TOWN OF EXETER, NEW HAMPSHIRE

10 FRONT STREET • EXETER, NH • 03833-3792 • (603) 778-0591 •FAX 772-4709
www.exeternh.gov

PUBLIC NOTICE
EXETER CONSERVATION COMMISSION
MONTHLY MEETING

The Exeter Conservation Commission will meet in the Nowak Room, Exeter Town Offices at 10 Front Street, Exeter on **Tuesday, August 12th, 2025 at 7:00 P.M.**

Call to Order:

1. Introduction of Members Present
2. Public Comment

Action Items:

1. Wetland Dredge and Fill application for the Bank Stabilization along the Exeter River at River Run at Exeter, Tax Map 104/79 (Tracy Degnan-RCCD, George Holt-Aries Eng.)
2. Budget Planning
3. Committee Reports
    a. Property Management – Intern update
    b. Outreach Events
    c. Other Committee Reports (River Study, Sustainability, Energy, Tree, CC Roundtable)
4. Approval of Minutes: 7/8/25 Meeting
5. Correspondence

Other Business

6. Next Meeting: 9/9/25, Submission Deadline 8/29/25

Dave Short
Exeter Conservation Commission
Posted August 8th, 2025 Exeter Town Website and Town Office kiosk.

ZOOM Public Access Information:

Virtual Meetings can be watched on Ch 22 or Ch 6 and YouTube.
To access the meeting, click this link: https://us02web.zoom.us/j/88240579637
To access the meeting via telephone, call: +1 646 558 8656 and enter the Webinar ID: 882 4057 9637
Please join the meeting with your full name if you want to speak.
Use the "Raise Hand" button to alert the chair you wish to speak. On the phone, press *9.
More instructions for how to access the meeting can be found here:
https://www.exeternh.gov/townmanager/virtual-town-meetings

Contact us at extvg@exeternh.gov or 603-418-6425 with any technical issues.

TOWN OF EXETER
PLANNING DEPARTMENT MEMORANDUM

Date: August 8th, 2025
To: Conservation Commission Board Members
From: Kristen Murphy, Conservation & Sustainability Planner
Subject: August 12th Meeting

1. **River Run**
In July 2023 you reviewed a wetland application for 3 riverbank stabilization areas and approved it with the condition that the trail be roped to avoid impact on the restoration areas. The applicant has included some design modifications and added an additional restoration site and is seeking your support of the wetland application.

Suggested Motion:
Send a memo to the State DES indicating:
____ *We have reviewed this application and have no objection to the application as proposed.*
____ *We have reviewed this application and recommend that the application be (approved)(denied) as noted below:*

2. **Budget Planning**
Expense approvals:
$190.05 – trail paint – Conservation Land Administration
$300/350 – ESRLAC – Dues – this is a change from prior years. I will share at the meeting.

Town departments have been advised this budget season will be especially challenging with rising healthcare costs. We have been advised to critically review our budget request and only present essential expenses for the upcoming year. If necessary, I think we could skip hiring interns in 2026, freeing up $2,500 to be used for other expenses. Your packet has the 2025 budget so we can discuss 2026 priorities and funding needs. There have been discussions of expansion of programming for Raynes so I have included those numbers below.

- stairway $4,500
- mowing $300 each time, Keith estimated 8-10x/yr $2,400-3,000
- port-o-potty rental $175/mo - more if larger accessible one used

WETLANDS PERMIT APPLICATION
SHORELINE STABILIZATION PROJECT
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

Prepared for:
Jim Baird
Cobblestone Assets
12 Sir Lancelot Drive
Exeter, NH 03885

Prepared by:
Aries Engineering, LLC
104 Pleasant Street
Concord, New Hampshire 03301
(603) 228-0008

July 29, 2025
File No. 2025-028

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Geotechnical Engineer

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SECTION 1.0 - INTRODUCTION

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is pleased to submit to New Hampshire Department of Environmental Services (NHDES) this Standard Wetlands Permit Application for installation of riverbank stabilization measures to be constructed along four reaches of the Exeter River at the River Run at Exeter property (site) located in Exeter, New Hampshire.

The project proposes the stabilization of four areas of actively eroding banks on the Exeter River that threaten existing residential buildings. Three residential buildings and several ancillary structures have been demolished and/or relocated due to riverbank erosion compromising the foundation systems of the structures. This project proposes stabilization of the shoreline utilizing SCOURLOK, a vegetated engineered stabilization measure developed by Solmax to reduce the threat of further erosion and loss of residential structures. This system provides a durable, geotechnically stable structure that provides immediate erosion protection and long-term vegetative cover while providing suitable natural habitats. The total linear impact is estimated to be approximately 1,050 feet.

