:	**Riprap Sizing at Abutments - Summary of Calculations**		

Method		Q100 D_{50} (in)	Q500 D_{50} (in)	
HEC-23 DG-4		**2**	**2**	
HEC-23 DG-14		**2**	**3**	
HEC-23 DG-18		**7**	**8**	
HEC-14 Ch 10		*26*	*33*	*Method for culverts based on pipe diameter - not appropriate*
HEC-14 Appendix D	**D-1**	**1**	**2**	
	D-2	**1**	**2**	
	D-3	**1**	**1**	
	D-4	*9*	*10*	*Method for culverts based on pipe diameter - not appropriate*
	D-5	*17*	*24*	*Method for culverts based on pipe diameter - not appropriate*
Average		3	3	
Maximum		**7**	**8**	

Recommendation: Use NHDOT Class III riprap, D50 = 12"

Riprap Sizing Worksheet

RESULTS

Project:	**Proposed Rt 202 over Contoocook River**	**Project #**	**52792.00**
Location:	**Milford, CT**	**Sheet**	**2**
Calculated by:	**DWC**	**Date:**	**3/15/2022**
Checked by:		**Date:**	
Title:	**RipRap Sizing Check at Abutments**		

Notes:

1) Calculations based on methodology outlined in HEC-23 3rd Edition (FHWA-NHI-09-112, 2009), Design Guide 4

2) Scour Countermeasure Design Storm = Q100; Check Storm = Q500

USACE Riprap Revetment Equation is applicable to uniform or gradually varying flow.

$$d_{30} = y(S_f C_S C_V C_T)\left[\frac{(V_{des})}{\sqrt{K_1(S_g - 1)gy}}\right]^{2.5}$$

Where d_{30} is equal to the particle size for which 30% is finer by weight, ft

Event	Q100	Q500	
Y	6.69	7.66	Average channel flow depth (ft)
SF	1.1	1.1	Safety factor for bank revetment
C_s	1	1	Stability coefficient (Angular Rock)
W	65.7	65.7	Channel width (ft)
C_v	1.00	1	Velocity distribution coefficient (1 for straight channel reaches)
C_t	1	1	Blanket thickness coefficient (1 is recommended)
V_{avg}	3.14	3.83	Average channel velocity (ft/s)
V_{des}	3.14	3.83	Characteristic velocity, (Use average velocity for straight reaches)
⊖	17.7	17.7	Bank angle in degrees, 1.5:1 max slope
g	32.2	32.2	Gravitational acceleration (ft/s^2)
S_g	2.65	2.65	Specific Gravity

Determine the side slope correction factor, K_1

K_1	0.98	0.98	

$$K_1 = \sqrt{1 - \left(\frac{\sin(\theta - 14^\circ)}{\sin(32^\circ)}\right)^{1.6}}$$

Calculate the d_{30} riprap size

d_{30}=	0.09	0.14	ft
d_{30}=	1.0	1.6	inches

Calculate the d_{50} from the d_{30}

d50=	0.10	0.16	ft
d50=	2.0	2.0	inches

$$d_{50} = 1.20\, d_{30}$$

Minimum Recommended Riprap	12	12	inches
Minimum Riprap Thicness	24	24	inches

Riprap Sizing Worksheet

Project:	**Proposed Rt 202 over Contoocook Riv**	**Project #**	**52792.00**
Location:	**Jaffrey, NH**	**Sheet**	**3**
Calculated by:	**DWC**	**Date:**	**3/15/2022**
Checked by:		**Date:**	
Title:	**Riprap Sizing at Abutments - Summary of Calculations**		

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 = 500 year

A) Determine Set-Back Ratio (SBR)

	Q100	Q500	
Setback Length	13.3	14.4	ft
Avg. Chan. Flow Depth	8.33	9.29	ft
SBR	1.59663866		

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

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

For Fr <0.80: *(Eq 14.1)*

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

For Fr >=0.80:

$$\frac{D_{50}}{y} = \frac{K}{(S_s - 1)}\left[\frac{V^2}{gy}\right]^{0.14}$$ *(Eq 14.2)*

Q	1740	2390	cfs	Flow Through Bridge Opening
A	554.14	624.02	sf	Contracted Area thru Bridge
V	3.14	3.83	ft/s	Channel Velocity through Bridge
S_g	2.65	2.65	pcf	Specific Gravity of Rip Rap
g	32.2	32.2	ft/s2	Gravitational Acceleration
y	6.69	7.66	ft	Average flow depth
K	1.02	1.02	ft	Vertical Wall Abutment, Fr<.80
Fr	0.21	0.24		Froude Number

D_{50}	0.2	0.3	median stone diameter, ft
D_{50}	**2.3**	**3.4**	median stone diameter, inches

C) Determine Recommended Riprap Extents

Flow Depth	6.69	7.66	ft
Extent from Toe	13	15	ft
Extent Downstream	13.38	15.32	ft
Extent Up Slope	*NA*	*NA*	ft
Recommended D_{50}	0.2	0.3	ft
Minimum Riprap Thickness	0.4	0.6	ft

Riprap Sizing Worksheet

Project:	**Proposed Rt 202 over Contoocook I**	**Project #**	**52792**
Location:	**Jaffrey, NH**	**Sheet**	**4**
Calculated by:	**DWC**	**Date:**	**3/15/2022**
Checked by:		**Date:**	
Title:	**Riprap Sizing at Abutments (HEC-23 DG 18)**		

Notes:

1) Calculations based on methodology outlined in HEC-23 3rd Edition (FHWA-NHI-09-112, 2009), Design Guide 18

2) Scour Countermeasure Design Check Storm = 500 year

1. Determine input variables

	Q100 Outlet	Q500 Outlet		
V_g[1]	3.14	3.83	ft/s	Flow velocity through bridge
S_g	2.65	2.65	pcf	Specific Gravity of Rip Rap
g	32.2	32.2	ft/s2	Gravitational Acceleration
y_0[2]	6.69	7.66	ft	Flow depth through bridge
Fr	0.21	0.24		Froude Number
K_r	0.38	0.38		sizing coefficient equal to 0.38 from the best fit lab data

2. Calculate Minimum Riprap size using HEC-23 equation 18.1

$$d_{50} = \frac{K_r y_0}{(S_g - 1)}\left(\frac{V_{AC}^2}{g y_0}\right)^{0.33}$$

equation 18.1

D_{50}	**0.56**	**0.70**	median stone diameter, ft	median stone diameter, ft
D_{50}	**6.7**	**8.3**	median stone diameter, inches	

Recommendation: Use NHDOT Class III riprap, D50 = 12"

3. Determine minimum riprap thickness.

	Left	Right	
Thickness, ft	3.00	3.00	Riprap thickness should not be less than 3xd5

Riprap Sizing Worksheet

Project:	**Proposed Rt 202 over Contoocook I**	**Project #**	**52792**
Location:	**Jaffrey, NH**	**Sheet**	**5**
Calculated by:	**DWC**	**Date:**	**3/15/2022**
Checked by:		**Date:**	
Title:	**Riprap Sizing at Abutments (HEC-14 10)**		

1. Determine input variables

	Q100 Outlet	Q500 Outlet		
V_g[1]	3.14	3.83	ft/s	Velocity through bridge
Q	1740.00	2390.00	cfs	Flow Through Culvert Opening
D	14.00	14.00	ft	Culvert diameter (approximated from bridge opening height)
D'	10.35	10.83	ft	Adjusted diameter for supercritical flow
S_g	2.65	2.65	pcf	Specific Gravity of Rip Rap
g	32.2	32.2	ft/s2	Gravitational Acceleration
y_0[2]	6.69	7.66	ft	Outlet Flow Depth
TW	8.54	9.59	ft	Tailwater depth of outlet channel
Fr	0.21	0.24		Froude Number

2. Calculate Riprap size using HEC-14 equation 10.4

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{gD^{2.5}}}\right)^{4/3}\left(\frac{D}{TW}\right)$$ *equation 10.4*

D_{50}	**2.15**	**2.75**	median stone diameter, ft
D_{50}	**25.8**	**33.0**	median stone diameter, inches

3. Determine riprap thickness.

	Left	Right	
Thickness, ft	6.44	8.24	Riprap thickness should not be less than 3xd50.

Riprap Sizing Worksheet

Project:	**Proposed Rt 202 over Contoocook I**	**Project #**	**52792**
Location:	**Jaffrey, NH**	**Sheet**	**6**
Calculated by:	**DWC**	**Date:**	**3/15/2022**
Checked by:		**Date:**	
Title:	**Riprap Sizing at Abutments (HEC-14 Appdx D)**		

1. Determine input variables

	Q100 Outlet	Q500 Outlet		
V_g[1]	3.14	3.83	ft/s	Culvert Outlet Velocity
Q	1740.00	2390.00	cfs	Flow Through Bridge Opening
D	14.00	14.00	ft	Culvert height (use bridge opening height)
B	92.00	92.00	ft	Culvert width (use bridge span)
S_g	2.65	2.65	pcf	Specific Gravity of Rip Rap
g	32.2	32.2	ft/s2	Gravitational Acceleration
y_0[2]	6.69	7.66	ft	Outlet Flow Depth
TW	8.54	9.59	ft	Tailwater depth of outlet channel
Fr	0.21	0.24		Froude Number
α	1.00	1.00		unit conversion constant (equation D1.b)
α	0.0126	0.0126		unit conversion constant (equation D.2)

2. Calculate Riprap size using HEC-14 equations

$$D_{50} = 0.014D\left(\frac{Q}{\alpha BD^{1.5}}\right)\left(\frac{D}{TW}\right)$$ *equation D.1b*

D_{50}	**0.12**	**0.14**	median stone diameter, ft

$$D_{50} = \alpha V^2$$ *equation D.2*

D_{50}	**0.12**	**0.18**	median stone diameter, ft

$$D_{50} = \frac{0.692}{S-1}\left(\frac{V^2}{2g}\right)$$ *equation D.3*

D_{50}	**0.06**	**0.10**	median stone diameter, ft

$$D_{50} = 0.25DFr_o$$ *equation D.4a*

D_{50}	**0.75**	**0.85**	median stone diameter, ft

$$D_{50} = 0.020D\left(\frac{Q}{\alpha D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$ *equation D.5*

D_{50}	**1.45**	**1.98**	median stone diameter, ft
	0.78	**1.06**	D1-D5 average
	0.09	**0.14**	D3-D4 average

3. Determine riprap thickness.

	Left	Right

Memorandum

To: NHDES Wetlands Bureau
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095

Date: December 20, 2022

Project #: 52792.00

From: Greg Goodrich, PE

Re: Env-Wt 904.10 Alternative Design Request
US 202/NH 124/NH 137 Intersection Improvements Project
Jaffrey, NH

This memorandum serves to satisfy a Request for Approval of an Alternative Design in accordance with NHDES Env-Wt 904.10 for the US 202/NH 124/NH 137 Intersection Improvements Project in Jaffrey, New Hampshire (NHDOT Project Number 16307). Section Env-Wt 904.10 is outlined below with each criterion individually addressed.

Env-Wt 904.10: Alternative Designs

(a) If the applicant can demonstrate that installing the structure specified in the applicable rule is not practicable, as that term is defined in Env-Wt 103, the applicant may propose an alternative design in accordance with this section.

(b) To request approval of an alternative design, the applicant shall submit a written request to the department, accompanied by a technical report that:

(1) Clearly explains how the proposed alternative meets the criteria for approval specified in (c) or (d), below, as applicable; and

(2) Has been prepared by:

a. An environmental scientist or professional engineer for a tier 1 stream crossing; or

b. A professional engineer for a tier 2, tier 3, or tier 4 stream crossing.

This alternative design request was prepared by Mr. Gregory Goodrich, VHB, NH Professional Engineer #12284.

(c) The department shall approve an alternative design for a tier 3 or tier 4 stream crossing if:

(1) The report submitted pursuant to (b), above, demonstrates that adhering to the stated requirements is not practicable, by providing:

a. A detailed financial comparison of the costs of a structure that complies with all applicable design requirements, the proposed structure, and a structure that requires fewer waivers than the proposed structure, with a range of costs estimates for each;

A fully compliant structure would be an approximately 120-foot-clear-span bridge crossing that would cost approximately $5.2M. The proposed structure is a 92-foot-clear-span bridge crossing that is expected to cost approximately $4.3M. Refer to Table 1 below for the cost comparison.

Table 1: Preliminary Cost Comparison[1]

Element	92-Foot Span	120-Foot Span
Superstructure	$2,500,000	$3,400,000
Substructure	$1,300,000	$1,300,000
Other	$500,000	$500,000
TOTAL	$4,300,000	$5,200,000

[1]These costs will be refined as the project design progresses.

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b. A detailed description of the physical limitations of the site; and

Site Limitations

The portion of the river where the bridge is proposed is artificially impounded by the Contoocook River Dam, so a stream geomorphic assessment (SGA) is not applicable. VHB prepared an SGA of a downstream reach that represented the best available (but still undesirable) reference for geomorphic evaluation of the Contoocook River. Therefore, the reference reach stream type (C5) should be interpreted cautiously as it differs from the impounded crossing location.

Furthermore, the topography and morphology of the crossing location is different from the SGA reference reach, as the effective floodplain at the proposed crossing is narrower and steeper. HEC-RAS hydraulic modeling shows the impounded bankfull width (BFW) is ±65 feet at bankfull stage (50% AEP, 2-year flood), but the floodplain width (2% AEP, 50-year flood) is only ±90 feet, resulting in an approximate entrenchment ratio of 1.38 (90/65) at the crossing location; compared to the entrenchment ratio of the downstream SGA reference reach (which was calculated to be 7.5).

Project-Specific ADR Criteria:

1. **The minimum entrenchment ratio for a Type C stream is 2.2 and the average bankfull width (BFW) of the reference reach was determined to be 54 feet. Therefore, based on the entrenchment ratio x BFW, the minimum required span is about 118.8 feet (rounded to 120 feet).**
2. **The proposed entrenchment ratio of 1.70 for the new crossing does not meet the minimum ratio for a Type C Stream (which is 2.2), as noted in Section 10 of the NHDES Stream Crossing Form.**

Design Benefits

Despite the inability to comply with the above criteria, the proposed bridge crossing is beneficial in the following ways:

- **The crossing is proposed at a naturally constricted point in the floodplain, making the 92-foot span align better with existing channel bank geometry and floodplain topography compared to the 120-foot span.**
- **The 92-foot span leaves the existing riverbed largely undisturbed and provides shelves for terrestrial wildlife passage above both banks that are located above the ordinary high-water elevation (1005.9 feet NGVD29).**
- **The 92-foot span allows for a shallower beam depth, increasing clearance below the bridge by about 1.5 feet compared to the 120-foot span alternative, totaling 5.5 feet of vertical clearance over the wildlife shelf for wildlife, ice/debris, and maintenance.**
- **The 92-foot span represents a significant reduction in construction cost compared to longer spans, as detailed above.**

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c. A hydraulic analysis to show that the proposed stream crossing can accommodate the applicable design storm or that the crossing, together with the associated roadway and roadway embankment, can safely accommodate overtopping flows; and

According to hydraulic modeling, the proposed bridge crossing can accommodate the predicted 100-year (Q100) flood flows and does not restrict flood hydraulics or sediment transport. Changes in flood elevations and channel velocities measured at the crossing location are negligible between the 120-foot and 92-foot span designs. The Q100 flows were determined to be approximately 1,740 cfs at elevation 1010.1 feet NGVD29 (as shown on the Wetland Impact Plans provided in *Appendix Q*).

(2) The proposed alternative meets:

a. The general design criteria established in Env-Wt 904.01; and

Refer to Section 11.3 of the Application Narrative which details the Project's compliance with this section of the rules.

b. The applicable design criteria established in Env-Wt 904.07 to the maximum extent practicable.

Refer to Section 11.4 of the Application Narrative which details the Project's compliance with this section of the rules.

_____

Greg Goodrich, PE

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Appendix F – Env-Wt 514 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 project is located within a densely populated urban area in the town of Jaffrey with little undeveloped space. The Contoocook River flows through the project area adjacent to Route 202 and under Main Street via the Contoocook River Dam. At the downstream project limits, the river flows between two mill buildings. The bank of the Contoocook River near the dam is composed of a concrete retaining wall and sidewalk, which transitions to a built stone wall bordering a paved sidewalk for approximately 85 feet along the eastern bank of the river. From there the eastern bank transitions to a more natural bank near the northern edge of the public parking lot off Blake Street. The concrete retaining wall near the bridge transitions to a mixed stone and concrete retaining wall for approximately 340 feet along the western bank from the dam, after which the bank transitions to a more natural bank. The field top of bank delineations along each bank began in the naturalized areas where the constructed walls end. The eastern and western banks of the river through the Site are densely vegetated with trees, shrubs, and invasive plant species and were observed to be relatively stable with no significant erosion or undercutting present. Little to no disturbance is noted along the natural riverbanks.

- Identify all known causes of erosion to the bank/shoreline in that location.

  As there is no existing structure at the crossing location, there is no history of scour. Historic aerial photographs show no change in channel alignment dating to 1998 and historic USGS maps show no noticeable change in channel alignment to 1936, the oldest available map after downstream dam was constructed. 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.

  The proposed riprap installation is required in order to prevent damage to the proposed bridge in accordance with standard engineering practices. A scour analysis calculated the scour elevation at the new bridge abutments to be 1002.9 feet. Refer to the Hydraulic Analysis Memo provided in Appendix E for more information.

- Identify information and, for minor and major projects, engineering standards used to determine the appropriateness of the proposed bank stabilization treatment or practice.

  A scour analysis assuming the check scour event (500-year flood frequency), a rare flood scenario, was conducted as part of the hydraulic analysis of the proposed bridge. Although existing vegetation is stable under smaller flow conditions, it will be removed to construct the bridge and remaining vegetation upstream would not protect the bridge structure under a scour design flood and therefore more robust countermeasures are needed to protect the stability of this key infrastructure. The riprap and toe extension has been designed in accordance with applicable NHDOT design guidelines and specifications: Standard Specifications for Road and Bridge Construction (2016), HEC-18 for evaluating bridge scour, and HEC-23 Bridge Scour Countermeasures. Refer to the Hydraulic Analysis Memo provided in Appendix E for more information. Although the existing banks are vegetated, it will be infeasible to maintain any vegetation or bioengineered bank stabilization below the footprint of the bridge. Existing vegetation will need to be removed for construction and once complete, the 62-foot wide bridge deck will block rainfall and sunlight, creating an area of dry unvegetated soil that is highly susceptible to erosion if left unprotected.

- Explain the design elements that have been incorporated to address erosion, by eliminating or minimizing the causes therefor.

  Preliminary design considered several substructure types including spread footings founded on tremie seals and micropiles. Tremie seals are cost prohibitive and no longer considered for this project. The bottom of footing for the abutments is located to idealize design of the micropiles. Lowering the footing elevation below the calculated scour elevation make the use of micropiles impractical. Therefore, including riprap in front of both abutments, allows the use of the ideal substructure type while also providing robust scour countermeasures that mitigate the loss of vegetation under the footprint of the bridge above. The proposed riprap layout and grading has been designed to minimize changes to existing channel and bank geometry and the proposed design maintains a wildlife passage shelf along the top of both banks above the riprap to preserve passage for terrestrial wildlife along the banks of the river. The proposed bridge is located within a naturally constricted section of channel and proposed grading has been designed to maintain existing grading to the extent practicable, minimizing potential erosion from changes to the river channel/floodplain geometry.

- 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.

  The proposed project will not substantially impact the Base Flood Elevation (BFE), floodway elevation, and floodway width of the Contoocook River. Refer to the Hydraulic Analysis Memo provided in Appendix E. The riprap placed in front of both abutments will closely match existing conditions with moderate variation in grading. This bridge is not located within a regulatory floodway and therefore not subject to the Floodway Requirement CRF 60.3(d)(3). The riprap has been designed and sized in accordance with HEC-23 and therefore has a high flood risk tolerance.

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.

Appendix G – NHB DataCheck Report

New Hampshire Natural Heritage Bureau
NHB DataCheck Results Letter

To: New Hampshire Department of Transportation
2 Bedford Farms Drive Suite 200
Bedford, NH 03110

From: NH Natural Heritage Bureau

Date: 11/7/2022 (This letter is valid through 11/7/2023)

Re: Review by NH Natural Heritage Bureau of request dated 11/7/2022

Permit Types: Stormwater Pollution Prevention
Alteration of Terrain Permit
Shoreland Standard Permit
Wetland Standard Dredge & Fill - Major
General Permit

NHB ID: NHB22-3543

Applicant: New Hampshire Department of Transportation

Location: Jaffrey
Tax Map: NA, Tax Lot: NA
Address: Main Street, Jaffrey, NH 03452

Proj. Description: NHDOT proposes improvements to the five-way intersection of US 202 with NH 124, Stratton Road, and Blake Street to address the traffic congestion and safety deficiencies associated with the current configuration of the US 202 “dog-leg” intersections. Proposed improvements include two roundabouts, rehab of the Main Street bridge, and a new bridge over the Contoocook River. Jurisdictional impacts are limited to around the new stream crossing. Work will be contained with existing and acquired right-of-way and easements. Wildlife friendly erosion controls and standard NHDOT BMPs will be implemented throughout construction.

The NH Natural Heritage database has been checked for records of rare species and exemplary natural communities near the area mapped below. The species considered include those listed as Threatened or Endangered by either the state of New Hampshire or the federal government. We currently have no recorded occurrences for sensitive species near this project area.

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.

Based on the information submitted, no further consultation with the NH Fish and Game Department pursuant to Fis 1004 is required.

MAP OF PROJECT BOUNDARIES FOR: NHB22-3543

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

Appendix H – USFWS IPaC Report & Correspondence

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: January 25, 2023
Project Code: 2023-0010708
Project Name: Jaffrey - US 202 & NH 124 Improvments

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 12/27/2022 - 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 ECOS-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 12/27/2022) Please visit our New England Field Office Project Review webpage at the link above for updated northern long-eared bat consultation guidance. The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule will go into effect on **January 30, 2023**. After that date, the current 4(d) rule for NLEB will no longer be in effect, and the 4(d) determination key will no longer be available. New compliance tools will be available by mid- to late-January, and information will be posted on our New England Field Office Project Review webpage in January, so please check this site often for updates.
Depending on the type of effects a project has on NLEB, 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 may result in incidental take of NLEB after the new listing goes into effect, this will need to be addressed in an updated consultation that includes an Incidental Take Statement. Many of these situations will be addressed through the new compliance tools. If your project may require re-initiation of consultation, please wait for information on the new tools to appear on our website or contact our office at **newengland@fws.gov** for additional guidance.

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: 2023-0010708
Project Name: Jaffrey - US 202 & NH 124 Improvments
Project Type: Road/Hwy - Maintenance/Modification
Project Description: Proposed improvements include a 3 leg, single lane roundabout along existing US 202 (River Street) where a new roadway will be built to the east, which will become US 202 resulting in a new bridge over the Contoocook River. This new relocated section of US 202 will include a new bridge over the Contoocook River and will land near Blake Street where it will be one leg of a proposed 5 leg, single lane roundabout with, Stratton Road, NH 124 (Turnpike Road), US 202 and NH 124 (Main Street). Improvements are intended to match the intent of the plan presented at the public hearing.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.814476799999994,-72.02275165664184,14z

Counties: Cheshire 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.

IPaC User Contact Information

Agency: VHB, Inc.
Name: Nicole Martin
Address: 2 Bedford Farms Drive
Address Line 2: Suite 200
City: Bedford
State: NH
Zip: 03110
Email nmartin@vhb.com
Phone: 6033913900

Lead Agency Contact Information

Lead Agency: Federal Highway Administration

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
http://www.fws.gov/newengland

IPaC Record Locator: 063-15536544 March 06, 2019

Subject: Consistency letter for the 'US 202 / NH 124 / NH 137 Intersection Improvement Project' project (TAILS 05E1NE00-2018-R-0899) under the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

To whom it may concern:

The U.S. Fish and Wildlife Service (Service) has received your request dated to verify that the US 202 / NH 124 / NH 137 Intersection Impr ovement Pr oject (Proposed Action) may rely on the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (PBO) to satisfy requirements under Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based on the information you provided (Project Description shown below), you have determined that the Proposed Action is within the scope and adheres to the criteria of the PBO, including the adoption of applicable avoidance and minimization measures, and may affect, and is likely to adversely affect the endangered Indiana bat (Myotis sodalis) and/or the threatened Northern long-eared bat (Myotis septentrionalis). Consultation with the Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required.

This "may affect - likely to adversely affect" determination becomes effective when the lead Federal action agency or designated non-federal representative uses it to ask the Service to rely on the PBO to satisfy the agency's consultation requirements for this project. Please provide this consistency letter to the lead Federal action agency or its designated non-federal representative with a request for its review, and as the agency deems appropriate, transmittal to this Service Office for verification that the project is consistent with the PBO.

This Service Office will respond by letter to the requesting Federal action agency or designated non-federal representative within 30 calendar days to:

- verify that the Proposed Action is consistent with the scope of actions covered under the PBO;
- verify that all applicable avoidance, minimization, and compensation measures are included in the action proposal;
- identify any action-specific monitoring and reporting requirements, consistent with the monitoring and reporting requirements of the PBO, and
- identify anticipated incidental take.

ESA Section 7 compliance for this Proposed Action is not complete until the Federal action agency or its designated non-federal representative receives a verification letter from the Service.

For Proposed Actions that include bridge/structure removal, replacement, and/or maintenance activities: If your initial bridge/structure assessments failed to detect Indiana bats, but you later detect bats during construction, please submit the Post Assessment Discovery of Bats at Bridge/Structure Form (User Guide Appendix E) to this Service Office. In these instances, potential incidental take of Indiana bats may be exempted provided that the take is reported to the Service.

If the Proposed Action may affect any other federally-listed or proposed species and/or designated critical habitat, additional consultation between the lead Federal action agency and this Service Office is required. If the proposed action has the potential to take bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act may also be required. In either of these circumstances, please advise the lead Federal action agency for the Proposed Action accordingly.

Project Description

The following project name and description was collected in IPaC as part of the endangered species review process.

Name

US 202 / NH 124 / NH 137 Intersection Improvement Project

Description

The NHDOT proposes to improve the intersection of US 202 with NH 124 in the town of Jaffrey, NH. The project includes improving the five-way signal-controlled intersection to a roundabout. Additionally, US 202 would be re-realigned along a new segment of roadway proposed to be constructed between Blake Street and River Street across the Contoocook River, requiring the construction of a new bridge. The new bridge would tie into a smaller three-leg roundabout west of the Contoocook River that would reconnect US 202 with River Street.

Determination Key Result

Based on your answers provided, this project is likely to adversely affect the endangered Indiana bat and/or the threatened Northern long-eared bat. Therefore, consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended 16 U.S.C. 1531 et seq.) is required. However, also based on your answers provided, this project may rely on the conclusion and Incidental Take Statement provided in the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

Qualification Interview

1. Is the project within the range of the Indiana bat[1]?

   [1] See Indiana bat species profile

   Automatically answer ed
   No

2. Is the project within the range of the Northern long-eared bat[1]?

   [1] See Northern long-eared bat species profile

   Automatically answer ed
   Yes

3. Which Federal Agency is the lead for the action?

   A) Federal Highway Administration (FHWA)

4. Are all project activities limited to non-construction[1] activities only? (examples of non-construction activities include: bridge/abandoned structure assessments, surveys, planning and technical studies, property inspections, and property sales)

   [1] Construction refers to activities involving ground disturbance, percussive noise, and/or lighting.

   No

5. Does the project include any activities that are greater than 300 feet from existing road/rail surfaces[1]?

   [1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

   No

6. Does the project include any activities within 0.5 miles of a known Indiana bat and/or NLEB hibernaculum[1]?

   [1] For the purpose of this consultation, a hibernaculum is a site, most often a cave or mine, where bats hibernate during the winter (see suitable habitat), but could also include bridges and structures if bats are found to be hibernating there during the winter.

   No

7. Is the project located within a karst area?

   No

8. Is there any suitable[1] summer habitat for Indiana Bat or NLEB within the project action area[2]? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   [2] The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Section 402.02). Further clarification is provided by the national consultation FAQs.

   Yes

9. Will the project remove any suitable summer habitat[1] and/or remove/trim any existing trees within suitable summer habitat?

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   Yes

10. Will the project clear more than 20 acres of suitable habitat per 5-mile section of road/rail?

    No

11. Have presence/probable absence (P/A) summer surveys[1][2] been conducted[3][4] within the suitable habitat located within your project action area?

    [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

    [2] Presence/probable absence summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate distance from hibernacula) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

    [3] For projects within the range of either the Indiana bat or NLEB in which suitable habitat is present, and no bat surveys have been conducted, the transportation agency will assume presence of the appropriate species. This assumption of presence should be based upon the presence of suitable habitat and the capability of bats to occupy it because of their mobility.

    [4] Negative presence/probable absence survey results obtained using the summer survey guidance are valid for a minimum of two years from the completion of the survey unless new information (e.g., other nearby surveys) suggest otherwise.

    No

12. Does the project include activities within documented NLEB habitat [1][2]?

    [1] Documented roosting or foraging habitat – for the purposes of this consultation, we are considering documented habitat as that where Indiana bats and/or NLEB have actually been captured and tracked using (1) radio telemetry to roosts; (2) radio telemetry biangulation/triangulation to estimate foraging areas; or (3) foraging areas with repeated use documented using acoustics. Documented roosting habitat is also considered as suitable summer habitat within 0.25 miles of documented roosts.)

    [2] For the purposes of this key, we are considering documented corridors as that where Indiana bats and/or NLEB have actually been captured and tracked to using (1) radio telemetry; or (2) treed corridors located directly between documented roosting and foraging habitat.

    No

13. Will the removal or trimming of habitat or trees occur within suitable but undocumented NLEB roosting/foraging habitat or travel corridors?

    Yes

14. What time of year will the removal or trimming of habitat or trees within suitable but undocumented NLEB roosting/foraging habitat or travel corridors occur?

    C) During both the active and inactive seasons

15. Will any tree trimming or removal occur within 100 feet of existing road/rail surfaces?

    Yes

16. Will more than 10 trees be removed between 0-100 feet of the road/rail surface during the active season[1]?

    [1] Areas containing more than 10 trees will be assessed by the local Service Field Office on a case-by-case basis with the project proponent.

    Yes

17. Will the tree removal alter any documented Indiana bat or NLEB roosts and/or alter any surrounding summer habitat within 0.25 mile of a documented roost?

    No

18. Will any tree trimming or removal occur between 100-300 feet of existing road/rail surfaces?

    Yes

19. Are all trees that are being removed clearly demarcated?

    Yes

20. Will the removal of habitat or the removal/trimming of trees involve the use of temporary lighting?

    No

21. Will the removal of habitat or the removal/trimming of trees include installing new or replacing existing permanent lighting?

    Yes

22. Does the project include maintenance of the surrounding landscape at existing facilities (e.g., rest areas, stormwater detention basins)?

    No

23. Does the project include wetland or stream protection activities associated with compensatory wetland mitigation?

    No

24. Does the project include slash pile burning?

    No

25. Does the project include any bridge removal, replacement, and/or maintenance activities (e.g., any bridge repair, retrofit, maintenance, and/or rehabilitation work)?

    No

26. Does the project include the removal, replacement, and/or maintenance of any structure other than a bridge? (e.g., rest areas, offices, sheds, outbuildings, barns, parking garages, etc.)

    Yes

27. Is there any suitable habitat[1] for Indiana bat or NLEB within 1,000 feet of the structure? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

    [1] See the Service's current summer survey guidance for our current definitions of suitable habitat.

    Yes

28. Has a structure assessment[1] been conducted within the last 24 months[2] to determine if bats are using the structure(s)?

    [1] Structure assessment for occupied buildings means a cursory inspection for bat use. For abandoned buildings a more thorough evaluation is required (See User Guide Appendix D for bridge/abandoned structure assessment guidance).

    [2] Assessments must be completed no more than 2 years prior to conducting any work on the structures, regardless of whether assessments have been conducted in the past. Due to the transitory nature of bat use, a negative result in one year does not guarantee that bats will not use that structure in subsequent years.

    Yes

    SUBMITTED DOCUMENTS

    - 2019-02-28_Walker_Ash Telephone Note.pdf https://ecos.fws.gov/ipac/project/PVESERZ4DFG63N4DII4YEXE264/projectDocuments/15627195
    - 2019-03-04 Walker Cummings Telephone Note.pdf https://ecos.fws.gov/ipac/project/PVESERZ4DFG63N4DII4YEXE264/projectDocuments/15627198

29. Did the structure assessment detect any signs of Indiana bats and/or NLEBs roosting in/ under the structure (bats, guano, etc.)[1]?

    [1] If bridge assessment detects signs of any species of bats, coordination with the local FWS office is needed to identify potential threatened or endangered bat species. Additional studies may be undertaken to try to identify which bat species may be utilizing the bridge prior to allowing any work to proceed.

    No

30. Will the structure removal, replacement, and/or maintenance activities include installing new or replacing existing permanent lighting?

    Yes

31. Will the project involve the use of temporary lighting during the active season?

    No

32. Will the project install any new or replace any existing permanent lighting in addition to the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities?

    Yes

33. Is there any suitable habitat within 1,000 feet of the location(s) where permanent lighting (other than the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities) will be installed or replaced?

    Yes

34. Does the project include percussives or other activities (not including tree removal/ trimming or bridge/structure work) that will increase noise levels above existing traffic/ background levels?

    Yes

35. Will the activities that use percussives (not including tree removal/trimming or bridge/ structure work) and/or increase noise levels above existing traffic/background levels be conducted during the active season[1]?

    [1] Coordinate with the local Service Field Office for appropriate dates.

    Yes

36. Will any activities that use percussives (not including tree removal/trimming or bridge/structure work) and/or increase noise levels above existing traffic/background levels be conducted during the inactive season[1]?

    [1] Coordinate with the local Service Field Office for appropriate dates.

    Yes

37. Are all project activities that are not associated with habitat removal, tree removal/trimming, bridge and/or structure activities, temporary or permanent lighting, or use of percussives, limited to actions that DO NOT cause any additional stressors to the bat species?

    Examples: lining roadways, unlighted signage , rail road crossing signals, signal lighting, and minor road repair such as asphalt fill of potholes, etc.

    No

38. Will the project raise the road profile above the tree canopy?

    No

39. Are the project activities that use percussives (not including tree removal/trimming or bridge/structure work) consistent with a Not Likely to Adversely Affect determination in this key?

    Automatically answered

    Yes, because the activities are within 300 feet of the existing road/rail surface, greater than 0.5 miles from a hibernacula, conducted during the active season, and are not within documented habitat

40. Are the project activities that use percussives (not including tree removal/trimming or bridge/structure work) and/or increase noise levels above existing traffic/background levels consistent with a No Effect determination in this key?

    Automatically answered

    Yes, because the activities are within 300 feet of the existing road/rail surface, greater than 0.5 miles from a hibernacula, and conducted during the inactive season

41. Is the habitat removal portion of this project consistent with a Likely to Adversely Affect determination in this key?

    Automatically answered

    Yes, because tree removal that occurs during the active season occurs within 100 feet from the existing road/rail surface, is not in documented NLEB roosting/foraging habitat or travel corridors, and a visual survey has not been conducted

42. Is the habitat removal portion of this project consistent with a Likely to Adversely Affect determination in this key?

    Automatically answered

    Yes, because tree removal that occurs during the active season is 100-300 feet from the existing road/rail surface and is not in documented NLEB roosting/foraging habitat or travel corridors

43. Is the habitat removal portion of this project consistent with a Not Likely to Adversely Affect determination in this key?

    Automatically answered

    Yes, because the tree removal/trimming that occurs outside of the active season occurs greater than 0.5 miles from the nearest hibernaculum, is less than 100 feet from the existing road/rail surface, includes clear demarcation of the trees that are to be removed, and does not alter documented roosts and/or surrounding summer habitat within 0.25 miles of a documented roost

44. Is the habitat removal portion of this project consistent with a Likely to Adversely Affect determination in this key?

    Automatically answered

    Yes, because the tree removal that occurs during the winter is 100-300 feet from the existing road/rail surface, and is not in documented roosting/foraging habitat or travel corridors

45. Is the structure removal, replacement, or maintenance activities portion of this project consistent with a No Effect determination in this key?

    Automatically answered

    Yes, because the structure has been assessed using the criteria documented in the BA and no signs of bats were detected

46. General AMM 1

    Will the project ensure all operators, employees, and contractors working in areas of known or presumed bat habitat are aware of all FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable Avoidance and Minimization Measures?

    Yes

47. Tree Removal AMM 1
Can all phases/aspects of the project (e.g., temporary work areas, alignments) be modified, to the extent practicable, to avoid tree removal[1] in excess of what is required to implement the project safely?

Note: Tree Removal AMM 1 is a minimization measure, the full implementation of which may not always be practicable. Projects may still be NLAA as long as Tree Removal AMMs 2, 3, and 4 are implemented and LAA as long as Tree Removal AMMs 3, 5, 6, and 7 are implemented.

[1] The word "trees" as used in the AMMs refers to trees that are suitable habitat for each species within their range. See the USFWS' current summer survey guidance for our latest definitions of suitable habitat.

Yes

48. Tree Removal AMM 3
Can tree removal be limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits)?

Yes

49. Lighting AMM 1
Will all temporary lighting used during the removal of suitable habitat and/or the removal/trimming of trees within suitable habitat be directed away from suitable habitat during the active season?

Yes

50. Lighting AMM 2
Does the lead agency use the BUG (Backlight, Uplight, and Glare) system developed by the Illuminating Engineering Society[1][2] to rate the amount of light emitted in unwanted directions?

[1] Refer to Fundamentals of Lighting - BUG Ratings

[2] Refer to The BUG System—A New Way To Control Stray Light

No

51. Lighting AMM 2
Will all permanent lighting used during removal of suitable habitat and/or the removal/ trimming of trees within suitable habitat use downward-facing, full cut-off[1] lens lights (with same intensity or less for replacement lighting)?

[1] Refer to Luminaire classification for controlling stray light

Yes

52. Lighting AMM 2
Will all permanent lighting used during removal of suitable habitat and/or the removal/ trimming of trees within suitable habitat be directed away from all areas with suitable habitat?

Yes

53. Lighting AMM 2
Does the lead agency use the BUG (Backlight, Uplight, and Glare) system developed by the Illuminating Engineering Society[1][2] to rate the amount of light emitted in unwanted directions?

[1] Refer to Fundamentals of Lighting - BUG Ratings

[2] Refer to The BUG System—A New Way To Control Stray Light

No

54. Lighting AMM 2
Will all permanent lighting (other than any lighting already indicated for tree clearing or bridge/structure removal, replacement or maintenance activities) use downward-facing, full cut-off[1] lens lights (with same intensity or less for replacement lighting)?

[1] Refer to Luminaire classification for controlling stray light

Yes

55. Lighting AMM 2
Will the permanent lighting (other than any lighting already indicated for tree clearing or bridge/structure removal, replacement or maintenance activities) be directed away from all areas with suitable habitat?

Yes

56. For Indiana bat, if applicable, compensatory mitigation measures are required to offset adverse effects on the species (see Section 2.10 of the BA). Please select the mechanism in which compensatory mitigation will be implemented:

    6. Not Applicable

Project Questionnaire

1. Have you made a No Effect determination for all other species indicated on the FWS IPaC generated species list?

   Yes

2. Have you made a May Affect determination for any other species on the FWS IPaC generated species list?

   No

3. How many acres[1] of trees are proposed for removal between 0-100 feet of the existing road/rail surface?

   [1] If described as number of trees, multiply by 0.09 to convert to acreage and enter that number.

   0.4

4. How many acres[1] of trees are proposed for removal between 100-300 feet of the existing road/rail surface?

   [1] If described as number of trees, multiply by 0.09 to convert to acreage and enter that number.

   0.6

5. Please verify:

   All tree removal will occur greater than 0.5 mile from any hibernaculum.

   Yes, I verify that all tree removal will occur greater than 0.5 miles from any hibernaculum.

6. Is the project location 0-100 feet from the edge of existing road/rail surface?

   Yes

7. Is the project location 100-300 feet from the edge of existing road/rail surface?

   Yes

8. Please verify:

No documented NLEB roosts or surrounding summer habitat within 150 feet of documented roosts will be impacted between June 1 and July 31.

Yes, I verify that no documented NLEB roosts or surrounding summer habitat within 150 feet of documented roosts will be impacted during this period.

9. Please describe the proposed structure work:

   The project would involve modifying the existing five-leg signal-controlled intersection to a five-leg roundabout at the intersection of Main Street, Peterborough Street, Turnpike Road, Stratton Road, and Blake Street. Additionally, US 202 would be realigned along a new segment of roadway proposed to be constructed between Blake Street and River Street across the Contoocook River, requiring the construction of a new bridge. The new bridge would tie into a smaller three-leg roundabout west of the Contoocook River that would reconnect US 202 with River Street.

10. Please state the timing of all proposed structure work:

    Currently unknown

11. You have indicated that the following Avoidance and Minimization Measures (AMMs) will be implemented as part of the proposed project:
    - General AMM 1
    - Lighting AMM 1
    - Lighting AMM 2
    - Tree Removal AMM 1
    - Tree Removal AMM 3

Avoidance And Minimization Measures (AMMs)

These measures were accepted as part of this determination key result:

GENERAL AMM 1

Ensure all operators, employees, and contractors working in areas of known or presumed bat habitat are aware of all FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable AMMs.

LIGHTING AMM 1

Direct temporary lighting away from suitable habitat during the active season.

LIGHTING AMM 2

When installing new or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting); or for those transportation agencies using the BUG system developed by the Illuminating Engineering Society, be as close to 0 for all three ratings with a priority of "uplight" of 0 and "backlight" as low as practicable.

TREE REMOVAL AMM 1

Modify all phases/aspects of the project (e.g., temporary work areas, alignments) to avoid tree removal.

TREE REMOVAL AMM 3

Ensure tree removal is limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits).

Determination Key Description: FHWA, FRA, FTA Programmatic Consultation For Transportation Projects Affecting NLEB Or Indiana Bat

This key was last updated in IPaC on March 16, 2018. Keys are subject to periodic revision.

This decision key is intended for projects/activities funded or authorized by the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and/or Federal Transit Administration (FTA), which require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 of the Endangered Species Act (ESA) for the endangered Indiana bat (Myotis sodalis) and the threatened Northern long-ear ed bat (NLEB) (Myotis septentrionalis).

This decision key should only be used to verify project applicability with the Service's February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects. The programmatic biological opinion covers limited transportation activities that may affect either bat species, and addresses situations that are both likely and not likely to adversely affect either bat species. This decision key will assist in identifying the effect of a specific project/activity and applicability of the programmatic consultation. The programmatic biological opinion is not intended to cover all types of transportation actions. Activities outside the scope of the programmatic biological opinion, or that may affect ESA-listed species other than the Indiana bat or NLEB, or any designated critical habitat, may require additional ESA Section 7 consultation.

Appendix I – NHDHR Section 106 Consultation

This appendix includes:
- Adverse Effect Memo
- 2020 Memorandum of Agreement
- 2022 Memorandum of Agreement

New Hampshire DOT
Department of Transportation

Victoria F. Sheehan
Commissioner

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

William Cass, P.E.
Assistant Commissioner

JAFFREY
16307
X-A001(234)
RPR 9564

Adverse Effect Memo

For the purpose of compliance with regulations of the National Historic Preservation Act, as amended, and the Advisory Council on Historic Preservation's *Procedures for the Protection of Historic Properties* (36 CFR 800), the NH Division of the Federal Highway Administration (FHWA) and the NH Division of Historical Resources (NHDHR) have coordinated regarding the identification and evaluation of historic and archeological properties potentially affected by plans to improve the intersection of US 202 (Main Street/Peterborough Street) with NH 124 (Turnpike Road), Stratton Road, and Blake Street in Jaffrey, New Hampshire. The Area of Potential Effect (APE) begins to the north along US 202 near Cross Street and continues southwest along US 202 to Tyler Hill Road. The APE also extends across the five-leg intersection from US 202 onto Blake Street, crossing the Contoocook River approximately 400 feet southwest of Main Street.

FHWA funds would be applied to the construction of the Proposed Action, and therefore FHWA is the lead federal agency for this consultation.

Project Description:

Intersection Improvements
The Proposed Action calls for the existing five-leg traffic signal controlled Main Street/Peterborough Street/Turnpike Road/Stratton Road/Blake Street intersection to be reconstructed to form a five-leg single-lane roundabout. The proposed roundabout would have an inscribed diameter (approximate outside curb-to-curb edge) of approximately 125 feet. Each approach to the roundabout would consist of only a single lane except for the northbound approach from a new connector roadway that would also provide a channelized right-turn lane.

US 202 Realignment
In addition to improving the five-leg intersection at Main Street, the Proposed Action calls for US 202 to be realigned by constructing a new 140-foot long bridge crossing the Contoocook River approximately 375 feet south of the Main Street bridge. A new segment of US 202 would extend south and west from the five-leg roundabout using portions of the current Blake Street alignment to cross the river to River Street. The new segment of US 202 would intersect River Street at a second proposed roundabout. The River Street roundabout would be a 3-leg single-lane roundabout with an inscribed diameter of approximately 125 feet.

Additional Improvements
In addition to the proposed improvements to traffic flow through the five-leg intersection and along US 202, the proposed improvements include new accommodations for pedestrians. The proposed connector roadway and Contoocook River bridge crossing would provide a 5.5-foot wide sidewalk and a 5- to 7-foot wide shoulder/bike lane on each side of the roadway. The two roundabouts would provide pedestrian crosswalks and pedestrian refuge islands on each approach to the roundabout, which would accommodate pedestrians crossing only one lane and one direction of traffic at a time. Access to the Monadnock Recreational Rail Trail located to the north and south of the intersection would also be maintained.

The Proposed Action also includes the implementation of a stormwater management plan to minimize water quality impacts. This plan would include the construction of a stormwater Best Management Practice (BMP) to treat the additional impervious area. This BMP would be constructed on the east side of the Contoocook River in the vicinity of the new proposed bridge structure and would drain to the Contoocook River. As the Project design progresses, the feasibility of constructing this BMP would be evaluated further as well as the potential use of porous pavers or asphalt in appropriate locations as a means of reducing the amount of impervious area. Additionally, use of other low impact measures such as tree planters would also be evaluated.

Identification:

Above-Ground Resources
In March 2018, a Request for Project Review (RPR) was submitted to NHDHR for the US 202 / NH 124 / NH 137 Intersection Improvement Project (Jaffrey 16307). NHDHR reviewed the RPR on April 18, 2018. In response to NHDHR request for additional information, an Area Form for the Downtown Jaffrey Historic District Boundary Increase was submitted to NHDHR in November 2018 to determine if the period of significance should be extended to 1968, the 50-year cut-off date in 2018, and to examine potential areas of expansion of the boundaries of the existing Downtown Jaffrey Historic District. The Area Form proposed to increase the Downtown Jaffrey Historic District to include Charlonne Street, which runs roughly parallel to the southwest boundary of the existing district, and a short portion of River Street terminating at Tyler Hill Road, as a directly related part of Downtown Jaffrey's development in the late nineteenth and early twentieth centuries. Field surveys for development of the Area Form within this area were conducted in January and September of 2018. A NHDHR determination of eligibility form dated January 30, 2019 indicated that NHDHR concurred with the extension of the period of significance to 1968 and the increased boundary of the Downtown Jaffrey Historic District, noting a number of new contributing resources.

Archaeological Resources
Independent Archaeological Consulting, LLC (IAC) conducted a Phase IA Archaeological Sensitivity Assessment of the Study Area in February 2018. The Phase IA Assessment report (IAC Report No. 1345), dated February 23, 2018, found archaeological sensitivity within the Study Area. Although a large extent of the investigated area has experienced ground disturbance in the past, the Phase IA found potential for intact archaeological resources below the modern areas of disturbance. Additionally, the project's proximity to the Contoocook River indicated sensitivity for Pre-Contact Archaeological sites. Therefore, field work for a Phase IB Intensive Archaeological Investigation was completed on

November 30 and December 3, 2018 in the area where construction would occur under the Proposed Action. The Phase IB Investigation report, dated March 6, 2019, reported that the project footprint was found to contain fill disturbance with no evidence of intact archaeological resources. Therefore, the Proposed Action would not result in impacts to archaeological resources, and no further archaeological testing was recommended.

Public Consultation:

Public informational meetings have been held on the following dates: October 17, 2107, February 20, 2018, and November 15, 2018. During these meetings, information regarding the Section 106 process and the role of consulting parties was included in the presentation and take-home materials. One individual, Robert Stephenson of Jaffrey, NH, was identified as a Section 106 Consulting Party. Mr. Stephenson was a former president of the Jaffrey Historical Society, former chairman of the Historic District Commission, former member of the New Hampshire State Historical Resources Council, and current member of the Jaffrey War Memorial Committee.

Determination of Effect:

Applying the criteria of effect at 36 CFR 800.5, we have determined that the Proposed Action would have an adverse effect on the Downtown Jaffrey Historic District and Boundary Increase Area (referred to as the "District"). Additionally, the Proposed Action is not considered an adverse effect on the Jaffrey Mills.

Downtown Jaffrey Historic District and Boundary Increase Area
The District was listed in the National Register of Historic Places in 2002 under Criterion A and C in the areas of Community Planning and Development and Architecture. A proposed boundary increase was determined eligible by NHDHR in 2019 under Criterion A and C in the areas of Community Planning and Development and Architecture. Both the District and the boundary increase retain integrity of location, design, setting, and materials.

Proposed impacts to the District would result in physical and visual effects. Proposed physical effects within the District includes construction of two new roundabouts, the US 202 realignment including the construction of a new bridge across the Contoocook River, and a stormwater BMP. Two contributing properties (4 Stratton Road and 15 River Street) would be fully acquired and demolished to accommodate the two roundabouts under the Proposed Action. Two contributing properties (21 River Street and 23 River Street) would be partially acquired under the Proposed Action to accommodate the three-way roundabout, with greater physical property impacts proposed to the parcel at 21 River Street. The joint driveway to 19 and 21 River Street, both contributing properties, would be reconfigured to accommodate the new three-way roundabout. These impacts would result in physical destruction or damage to part of the District resource [refer to 36 CFR Section 800.5(a)(2)(i)].

Visually, the Proposed Action would introduce multiple new transportation elements into the setting of the District including two roundabouts and a new bridge located at a new river crossing. At a minimum, views from the Main Street bridge south along the Contoocook River would be partially obstructed by the introduction of the proposed bridge structure. Although a sensitive design of the new bridge structure could minimize these visual impacts, the bridge would introduce a modern element into a natural

viewshed of the District's setting [36 CFR Section 800.5(a)(2)(v)] and change the character of a physical feature (the Contoocook River) within the District's setting [36 CFR 800.5(a)(2)(iv)].

Jaffrey Mills

The Jaffrey Mills, also known as the Stone Brothers and Curtis (White Brothers) Mill, was listed in the National Register of Historic Places in 1982 under Criterion A for Industry as being the most substantial and ambitious industrial complex ever built in Jaffrey, contributing to the economic base and cultural history of the town. In addition, the Mill is listed under Criterion C for Architecture as a complex that comprises intact representatives of Second Empire and Italianate-style industrial buildings. The Mill is also a contributing property to the Downtown Jaffrey Historic District.

The complex is located on the north side of Main Street at the intersection of North Street/NH 137. The National Register boundary for the Jaffrey Mills is defined as the property boundary of Jaffrey Tax Map 238 Lot 257.1 and Tax Map 238 Lot 257.[1] The Proposed Action would not require acquisition of any permanent or temporary right-of-way or easement from either of these parcels.