The proposed erosion stabilization measures include installation of sheet pile walls at the approximate low water shoreline to provide a base for construction of vegetated SCOURLOK gabions with anchored turf reinforcement mats above to stabilize the eroded shoreline.

In accordance with Env-Wt 313.04(b)(2), the proposed project is exempt from compensatory mitigation as the work involves bank stabilization techniques using bio-engineering methods.

As required under Env-Wt 514.02, the second, least impacting tier of bank stabilization practices is proposed, as the first-tier practice of bank regrading and replanting is not anticipated to provide long-term protection of the shoreline and would be susceptible to further erosion.

On May 15, 2025, Aries met with Mr. Eben Lewis, NHDES Wetlands Bureau, for a pre-application site walk and review of the proposed riverbank restoration concept plans. At the site meeting, the following was agreed to:

1. One application would be required for four proposed impact areas at the site (identified as Areas A, B, C, and D on the plans);

2. The existing wetlands delineations and functional assessment conducted By Gove Environmental Services, Inc. could be used for the current permit application and that additional wetlands delineation would not be required; and

3. The application should be submitted to NHDES before contacting the US Army Corps of Engineers and the US Environmental Protection Agency.

SECTION 2.0

WETLANDS PERMIT APPLICATION FORM

STANDARD DREDGE AND FILL WETLANDS PERMIT APPLICATION

Water Division / Land Resources Management

Check the Status of your Application

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

APPLICANT'S NAME: Cobblestone Assets **TOWN NAME:** Exeter

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 (NHFG) 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? o If yes, species or habitat name(s): Bridle Shiner, Northern Long o NHB Project ID #: NHB25-1796	(●) 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): Exeter • A copy of the application was sent to the LAC on Month: 7 Day: 29 Year: 2025	(●) Yes ( ) No

For dredging projects, is the subject property contaminated? • If yes, list contaminant:	○ 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): N/A	

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

Provide a description of the project and the purpose of the project, the need for the proposed impacts to jurisdictional areas, an outline of the scope of work to be performed, and whether impacts are temporary or permanent.

The project proposes the stabilization of four areas of eroded banks on the Exeter River that threaten existing residential buildings utilizing SCOURLOK, a vegetated engineered stabilization measure developed by Solmax. This system provides a durable, geotechnically stable structure that provides immediate erosion protection and long-term vegetative cover while providing suitable natural habitats. The total linear impact is estimated to be approximately 1,100 feet.

The proposed erosion stabilization measures include installation of sheet pile walls at the approximate low water shoreline to provide a base for construction of vegetated SCOURLOK gabions with anchored turf reinforcement mats above to stabilize the eroded shoreline.

SECTION 3 - PROJECT LOCATION

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

ADDRESS:	River Run at Exeter
TOWN/CITY:	Exeter
TAX MAP/BLOCK/LOT/UNIT:	104/79
US GEOLOGICAL SURVEY (USGS) TOPO MAP WATERBODY NAME: ☐ N/A	Exeter River
(Optional) LATITUDE/LONGITUDE in decimal degrees (to five decimal places):	42.961122, -70.973343

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: Cobblestone Assets, ATTN: Jim Baird		
MAILING ADDRESS: 317 Exeter River Landing		
TOWN/CITY: Exeter	STATE: NH	ZIP CODE: 03833
EMAIL ADDRESS: Exeterfacilities@cobblestoneassets.com		
FAX:	PHONE: (603)772-5377	

ELECTRONIC COMMUNICATION: By initialing here, 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.: Holt, George, C.		
COMPANY NAME: Aries Engineering, LLC		
MAILING ADDRESS: 104 Pleasant Street		
TOWN/CITY: Concord	STATE: NH	ZIP CODE: 03301
EMAIL ADDRESS: gholt@aries-eng.com		
FAX:	PHONE: 603.228.0008	

ELECTRONIC COMMUNICATION: By initialing here, 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):

This project is a bank stabilization project and meets the requirements set forth in Env-Wt 514. The project uses the construction of vegetated SCOURLOK gabions and anchored turf reinforcement mats that are installed on sheet pile walls at the approximate low water shoreline elevation. This project meets the requirements of Env-Wt 514.02(c)(2), which allows for bioengineered bank stabilization design techniques that uses a combination of live vegetation, woody material, or geotextile matting and may include regrading and replanting of slopes. Photos of the existing erosion have been included in this permit application. In addition to the proposed stabilization, this project also increases public well-being by regrading the section of slope that provides access to the river making access into the water safer for the citizens as well as protects residential structures that are threatened by continuing erosion of the riverbank in the four proposed restoration areas. Impacts have been minimized to the surrounding area to the greatest extent practicable, and proposed plantings are included to maintain ecosystem health after the project completion in a natural state.