The Proposed Action would reduce the number of travel lanes along Main Street and would reconfigure on-street parking in front of the Jaffrey Mills. Roadway work includes new sub-base and pavement to the east of the Contoocook River (Main Street) bridge, and simple mill and overlay of existing pavement to the west of the bridge. No work on the bridge is proposed other than pavement rehabilitation.

Additionally, the Proposed Action would reconstruct the existing sidewalk adjacent to the East Building and Mill Office. The East Building directly abuts the existing sidewalk, whereas landscaping and shrub plantings are located between the Mill Office and the existing sidewalk. The proposed sidewalk reconstruction would occur within the existing footprint and would not impact the Jaffrey Mills buildings; the existing distance between the sidewalk and the mill buildings would be maintained. The reconstructed sidewalk would be configured so as to direct water flow away from the buildings. Additionally, a weather tight expansion joint would be installed between the East Building and the reconstructed sidewalk to prevent damage to the mill building.

No direct impacts to the mill buildings are proposed to occur as a result of the Proposed Action. However, dust, noise, and vibrations from the sidewalk replacement construction could cause minimal temporary impacts to the mill buildings. As project plans progress, the equipment and methods that would be implemented would be identified, and, if needed, a "Construction Vibration Assessment" would be developed.[2] Methods for reducing construction vibrations are considered on a case-by-case basis, but they could include temporary construction monitoring and any adjustments to proposed machinery and methods of construction.

Overall, the Proposed Action would reduce traffic congestion, air quality, and noise along the portion of Main Street directly abutting the Mill. Additional improvements, including the reduction of the number

[1] The 1982 Jaffrey Mills National Register Nomination Form notes that the property boundary is defined as Tax Map #5E4 Parcel #157. That parcel was subdivided in 2008, and the Town of Jaffrey subsequently re-designated all tax parcels in the community using a new numbering system.

[2] Assessments will be made using the following guidance documents: "New Hampshire DOT Research Record: Ground Vibrations Emanating from Construction Equipment" (2012) and "NCHRP 25-25/Task 72: Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects" (2012).

of lanes, the introduction of additional street parking, and sidewalk improvements would also occur along Main Street.

Based on the impacts and benefits discussed above, the Proposed Action would have No Adverse Effect on Jaffrey Mills. Although limited construction within existing right-of-way would occur directly adjacent to the Mills, it would not affect the significance of the industrial history or architecture of the mill, from which it derives its significance.

Archaeological Resources
Based on archaeological assessments completed to date, there would be no effect on archaeological resources.

The result of identification and evaluation for the proposed US 202 / NH 124 / NH 137 Intersection Improvement Project is a finding of *Adverse Effect*.

Mitigation Measures
All mitigation will be recorded in a Memorandum of Agreement developed in consultation with FHWA, NHDHR, NHDOT, the Town and Consulting Parties.

Section 4(f) Evaluation concerning Historic Resources	
Finding per FHWA	***Applies to Historic Resource***
☐ No 4(f)	
☐ Programmatic 4(f)	
☐ *de minimis* 4(f)	
☒ Full 4(f)	Downtown Jaffrey Historic District
NHDHR's signature represents concurrence with Section 4(f) impacts outlined in this memorandum, and in accordance with 23 CFR 774.3. Parties to the Section 106 process have been consulted and their concerns have been taken into account. Therefore, the requirements of Section 4(f) have been satisfied.	

In accordance with the Advisory Council's regulations, consultation will continue, as appropriate, as this project proceeds.

for Patrick Bauer, Administrator — 09/18/2019 Date
Federal Highway Administrator

Jill Edelmann — 9/17/2019 Date
Cultural Resources Manager

Concurred with by the NH State Historic Preservation Officer:

Nadine Miller — 9/19/19 Date
Deputy State Historic Preservation Officer
NH Division of Historical Resources

cc: Jamie Sikora, FHWA
Marika Labash, NHDHR
Loretta Girard Doughty, NHDOT
Marc Laurin, NHDOT
Peter Walker, VHB

MEMORANDUM OF AGREEMENT

AMONG NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION,

FEDERAL HIGHWAY ADMINISTRATION,

and the

NEW HAMPSHIRE STATE HISTORIC PRESERVATION OFFICER

Regarding the project known as the Jaffrey NH 202 Traffic Intersection Improvement Project [NHDOT Project Jaffrey 16307, FHWA Project X-A001(234)] which plans to improve the five-way intersection of US 202 (Main Street/Peterborough Street) with NH 124 (Turnpike Road), Stratton Road, and Blake Street in the Town of Jaffrey.

WHEREAS, the Federal Highway Administration (FHWA) plans to provide funds for the New Hampshire Department of Transportation (NHDOT) for construction of the improved Route 202/124 intersection with a new 140-foot long bridge crossing the Contoocook River and two roundabouts in the Town of Jaffrey, New Hampshire; and

WHEREAS, FHWA has defined the undertaking's area of potential effect (APE) as 400 feet around the project area; and

WHEREAS, the undertaking would involve clearing, site work to construct the new bridge and new roadway segments as well as related transportation and stormwater infrastructure, would necessitate the acquisition and demolition of buildings at 5 Stratton Road and 15 River Street, as well as partial acquisitions at 21 and 23 River Street, all of which contribute to the Downtown Jaffrey Historic District; and

WHEREAS, FHWA has determined that the undertaking will have an adverse effect on the Downtown Jaffrey Historic District, which was listed in the National Register of Historic Places, and Boundary Increase Area, which was determined to be eligible for listing in the National Register; and

WHEREAS, FHWA has consulted with the NHDOT, the New Hampshire State Historic Preservation Officer (NHSHPO), and a Consulting Party (Robert B. Stephenson) pursuant to 36 C.F.R. part 800, of the regulations implementing Section 106 of the National Historic Preservation Act (54 USC §306108); and

WHEREAS, FHWA has held coordination meetings with NHDOT, NHSHPO, and the Consulting Party on April 11, 2019, July 11, 2019, and September 12, 2019; and

WHEREAS, NHDOT has coordinated with the Town of Jaffrey and other interested parties through Public Meetings held on October 17, 2017, February 20, 2018, November 15, 2018, and October 2, 2019; and

WHEREAS, in accordance with 36 CFR §800.6(a)(1), FHWA has notified the Advisory Council on Historic Preservation (ACHP) of its adverse effect determination with specified

documentation and the ACHP has chosen not to participate in the consultation pursuant to 36 CFR §800.6(a)(1)(iii);

NOW, THEREFORE, FHWA, NHDOT and the NHSHPO agree that the undertaking shall be implemented in accordance with the following stipulations to take into account the effect of the undertaking on historic properties.

I. STIPULATIONS

FHWA and NHDOT shall ensure that the following measures are carried out:

1. The NHSHPO, FHWA, and the Town will be provided the opportunity to review and comment on the bridge design developed by NHDOT during the design process at the following milestones: *30% plans (30-day review) and 60% plans (30-day review).*
2. NHDOT will prepare a Downtown Jaffrey National Register Historic District nomination update and boundary increase. The nomination will be prepared to meet the guidelines and requirements as set forth by the National Park Service (NPS) and NHSHPO. The draft text and information will be incorporated into the National Register nomination format and will also include the production of the required archival photographs. The nomination will be submitted to the Town of Jaffrey (through the Jaffrey Historic District Commission) and to the NHSHPO for review and comment (*45-day review*). Following receipt of any comments, the nomination will be revised and the final package, including two copies for the final nomination and associated archival photographs, will be submitted to the Town of Jaffrey for final action. If the Town wishes to proceed with submittal of the updated nomination following public notice and outreach, they will be responsible for submission to the NHSHPO for subsequent transmittal to the NPS.
3. To avoid impacts to the Jaffrey Mills during construction, the design of the reconstructed sidewalk along Main Street will be configured to direct water flow away from the East Building and Mill Office. Additionally, a weather tight expansion joint will be installed between the East Building and the reconstructed sidewalk to prevent damage to the mill building.
4. During final design, NHDOT will determine the likely construction equipment and methods to be used for sidewalk and roadway work along Main Street directly adjacent to the Jaffrey Mills East Building and Mill Office. If warranted, NHDOT will develop a Construction Vibration Assessment. Methods for reducing construction vibrations would be considered on a case-by-case basis, but they could include temporary construction monitoring and any adjustments to proposed machinery and methods of construction. Assessments will be made using the following guidance documents: *"New Hampshire DOT Research Record: Ground Vibrations Emanating from Construction Equipment"* (2012) and *"NCHRP 25-25/Task 72: Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects"* (2012).
5. NHDOT will commission three outside interpretive signs/panels about the Downtown

Jaffrey Historic District and its resources to be installed at a location or locations to be determined in consultation with the NHDOT and the Jaffrey Historic District Commission. Development of the panels will be overseen by a 36 CFR 61(Appendix A)-qualified Architectural Historian. The design and content of the panel will be subject to the review by the NHDOT, NHSHPO and the Jaffrey Historic District Commission, who will each be provided 30 days to review and comment on the draft text of each panel. The panel will be erected as part of the project construction contract.

The interpretive panels are anticipated to examine one or more of the following themes:

- Downtown Jaffrey Historic District: Topics for this panel may include the history of industrial or commercial development, infrastructure, and the roadway network as well as the architecture in the district. The panel would also include historic images that correlate the subject matter.
- Monadnock Railroad: Interpretation may include a history of the railroad line with a map of the route, with subtopics including major businesses that benefited from the railroad, former stations, railroad cars that used to operate along the route, or photographs from the construction of the railroad (if extant).
- Jaffrey Mills: The significance of the mill is derived from its contributions to the economic base and cultural of the Town of Jaffrey, as well as for its architecture. Information about the history of the mill, its impacts on the growth of the community, including images, would be depicted on the panel.
- Historic and Extant Contoocook River Crossings: Topics on such a sign may include historic images of the former and current bridge crossings within the Downtown Jaffrey Historic District, with information about the construction of those bridges, the bridge placement, and the significance of the crossing to the community.

II. UNANTICIPATED DISCOVERIES

The NHDOT will ensure that if additional previously unidentified architectural and / or archeological properties are discovered, which may be affected by the undertaking or known properties are affected in an unanticipated manner, it will notify FHWA and the NHSHPO. FHWA and the NHSHPO will apply the criteria of eligibility and consult pursuant to 36 CFR 800.13.

III. DURATION

This MOA will expire if its terms are not carried out within seven (7) years from the date of its execution. Prior to such time, FHWA may consult with the other signatories to reconsider the terms of the MOA and amend it in accordance with Item VI below.

IV. MONITORING AND REPORTING

Each year following the execution of this MOA until it expires, is terminated, or stipulations completed, NHDOT shall provide all parties to this MOA a summary report detailing work undertaken pursuant to its terms. Such report shall include any scheduling changes proposed, any problems encountered, and any disputes and objections received in FHWA's efforts to carry out the terms of this MOA.

V. DISPUTE RESOLUTION

Should any signatory to this MOA object at any time to any actions proposed or the manner in which the terms of this MOA are implemented, FHWA shall consult with such party to resolve the objection. If the FHWA determines that such objection cannot be resolved, FHWA will:

1. Forward all documentation relevant to the dispute, including FHWA's proposed resolution, to the ACHP. The ACHP shall provide FHWA with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, FHWA shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and provide them with a copy of this written response. FHWA will then proceed according to its final decision.

2. If the ACHP does not provide its advice regarding the dispute within the thirty (30)-day time period, FHWA may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, FHWA shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and concurring parties to the MOA and provide them and the ACHP with a copy of such written response.

3. FHWA's responsibility to carry out all other actions subject to the terms of this MOA that are not the subject of the dispute remain unchanged.

VI. AMENDMENTS

This MOA may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

VII. TERMINATION

If any signatory to this MOA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other parties to attempt to develop an amendment per Stipulation V, above. If within thirty (30) days (or another time period agreed to by all signatories) an amendment cannot be reached, any signatory may terminate the MOA upon written notification to the other signatories.

Once the MOA is terminated, and prior to work continuing on the undertaking, FHWA must either (a) execute a MOA pursuant to 36 CFR § 800.6 or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. FHWA shall notify the signatories as to the course of action it will pursue.

Execution of this MOA by FHWA, NHDOT and SHPO and implementation of its terms evidence that FHWA has taken into account the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

SIGNATORIES:

FEDERAL HIGHWAY ADMINISTRATION

By: LEIGH I LEVINE Digitally signed by LEIGH I LEVINE Date: 2020.08.20 14:55:39 -04'00' *for* Date: 8/20/2020

Patrick A. Bauer
NH Division Administrator

NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES

By: Jodine Mullin, DSHPO for 8/11/2020

Benjamin Wilson
State Historic Preservation Officer
Date

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

By: 8/19/2020

Peter E. Stamnas
Director of Project Development
Date

TOWN OF JAFFREY, NEW HAMPSHIRE

By: 7/27/2020

Jon Frederick
Town Manager
Date

RECEIVED JUN 1 7 2022

AMENDMENT TO

MEMORANDUM OF AGREEMENT

AMONG NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION,

FEDERAL HIGHWAY ADMINISTRATION,

and the

NEW HAMPSHIRE STATE HISTORIC PRESERVATION OFFICER

Regarding the JAFFREY, X-A001(234), 16307 project with plans to improve the five-way intersection of US 202 (Main Street/Peterborough Street) with NH 124 (Turnpike Road), Stratton Road and Blake Street in the Town of Jaffrey.

WHEREAS, the Agreement was executed August 20, 2020; and

WHEREAS, the undertaking has been modified to include full acquisition of the properties located at 19 River Street and 21 River Street, in Jaffrey, New Hampshire; and

WHEREAS, the properties at 19 River Street and 21 River Street are contributing resources to the Downtown Jaffrey Historic District, listed on the National Register of Historic; and

WHEREAS, FHWA will send a copy of this executed amendment to the ACHP; and

WHEREAS, this Agreement will expire on August 20, 2027;

NOW, THEREFORE, FHWA, NHDOT and the SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

ADD NEW STIPULATIONS

FHWA/NHDOT shall ensure that the following measures are carried out:

6. At the request of the current owners, NHDOT will acquire the properties located at 19 River Street and 21 River Street in Jaffrey, New Hampshire. The properties are located within the Downtown Jaffrey Historic District and are a contributing feature to the district, although not individually eligible for the National Register of Historic Places. The properties will remain in State ownership until the River Street roundabout is fully operational, at which time the DOT will attempt to sell the properties.
    a. A mothballing plan, including a site visit, will be developed by NHDOT and reviewed by NHSHPO three months after full acquisition of the properties. The mothballing plan will lay

out any stabilization recommendations, necessary monitoring, and responsible parties.

b. Following RSA 4:39-c, once fully acquired, NHDOT will actively work towards the final disposition of the properties in the following order:
    i. NHDOT will work to sell the properties. This will include an analysis to determine if any modifications to the properties can/should be made to enhance their marketability such as (but not limited to) redesigning the driveway(s), combining the properties into a single property, etc. Should one property sell and not the other, the unsold property will continue to follow stipulations 6.b.ii-iv of this MOA amendment. The properties will be sold without historic covenants.
    ii. NHDOT will attempt to sell or transfer ownership of the properties to a public or nonprofit entity.
    iii. NHDOT will perform a cost/benefit analysis to determine the feasibility of moving one or both residences. This will include a review of available vacant parcels within the Downtown Jaffrey Historic District, costs, marketability, as well as the natural, cultural, and socioeconomic impacts of moving one or both residences.
    iv. NHDOT will demolish the residences. NHDOT will work with Signatories to determine appropriate mitigation for the demolition of the properties within the historic district.
c. Archaeology will be completed if ground disturbing work is proposed outside of previously surveyed areas.

SIGNATORIES:

FEDERAL HIGHWAY ADMINISTRATION

By: _____ Date: 6/29/2022
for Patrick A. Bauer
NH Division Administrator

NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES

By: _____ Date: 6/21/22
Nadine Miller
Deputy State Historic Preservation Officer

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

By: _____ Date: 6/29/2022
Peter E. Stamnas
Director of Project Development

TOWN OF JAFFREY, NEW HAMPSHIRE

By: _____ Date: 6/15/2022
Jon Frederick
Town Manager

Appendix J – ACOE Appendix B

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[1]	
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]	
2.3 If wetland crossings are proposed, are they adequately designed to maintain hydrology, sediment transport & wildlife passage?	X[3]	
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[4]	
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?	7,057 sq ft	
2.8 What % of the overall project sire will be previously and proposed filled wetlands?	N/A	
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[5]	

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[6]
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[7]	
4. Flooding/Floodplain Values	Yes	No
4.1 Is the proposed project within the 100-year floodplain of an adjacent river or stream?	X[8]	
4.2 If 4.1 is yes, will compensatory flood storage be provided if the project results in a loss of flood storage?		X[8]
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[9]	
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.	N/A	
6.1 Will there be complete loss of aquatic resources on site?		
6.2 Have the impacts to the aquatic resources been avoided and minimized to the greatest extent practicable?		
6.3 Will all aquatic resource function be lost?		
6.4 Does the aquatic resource (s) have regional significance (watershed or ecoregion)?		
6.5 Is there an on-site alternative with less impact?		
6.6 Is there an off-site alternative with less impact?		
6.7 Will there be a loss to a resource dependent species?		
6.8 Are indirect impacts greater than 1 acre within and adjacent to the project area?		
6.9 Does the proposed mitigation replace aquatic resource function for direct, indirect, and cumulative impacts?		

*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.

Supporting Notes

1. According to the NHDES 2020/2022 303(d) list, the Contoocook River Dam impoundment (AUID: NHIMP700030101-02) in the vicinity of the proposed new bridge does not meet designated uses for aquatic life due to dissolved oxygen saturation, dissolved oxygen concentration, and non-native aquatic plant impairments. Downstream (north) of the project area, the Contoocook River (AUID: NHIMP700030101-03) does not meet designated uses for aquatic life due to dissolved oxygen saturation, dissolved oxygen concentration, and pH impairments. The proposed project is not anticipated to contribute to these impairments.
2. According to the NHDES Wetland Permit Planning Tool (WPPT), there are no tidal SAS, prime wetlands, or priority resource areas within the project area. There is a Floodplain Wetland Adjacent to a Tier 3 Stream upstream (south) of the project area which will not be impacted by the project. Although not identified on the NHDES WPPT, Wetland 1 is a floodplain wetland adjacent/contiguous to a Tier 3 stream that is also located in the FEMA-mapped 100-year floodplain. Consequently, Wetland 1 meets the definition of a PRA per Env-Wt 103.66(c), and permanent impacts to this wetland will require mitigation.
3. The proposed new bridge will be a 92-foot-long clear span bridge crossing the Contoocook River approximately 375 feet upstream (south) of the existing Main Street bridge. The single span bridge includes two wildlife shelves along each bank of the river, with the shelves and the abutments stabilized and protected from scour with rip-rap installed on the bed of the river. The proposed new bridge will maintain the existing hydrology and sediment transport of the Contoocook River. However, Wetlands 1 and 2 will be permanently impacted due to the road construction and construction of a new paved parking area. Wetlands 1 and 2 will therefore not maintain hydrology, sediment transport, or wildlife passage. Refer to the Application Narrative for more information.
4. For the new bridge crossing the Contoocook River, riparian tree and vegetation clearing will be necessary for road and bridge construction. The area requiring removal of mature vegetation and trees in the immediate vicinity of the Contoocook River (+/- 100 feet) is estimated to be approximately 0.4 acres.
5. NHB22-3543 DataCheck did not indicate the presence of any sensitive species in the project area. The USFWS IPaC report identified the potential presence of the northern long-eared bat (NLEB) and monarch butterfly. A verification letter will be generated for the NLEB through the IPaC determination key to satisfy the consultation requirements for this species. While the candidate status of the monarch butterfly does not provide protection under the Endangered Species Act, we believe that suitable habitat for this species is absent from the project area.
6. According to the NHF&G Wildlife Action Plan, the proposed work does not include nor is adjacent to any Highest Ranked Habitats.
7. In accordance with General Condition 31, "Stream Work and Crossings, and Wetland Crossings," the proposed new bridge will not interfere with the natural processes of the Contoocook River.
8. The proposed work is located within the FEMA-mapped 100-year floodplain Special Flood Hazard Area Zone AE of the Contoocook River. Refer to the FEMA Floodplain Map provided in Appendix D. The location of the proposed new bridge will be located approximately 375 feet upstream of the dam at the floodplain's narrowest point, where the Base Flood Elevation is 1011.8 feet. According to the Flood Insurance Study for Cheshire County, New Hampshire, no floodway was computed for the Contoocook River. While the proposed work will require floodplain fill, hydraulic modeling completed to date indicates that the floodplain impacts are negligible, calculated to be less than 0.1 feet. Refer to the Hydraulic Analysis Memo provided in Appendix E for more information.
9. A Request for Project Review (RPR) for the proposed project was submitted to the NH Division of Historical Resources (NHDHR) in March 2018. NHDHR reviewed the RPR on April 18, 2018 and subsequent meetings were held on July 11 and September 12, 2019. A Memorandum of Agreement between NHDOT, FHWA, and NHDHR was signed on August 20, 2020 and amended on June 29, 2022.

Appendix K – ACOE Wetland Determination Field Data Sheets

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Jaffrey US 202 / NH 124 / NH 137 City/County: Jaffrey/Cheshire Sampling Date: 10/7/2021

Applicant/Owner: New Hampshire Department of Transportation State: NH Sampling Point: WET-1

Investigator(s): K. Wilkes and N. Martin Section, Township, Range: Jaffrey

Landform (hillside, terrace, etc.): flat/slight depression Local relief (concave, convex, none): flat/slight depression Slope %: 0-2

Subregion (LRR or MLRA): LRR R, MLRA 144B Lat: 42.81314757 Long: -72.02311823 Datum: NAD 83

Soil Map Unit Name: on divide between moosilauke fine sandy loam & caesar loamy sand, 3 to 8% slopes NWI classification: PEM1E & PSS1E

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: Wetland 1 (W-1)

Remarks: (Explain alternative procedures here or in a separate report.)
All three wetland criteria are met for Wetland 1. Minor disturbance was noted within the wetland (tire ruts and exposed soils).

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- ____ High Water Table (A2)
- X Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ 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)
- X 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 X	No ____	Depth (inches): 1
Water Table Present?	Yes ____	No X	Depth (inches): ____
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:
Wetland hydrology criterion met. This wetland drains along the eastern bank of the Contoocook River in two locations.

VEGETATION – Use scientific names of plants. Sampling Point: WET-1

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. *Frangula alnus*	10	Yes	FAC
2. *Rosa multiflora*	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	15 =Total Cover		
Herb Stratum (Plot size: 5')			
1. *Lythrum salicaria*	80	Yes	OBL
2. *Euthamia graminifolia*	15	No	FAC
3. *Scirpus cyperinus*	5	No	OBL
4. *Symphyotrichum novae-angliae*	5	No	FACW
5. *Phalaris arundinacea*	5	No	FACW
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	110 =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: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	85	x 1 =	85
FACW species	10	x 2 =	20
FAC species	25	x 3 =	75
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	125 (A)		200 (B)

Prevalence Index = B/A = 1.60

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.)
Hyrdophytic vegetation criterion met. This plot was collected in the emergent portion of the wetland which is the dominant wetland classification.

SOIL

Sampling Point WET-1

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
0-10	10yr 3/2	95	7.5yr 3/4	5	C	M	Gravelly fine sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 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)
- X 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: Rock

Depth (inches): 10

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

Remarks:

Hydric soil criterion met with indicator F6 at the plot. F3 soils were observed elsewhere within this wetland. Deposits of sand present along the wetland edges from adjacent parking lot runoff.

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 1 (wetland plot)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Jaffrey US 202 / NH 124 / NH 137 City/County: Jaffrey/Cheshire Sampling Date: 10/7/2021

Applicant/Owner: New Hampshire Department of Transportation State: NH Sampling Point: UP-1

Investigator(s): K. Wilkes and N. Martin Section, Township, Range: Jaffrey

Landform (hillside, terrace, etc.): flat Local relief (concave, convex, none): flat Slope %: 0-2

Subregion (LRR or MLRA): LRR R, MLRA 144B Lat: 42.81331340 Long: -72.02324657 Datum: NAD 83

Soil Map Unit Name: Caesar loamy sand, 3 to 8 percent slopes NWI classification: N/A

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 ____	No X	**within a Wetland?** **Yes** ____ **No** X
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
One of the three wetland criteria is met for this upland plot located outside of Wetland 1.

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)
- ___ 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 ____	Depth (inches): ____
Water Table Present?	Yes ____	No ____	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ____	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

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

Remarks:
Wetland hydrology criterion not met.

VEGETATION – Use scientific names of plants.

Sampling Point: UP-1

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	15	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	15	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. *Frangula alnus*	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Herb Stratum (Plot size: 5')			
1. *Mowed grasses*	90	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	90	=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: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	25	x 3 =	75
FACU species	0	x 4 =	0
UPL species	90	x 5 =	450
Column Totals:	115 (A)		525 (B)

Prevalence Index = B/A = 4.57

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.)
Hyrdophytic vegetation criterion met.

SOIL

Sampling Point UP-1

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
0-4	10yr 3/3	100					Fine sandy loam	
4-12	2.5y 4/4	100					Fine sandy loam	Gravel present at 6 inches in depth.

[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:
Hydric soil criterion not met.

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 1 (upland plot)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Jaffrey US 202 / NH 124 / NH 137 City/County: Jaffrey/Cheshire Sampling Date: 10/7/2021

Applicant/Owner: New Hampshire Department of Transportation State: NH Sampling Point: WET-2

Investigator(s): K. Wilkes and N. Martin Section, Township, Range: Jaffrey

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

Subregion (LRR or MLRA): LRR R, MLRA 144B Lat: 42.81356333 Long: -72.02375331 Datum: NAD 83

Soil Map Unit Name: Caesar loamy sand, 3 to 8 percent slopes NWI classification: PEM1E

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: Wetland 2 (W-2)

Remarks: (Explain alternative procedures here or in a separate report.)
All three wetland criteria are met for Wetland 2. Minor disturbance was observed within the wetland (rutting, exposed soil, depressed vegetation) which appears to be the result of recent geotechnical boring work.

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ 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)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes 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:
Wetland hydrology criterion met.

VEGETATION – Use scientific names of plants. Sampling Point: WET-2

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	30	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. *Frangula alnus*	50	Yes	FAC
2. *Spiraea alba*	20	Yes	FACW
3. *Rhamnus cathartica*	5	No	FAC
4. *Cornus amomum*	5	No	FACW
5. *Pinus strobus*	5	No	FACU
6. *Acer platanoides*	5	No	UPL
7.			
	90	=Total Cover	
Herb Stratum (Plot size: 5')			
1. *Onoclea sensibilis*	10	No	FACW
2. *Symphyotrichum novae-angliae*	45	Yes	FACW
3. *Solidago rugosa*	10	No	FAC
4. *Solidago gigantea*	10	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	75	=Total Cover	
Woody Vine Stratum (Plot size: 30')			
1. *Celastrus orbiculatus*	15	Yes	UPL
2.			
3.			
4.			
	15	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	90	x 2 =	180
FAC species	95	x 3 =	285
FACU species	5	x 4 =	20
UPL species	20	x 5 =	100
Column Totals:	210 (A)		585 (B)

Prevalence Index = B/A = 2.79

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.)
Hyrdophytic vegetation criterion met.

SOIL

Sampling Point WET-2

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
0-2	10yr 3/2	100					Fine sandy loam	Saturated.
2-10	2.5y 5/2	95	10yr 4/6	5	C	M	Fine sandy loam	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)
- 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: Rock

Depth (inches): 10

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

Remarks:

Hydric soil criterion met with indicators A11 and F3.

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 2 (wetland plot)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Jaffrey US 202 / NH 124 / NH 137 City/County: Jaffrey/Cheshire Sampling Date: 10/7/2021

Applicant/Owner: New Hampshire Department of Transportation State: NH Sampling Point: UP-2

Investigator(s): K. Wilkes and N. Martin Section, Township, Range: Jaffrey

Landform (hillside, terrace, etc.): gradual slope Local relief (concave, convex, none): gradual slope Slope %: 0-2

Subregion (LRR or MLRA): LRR R, MLRA 144B Lat: 42.81357736 Long: -72.02363710 Datum: NAD 83

Soil Map Unit Name: Caesar loamy sand, 3 to 8 percent slopes NWI classification: N/A

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	**Is the Sampled Area**
Hydric Soil Present?	Yes ____	No X	**within a Wetland?** **Yes** ____ **No** X
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
None of the three wetland criteria are met for this upland plot located outside of Wetland 2.

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)
- ___ 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 ____	Depth (inches): ____
Water Table Present?	Yes ____	No ____	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ____	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

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

Remarks:
Wetland hydrology criterion not met.

VEGETATION – Use scientific names of plants.

Sampling Point: UP-2

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30	Yes	FAC
2. *Frangula alnus*	10	No	FAC
3. *Fraxinus americana*	15	No	FACU
4. *Acer saccharum*	50	Yes	FACU
5. *Prunus serotina*	10	No	FACU
6.			
7.			
	115	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. *Frangula alnus*	50	Yes	FAC
2. *Berberis thunbergii*	45	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	95	=Total Cover	
Herb Stratum (Plot size: 5')			
1. *Acer platanoides*	60	Yes	UPL
2. *Quercus rubra*	15	No	FACU
3. *Fraxinus americana*	5	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80	=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: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	90	x 3 =	270
FACU species	140	x 4 =	560
UPL species	60	x 5 =	300
Column Totals:	290 (A)		1130 (B)

Prevalence Index = B/A = 3.90

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.)
Hyrdophytic vegetation criterion not met.

SOIL

Sampling Point UP-2

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
0-18	10yr 2/1	100					Fine sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 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): _____

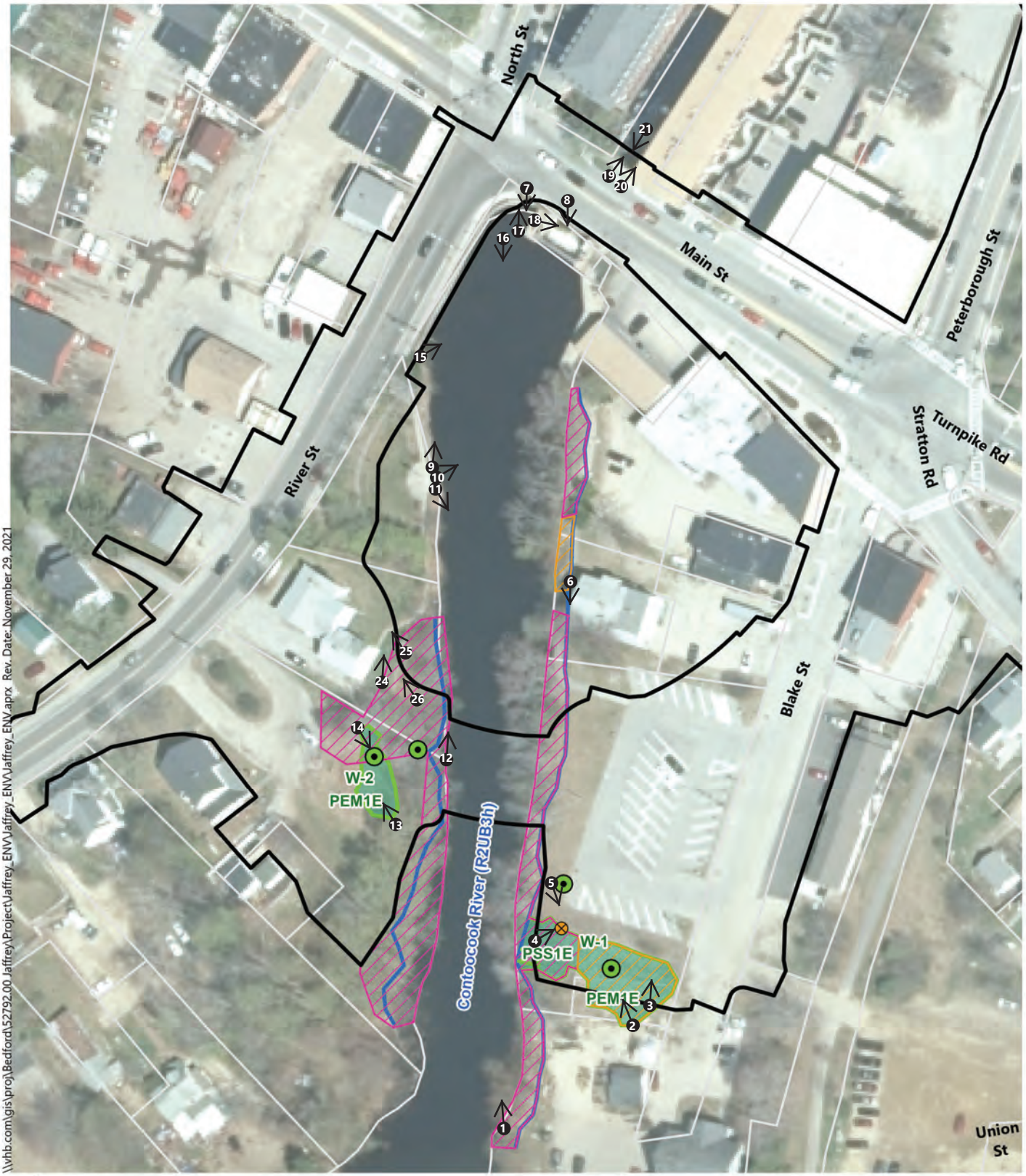
Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Hydric soil criterion not met.

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 2 (upland plot)

Appendix L – Photographs and Existing Conditions Figure



\\vhb.com\gis\proj\Bedford\52792.00 Jaffrey\Project\Jaffrey_ENV\Jaffrey_ENV.aprx Rev. Date: November 29, 2021

0 50 100 200 Feet

Jaffrey 16307

Jaffrey, New Hampshire

- Limit of Disturbance
- Culvert
- USACE Sampling Point
- Delineated TOB
- Delineated Wetland Edge
- Wetland Resource Area
- Parcel Boundary
- Invasive Type 1
- Invasive Type 2
- Photo Location Symbol

Delineated Natural Resources - Detailed

Source: VHB, NHGRANIT

Photo 1: Downstream view north of the Contoocook River. 10/07/2021.

Photo 2: View northwest of the flat emergent portion of Wetland 1 in the foreground and the scrub-shrub portion in the background. 10/07/2021.

Photo 3: View north of the flat emergent portion of Wetland 1. 10/07/2021.

Photo 4: View northeast of the culvert within the depressional scrub-shrub portion of Wetland 1. 10/07/2021.

Photo 5: View southeast of Wetland 1 in the distance, with the emergent portion to the left and scrub-shrub portion to the right. 10/07/2021.

Photo 6: Upstream view south of the eastern Contoocook River bank and adjacent paved walking path. 10/07/2021.

Photo 7: Upstream view south of the Contoocook River, taken from the US 202/Main Street Bridge. 10/07/2021.

Photo 8: View south of the Contoocook River Dam spillway. 10/07/2021.

Photo 9: Downstream view north of the US 202/Main Street Bridge over the Contoocook River. Note the constructed walls on either side. 10/07/2021.

Photo 10: View northeast of the eastern bank of the Contoocook River. 10/07/2021.

Photo 11: View southeast of the eastern bank of the Contoocook River. 10/07/2021.

Photo 12: View north of the western bank of the Contoocook River. 10/07/2021.

Photo 13: View northwest of Wetland 2. 10/07/2021.

Photo 14: View southeast of Wetland 2. 10/07/2021.

Photo 15: View northeast of the Site towards the existing Main Street Bridge during drawdown conditions. 10/16/2022.

Photo 16: View south/upstream of the Contoocook River during drawdown conditions. 10/16/2022.

Photo 17: View north of the 24" RCP stormwater culvert and mill race box culvert. Note the deteriorated trash rack and accumulated sediment. 10/16/2022.

Photo 18: View east of the concrete damage along the sidewalk on the existing Main Street Bridge. 10/16/2022.

Photo 19: View northeast of the channelized portion of the Contoocook River downstream of the Site between the old mill buildings during drawdown conditions. 10/16/2022.

Photo 20: View northeast of the channelized portion of the Contoocook River downstream of the Site between the old mill buildings during normal flow conditions. 05/05/2022.

Photo 21: View southwest/upstream of the existing Main Street Bridge with the spillway visible in the background. 10/16/2022.

Photo 22: View northwest of the existing masonry wall. 10/16/2022.

Photo 23: View southeast of the confluence of the Main Street Bridge with the mill building. Note the pipes present in the concrete bridge wall. 10/16/2022.

Photo 24: View north of the retaining wall on NHDOT Parcel #11. 05/05/2022.

Photo 25: Closeup view northwest of the retaining wall on NHDOT Parcel #11. 05/05/2022.

Photo 26: View northwest of the retaining wall on NHDOT Parcel #11 taken from near the top of bank of the river. 05/05/2022.

Photo 27: Close-up view north of the retaining wall on NHDOT Parcel #11. 05/05/2022.

Appendix M – Construction Sequence Narrative

Construction Sequences

Construction Sequence (Mill Race):

1. Drawdown water levels.
2. Install traffic control items.
3. Install sandbag cofferdam or similar perimeter control around inlet, if required by flow conditions, and erosion control measures.
4. Dewater inside cofferdams and remove material at inlet.
5. Complete concrete repairs at headwall and inside face of culvert.
6. Install new trash rack.
7. Remove cofferdam.
8. Remove traffic control, erosion control measures, and dam controls.

Construction Sequence (Main Street Bridge Preservation):

1. Drawdown water levels.
2. Install traffic control items and erosion control/stream diversion measures as needed.
3. Complete concrete repairs using single lane closures as needed to accommodate equipment and laborers.
4. Remove traffic control and erosion control/stream diversion measures.

Construction Sequence (New Bridge):

1. Install erosion control measures and cofferdam associated with substructure construction.
2. Excavate to bottom of footings and drive micropiles.
3. Construct footings, abutment stemwalls, and wingwalls.
4. Construct MSE retaining walls, backfill along with abutments.
5. Drawdown impoundment prior to riprap installation (with NHF&G notification).
6. Install water diversion structure or similar perimeter control at riprap limits.
7. Install riprap in front of abutments.
8. Remove erosion control measures and cofferdams.
9. End drawdown.
10. Install girders and construct remaining abutment backwalls and upper wingwalls.
11. Construct concrete deck and approach slabs, followed by sidewalk and bridge rail.
12. Install deck membrane and pavement.
13. Final grading, restoration, and pavement markings.
14. Remove remaining erosion control measures.

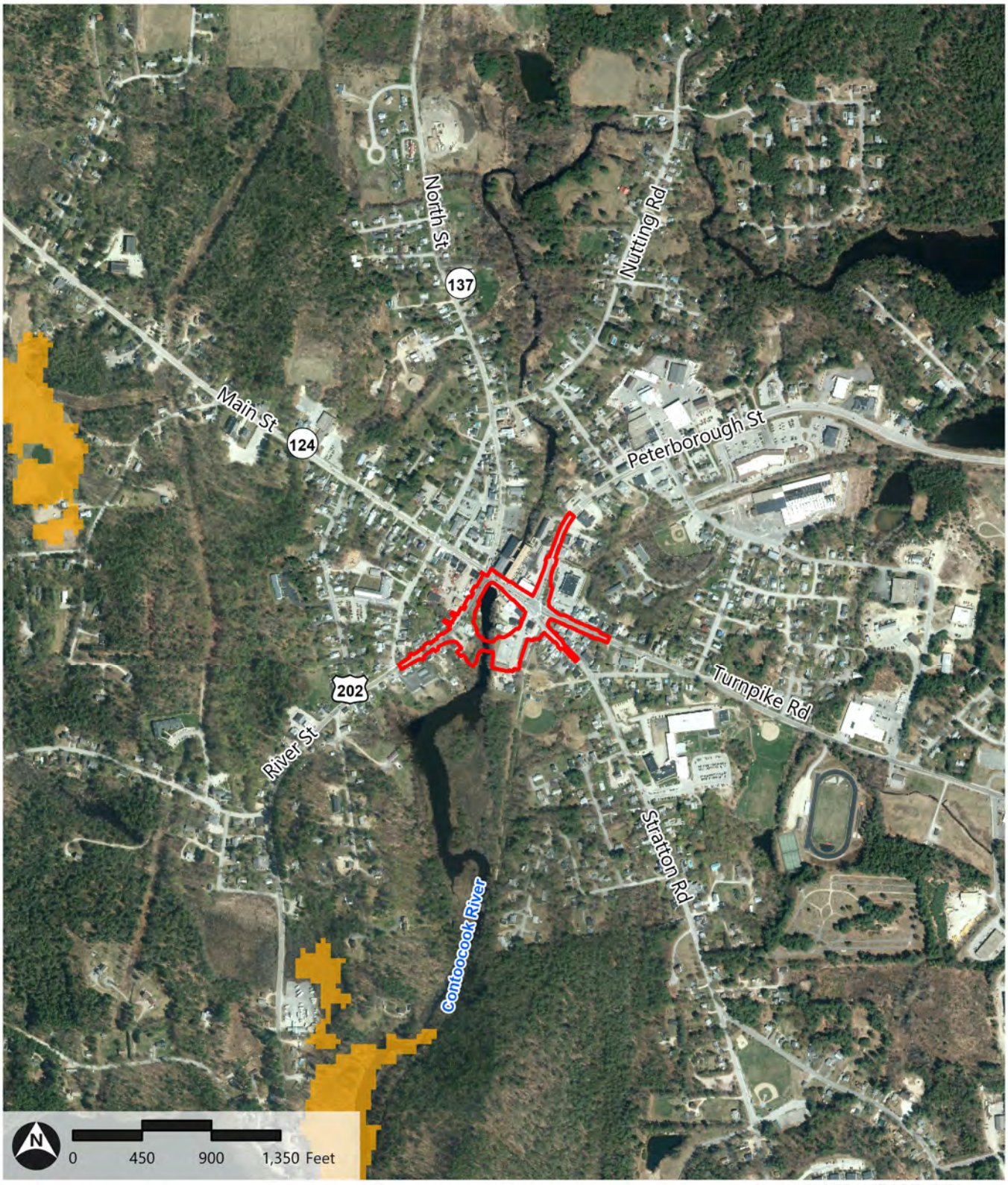
Appendix N – Wildlife Maps

This appendix includes the following NHF&G Wildlife Action Plan Maps:

- Ranked Habitat
- Habitat Type

Figure 5: NHF&G WAP Ranked Habitat Map

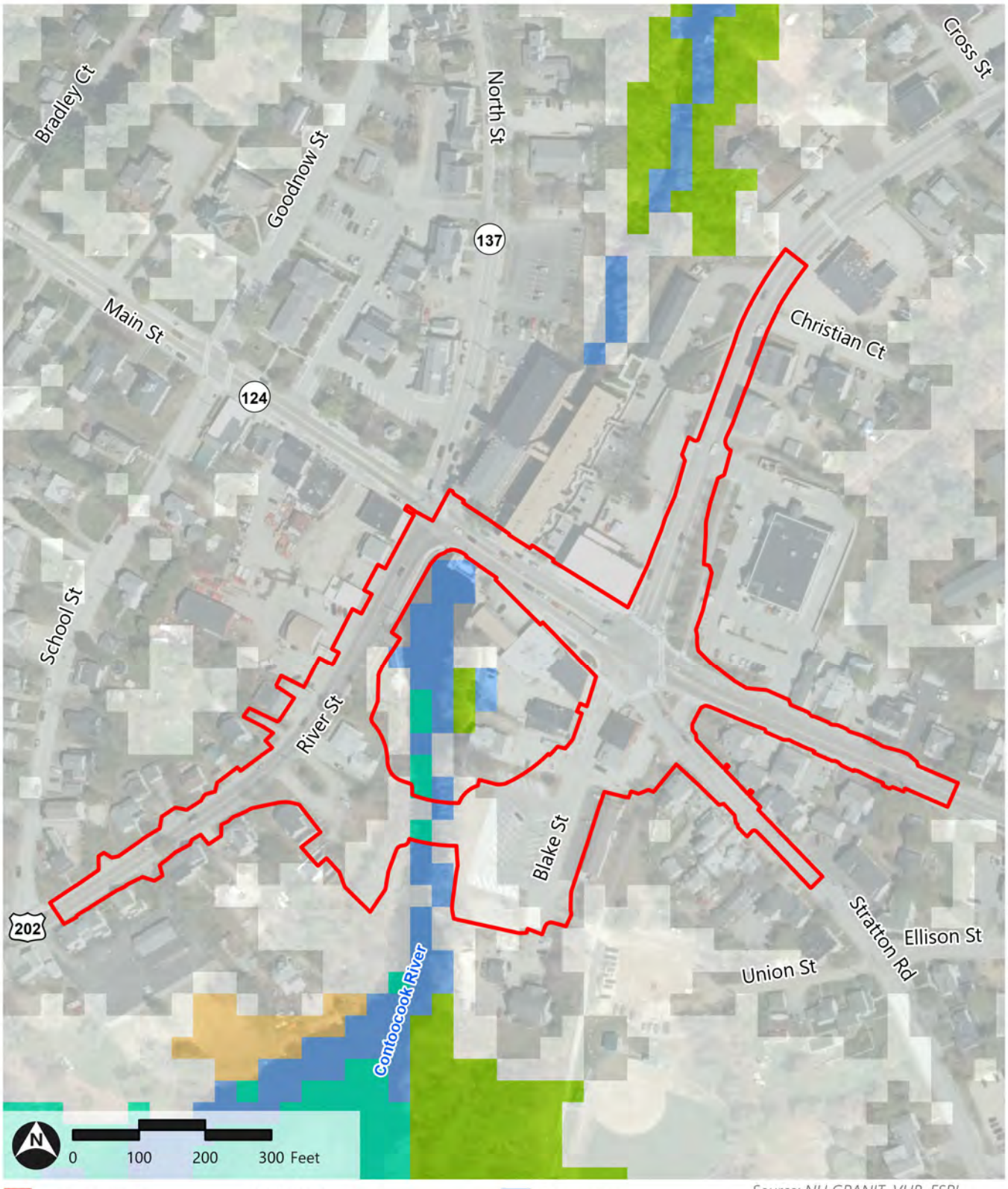
Jaffrey Wetlands Permit Application | Jaffrey, NH



Source: NH GRANIT, VHB, ESRI

Figure 6: NHF&G WAP Habitat Type Map

Jaffrey Wetlands Permit Application | Jaffrey, NH



Appendix O – EFH Documentation

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

Victoria F. Sheehan
Commissioner

William Cass, P.E.
Assistant Commissioner

April 17, 2019

Mr. Mike Johnson
Marine Habitat Resource Specialist
Habitat Conservation Division, NOAA Fisheries
US Department of Commerce, Northeast Regional Office
55 Great Republic Drive
Gloucester, MA 01930

RE: Jaffrey, X-A001(234), 16307
US 202/NH 124/NH 137 Intersection Improvements

Dear Mr. Johnson:

The New Hampshire Department of Transportation (NHDOT), together with the Federal Highway Administration (FHWA), is proposing the reconstruction and roadway improvements to US Route 202 at its intersections with NH Route 124 and NH Route 137 within the central business district of Jaffrey, New Hampshire (see USGS Site Location Map). The Purpose and Need of the project is to address traffic congestions and safety deficiencies associated with the current configuration of the US 202 "dog-leg" intersection of Main Street with Peterborough Street and Main Street with River Street, reduce the impact of highway traffic by enhancing pedestrian mobility and supporting the quality of life and economic vitality of Jaffrey's downtown. The Proposed Action will reconstruct the US 202/NH 124 intersection providing a five-leg roundabout, realign US 202 out of the downtown by constructing a new bridge to the south over the Contoocook River, and intersect River Street with a three-leg roundabout south of the existing US 202/NH 124/NH 137 intersection (see Proposed Action).

The Merrimack River and its tributaries has been identified as EFH for all life stages of Atlantic salmon (*Salmo salar*). In order to assess potential effects to this specie due to proposed work adjacent to and potentially within the Contoocook River, a tributary to the Merrimack River, the attached Essential Fish Habitat Assessment has been prepared on behalf of FHWA. Based upon the information in the EFH assessment, FHWA and NHDOT have determined that the proposed project would have no adverse effect on EFH for Atlantic salmon as the proposed project's work to construct a new bridge spanning the Contoocook River will be negligible. Under the provisions of Section 7 of the Endangered Species Act, FHWA and NHDOT respectfully request your concurrence with our finding. Please contact me should you have any questions.

Sincerely,

Marc G. Laurin
Senior Environmental Manager
Room 109 - Tel. (603) 271-4044
E-mail – marc.laurin@dot.nh.gov

Encl.
cc Jamison Sikora, FHWA; Michael Hicks, ACOE; Keith Cota, NHDOT
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EFH ASSESSMENT WORKSHEET FOR FEDERAL AGENCIES (modified 3/2016)

PROJECT NAME: US 202 / NH 124 / NH 137 Intersection Improvement Project (Downtown Jaffrey Improvements)

DATE: 06/25/2019

PROJECT NO.: NHDOT Jaffrey 16307

LOCATION (Water body, county, physical address):

The project is located in downtown Jaffrey and includes the five-way intersection of US 202 (Main Street/Peterborough Street) with Turnpike Road, Blake Street, and Stratton Road. The project also encompasses all of Blake Street, River Street, and the land between the two roadways. In order to safely realign US 202, a new bridge crossing of Contoocook River would be constructed as part of this project.

PREPARER: Lindsay Matras, VHB; Marc Laurin, NHDOT

Step 1: Use NOAA's EFH Mapper to generate the list of designated EFH for federally-managed species and life stages for the geographic area of interest. Use this list as part of the initial screening process to determine if EFH for those species occurs in the vicinity of the proposed action. The list can be included as an attachment to the worksheet. Make a preliminary determination on the need to conduct an EFH consultation.

1. INITIAL CONSIDERATIONS

EFH Designations	Yes	No
Is the action located in or adjacent to EFH designated for eggs? **List the species:** Atlantic salmon	✓	
Is the action located in or adjacent to EFH designated for larvae? **List the species:** Atlantic salmon	✓	
Is the action located in or adjacent to EFH designated for juveniles? **List the species:** Atlantic salmon	✓	

Is the action located in or adjacent to EFH designated for adults or spawning adults? List the species: Atlantic salmon	✓	

If you answered 'no' to all questions above, then an EFH consultation is not required - go to Section 5.

If you answered 'yes' to any of the above questions, proceed to Section 2 and complete the remainder of the worksheet.

Step 2: In order to assess impacts, it is critical to know the habitat characteristics of the site before the activity is undertaken. Use existing information, to the extent possible, in answering these questions. Identify the sources of the information provided and provide as much description as available. These should not be yes or no answers. Please note that there may be circumstances in which new information must be collected to appropriately characterize the site and assess impacts. Project plans that show the location and extent of sensitive habitats, as well as water depths, the HTL, MHW and MLW should be provided.

2. SITE CHARACTERISTICS

Site Characteristics	Description
Is the site intertidal, sub-tidal, or water column?	The US 202 / NH 124 / NH 137 Intersection Improvement Project is located along the freshwater portion of the Contoocook River within the vicinity of the Contoocook River Dam (#124.03) in Jaffrey NH. Some work is anticipated to occur within and adjacent to the banks of the Contoocook River to construct a new bridge structure across the river.
What are the sediment characteristics?	The project is located within the impounded portion of the Contoocook River in Jaffrey where the sediment is primarily an unconsolidated bottom composed of sand or mud. Finer sediments settle out within this portion of the river upstream of the dam.
Is there submerged aquatic vegetation (SAV) at or adjacent to project site? If so describe the SAV species and spatial extent.	Planning for the proposed project did not include a survey for SAV within the Contoocook River. However, some SAV and emergent vegetation (e.g., pickerel weed) was observed during the field work conducted as part of project planning where a bridge is proposed to be constructed.
Are there wetlands present on or adjacent to the site? If so, describe the spatial extent and vegetation types.	A small, circular wetland was delineated along the Contoocook River within the vicinity of the project. The wetland is classified as Palustrine, Scrub Shrub, Broad-Leaved Deciduous, Seasonally Flooded (PSS1C). This small wetland receives water from a 24-inch concrete pipe with a flared end, and the wetland drains toward the Contoocook River. Vegetation observed in this wetland include glossy buckthorn (Rhamnus frangula), multiflora rose (Rosa multiflora), red maple (Acer rubrum), deer tongue (Dichanthelium clandestinum), beggars tick (Bidens frondosa), meadowsweet (Spiraea alba), reed canary grass (Phalaris arundinaceae), and speckled alder (Alnus incana). This wetland would be impacted by the project.