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: Day: Year:

(☒ N/A - Mitigation is not required)

SECTION 10 - THE PROJECT MEETS COMPENSATORY MITIGATION REQUIREMENTS (Env-Wt 313.01(a)(1)c)

Confirm that you have submitted a compensatory mitigation proposal that meets the requirements of Env-Wt 800 for all permanent unavoidable impacts that will remain after avoidance and minimization techniques have been exercised to the maximum extent practicable: ☐ I confirm submittal.

(☒ N/A – Compensatory mitigation is not required)

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

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

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

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

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

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

	JURISDICTIONAL AREA	PERM. SF	PERM. LF	PERM. ATF	TEMP. SF	TEMP. LF	TEMP. ATF
Wetlands	Forested Wetland			☐			☐
	Scrub-shrub Wetland			☐			☐
	Emergent Wetland			☐			☐
	Wet Meadow			☐			☐
	Vernal Pool			☐			☐
	Designated Prime Wetland			☐			☐
	Duly-established 100-foot Prime Wetland Buffer			☐			☐
Surface	Intermittent / Ephemeral Stream			☐			☐
	Perennial Stream or River			☐			☐
	Lake / Pond			☐			☐
	Docking - Lake / Pond			☐			☐
	Docking - River			☐			☐
Banks	Bank - Intermittent Stream			☐			☐
	Bank - Perennial Stream / River	18,171	1,048	☐			☐
	Bank / Shoreline - Lake / Pond			☐			☐
Tidal	Tidal Waters			☐			☐
	Tidal Marsh			☐			☐
	Sand Dune			☐			☐
	Undeveloped Tidal Buffer Zone (TBZ)			☐			☐
	Previously-developed TBZ			☐			☐
	Docking - Tidal Water			☐			☐
	TOTAL						

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): 18171	SF	× $0.40 =	$ 7268.4
Seasonal docking structure:	SF	× $2.00 =	$
Permanent docking structure:	SF	× $4.00 =	$
Projects proposing shoreline structures (including docks) add $400 =			$
		Total =	$ 7268.4
The application fee for minor or major impact is the above calculated total or $400, whichever is greater =			*$ 7268.4*

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: GB	To the best of the signer's knowledge and belief, all required notifications have been provided.
Initials: GB	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:	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.
Initials: GB	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):	PRINT NAME LEGIBLY: Cobblestone Assets, ATTN: Jim Baird	DATE: 7/31/2025
SIGNATURE (APPLICANT, IF DIFFERENT FROM OWNER):	PRINT NAME LEGIBLY:	DATE:
SIGNATURE (AGENT, IF APPLICABLE):	PRINT NAME LEGIBLY: George C. Holt. P.G.	DATE: 7/30/25

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: Andrea J. Kohler	PRINT NAME LEGIBLY: Andrea J. Kohler
TOWN/CITY: Exeter	DATE: 7.30.2025

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”.

Keep this checklist for your reference; do not submit with your application.

APPLICATION CHECKLIST

Unless specified, all items below are required. Failure to provide the required items will delay a decision on your project and may result in denial of your application. Please reference statute RSA 482-A, Fill and Dredge in Wetlands, and the Wetland Rules Env-Wt 100-900.