Is there shellfish present at or adjacent to the project site? If so, please describe the spatial extent and species present.	A field survey for shellfish has not been completed for the proposed project. However, the NH Natural Heritage Bureau DataCheck report for the project did not indicate the presence of any rare, threatened, or endangered shellfish species located near the project area. Because this reach of the river is impounded, its suitability as habitat for shellfish is limited.
Are there mudflats present at or adjacent to the project site? If so please describe the spatial extent.	The project is located within a freshwater impoundment of the Contoocook River upstream of the Contoocook River dam. Mudflats are not present in this area.
Is there rocky or cobble bottom habitat present at or adjacent to the project site? If so, please describe the spatial extent.	The Contoocook River does not have rocky or cobble bottom habitat in the vicinity of the project area. The substrate is primarily sand or mud with finer sediments that settle out upstream of the dam.
Is Habitat Area of Particular Concern (HAPC) designated at or near the site? If so for which species, what type habitat type, size, characteristics?	No HAPC is designated at or near the project area.
What is the typical salinity, depth and water temperature regime/range?	The Contoocook River is a freshwater river. The project area is located within the impounded portion of the river behind the Contoocook River Dam. The dam structure is located approximately 350 feet north of the proposed bridge. Water depth of the river is about 9 feet at the center of the channel, but water depth varies within the vicinity of the project depending on the time of year. Based on data collected in 1991 and 2004 (obtained from the NHDES Environmental Monitoring Database), the Contoocook River has an average temperature of 24 degrees Celsius in the summer months (June through August).
What is the normal frequency of site disturbance, both natural and man-made?	The project area is relatively developed, with the area mainly composed of existing roadways, residential and commercial development typical of a New England town center. The land use near the Contoocook River is primarily residential backyards to the west and walking paths and a public parking lot to the east. Additionally, retaining walls are located on both sides of the Contoocook River around the dam. Natural disturbances within the river are primarily related to flood flows; flows in this reach of the river are regulated by several large dam impoundments upstream (e.g., Contoocook Lake), so this effect is limited.
What is the area of proposed impact (work footprint & far afield)?	Some impacts are proposed within the bank of the Contoocook River as a result of the construction of the new bridge structure over the river. Impacts would be limited to a relatively small area to construct the bridge, including grading and shaping around the bridge abutments and footings, and rip-rap on the banks to protect these features. The footings and abutments themselves would be constructed above and outside of the bank of the river. Total impact areas have yet to be finalized, but the current conceptual plans indicate that total bank impacts would be approximately 1,800 square feet along approximately 220 linear feet of river bank (110 feet on both the east and west banks). Rip-rap protection near the bridge features would be keyed into the river bed, but would extend only a few feet into the river bed.

Step 3: This section is used to describe the anticipated impacts from the proposed action on the physical/chemical/biological environment at the project site and areas adjacent to the site that may be affected.

3. DESCRIPTION OF IMPACTS

Impacts	Y	N	Description
Nature and duration of activity(s). Clearly describe the activities proposed and the duration of any disturbances.			The anticipated duration of construction for the proposed project is approximately 2.5 years. The project would involve modifying the existing five-leg signal-controlled intersection to a five-leg roundabout at the intersection of Main Street, Peterborough Street, Turnpike Road, Stratton Road, and Blake Street. Along with improving the five-leg intersection, US 202 would be realigned along a new segment of roadway would be constructed between Blake Street and River Street across the Contoocook River, requiring the construction of a new bridge. This realignment would redirect traffic along US 202 from Peterborough Street through the five-leg intersection onto Blake Street for a short distance before turning west onto a new bridge crossing the Contoocook River. The new bridge would tie into a smaller three-leg roundabout west of the Contoocook River that would reconnect US 202 with River Street. The proposed improvements would also include new accommodations for pedestrians, adding bike lanes on both roadway edges and a sidewalk for pedestrians on the northern side of the alignment. The Monadnock Recreational Rail Trail would be maintained and improved north and south of the intersection.
Will the benthic community be disturbed? If no, why not? If yes, describe in detail how the benthos will be impacted.		✓	The benthic community within the Contoocook River would not be significantly impacted by the proposed project. During construction of the proposed bridge, some disturbance of the river bank would occur associated with grading and shaping around the footings and abutment of the new bridge structure. A portion of the river bank would be impacted by riprap for bank armoring. The riprap would be keyed into the river bed, but would extend only a few feet into the river bed.
Will SAV be impacted? If no, why not? If yes, describe in detail how the SAV will be impacted. Consider both direct and indirect impacts. Provide details of any SAV survey conducted at the site.		✓	Existing SAV within the river is not anticipated to be significantly impacted by the proposed project. No formal SAV survey was conducted during project planning. Some SAV was observed in the Contoocook River in the vicinity of the proposed project, which may be temporarily impacted during construction. Additionally, once the new bridge structure over the Contoocook River is complete, indirect impacts to SAV may occur due to shading from the presence of the bridge. However, these impacts are not anticipated to result in long-term, significant impact to SAV.
Will salt marsh habitat be impacted? If no, why not? If yes, describe in detail how wetlands will be impacted. What is the aerial extent of the impacts? Are the effects temporary or permanent?		✓	No salt marsh habitat is located within the vicinity of the project, therefore this habitat type would not be impacted.

Will mudflat habitat be impacted? If no, why not? If yes, describe in detail how mudflats will be impacted. What is the aerial extent of the impacts? Are the effects temporary or permanent?		✓	No mudflat habitat is located within the vicinity of the project, therefore this habitat type would not be impacted.
Will shellfish habitat be impacted? If so, provide in detail how the shellfish habitat will be impacted. What is the aerial extent of the impact? Provide details of any shellfish survey conducted at the site.		✓	Impact to shellfish is unlikely. The NH Natural Heritage Bureau DataCheck report generated for this project did not identify any rare, threatened, or endangered shellfish occurring within or near the project area, and shellfish habitat in this reach of the river is limited.
Will hard bottom (rocky, cobble, gravel) habitat be impacted at the site? If so, provide in detail how the hard bottom will be impacted. What is the aerial extent of the impact?		✓	The substrate of the Contoocook River within the vicinity of the project area is mainly composed of mud and sand, since it is within an impounded area upstream of the Contoocook River dam; therefore, no impacts to hard bottom habitat is anticipated as part of the proposed project.
Will sediments be altered and/or sedimentation rates change? If no, why not? If yes, describe how.		✓	Sediments and sedimentation rates within the Contoocook River are not anticipated to change as part of the proposed project. Limited work below the bank of the Contoocook River may occur from grading and shaping around the footings for the bridge structure, however this work is limited to the vicinity of the bridge structure and is not anticipated to change flow or sedimentation rates within the river. Additionally, appropriate BMPs would be used throughout the duration of the proposed project to protect the Contoocook River from erosion and sedimentation. For long-term sedimentation and erosion control measures, stormwater BMPs (detention basins and tree wells) are proposed to be constructed as part of the project to capture and treat stormwater runoff from around the project area before it discharges into the Contoocook River.
Will turbidity increase? If no, why not? If yes, describe the causes, the extent of the effects, and the duration.		✓	Turbidity is not anticipated to increase within the Contoocook River as part of the proposed project. BMPs would be used throughout the duration of project construction to protect the Contoocook River and wetlands near the project area from sedimentation or erosion.

Will water depth change? What are the current and proposed depths?		✓	The conceptual design of the proposed bridge complies with NHDES stream rules regarding geomorphic compatibility, which will limit hydraulic impacts. Therefore, no measurable changes in water depths under normal flows would result from the project. Hydraulic modeling would be conducted during final design to further assess the hydraulic effects and ensure that the project would not change water depths.
Will contaminants be released into sediments or water column? If yes, describe the nature of the contaminants and the extent of the effects.		✓	The project would use appropriate BMPs to protect the Contoocook River and adjacent wetlands near the proposed project from erosion, sedimentation, pollutants, and contaminants. Any disturbance of sediment along the bank of the Contoocook River would be contained by appropriate erosion controls to prevent release into the water column. Additionally, a Soils Management Plan will be prepared for the project to provide guidance for the identification, handling, storage, reuse, and disposal of limited reuse soils and other hazardous materials that may be generated during construction.
Will tidal flow, currents, or wave patterns be altered? If no, why not? If yes, describe in detail how.		✓	Tidal flow, currents, and wave patterns would not be altered since the proposed project does not occur within coastal areas. Additionally, minimal work would occur within the bed of the Contoocook River; most of the work would occur along the bank of the river and areas above.
Will water quality be altered? If no, why not? If yes, describe in detail how. If the effects are temporary, describe the duration of the impact.		✓	The project includes implementation of a stormwater management plan. The plan calls for construction of one or two stormwater BMPs, with optional porous pavement and low impact development tree wells. While the project would increase the amount of impervious areas within the vicinity of the Contoocook River (net change of approximately 0.3 acres of new impervious surface), the stormwater BMPs would detain and treat stormwater generated by this additional pavement area.
Will ambient noise levels change? If no, why not? If yes, describe in detail how. If the effects are temporary, describe the duration and degree of impact.		✓	No. Ambient noise levels within the waters of the Contoocook River would not change as a result of the project. Some temporary impacts (construction phase) may result from the installation of riprap in the river bank, but these temporary impacts are not expected to result in negative impacts to fish species.
Does the action have the potential to impact prey species of federally managed fish with EFH designations?		✓	Water flows, water quality, benthic habitat, and other functions of the river are anticipated to remain unchanged or would only be temporarily impacted as a result of the proposed project. Therefore, Atlantic salmon prey species are unlikely to be impacted.

Step 4: This section is used to evaluate the consequences of the proposed action on the functions and values of EFH as well as the vulnerability of the EFH species and their life stages. Identify which species (from the list generated in Step 1) will be adversely impacted from the action. Assessment of EFH impacts should be based upon the site characteristics identified in Step 2 and the nature of the impacts described within Step 3. NOAA's EFH Mapper should be used during this assessment to determine the ecological parameters/ preferences associated with each species listed and the potential impact to those parameters.

4. EFH ASSESSMENT

Functions and Values	Y	N	Describe habitat type, species and life stages to be adversely impacted
Will functions and values of EFH be impacted for:			
Spawning **If yes, describe in detail how, and for which species. Describe how adverse effects will be avoided and minimized.**		✓	Negligible changes to water quality, hydrology, and benthic communities are anticipated as part of the proposed project, therefore functions and values for spawning habitat would not be impacted. Additionally, the impact area is adjacent to an impounded reach of the river; it is therefore very unlikely that Atlantic salmon would spawn in this location.
Nursery **If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.**		✓	Negligible changes to water quality, hydrology, and benthic communities are anticipated as part of the proposed project, therefore functions and values for nursery habitat would not be impacted.
Forage **If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.**		✓	Negligible changes to water quality, hydrology, and benthic communities are anticipated as part of the proposed project, therefore functions and values for forage habitat would not be impacted.
Shelter **If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.**		✓	Negligible changes to water quality, hydrology, and benthic communities are anticipated as part of the proposed project, therefore functions and values for shelter habitat would not be impacted.

Will impacts be temporary or permanent? Please indicate in description box and describe the duration of the impacts.			Temporary impacts along the bed and permanent and temporary impacts along the bank of the Contoocook River may occur from the construction of a new bridge structure. The footings and abutments of the new bridge structure would be located outside of the bank of the river, and limited shaping and grading would occur around the footings at or below bank of the river. The duration of construction for the proposed project is anticipated to last approximately 2.5 years, which would include the construction of the bridge structure.
Will compensatory mitigation be used? If no, why not? Describe plans for mitigation and how this will offset impacts to EFH. Include a conceptual compensatory mitigation plan, if applicable.		✓	Compensatory mitigation for EFH is not anticipated at this time since limited, temporary impacts are anticipated to occur within the bed of the Contoocook River. The proposed project would construct a bridge structure that would span the impounded portion of the Contoocook River just south of the dam structure. Based on the current conceptual plans, direct impacts would be approximately 220 linear feet within the banks of the Contoocook River (110 feet on both the east and west banks). Rip-rap will also be keyed into the bank and bed of the riever, but would extend only a few feet into the river bed. Additionally, no indirect impacts to the Contoocook River are anticipated due to the use of BMPs throughout the duration of the project that would protect the Contoocook River and adjacent surface waters and wetlands from sedimentation, erosion, pollution, and contaminants.

<u>Step 5</u>: This section provides the federal agency's determination on the degree of impact to EFH from the proposed action. The EFH determination also dictates the type of EFH consultation that will be required with NOAA Fisheries.

Please note: if information provided in the worksheet is insufficient to allow NOAA Fisheries to complete the EFH consultation additional information will be requested.

5. DETERMINATION OF IMPACT

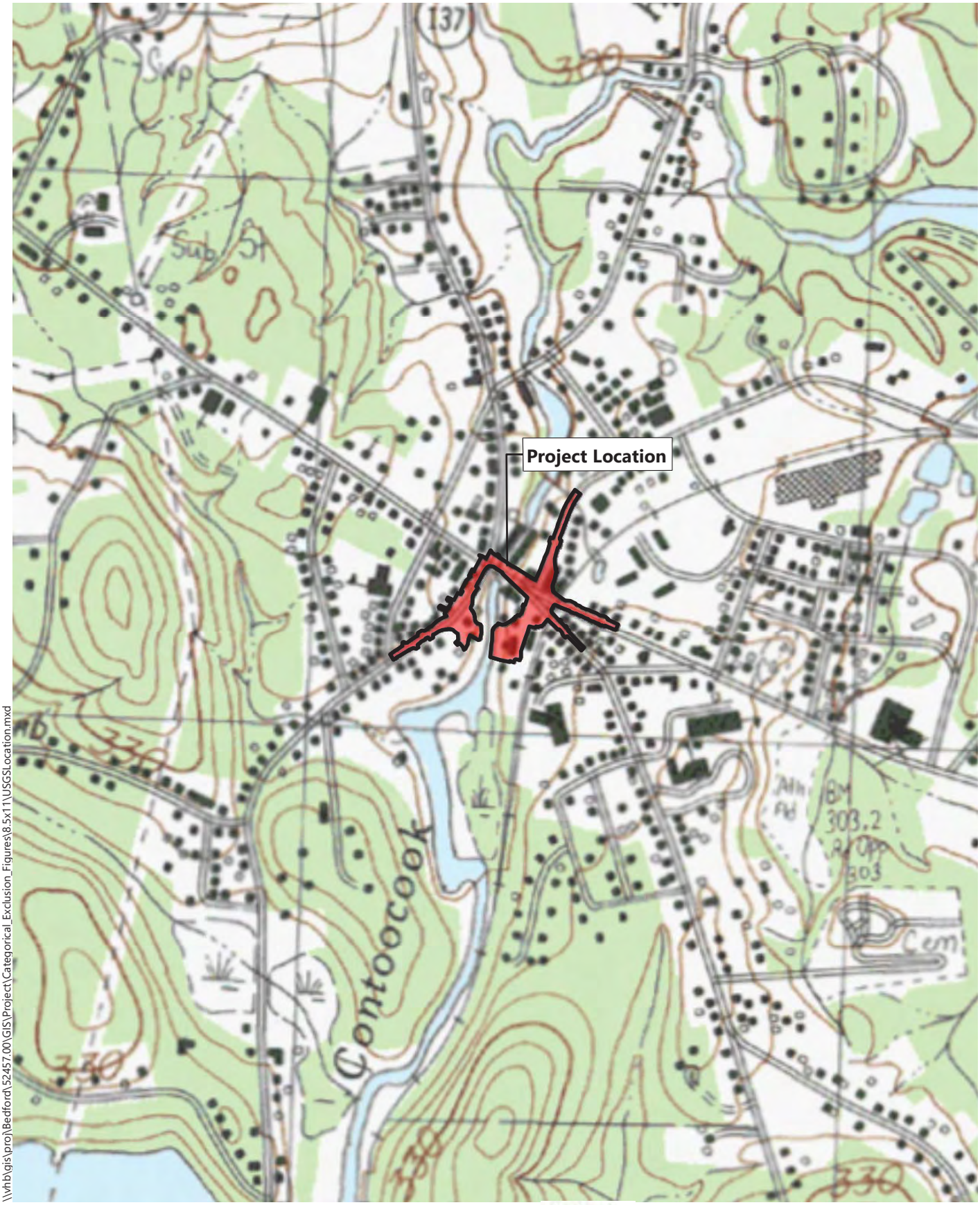
Federal Agency's EFH Determination		
Overall degree of adverse effects on EFH (not including compensatory mitigation) will be: **(check the appropriate statement)**		**There is no adverse effect on EFH or no EFH is designated at the project site.** **EFH Consultation is not required.**
	✓	**The adverse effect on EFH is not substantial. This means that the adverse effects are either no more than minimal, temporary, or that they can be alleviated with minor project modifications or conservation recommendations.** **This is a request for an abbreviated EFH consultation.**
		The adverse effect on EFH is substantial. **This is a request for an expanded EFH consultation.**

Step 6: Consultation with NOAA Fisheries may also be required if the proposed action results in adverse impacts to other NOAA-trust resources, such as anadromous fish, shellfish, crustaceans, or their habitats as part of the Fish and Wildlife Coordination Act Some examples of other NOAA-trust resources are listed below. Inquiries regarding potential impacts to marine mammals or threatened/endangered species should be directed to NOAA Fisheries' Protected Resources Division.

6. OTHER NOAA-TRUST RESOURCES IMPACT ASSESSMENT

Species known to occur at site (list others that may apply)	Describe habitat impact type (i.e., physical, chemical, or biological disruption of spawning and/or egg development habitat, juvenile nursery and/or adult feeding or migration habitat). Please note, impacts to federally listed species of fish, sea turtles, and marine mammals must be coordinated with the GARFO Protected Resources Division.
alewife	No
American eel	No
American shad	No
Atlantic menhaden	No
blue crab	No
blue mussel	No
blueback herring	No

Eastern oyster	No
horseshoe crab	No
quahog	No
soft-shell clams	No
striped bass	No
other species:	No



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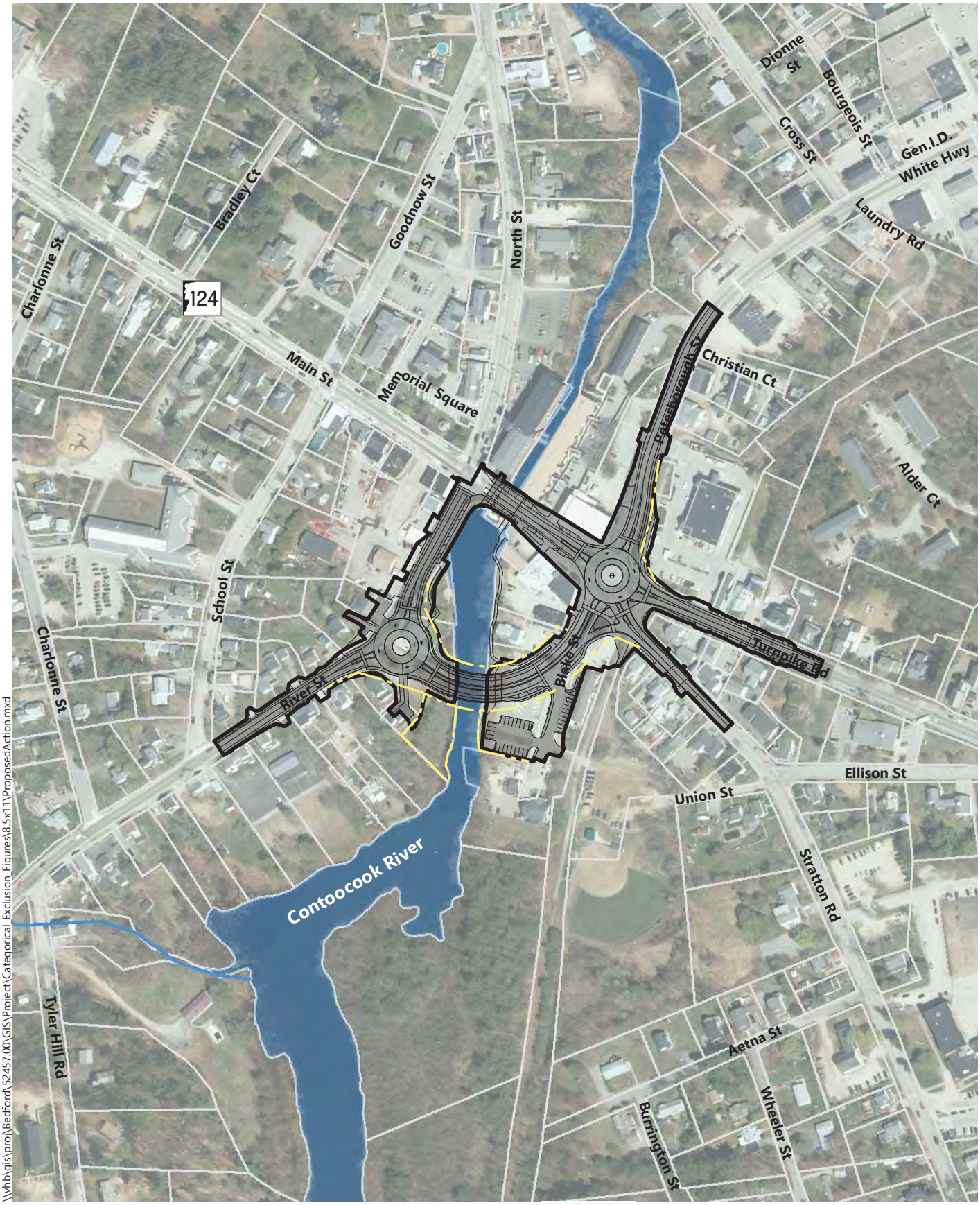
0 400 800 1600 Feet

Project Footprint

Jaffrey 16307 | Jaffrey, New Hampshire

USGS Site Location Map

Source: VHB, NHGRANIT



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0 150 300 600 Feet

Project Footprint
Proposed ROW
Design Detail
Stream (USGS)
Surface Water
Parcel Boundary

Jaffrey 16307 | Jaffrey, New Hampshire

Proposed Action

Source: VHB, NHGRANIT

Matras, Lindsay

From: Laurin, Marc <Marc.Laurin@dot.nh.gov>
Sent: Tuesday, June 25, 2019 10:18 AM
To: 'Mike R Johnson - NOAA Federal'
Cc: Jamie Sikora; Michael Hicks; Cota, Keith; Walker, Peter; Doughty, Loretta
Subject: RE: Jaffrey, 16307 - EFH Assessment
Attachments: assessworksheetfinal_Jaffrey16307_06-25-2019 Final Revised.pdf

Mike,

Thanks for your comments. I have changed the Determination of Impact to indicate that the project will have an adverse effect on EFH that is not substantial. Attached is the revised worksheet with that conclusion for your records.

Marc

From: Mike R Johnson - NOAA Federal [mailto:mike.r.johnson@noaa.gov]
Sent: Friday, June 21, 2019 8:52 AM
To: Laurin, Marc
Cc: Jamie Sikora; Michael Hicks; Cota, Keith
Subject: Re: Jaffrey, 16307 - EFH Assessment

Marc,

Based on the information in the EFH assessment, we cannot concur with your determination that the project would not adversely affect EFH. According to the assessment, the "current conceptual plans indicate that total bank impacts would be approximately 1,800 square feet along approximately 220 linear feet of river bank (110 feet on both the east and west banks). Rip-rap protection near the bridge features would be keyed into the river bed, but would extend only a few feet into the river bed."

This suggests to me that there will be impacts to the river bank and bed, albeit minimal amount of impacts. Let me know if the project scope and design has changed.

That said, because the impacts to the Contoocook River are minimal, we do not have any EFH conservation recommendations to provide for the project.

Thanks,

MIke

On Wed, Apr 17, 2019 at 3:06 PM Laurin, Marc <Marc.Laurin@dot.nh.gov> wrote:

> Mike,
>
> Attached for your review is the EFH Assessment Worksheet that assesses the potential effects to EFH in the vicinity of the project , the reconstruction and improvements to the US Route 202 intersection with NH Route 124 and NH Route 137 in the Town of Jaffrey, NH.
>
> Please review for concurrence on the determination of no adverse effect on EFH. Contact me if you have any questions or need more information.

> Thanks,
>
> Marc

--
Michael R. Johnson
U.S. Department of Commerce
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
Habitat Conservation Division
55 Great Republic Drive
Gloucester, MA 01930
978-281-9130
mike.r.johnson@noaa.gov
http://www.greateratlantic.fisheries.noaa.gov/

Web www.nmfs.noaa.gov
Facebook www.facebook.com/usnoaafisheriesgov
Twitter www.twitter.com/noaafisheries
YouTube www.youtube.com/usnoaafisheriesgov

Appendix P – USCG Correspondence

U.S. Department of Homeland Security

United States Coast Guard

Commander
First Coast Guard District

One South Street
Battery Park Building
New York, NY 10004-1466
Staff Symbol: dpb
Phone: (516) 241-5152

16211
January 12, 2022

Federal Highway Administration – New Hampshire Division
Attn: Jamison S. Sikora
Environmental Programs Manager
53 Pleasant Street, Suite 2200
Concord, NH 03301

Re: NV-1120: US 202 Bridge, Contoocook River, Jaffrey, NH

Dear Mr. Sikora:

This is in response to your letter e-mail dated January 10, 2022, invoking 23 U.S.C. Section 144 (c) for the referenced waterway construction project. Based upon information you have provided, we concur with your determination.

Although this project will not require a bridge permit, other areas of Coast Guard jurisdiction apply. The following stipulations must be met:

a. The lowest portion of the superstructure of the bridge across the waterway should clear high water pursuant to 33 CFR 115.70.

b. We have determined that bridge navigational lighting or signals under 33 CFR Part 118 will not be required at this time, however, the Coast Guard reserves the right to require lighting or signals at any time in the future should nighttime navigation increase in the vicinity of, or through the bridge.

c. Any spillage of oil or oil-based products during construction must be promptly reported to the Coast Guard by calling 1-800-424-8802.

d. This approval does not relieve the bridge owner of the obligation or responsibility for compliance with the provisions of any other law or regulation as may be under the jurisdiction of any other federal, state or local authority having cognizance of any aspect of the location, construction or maintenance for the proposed bridge.

If you have any further questions feel free to contact this office at the number above.

Sincerely,

FISHER.DONNA.A.1063032430 Digitally signed by FISHER.DONNA.A.1063032430 Date: 2022.01.12 09:54:09 -05'00'

D. A. FISHER
Bridge Program Manager
U.S. Coast Guard
By direction

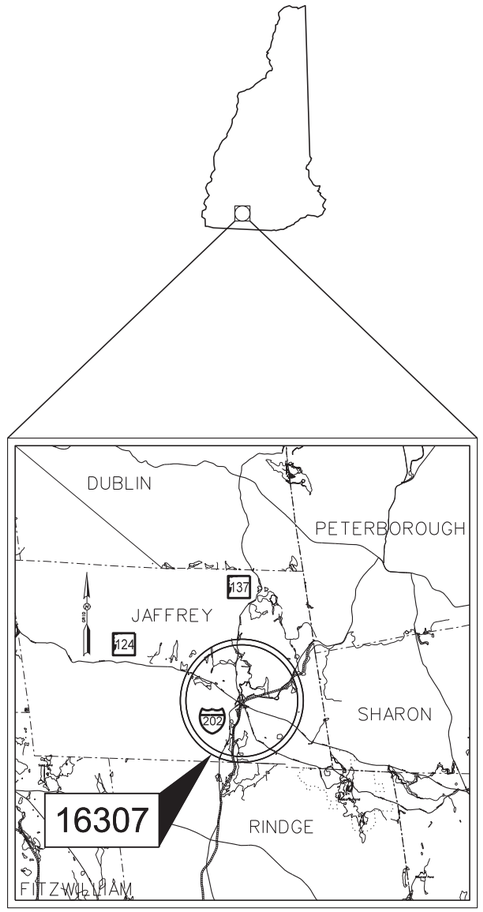
Copy: CG Sector Northern New England
USACE, New England Division, Navigation Section

Appendix Q – Wetland Impact Plans

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

WETLANDS IMPACT PLANS
FEDERAL AID PROJECT

X-(A001)234
N.H. PROJECT NO. 16307
US 202, NH 124, NH 137, STRATTON ROAD



LOCATION MAP

2 1 0 2 4 mi.

GRAPHIC SCALE

GRID

TO TROY

TO PETERBOROUGH

NH ROUTE 124 MAIN STREET

NH ROUTE 137 TO DUBLIN

RIVER STREET

CONTOOCOOK RIVER

US ROUTE 202 CONNECTOR

BLAKE STREET

ELLISON STREET

UNION STREET

STRATTON ROAD

TO RINDGE

US ROUTE 202 SOUTH

TO SHARON

NH ROUTE 124/ TURNPIKE ROAD

STA. 704+50
NH ROUTE 124/
MAIN STREET
LIMIT OF WORK

STA. 308+50
US 202 ROUTE NORTH
END APPROACH
LIMIT OF WORK

STA. 303+30
US ROUTE 202 NORTH
END FULL DEPTH
CONSTRUCTION
BEGIN APPROACH

STA. 402+25
NH ROUTE 124
END FULL DEPTH
CONSTRUCTION
BEGIN APPROACH

STA. 401+25
NH ROUTE 124 / TURNPIKE ROAD
LIMIT OF APPROACH

STA. 399+84
NH ROUTE 124 / TURNPIKE ROAD
LIMIT OF WORK

STA. 30+25
BLAKE STREET
LIMIT OF WORK

STA. 598+95
STRATTON ROAD
LIMIT OF WORK

STA. 101+50
US ROUTE 202 SOUTH
LIMIT OF WORK
BEGIN APPROACH

STA. 102+00
US ROUTE 202 SOUTH
END APPROACH
BEGIN FULL DEPTH
CONSTRUCTION

STA. 601+50
STRATTON ROAD
END FULL DEPTH
CONSTRUCTION
BEGIN APPROACH

US 202	
AVERAGE DAILY TRAFFIC 20 26	14,200
AVERAGE DAILY TRAFFIC 20 46	18,500
PERCENT OF TRUCKS	2%
DESIGN SPEED	30 MPH
LENGTH OF PROJECT	1295

NH 124 (MAIN STREET / TURNPIKE STREET)	
AVERAGE DAILY TRAFFIC 20 26	7,300
AVERAGE DAILY TRAFFIC 20 46	9,700
PERCENT OF TRUCKS	2%
DESIGN SPEED	30 MPH
LENGTH OF PROJECT	965

NH 137 (RIVER STREET):	
AVERAGE DAILY TRAFFIC 20 26	7,100
AVERAGE DAILY TRAFFIC 20 46	9,300
PERCENT OF TRUCKS	2%
DESIGN SPEED	30 MPH
LENGTH OF PROJECT	385

PERMITTING - LEVEL PLANS
SUBJECT TO CHANGE
NOT FOR CONSTRUCTION
MARCH 23, 2023

INDEX OF SHEETS

DRAWN BY DATE
CHECKED BY DATE

TOWN OF JAFFREY
COUNTY OF CHESHIRE

100 0 100 200
SCALE IN FEET
SCALE: 1" = 100'

FOR CONSTRUCTION AND ALIGNMENT DETAILS
- SEE CONSTRUCTION PLANS

VHB STRUCTURES — GREGORY S. GOODRICH No. 12204 LICENSED PROFESSIONAL ENGINEER — STATE OF NEW HAMPSHIRE

VHB HIGHWAY — CHARLES GREGORY No. 7133 LICENSED PROFESSIONAL ENGINEER — STATE OF NEW HAMPSHIRE

VHB ENVIRONMENTAL — KRISTOPHER P. WILKES No. 288 CERTIFIED WETLAND SCIENTIST — STATE OF NEW HAMPSHIRE

NHDOT — THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

RECOMMENDED FOR APPROVAL:

DIRECTOR OF PROJECT DEVELOPMENT — DATE

MUNICIPAL HIGHWAYS ENGINEER
BUREAU OF PLANNING AND COMMUNITY ASSISTANCE — DATE

APPROVED:

ASSISTANT COMMISSIONER AND CHIEF ENGINEER — DATE

DRAWING NAME	FEDERAL PROJECT NO.	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
16307FSC_Wet.dgn	X-(A001)234	16307	1	18

GENERAL

EDGE OF PAVEMENT — PROPOSED ROADWAY
TRAVELED WAY — existing roadway — (pavement removed outside slope lines)

DRIVEWAYS — (label surface type)

BUILDINGS — (building to be removed)
(label house or type of building)

FOUNDATION — (label type)

LEACH FIELD — leach field

BRIDGE CROSSINGS — STREAM — OVERPASS

STEPS AND WALK — (label type)

INTERMITTENT WATER COURSE

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 W

WELL — W

FLAG POLE — fp

ORIGINAL GROUND (TYPICALS)

ROCK OUTCROP

ROCK LINE (TYPICALS & SECTIONS ONLY)

GUARDRAIL (label type) — existing — PROPOSED — 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 — B

TEST PIT — TP

INTERSTATE NUMBERED HIGHWAY — 293

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) — 72.5
FINISHED GRADE ELEVATION (RIGHT) — 79.14

REVISIONS AFTER PROPOSAL

NUMBER	DESCRIPTION	STATION	DATE

SDR PROCESSED	NHDOT & VHB	DATE 9/2021
NEW DESIGN	VHB TEAM	DATE 3/2023
SHEET CHECKED	PJW	DATE 3/2023
AS BUILT DETAILS		DATE

SHEET 1 OF 2

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

STANDARD SYMBOLS

REVISION DATE	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
11-21-2014	3/17/2023	52792.00	16307SYM.dgn	16307	2	18

DRAINAGE

MANHOLE
CATCH BASIN — cb
DROP INLET — di
(existing) (PROPOSED)

DRAINAGE PIPE (existing) (label size & type)
DRAINAGE PIPE (PROPOSED)
UNDERDRAIN (existing) W/ FLUSHING BASIN — fb (label size & type)
UNDERDRAIN (PROPOSED) W/ FLUSHING BASIN
show direction of flow
HEADER (existing & PROPOSED) (with stone outlet protection)
END SECTION (existing & PROPOSED) METAL or PLASTIC / RCP
OPEN DITCH (PROPOSED)
EROSION CONTROL/ STONE SLOPE PROTECTION

BOUNDARIES / RIGHT-OF-WAY

RIGHT-OF-WAY LINE (label type)
RR RIGHT-OF-WAY LINE
PROPERTY LINE
PROPERTY LINE (COMMON OWNER) — Z — Z —
TOWN LINE — BOW / CONCORD
COUNTY LINE — COOS / GRAFTON
STATE LINE — MAINE / NEW HAMPSHIRE
NATIONAL FOREST
CONSERVATION LAND — 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		
MISCELLANEOUS/UNKNOWN POLE		
GUY POLE OR PUSH BRACE		
LIGHT POLE		
LIGHT ON POWER POLE		
LIGHT ON JOINT POLE		

(plot point at face not center of symbol)

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	
FIBER OPTIC	FO — FO	PFO — PFO
WATER SHUT OFF	WSO	WS
GAS SHUT OFF	GSO	GS
HYDRANT	HYD	HYD

MANHOLES

SEWER	S	MHS
TELEPHONE	T	MHT
ELECTRICAL	E	MHE
GAS	G	MHG
UNKNOWN	U	

TRAFFIC SIGNALS / ITS

	existing	PROPOSED
MAST ARM (existing)		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		SVF
ITS EQUIPMENT CABINET	its	ITS
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

SHEET 2 OF 2

REVISIONS AFTER PROPOSAL

NUMBER	DESCRIPTION	STATION	DATE

		DATE
SDR PROCESSED	NHDOT & VHB	9/2021
NEW DESIGN	VHB TEAM	3/2023
SHEET CHECKED	PJW	3/2023
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

STANDARD SYMBOLS

REVISION DATE	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
9-1-2016	3/17/2023	52792.00	16307SYM.dgn	16307	3	18

REVISIONS AFTER PROPOSAL

NUMBER	DESCRIPTION	DATE	STATION
			STATION
			STATION

SDR PROCESSED	NHDOT & VHB	DATE 9/2021
NEW DESIGN	VHB TEAM	DATE 3/2023
SHEET CHECKED	PJW	DATE 3/2023
AS BUILT DETAILS		DATE

MATCH TO SHEET EXCOND02

13 PEARD PROPERTIES, LLC

12 JAFFREY WAR MEMORIAL COMMITTEE, INC.

11 COM2 MEDIA LLC

10 NORTHERN NEW ENGLAND TELEPHONE OPERATIONS, LLC

APPROX. EXIST. R.O.W.

9 CAISSIE, DOMINIQUE CAISSIE, ANNE MARIE & VANCAMPEN, JAMES K.

APPROX. LOCATION OF EXIST. ACCESS EASE. TO TM 239 LT 230

7 LANGOREN, BJORN FRODE

27 PANAGIOTES, ARTHUR G. & PANAGIOTES, ANTHONY V.

EXIST. 20' WIDE R.O.W.

28 STATE OF NH (DOT)

EXIST. 20' WIDE EASE. PER PLAN CAB. 11 DR. 6-674

29 MONOMONAC EQUITIES, LLC

EXIST. 20' WIDE SEWER EASE.

EXIST. 5' WIDE ACCESS EASE.

EXIST. 25' WIDE ACCESS EASE

30 SILVER RANCH, INC.

31 DAVID P. RIVARD REVOCABLE TRUST OF 2011

CONTOOCOOK RIVER R2UB3h

S-1 R2UB3h

1 PSS1E

2 PEM1E

1 PEM1E

NOTES

1. VHB SENIOR ENVIRONMENTAL SCIENTIST, KRISTOPHER WILKES (NH CWS #288), DELINEATED JURISDICTIONAL WETLANDS AND SURFACE WATERS WITHIN AND ADJACENT TO THE PROPOSED LIMITS DISTURBANCE ON OCTOBER 7, 2021.
2. WETLAND DELINEATION WAS PERFORMED IN ACCORDANCE WITH THE PROCEDURES AND STANDARDS OUTLINED IN THE REGIONAL SUPPLEMENT TO THE U.S. ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL: NORTHCENTRAL AND NORTHEAST REGION, VERSION 2.0 (JANUARY 2012).
3. WETLAND DELINEATION ALSO RELIED UPON THE FIELD INDICATORS FOR IDENTIFYING HYDRIC SOILS IN THE UNITED STATES, VERSION 8.2, PUBLISHED BY THE NATURAL RESOURCE CONSERVATION SERVICE AND THE FIELD INDICATORS FOR IDENTIFYING HYDRIC SOILS IN NEW ENGLAND, VERSION 4.0, PUBLISHED BY THE NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION.
4. DOMINANT WETLAND VEGETATION WAS ASSESSED USING THE NORTHCENTRAL AND NORTHEAST REGION WETLAND PLANT LIST PUBLISHED BY THE U.S. ARMY CORPS OF ENGINEERS.
5. WETLANDS AND SURFACE WATERS WERE CLASSIFIED USING THE USFWS METHODOLOGY CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES (COWARDIN ET AL. 1979, REVISED 1985).
6. STREAM TOP-OF-BANK DELINEATION WAS PERFORMED IN ACCORDANCE WITH ENV-WT 102.15 AND THE ORDINARY HIGH-WATER ELEVATION WAS SET AT 1005.9 FEET NGVD29.

WETLAND CLASSIFICATION CODES	
PEM1E	PALUSTRINE, EMERGENT, PERSISTENT, SEASONALLY FLOODED/SATURATED
PSS1E	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
R2UB3h	RIVERINE, LOWER PERENNIAL, UNCONSOLIDATED BOTTOM, MUD, DIKED/IMPOUNDED

20 0 20 40
SCALE IN FEET

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
EXCOND01	3/17/2023	52792.00	16307Ex_Cond.dgn	16307	5	18

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED NHDOT & VHB DATE 9/2021
NEW DESIGN VHB TEAM DATE 3/2023
SHEET CHECKED PJW DATE 3/2023

AS BUILT DETAILS DATE

GRID

16 GREAT BRIDGE MONADNOCK CONDOMINIUM

17 RIVERMILL AT BASCOM FALLS

21 RARED JAFFREY LLC

23 STATE OF NH (DOT)

APPROX. LOCATION OF EXIST. 10' WIDE PEDESTRIAN/BIKE TRAFFIC EASE.

MILL RACE
BRIDGE NO.
154/084

BRIDGE NO.
155/084

15-1 WE SERVE HIM, LLC

15 THE PARK THEATRE

14 J.M.P. REAL ESTATE, LLC

18 JAFFREY CHAMBER OF COMMERCE

24 J.M.P. REAL ESTATE, LLC

25 ARTHUR G. PANAGIOTES REVOCABLE TRUST & PANAGIOTES, ANTHONY V.

26 ASHWORTH INVESTMENTS LLC

APPROX. LOCATION OF RIVER WALK EASE.

CONTOOCOOK RIVER R2UB3n

S-1 R2UB3h

MATCH TO SHEET EXCONDOI

MATCH TO SHEET EXCONDOI

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EXISTING CONDITIONS PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
EXCOND02	3/17/2023	52792.00	16307Ex_Cond.dgn	16307	6	18

WETLAND CLASSIFICATION CODES	
PEM1E	PALUSTRINE, EMERGENT, PERSISTENT, SEASONALLY FLOODED/SATURATED
PSS1E	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
R2UB3h	RIVERINE, LOWER PERENNIAL, UNCONSOLIDATED BOTTOM, MUD, DIKED/IMPOUNDED

LEGEND

- △ # — WETLAND DESIGNATION NUMBER
- # — WETLAND IMPACT LOCATION

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 (NON-WETLAND)	
TEMPORARY IMPACTS (WETLAND)	

MATCH TO SHEET WET02

TEMP. CONST. EASE. (TYP.)

BUILDING DEMOLITION (BY OTHERS)

WILDLIFE SHELF

CONTOOCOOK RIVER R2UB3h

US Rte 202 Connector

SEWER EASE.

EXIST. 5' WIDE ACCESS EASE.

DRAINAGE EASEMENT

Union Street

Blake Street

APPROX. LOCATION OF EXIST. ACCESS TO TM 23

18" rcp outlet

SCALE IN FEET

WETLAND IMPACT SUMMARY

WETLAND IDENT-IFICATION	WETLAND CLASS-IFICATION	WETLAND DESIGNA-TION	AREA IMPACTS									
			PERMANENT					TEMPORARY				
			N.H.W.B. (NON-WETLAND) BANK		N.H.W.B. & A.C.O.E. (WETLAND) BED		PALUSTRINE WETLAND	(NON-WETLAND)		(WETLAND)		PALUSTRINE WETLAND
			SF	LF	SF	LF	SF	SF	LF	SF	LF	SF
A	PSS1E	1					1016					
B	PEM1E	1					2284					
C	PEM1E	2					1217					
D	BANK	S-1	762	107								
E	R2UB3h	S-1			1143	110						
F	R2UB3h	S-1			1397	115						
G	BANK	S-1	652	76								
H	BANK	S-1	90	57								
TA	PEM1E	1										244
TB	BANK	S-1						46	5			
TC	R2UB3h	S-1								663	117	
TD	BANK	S-1						214	104			
TE	R2UB3h	S-1								732	125	
TF	BANK	S-1						36	5			

REVISIONS AFTER PROPOSAL	DESCRIPTION	STATION	DATE	NUMBER
SDR PROCESSED NHDOT & VHB	DATE 9/2021			
NEW DESIGN VHB TEAM	DATE 3/2023			
SHEET CHECKED PJW	DATE 3/2023			
AS BUILT DETAILS	DATE			

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET01	3/17/2023	52792.00	16307Wet_Plans.dgn	16307	7	18

WETLAND IMPACT SUMMARY											
WETLAND IDENT-IFICATION	WETLAND CLASS-IFICATION	WETLAND DESIGNA-TION	AREA IMPACTS								
			PERMANENT					TEMPORARY			
			N.H.W.B. (NON-WETLAND) BANK		N.H.W.B. & A.C.O.E. (WETLAND) BED		PALUSTRINE WETLAND	(NON-WETLAND)		(WETLAND)		PALUSTRINE WETLAND
			SF	LF	SF	LF	SF	SF	LF	SF	LF	SF
A	PSS1E	1					1016					
B	PEM1E	1					2284					
C	PEM1E	2					1217					
D	BANK	S-1	762	107								
E	R2UB3h	S-1			1143	110						
F	R2UB3h	S-1			1397	115						
G	BANK	S-1	652	76								
H	BANK	S-1	90	57								
TA	PEM1E	1										244
TB	BANK	S-1						46	5			
TC	R2UB3h	S-1								663	117	
TD	BANK	S-1						214	104			
TE	R2UB3h	S-1								732	125	
TF	BANK	S-1						36	5			
TG	R2UB3h	S-1								267	32	
TH	R2UB3h	S-1								864	84	
TI	R2UB3h	S-1								846	84	
TOTAL			1504	240	2540	225	4517	296	114	3372	442	244

LEGEND

- # — WETLAND DESIGNATION NUMBER
- # — WETLAND IMPACT LOCATION

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 (NON-WETLAND)	
TEMPORARY IMPACTS (WETLAND)	

WETLAND CLASSIFICATION CODES	
PEM1E	PALUSTRINE, EMERGENT, PERSISTENT, SEASONALLY FLOODED/SATURATED
PSS1E	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
R2UB3h	RIVERINE, LOWER PERENNIAL, UNCONSOLIDATED BOTTOM, MUD, DIKED/IMPOUNDED

REVISIONS AFTER PROPOSAL			
DESCRIPTION	DATE	NUMBER	STATION
SDR PROCESSED NHDOT & VHB	DATE 9/2021		
NEW DESIGN VHB TEAM	DATE 3/2023		
SHEET CHECKED PJW	DATE 3/2023		
AS BUILT DETAILS	DATE		

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ◦ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
WET02	3/17/2023	52792.00	16307Wet_Plans.dgn	16307	8	18

Appendix R – Erosion Control Plans

EROSION CONTROL STRATEGIES

1. ENVIRONMENTAL COMMITMENTS:
   1.1. THESE GUIDELINES DO NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH ANY CONTRACT PROVISIONS, OR APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS.
   1.2. THIS PROJECT WILL BE SUBJECT TO THE US EPA'S NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORM WATER CONSTRUCTION GENERAL PERMIT AS ADMINISTERED BY THE ENVIRONMENTAL PROTECTION AGENCY (EPA). THIS PROJECT IS SUBJECT TO REQUIREMENTS IN THE MOST RECENT CONSTRUCTION GENERAL PERMIT (CGP).
   1.3. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE NHDES WETLAND PERMIT, THE US ARMY CORPS OF ENGINEERS PERMIT, WATER QUALITY CERTIFICATION AND THE SPECIAL ATTENTION ITEMS INCLUDED IN THE CONTRACT DOCUMENTS.
   1.4. ALL STORM WATER, EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE NEW HAMPSHIRE STORMWATER MANUAL, VOLUME 3, EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION (DECEMBER 2008) (BMP MANUAL) AVAILABLE FROM THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES (NHDES).
   1.5. THE CONTRACTOR SHALL COMPLY WITH RSA 485-A:17, AND ALL, PUBLISHED NHDES ALTERATION OF TERRAIN ENV-WQ 1500 REQUIREMENTS (HTTP://DES.NH.GOV/ORGANIZATION/COMMISSIONER/LEGAL/RULES/INDEX.HTM)
   1.6. THE CONTRACTOR IS DIRECTED TO REVIEW AND COMPLY WITH SECTION 107.1 OF THE CONTRACT AS IT REFERS TO SPILLAGE, AND ALSO WITH REGARDS TO EROSION, POLLUTION, AND TURBIDITY PRECAUTIONS.

2. STANDARD EROSION CONTROL SEQUENCING APPLICABLE TO ALL CONSTRUCTION PROJECTS:
   2.1. PERIMETER CONTROLS SHALL BE INSTALLED PRIOR TO EARTH DISTURBING ACTIVITIES. PERIMETER CONTROLS AND STABILIZED CONSTRUCTION EXITS SHALL BE INSTALLED AS SHOWN IN THE BMP MANUAL AND AS DIRECTED BY THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) PREPARER.
   2.2. EROSION, SEDIMENTATION CONTROL MEASURES AND INFILTRATION BASINS SHALL BE CLEANED, REPLACED AND AUGMENTED AS NECESSARY TO PREVENT SEDIMENTATION BEYOND PROJECT LIMITS THROUGHOUT THE PROJECT DURATION.
   2.3. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED IN ACCORDANCE WITH THE CONSTRUCTION GENERAL PERMIT AND SECTION 645 OF THE NHDOT SPECIFICATIONS FOR ROAD AND BRIDGES CONSTRUCTION.
   2.4. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURRED:
      (A) BASE COURSE GRAVELS HAVE BEEN INSTALLED IN AREAS TO BE PAVED;
      (B) A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED;
      (C) A MINIMUM OF 3" OF NON-EROSIVE MATERIAL SUCH AS STONE OR RIP-RAP HAS BEEN INSTALLED;
      (D) TEMPORARY SLOPE STABILIZATION CONFORMING TO TABLE 1 HAS BEEN PROPERLY INSTALLED
   2.5. ALL STOCKPILES SHALL BE CONTAINED WITH A PERIMETER CONTROL. IF THE STOCKPILE IS TO REMAIN UNDISTURBED FOR MORE THAN 14 DAYS, MULCHING WILL BE REQUIRED.
   2.6. A WATER TRUCK SHALL BE AVAILABLE TO CONTROL EXCESSIVE DUST AT THE DIRECTION OF THE CONTRACT ADMINISTRATOR.
   2.7. TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES SHALL REMAIN UNTIL THE AREA HAS BEEN PERMANENTLY STABILIZED.
   2.8. CONSTRUCTION PERFORMED ANY TIME BETWEEN NOVEMBER 30" AND MAY 1" OF ANY YEAR SHALL BE CONSIDERED WINTER CONSTRUCTION AND SHALL CONFORM TO THE FOLLOWING REQUIREMENTS.
      (A) ALL PROPOSED VEGETATED AREAS WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15", OR WHICH ARE DISTURBED AFTER OCTOBER 15", SHALL BE STABILIZED IN ACCORDANCE WITH TABLE 1.
      (B) ALL DITCHES OR SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15", OR WHICH ARE DISTURBED AFTER OCTOBER 15", SHALL BE STABILIZED TEMPORARILY WITH STONE OR IN ACCORDANCE WITH TABLE 1.
      (C) AFTER NOVEMBER 30" INCOMPLETE ROAD SURFACES, WHERE WORK HAS STOPPED FOR THE SEASON, SHALL BE PROTECTED IN ACCORDANCE WITH TABLE 1.
      (D) WINTER EXCAVATION AND EARTHWORK SHALL BE DONE SUCH THAT NO MORE THAN 1 ACRE OF THE PROJECT IS WITHOUT STABILIZATION AT ONE TIME, UNLESS A WINTER CONSTRUCTION PLAN HAS BEEN APPROVED BY NHDOT THAT MEETS THE REQUIREMENTS OF ENV-WQ 1505.02 AND ENV-WQ 1505.05.
      (E) A SWPPP AMENDMENT SHALL BE SUBMITTED TO THE DEPARTMENT, FOR APPROVAL, ADDRESSING COLD WEATHER STABILIZATION (ENV-WQ 1505.05) AND INCLUDING THE REQUIREMENTS OF NO LESS THAN 30 DAYS PRIOR TO THE COMMENCEMENT OF WORK SCHEDULED AFTER NOVEMBER 30".