- ☐ The completed, dated, signed, and certified application (Env-Wt 311.03(b)(1)).
- ☐ Correct fee as determined in RSA 482-A:3, I(b) or (c), subject to any cap established by RSA 482-A:3, X (Env-Wt 311.03(b)(2)). Make check or money order payable to "Treasurer – State of NH".
- ☐ The Required Planning actions required by Env-Wt 311.01(a)-(c) and Env-Wt 311.03(b)(3).
- ☐ US Army Corps of Engineers (ACE) "Appendix B, New Hampshire General Permits (GPs), Required Information and Corps Secondary Impacts Checklist" and its required attachments (Env-Wt 307.02). This includes the US Fish and Wildlife Service IPAC review and Section 106 Historic/Archaeological Resource review.
- ☐ Project plans described in Env-Wt 311.05 (Env-Wt 311.03(b)(4)).
- ☐ Maps, or electronic shape files and meta data, and other attachments specified in Env-Wt 311.06 (Env-Wt 311.03(b)(5)).
- ☐ Explanation of the methods, timing, and manner as to how the project will meet standard permit conditions required in Env-Wt 307 (Env-Wt 311.03(b)(7)).
- ☐ If applicable, the information regarding proposed compensatory mitigation specified in Env-Wt 311.08 and Chapter Env-Wt 800 - Permittee Responsible Mitigation Project Worksheet, unless not required under Env-Wt 313.04 (Env-Wt 311.03(b)(8); Env-Wt 311.08; Env-Wt 313.04).
- ☐ Any additional information specific to the **type of resource** as specified in Env-Wt 311.09 (Env-Wt 311.03(b)(9); Env-Wt 311.04(j)).
- ☐ Project specific information required by Env-Wt 500, Env-Wt 600, and Env-Wt 900 (Env-Wt 311.03(b)(11)).
- ☐ A list containing the name, mailing address and tax map/lot number of each abutter to the subject property (Env-Wt 311.03(b)(12)).
- ☐ Copies of certified postal receipts or other proof of receipt of the notices that are required by RSA 482-A:3, I(d) (Env-Wt 311.03(b)(13)).
- ☐ Project design considerations required by Env-Wt 313 (Env-Wt 311.04(j)).
- ☐ Town tax map showing the subject property, the location of the project on the property, and the location of properties of abutters with each lot labeled with the name and mailing address of the abutter (Env-Wt 311.06(a)).
- ☐ Dated and labeled color photographs that:
  - (1) Clearly depict:
    - a. All jurisdictional areas, including but not limited to portions of wetland, shoreline, or surface water where impacts have or are proposed to occur.
    - b. All existing shoreline structures.
  - (2) Are mounted or printed no more than 2 per sheet on 8.5 x 11 inch sheets (Env-Wt 311.06(b)).
- ☐ A copy of the appropriate US Geological Survey map or updated data based on LiDAR at a scale of one inch equals 2,000 feet showing the location of the subject property and proposed project (Env-Wt 311.06(c)).
- ☐ A narrative that describes the work sequence, including pre-construction through post-construction, and the relative timing and progression of all work (Env-Wt 311.06(d)).

lrm@des.nh.gov or (603) 271-2147
29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
des.nh.gov

- ☐ For all projects in the protected tidal zone, a copy of the recorded deed with book and page numbers for the property (Env-Wt 311.06(e)).
- ☐ If the applicant is not the owner in fee of the subject property, documentation of the applicant's legal interest in the subject property, provided that for utility projects in a utility corridor, such documentation may comprise a list that:
  - (1) Identifies the county registry of deeds and book and page numbers of all of the easements or other recorded instruments that provide the necessary legal interest; and
  - (2) Has been certified as complete and accurate by a knowledgeable representative of the applicant (Env-Wt 311.06(f)).
- ■ The NHB memo containing the NHB identification number and results and recommendations from NHB as well as documentation of any consultation requests made to NHFG, communications and information related to the consultation, with the consultation results and recommendations from NHFG. (Env-Wt 311.06(g)). See Wetlands Permitting: Protected Species and Habitat Fact Sheet.
- ■ A statement of whether the applicant has received comments from the local conservation commission and, if so, how the applicant has addressed the comments (Env-Wt 311.06(h)).
- ■ For projects in LAC jurisdiction, a statement of whether the applicant has received comments from the LAC and, if so, how the applicant has addressed the comments (Env-Wt 311.06(i)).
- ☐ If the applicant is also seeking to be covered by the state general permits, a statement of whether comments have been received from any federal agency and, if so, how the applicant has addressed the comments (Env-Wt 311.06(j)).
- ■ Avoidance and Minimization Written Narrative or the Avoidance and Minimization Checklist, or your own avoidance and minimization narrative (Env-Wt 311.07).
- ☐ For after-the-fact applications: information required by Env-Wt 311.12.
- ☐ Coastal Resource Worksheet for coastal projects as required under Env-Wt 600.
- ☐ Prime Wetlands information required under Env-Wt 700. See WPPT for prime wetland mapping.
- ☐ For non-tidal shoreline structure projects, the length of shoreline frontage per Env-Wt 311.09(b)(1)

Required Attachments for Minor and Major Projects

- ■ Attachment A: Minor and Major Projects (Env-Wt 313.03).
- ■ Functional Assessment Worksheet or others means of documenting the results of actions required by Env-Wt 311.10 as part of an application preparation for a standard permit (Env-Wt 311.03(b)(3); Env-Wt 311.03(b)(10)). See Functional Assessments for Wetlands and Other Aquatic Resources Fact Sheet. For shoreline structures, see shoreline structures exemption in Env-Wt 311.03(b)(10)).