GENERAL CONSTRUCTION PLANNING AND SELECTION OF STRATEGIES TO CONTROL EROSION AND SEDIMENT ON HIGHWAY CONSTRUCTION PROJECTS

3. PLAN ACTIVITIES TO ACCOUNT FOR SENSITIVE SITE CONDITIONS:
   3.1. CLEARLY FLAG AREAS TO BE PROTECTED IN THE FIELD AND PROVIDE CONSTRUCTION BARRIERS TO PREVENT TRAFFICKING OUTSIDE OF WORK AREAS.
   3.2. CONSTRUCTION SHALL BE SEQUENCED TO LIMIT THE DURATION AND AREA OF EXPOSED SOILS.
   3.3. PROTECT AND MAXIMIZE EXISTING NATIVE VEGETATION AND NATURAL FOREST BUFFERS BETWEEN CONSTRUCTION ACTIVITY AND SENSITIVE AREAS.
   3.4. WHEN WORK IS PERFORMED IN AND NEAR WATER COURSES, STREAM FLOW DIVERSION METHODS SHALL BE IMPLEMENTED PRIOR TO ANY EXCAVATION OR FILLING.
   3.5. WHEN WORK IS PERFORMED WITHIN 50 FEET OF SURFACE WATERS (WETLAND, OPEN WATER OR FLOWING WATER), PERIMETER CONTROL SHALL BE ENHANCED CONSISTENT WITH SECTION 2.1.2.1. OF THE 2012 NPDES CONSTRUCTION GENERAL PERMIT.

4. MINIMIZE THE AMOUNT OF EXPOSED SOIL:
   4.1. CONSTRUCTION SHALL BE SEQUENCED TO LIMIT THE DURATION AND AREA OF EXPOSED SOILS. MINIMIZE THE AREA OF EXPOSED SOIL AT ANY ONE TIME. PHASING SHALL BE USED TO REDUCE THE AMOUNT AND DURATION OF SOIL EXPOSED TO THE ELEMENTS AND VEHICLE TRACKING.
   4.2. UTILIZE TEMPORARY MULCHING OR PROVIDE ALTERNATE TEMPORARY STABILIZATION ON EXPOSED SOILS IN ACCORDANCE WITH TABLE 1.
   4.3. THE MAXIMUM AMOUNT OF DISTURBED EARTH SHALL NOT EXCEED A TOTAL OF 5 ACRES FROM MAY 1" THROUGH NOVEMBER 30", 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 CONTRACTORS CRITICAL PATH METHOD SCHEDULE (CPM), AND THE CONTRACTOR HAS ADEQUATE RESOURCES AVAILABLE TO ENSURE THAT ENVIRONMENTAL COMMITMENTS WILL BE MET.

5. CONTROL STORMWATER FLOWING ONTO AND THROUGH THE PROJECT:
   5.1. DIVERT OFF SITE RUNOFF OR CLEAN WATER AWAY FROM THE CONSTRUCTION ACTIVITY TO REDUCE THE VOLUME THAT NEEDS TO BE TREATED ON SITE.
   5.2. DIVERT STORM RUNOFF FROM UPSLOPE DRAINAGE AREAS AWAY FROM DISTURBED AREAS, SLOPES, AND AROUND ACTIVE WORK AREAS AND TO A STABILIZED OUTLET LOCATION.
   5.3. CONSTRUCT IMPERMEABLE BARRIERS AS NECESSARY TO COLLECT OR DIVERT CONCENTRATED FLOWS FROM WORK OR DISTURBED AREAS.
   5.4. STABILIZE, TO APPROPRIATE ANTICIPATED VELOCITIES, CONVEYANCE CHANNELS OR PUMPING SYSTEMS NEEDED TO CONVEY CONSTRUCTION STORMWATER TO BASINS AND DISCHARGE LOCATIONS PRIOR TO USE.
   5.5. DIVERT OFF-SITE WATER THROUGH THE PROJECT IN AN APPROPRIATE MANNER SO NOT TO DISTURB THE UPSTREAM OR DOWNSTREAM SOILS, VEGETATION OR HYDROLOGY BEYOND THE PERMITTED AREA.

6. PROTECT SLOPES:
   6.1. INTERCEPT AND DIVERT STORM RUNOFF FROM UPSLOPE DRAINAGE AREAS AWAY FROM UNPROTECTED AND NEWLY ESTABLISHED AREAS AND SLOPES TO A STABILIZED OUTLET OR CONVEYANCE.
   6.2. CONSIDER HOW GROUNDWATER SEEPAGE ON CUT SLOPES MAY IMPACT SLOPE STABILITY AND INCORPORATE APPROPRIATE MEASURES TO MINIMIZE EROSION.
   6.3. CONVEY STORMWATER DOWN THE SLOPE IN A STABILIZED CHANNEL OR SLOPE DRAIN.
   6.4. THE OUTER FACE OF THE FILL SLOPE SHOULD BE IN A LOOSE RUFFLED CONDITION PRIOR TO TURF ESTABLISHMENT. TOPSOIL OR HUMUS LAYERS SHALL BE TRACKED UP AND DOWN THE SLOPE, DISKED, HARROWED, DRAGGED WITH A CHAIN OR MAT, MACHINE-RAKED, OR HAND-WORKED TO PRODUCE A RUFFLED SURFACE.

7. ESTABLISH STABILIZED CONSTRUCTION EXITS:
   7.1. INSTALL AND MAINTAIN CONSTRUCTION EXITS, ANYWHERE TRAFFIC LEAVES A CONSTRUCTION SITE ONTO A PUBLIC RIGHT-OF-WAY.
   7.2. SWEEP ALL CONSTRUCTION RELATED DEBRIS AND SOIL FROM THE ADJACENT PAVED ROADWAYS AS NECESSARY.

8. PROTECT STORM DRAIN INLETS:
   8.1. DIVERT SEDIMENT LADEN WATER AWAY FROM INLET STRUCTURES TO THE EXTENT POSSIBLE.
   8.2. INSTALL SEDIMENT BARRIERS AND SEDIMENT TRAPS AT INLETS TO PREVENT SEDIMENT FROM ENTERING THE DRAINAGE SYSTEM.
   8.3. CLEAN CATCH BASINS, DRAINAGE PIPES, AND CULVERTS IF SIGNIFICANT SEDIMENT IS DEPOSITED.
   8.4. DROP INLET SEDIMENT BARRIERS SHOULD NEVER BE USED AS THE PRIMARY MEANS OF SEDIMENT CONTROL AND SHOULD ONLY BE USED TO PROVIDE AN ADDITIONAL LEVEL OF PROTECTION TO STRUCTURES AND DOWN-GRADIENT SENSITIVE RECEPTORS.

9. SOIL STABILIZATION:
   9.1. WITHIN THREE DAYS OF THE LAST ACTIVITY IN AN AREA, ALL EXPOSED SOIL AREAS, WHERE CONSTRUCTION ACTIVITIES ARE COMPLETE, SHALL BE STABILIZED.
   9.2. IN ALL AREAS, TEMPORARY SOIL STABILIZATION MEASURES SHALL BE APPLIED IN ACCORDANCE WITH THE STABILIZATION REQUIREMENTS (SECTION 2.2) OF THE 2012 CGP. (SEE TABLE 1 FOR GUIDANCE ON THE SELECTION OF TEMPORARY SOIL STABILIZATION MEASURES.)
   9.3. EROSION CONTROL SEED MIX SHALL BE SOWN IN ALL INACTIVE CONSTRUCTION AREAS THAT WILL NOT BE PERMANENTLY SEEDED WITHIN TWO WEEKS OF DISTURBANCE AND PRIOR TO SEPTEMBER 15, OF ANY GIVEN YEAR, IN ORDER TO ACHIEVE VEGETATIVE STABILIZATION PRIOR TO THE END OF THE GROWING SEASON.
   9.4. SOIL TACKIFIERS MAY BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND REAPPLIED AS NECESSARY TO MINIMIZE SOIL AND MULCH LOSS UNTIL PERMANENT VEGETATION IS ESTABLISHED.

10. RETAIN SEDIMENT ON-SITE AND CONTROL DEWATERING PRACTICES:
   10.1. TEMPORARY SEDIMENT BASINS (CGP-SECTION 2.1.3.2) OR SEDIMENT TRAPS (ENV-WQ 1506.10) SHALL BE SIZED TO RETAIN, ON SITE, THE VOLUME OF A 2-YEAR 24-HOUR STORM EVENT FOR ANY AREA OF DISTURBANCE OR 3,600 CUBIC FEET OF STORMWATER RUNOFF PER ACRE OF DISTURBANCE, WHICHEVER IS GREATER. TEMPORARY SEDIMENT BASINS USED TO TREAT STORMWATER RUNOFF FROM AREAS GREATER THAN 5-ACRES OF DISTURBANCE SHALL BE SIZED TO ALSO CONTROL STORMWATER RUNOFF FROM A 10-YEAR 24 HOUR STORM EVENT. ON-SITE RETENTION OF THE 10-YEAR 24-HOUR EVENT IS NOT REQUIRED.
   10.2. CONSTRUCT AND STABILIZE DEWATERING INFILTRATION BASINS PRIOR TO ANY EXCAVATION THAT MAY REQUIRE DEWATERING.
   10.3. TEMPORARY SEDIMENT BASINS OR TRAPS SHALL BE PLACED AND STABILIZED AT LOCATIONS WHERE CONCENTRATED FLOW (CHANNELS AND PIPES) DISCHARGE TO THE SURROUNDING ENVIRONMENT FROM AREAS OF UNSTABILIZED EARTH DISTURBING ACTIVITIES.

11. ADDITIONAL EROSION AND SEDIMENT CONTROL GENERAL PRACTICES:
   11.1. 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, AS APPROVED BY THE NHDES.
   11.2. ALL STOCKPILES SHALL BE CONTAINED WITH TEMPORARY PERIMETER CONTROLS. INACTIVE SOIL STOCKPILES SHOULD BE PROTECTED WITH SOIL STABILIZATION MEASURES (TEMPORARY EROSION CONTROL SEED MIX AND MULCH, SOIL BINDER) OR COVERED WITH ANCHORED TARPS.
   11.3. EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSPECTED IN ACCORDANCE WITH SECTION 645 OF NHDOT SPECIFICATIONS, WEEKLY AND WITHIN 24 HOURS AFTER ANY STORM EVENT GREATER THAN 0.25 IN. OF RAIN PER 24-HOUR PERIOD. EROSION AND SEDIMENT CONTROL MEASURES WILL ALSO BE INSPECTED IN ACCORDANCE WITH THE GUIDANCE MEMO FROM THE NHDES CONTAINED WITHIN THE CONTRACT PROPOSAL AND THE EPA CONSTRUCTION GENERAL PERMIT.
   11.4. THE CONTRACTOR SHOULD UTILIZE STORM DRAIN INLET PROTECTION TO PREVENT SEDIMENT FROM ENTERING A STORM DRAINAGE SYSTEM PRIOR TO THE PERMANENT STABILIZATION OF THE CONTRIBUTING DISTURBED AREA.
   11.5. PERMANENT STABILIZATION MEASURES WILL BE CONSTRUCTED AND MAINTAINED IN LOCATIONS AS SHOWN ON THE CONSTRUCTION PLANS TO STABILIZE AREAS. VEGETATIVE STABILIZATION SHALL NOT BE CONSIDERED PERMANENTLY STABILIZED UNTIL VEGETATIVE GROWTH COVERS AT LEAST 85% OF THE DISTURBED AREA. THE CONTRACTOR SHALL BE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROL FOR ONE YEAR AFTER PROJECT COMPLETION.
   11.6. CATCH BASINS: CARE SHALL BE TAKEN TO ENSURE THAT SEDIMENTS DO NOT ENTER ANY EXISTING CATCH BASINS DURING CONSTRUCTION. THE CONTRACTOR SHALL PLACE TEMPORARY STONE INLET PROTECTION OVER INLETS IN AREAS OF SOIL DISTURBANCE THAT ARE SUBJECT TO SEDIMENT CONTAMINATION.
   11.7. TEMPORARY AND PERMANENT DITCHES SHALL BE CONSTRUCTED, STABILIZED AND MAINTAINED IN A MANNER THAT WILL MINIMIZE SCOUR. TEMPORARY AND PERMANENT DITCHES SHALL BE DIRECTED TO DRAIN TO SEDIMENT BASINS OR STORM WATER COLLECTION AREAS.
   11.8. WINTER EXCAVATION AND EARTHWORK ACTIVITIES NEED TO BE LIMITED IN EXTENT AND DURATION, TO MINIMIZE POTENTIAL EROSION AND SEDIMENTATION IMPACTS. THE AREA OF EXPOSED SOIL SHALL BE LIMITED TO ONE ACRE, OR THAT WHICH CAN BE STABILIZED AT THE END OF EACH DAY UNLESS A WINTER CONSTRUCTION PLAN, DEVELOPED BY A QUALIFIED ENGINEER OR A CPESC SPECIALIST, IS REVIEWED AND APPROVED BY THE DEPARTMENT.
   11.9. CHANNEL PROTECTION MEASURES SHALL BE SUPPLEMENTED WITH PERIMETER CONTROL MEASURES WHEN THE DITCH LINES OCCUR AT THE BOTTOM OF LONG FILL SLOPES. THE PERIMETER CONTROLS SHALL BE INSTALLED ON THE FILL SLOPE TO MINIMIZE THE POTENTIAL FOR FILL SLOPE SEDIMENT DEPOSITS IN THE DITCH LINE.

BEST MANAGEMENT PRACTICES (BMP) BASED ON AMOUNT OF OPEN CONSTRUCTION AREA

12. STRATEGIES SPECIFIC TO OPEN AREAS LESS THAN 5 ACRES:
   12.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WQ 1500: ALTERATION OF TERRAIN FOR CONSTRUCTION AND USE ALL CONVENTIONAL BMP STRATEGIES.
   12.2. SLOPES STEEPER THAN 3:1 WILL RECEIVE TURF ESTABLISHMENT WITH MATTING.
   12.3. SLOPES 3:1 OR FLATTER WILL RECEIVE TURF ESTABLISHMENT ALONE.
   12.4. AREAS WHERE HAUL ROADS ARE CONSTRUCTED AND STORMWATER CANNOT BE TREATED THE DEPARTMENT WILL CONSIDER INFILTRATION.
   12.5. FOR HAUL ROADS ADJACENT TO SENSITIVE ENVIRONMENTAL AREAS OR STEEPER THAN 5%, THE DEPARTMENT WILL CONSIDER USING EROSION STONE, CRUSHED GRAVEL, OR CRUSHED STONE BASE TO HELP MINIMIZE EROSION ISSUES.
   12.6. ALL AREAS THAT CAN BE STABILIZED SHALL BE STABILIZED PRIOR TO OPENING UP NEW TERRITORY.
   12.7. DETENTION BASINS SHALL BE DESIGNED AND CONSTRUCTED TO ACCOMMODATE A 2 YEAR STORM EVENT.

13. STRATEGIES SPECIFIC TO OPEN AREAS BETWEEN 5 AND 10 ACRES:
   13.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WQ 1500 ALTERATION OF TERRAIN AND SHALL USE CONVENTIONAL BMP STRATEGIES AND ALL TREATMENT OPTIONS USED FOR UNDER 5 ACRES WILL BE UTILIZED.
   13.2. DETENTION BASINS WILL BE CONSTRUCTED TO ACCOMMODATE THE 2-YEAR 24-HOUR STORM EVENT AND CONTROL A 10-YEAR 24-HOUR STORM EVENT.
   13.3. SLOPES STEEPER THAN A 3:1 WILL RECEIVE TURF ESTABLISHMENT WITH MATTING OR OTHER TEMPORARY SOIL STABILIZATION MEASURES DETAILED IN TABLE 1. THE CONTRACTOR MAY ALSO CONSIDER A SOIL BINDER IN ACCORDANCE WITH THE NHDES APPROVALS OR REGULATIONS. OTHER ALTERNATIVE MEASURES, SUCH AS BONDED FIBER MATRIXES (BFMS) OR FLEXIBLE GROWTH MEDIUMS (FGMS) MAY BE UTILIZED, IF MEETING THE NHDES APPROVALS AND REGULATIONS.
   13.4. SLOPES 3:1 OR FLATTER WILL RECEIVE TURF ESTABLISHMENT OR OTHER TEMPORARY SOIL STABILIZATION MEASURES DETAILED IN TABLE 1. THE CONTRACTOR MAY ALSO CONSIDER A SOIL BINDER IN ACCORDANCE WITH THE NHDES APPROVALS OR REGULATIONS.

14. STRATEGIES SPECIFIC TO OPEN AREAS OVER 10 ACRES:
   14.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WQ 1500 ALTERATION OF TERRAIN AND SHALL USE CONVENTIONAL BMP STRATEGIES AND ALL TREATMENT OPTIONS USED FOR UNDER 5 ACRES AND BETWEEN 5 AND 10 ACRES WILL BE UTILIZED.
   14.2. THE DEPARTMENT ANTICIPATES THAT SOIL BINDERS WILL BE NEEDED ON ALL SLOPES STEEPER THAN 3:1, IN ORDER TO MINIMIZE EROSION AND REDUCE THE AMOUNT OF SEDIMENT IN THE STORMWATER TREATMENT BASINS.
   14.3. THE CONTRACTOR WILL BE REQUIRED TO HAVE AN APPROVED DESIGN IN ACCORDANCE WITH ENV-WQ 1506.12 FOR AN ACTIVE FLOCCULANT TREATMENT SYSTEM TO TREAT AND RELEASE WATER CAPTURED IN STORM WATER BASINS. THE CONTRACTOR SHALL ALSO RETAIN THE SERVICES OF AN ENVIRONMENTAL CONSULTANT WHO HAS DEMONSTRATED EXPERIENCE IN THE DESIGN OF FLOCCULANT TREATMENT SYSTEMS. THE CONSULTANT WILL ALSO BE RESPONSIBLE FOR THE IMPLEMENTATION AND MONITORING OF THE SYSTEM.

TABLE 1

GUIDANCE ON SELECTING TEMPORARY SOIL STABILIZATION MEASURES

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	YES'	YES'	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. PRODUCTS CONTAINING POLYACRYLAMIDE (PAM) SHALL NOT BE APPLIED DIRECTLY TO OR WITHIN 100 FEET OF ANY SURFACE WATER WITHOUT PRIOR WRITTEN APPROVAL FROM THE NH DEPARTMENT OF ENVIRONMENTAL SERVICES.
3. ALL EROSION CONTROL BLANKETS SHALL BE MADE WITH WILDLIFE FRIENDLY BIODEGRADABLE NETTING.

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL LEGEND AND STRATEGY

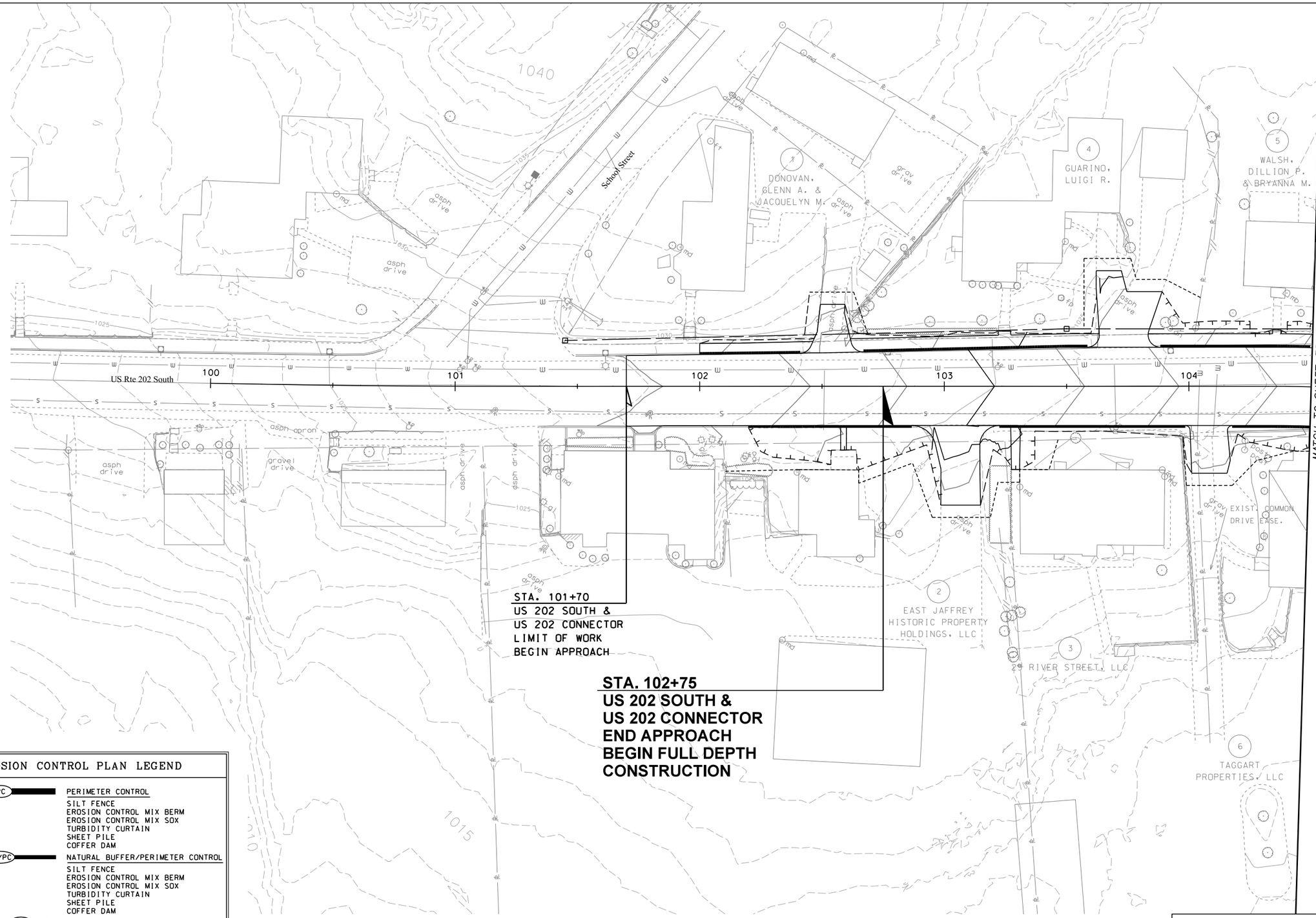
vhb

REVISION DATE	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
12-21-2015	3/17/2023	52792.00	16307Weterostrat.dgn	16307	4	18

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED	NHDOT & VHB	DATE 9/2021
NEW DESIGN	VHB TEAM	DATE 3/2023
SHEET CHECKED	PJW	DATE 3/2023
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

CWB — CLEAN WATER BYPASS
- PUMP THROUGH PIPE
- DRAIN THROUGH PIPE OR CHANNEL

20 0 20 40
SCALE IN FEET

vhb

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ER001	3/17/2023	52792.00	16307Ero_Plans.dgn	16307	9	18

MATCH TO SHEET ER003

MATCH TO SHEET ER004

MATCH TO SHEET ER001

TEMP. CONST. EASE. (TYP.)

BUILDING DEMOLITION (BY OTHERS)

LANDSCAPE AREA STA. 203+00 TO STA. 205+00

EXIST. 20' WIDE EASE. PER PLAN CAB. 11 DR. 6-674

EXIST. 20' WIDE SEWER EASE.

EXIST. 5' WIDE ACCESS EASE.

DRAINAGE EASEMENT

STA. 30+25
BLAKE STREET
LIMIT OF WORK

13 PEARD PROPERTIES, LLC

12 JAFFREY WAR MEMORIAL COMMITTEE, INC.

27 PANAGIOTES, ARTHUR G. & PANAGIOTES, ANTHONY V.

28 STATE OF NH DOT

29 MONOMONAC EQUITIES, LLC

30 SILVER RANCH, LLC

31 DAVID P. RIVARD REVOCABLE TRUST OF 2011

10 NORTHERN NEW ENGLAND TELEPHONE OPERATIONS, LLC

9 CAISSIE, DOMINIQUE CAISSIE, ANNE MARIE & VANCAMPEN, JAMES K.

5 WALSH, DILLION E. & BRYANNA M.

7 LANGOREN, BJORN FRODE

8 DEAN, KELLY L.

6 TAGGART PROPERTIES, LLC

M2 MEDIA LLC

CONTOOCOOK RIVER R2UB3h

Contoocook River

PEM1E

PSS1E

S-1 R2UB3h

BMP 203

US Rte 202 Connector

Blake Street

Union Street

SCALE IN FEET 20 0 20 40

REVISIONS AFTER PROPOSAL	NUMBER	DATE	STATION
DESCRIPTION			

SDR PROCESSED	NHDOT & VHB	DATE 9/2021
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SHEET CHECKED	PJW	DATE 3/2023
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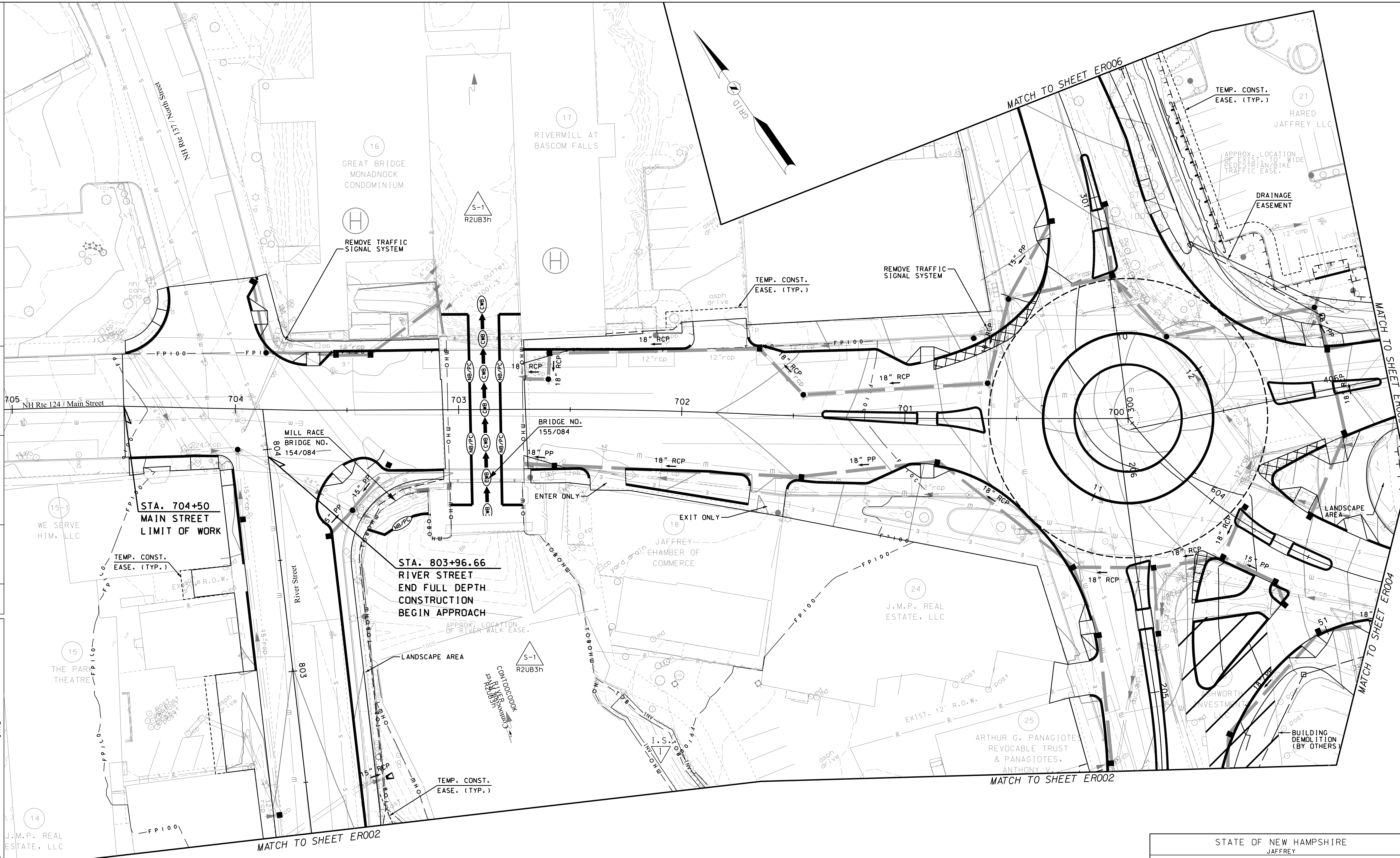
STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ER002	3/17/2023	52792.00	16307Ero_Plans.dgn	16307	10	18



20 0 20 40
SCALE IN FEET

SDR PROCESSED	NHDOT & VHB	DATE	9/2021
NEW DESIGN	VHB TEAM	DATE	3/2023
SHEET CHECKED	PJW	DATE	3/2023
AS BUILT DETAILS		DATE	

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

vhb

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ER003	3/17/2023	52792.00	16307Ero_Plans.dgn	16307	11	18

MATCH TO SHEET ER003

MATCH TO SHEET ER005

MATCH TO SHEET ER005

MATCH TO SHEET ER002

RECONSTRUCT RETAINING WALL

STA. 601+50
STRATTON ROAD
END APPROACH
BEGIN FULL DEPTH
CONSTRUCTION

STA. 598+95
STRATTON ROAD
LIMIT OF WORK

GRID

Stratton Road

Ellison Street

Union Street

603 602 601 600 599 598

18" RCP

18" PP

12" cmp

34 10 TURNPIKE ROAD, LLC

37 WILKIE, DAVID J.

33 PEARD, JR., JOHN MICHAEL

38 JOHNATTHEW HOLDINGS LLC

SCHRAMM, MARTIN

JMP REAL ESTATE, LLC

32 TOWN OF JAFFREY

3165 FL, LLC

asph drive

asphalt drive and parking

gravel drive

grav drive

asph parking lot

grav ing area

3 wood posts

20 0 20 40

SCALE IN FEET

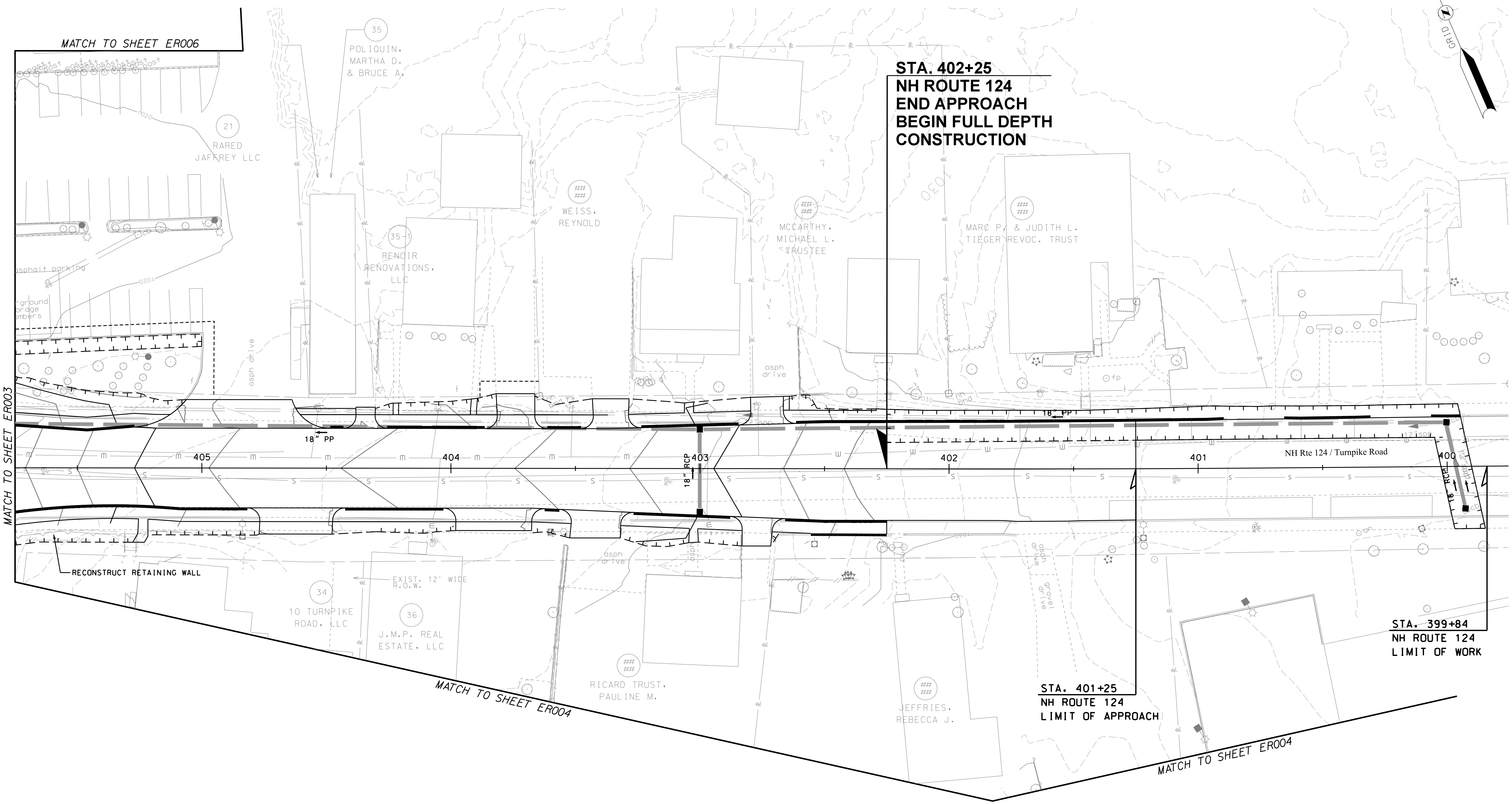
REVISIONS AFTER PROPOSAL			
DESCRIPTION	STATION	STATION	
NUMBER	DATE		

SDR PROCESSED	NHDOT & VHB	DATE 9/2021
NEW DESIGN	VHB TEAM	DATE 3/2023
SHEET CHECKED	PJW	DATE 3/2023
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ◦ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ER004	3/17/2023	52792.00	16307Ero_Plans.dgn	16307	12	18



SCALE IN FEET (20 0 20 40)

vhb

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ◦ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ER005	3/17/2023	52792.00	16307Ero_Plans.dgn	16307	13	18

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED NHDOT & VHB DATE 9/2021
NEW DESIGN VHB TEAM DATE 3/2023
SHEET CHECKED PJW DATE 3/2023
AS BUILT DETAILS DATE

STA. 303+30
US 202 NORTH &
US 202 CONNECTOR
END FULL DEPTH
CONSTRUCTION
BEGIN APPROACH

MATCH TO SHEET ER003

MATCH TO SHEET ER005

MATCH TO SHEET ER007

EAST JAFFREY TRUST

RIVERMILL AT BASCOM FALLS

20

22

STATE OF NH (DOT)

23

STATE OF NH (DOT)

22-1

MONADNOCK PROPERTIES, INC.

US Rte 202 North / Peterborough Street

Christian Court

APPROX. LOCATION OF EXIST. 10' WIDE PEDESTRIAN/BIKE TRAFFIC EASE.

APPROX. LOCATION OF EXIST. 10' WIDE PEDESTRIAN/BIKE TRAFFIC EASE.

EXIST. TELECOMMUNICATION EASE.

302 303 304 305 306

GRID N

SCALE IN FEET
20 0 20 40

REVISIONS AFTER PROPOSAL

NUMBER	DESCRIPTION	DATE	STATION

SDR PROCESSED	NHDOT & VHB	DATE 9/2021
NEW DESIGN	VHB TEAM	DATE 3/2023
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STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ER006	3/17/2023	52792.00	16307Ero_Plans.dgn	16307	14	18

STA. 308+50
US 202 NORTH &
US 202 CONNECTOR
LIMIT OF WORK
END APPROACH

MATCH TO SHEET GEN06

US Rte 202 North /
Peterborough Street

307

308

12"rcp

6"pvc

asph drive

grav

gravel drive

4"clay

asphalt

cmb

asph road

1005

1010

1015

1020

GRID

20 0 20 40
SCALE IN FEET

REVISIONS AFTER PROPOSAL

NUMBER	DESCRIPTION	DATE	STATION

SDR PROCESSED	NHDOT & VHB	DATE 9/2021
NEW DESIGN	VHB TEAM	DATE 3/2023
SHEET CHECKED	PJW	DATE 3/2023
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

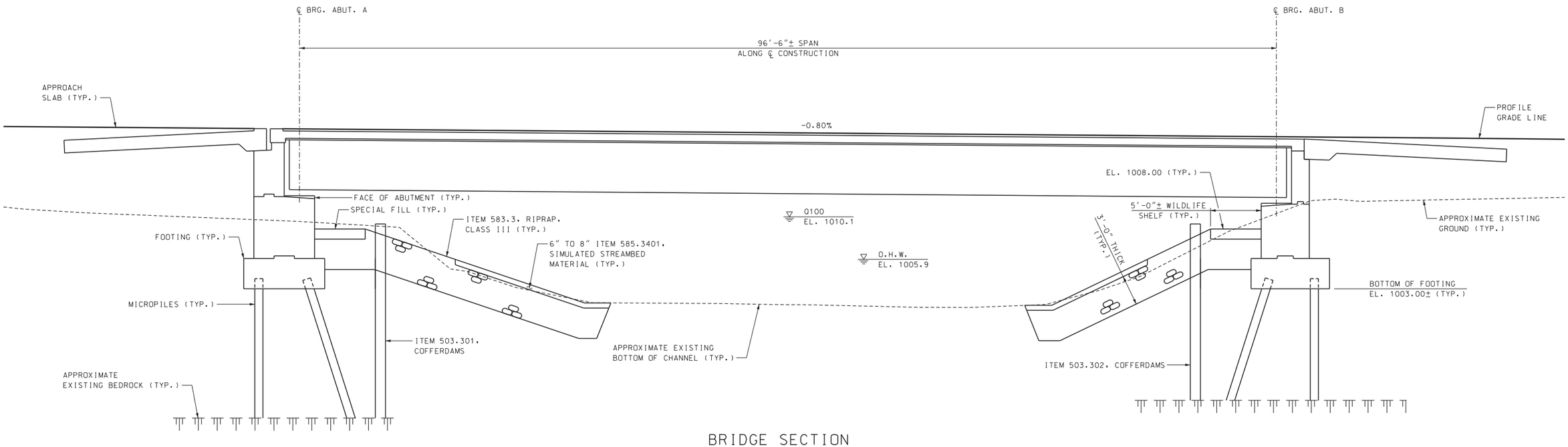
EROSION CONTROL PLANS

MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
ER007	3/17/2023	52792.00	16307Ero_Plans.dgn	16307	15	18

Appendix S – Additional Plan Sheets and Details

This appendix includes:

- Bridge Section (for the proposed new bridge)
- Bridge Repair Details (for the existing Main Street Bridge)
- Simulated Streambed Material Special Provision



BRIDGE SECTION

SCALE: 1" = 5'

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED $SDRNAME$ DATE $SDRDATE$
NEW DESIGN $DESIGNNAME$ DATE $DESIGNDATE$
SHEET CHECKED $CHECKEDNAME$ DATE $CHECKEDDATE$

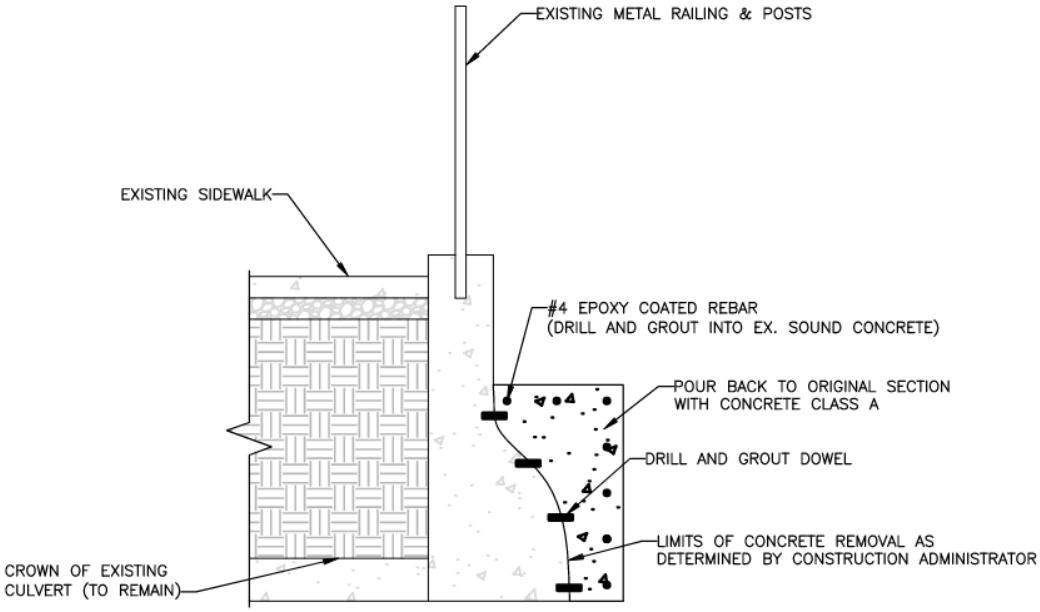
AS BUILT DETAILS DATE

STATE OF NEW HAMPSHIRE
JAFFREY
DEPARTMENT OF TRANSPORTATION ◦ BUREAU OF HIGHWAY DESIGN

BRIDGE SECTION

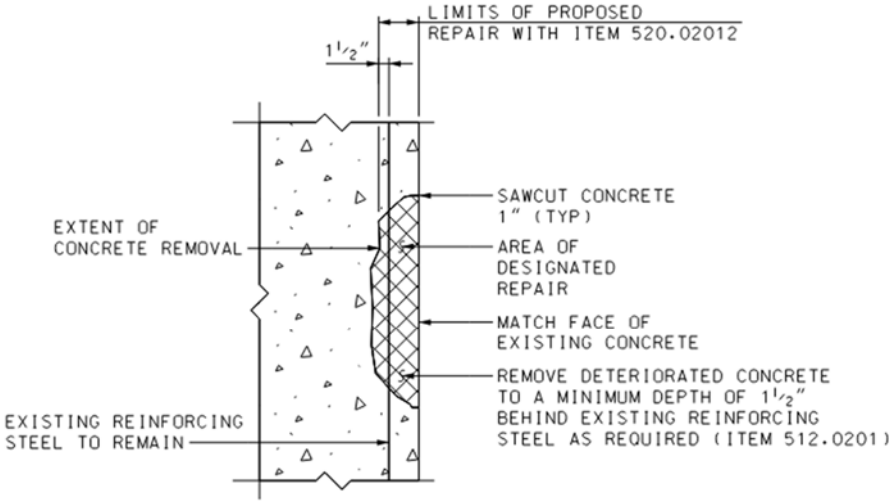
MODEL	DATE PLOTTED	VHB PROJECT NO.	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
Default	1/31/2023	52792.00	16307_div3	16307	3	3

Detail A – Culvert Headwall Rehabilitation Detail



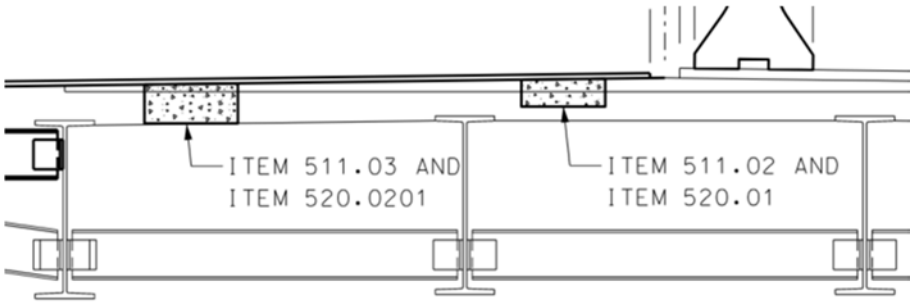
HEADWALL REHABILITATION DETAIL
SECTION VIEW AT MIDSPAN
(NTS)

Detail B – Typical Concrete Patch Repair



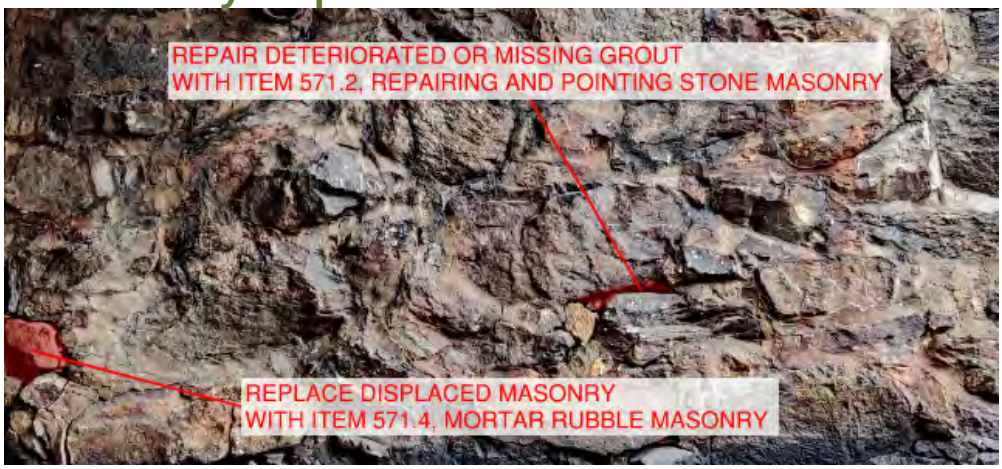
CONCRETE REPAIR
DETAIL
NOT TO SCALE

Detail C – Typical Concrete Deck Repair

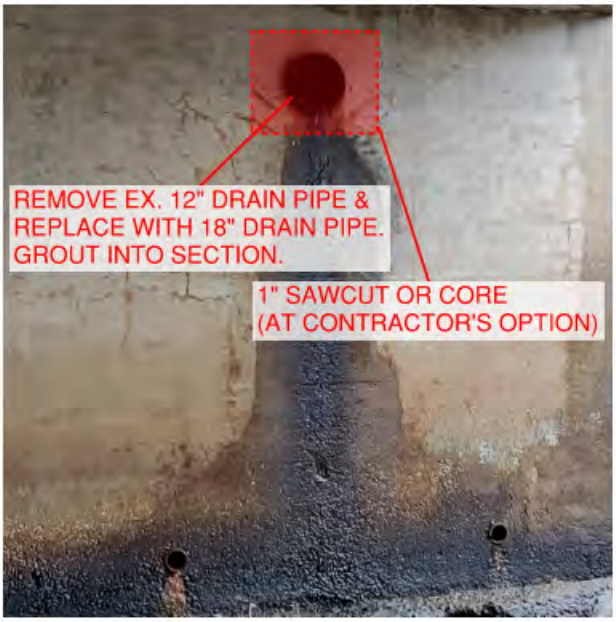


Item 511.03: Preparation for Full Depth Concrete Bridge Deck Repairs
Item 520.0201: Concrete Class AA, Above Footings
Item 511.02: Preparation for Partial Depth Concrete Bridge Deck Repairs
Item 520.01: Concrete Class AA

Detail D – Masonry Repair Detail

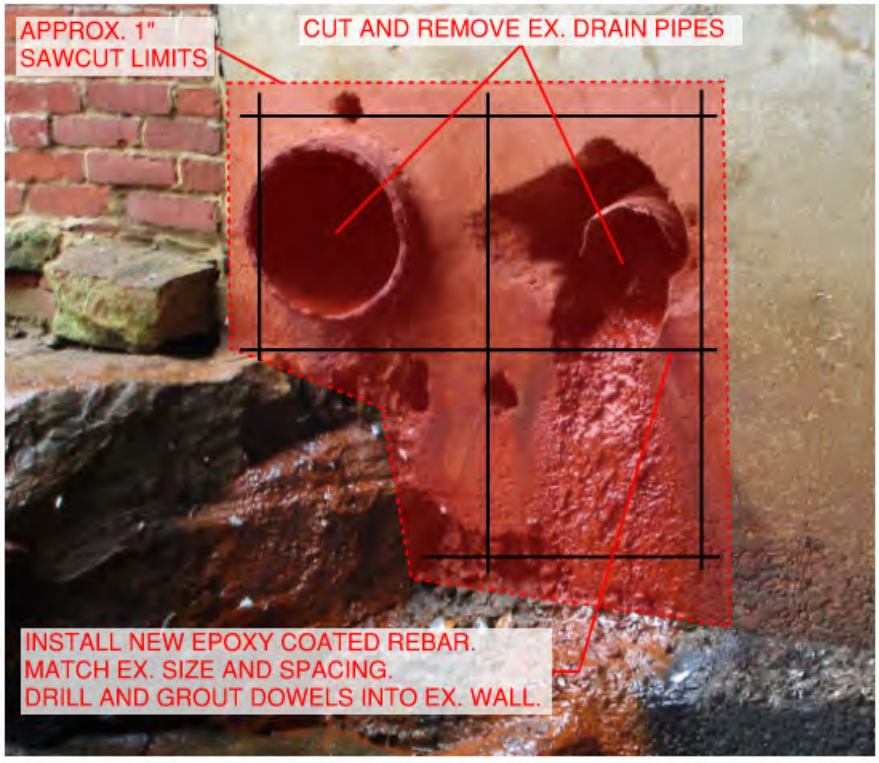


Detail E – Pipe Core Detail



Note: This detail is applicable to drainage or utilities.

Detail F – Pipe Plug Detail



Note: This detail is applicable to drainage or utilities. Pipes are to be plugged at the surface/inlet.

S P E C I A L P R O V I S I O N

SECTION 585 – STONE FILL

Item 585.3401 – Simulated Streambed Material

This special provision applies to simulated streambed material only and does not modify or amend other provisions of 585.

Description

1.1 The work shall consist of the furnishing, stockpiling, placing, and maintaining an approved stone to be utilized in constructing the restored streambed and as designated on the plans or as directed by the Engineer or Wetland Scientist.

Materials

2.1 General.

2.1.1 Simulated streambed fill shall consist of natural field stone or natural river rock. Crushed stone from a quarry or other sources will not be permitted. Stone gradation will approximate the following size distribution; amounts finer than each laboratory sieve (square openings) (percent by weight):

Size (Inches)	Material	Percentage
.01″	Sand	5
.07″	Coarse Sand	10
1 ½″-2″	Bank Run Gravel	25
2″-4″	Small Cobble	50
4″- 8″	Medium Cobble	10

The size of an individual stone particle will be determined by measuring its diameter across the intermediate axis. Stone particles shall be sound, tough, dense, resistant to the action of air and water, and suitable in all respects for the purpose intended. Simulated streambed fill may contain small amounts of fine aggregate but shall contain no amounts of soil material.

Simulated streambed material will be approved by the Engineer or Wetland Scientist prior to furnishing and stockpiling of materials on site.

Construction Requirements

3.1 General.

3.1.1 The Contractor shall install streambed material as shown on the plans, or as directed by the Engineer or Wetland Scientist. Sequencing and methods will conform to notes included on the plans and in the Prosecution of Work.

Method of Measurement

4.1 Simulated streambed material shall be measured by the cubic yard.

Basis of Payment

5.1 Simulated streambed material will be measured and paid for per cubic yard of fill installed complete and in place. This price will be full compensation for the transporting, furnishing, stockpiling, installation, including removal of unsuitable and surplus fill material, any required grading in and out of the streambed, backfilling, compaction, and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Add to Pay Items and Units:

585.3401	Simulated Streambed Material	Cubic Yard