Optional Materials

- ☐ Stream Crossing Worksheet which summarizes the requirements for stream crossings under Env-Wt 900.
- ☐ Request for concurrent processing of related shoreland / wetlands permit applications (Env-Wt 313.05).

SECTION - 3.0

AVOIDANCE AND MINIMIZATION CHECKLIST AND NARRATIVE

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.: Hamilton, Michelle	
PROJECT STREET ADDRESS: River Run at Exeter	PROJECT TOWN: Exeter
TAX MAP/LOT NUMBER: 104/79	

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 project proposes the stabilization of four areas of eroded banks on the Exeter River that threaten existing residential buildings utilizing SCOURLOK, a vegetated engineered stabilization measure developed by Solmax. This system provides a durable, geotechnically stable structure that provides immediate erosion protection and long-term vegetative cover while providing suitable natural habitats. The total linear impact is estimated to be approximately 1,050 feet.

The proposed erosion stabilization measures include installation of sheet pile walls at the approximate low water shoreline to provide a base for construction of vegetated SCOURLOK gabions with anchored turf reinforcement mats above to stabilize the eroded shoreline.

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

SECTION - 4.0

STANDARD DREDGE AND FILL – ATTACHMENT A

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: **Cobblestone Assets** **TOWN NAME:** Exeter

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.

SECTIONS OF THE BANK OF THE EXETER RIVER ALONG THE DEVELOPMENT, RIVER RUN MANUFACTURED HOME COMMUNITY HAVE ERODED COMPROMISING RESIDENTIAL STRUCTURES AND CAUSING STEPPED BANKINGS AND MINIMAL SPACE BETWEEN EXISTING STRUCTURES AND THE WATERS EDGE. THIS PROPOSAL AIMS TO BALANCE ENVIROMENTAL CONCERNS AND SOCIO-ECONOMINIC CONCERNS OF THE RIVER UNDERMINING THE DEVELOPMENT. THE BIOENGINEERED SLOPE PROPOSED PROVIDES ADEQUATE FLOOD TOLERANCE AND HABITATS WHILE PREVENTING FURTHER LOSS OF THE BANKS ALONG THE EXISTING DEVELOPMENT.

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.

N/A

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 construction of the vegetated gabions and anchored turf reinforcement mats provide suitable natural habitats in addition to stabilizing the slope. The vegetated gabions and anchored turf reinforcement mats allow water to pass through and vegetation to grow. This not only enhances the hydrologic connections between the stream and surrounding wetlands, but also promotes the health of the river and surrounding ecosystems. A sheet pile wall will be constructed flush with the low water river elevation to provide a working plaform to construct the vegetated gabions, which will not interfere with any hydrologic connections between the stream and surrounding wetlands.

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.

The proposed project construction uses multiple different erosion control methods all of which will provide potential habitat areas for aquatic life and wildlife species. Regrading is only occuring in areas where slopes are steeper than 1:1 and where signficant erosion has taken place, which would not allow for the construction of the erosion control measures to be possible.

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.

This site resides along the River Run at Exeter Manufactured Home Community and part of the project is to protect residential structures that are threatened by ongoing erosion of the riverbank in the four proposed restoration areas.

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.

N/A

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.

N/A

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 is anticipated to have negligible impacts on drinking water supplies and groundwater levels. Hydrologic connection between groundwater and surface water will be maintained because the gabions and mats are trasmissive, while the sheet pile wall, where installed is anticipated to extend only to 10 feet beneath the stream bed; groundwater will be allowed to seep over, around and under the wall.

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 project proposes to enhance runoff quality by preventing further erosion that occurs throughout storm events. A signficantly smaller amount of sediment would be entering the stream and the improved bank would also enhance flood storage capacity.

SECTION I.X - SHORELINE STRUCTURES - CONSTRUCTION SURFACE AREA (Env-Wt 313.03(c)(1))

Describe how the project has been designed to use the minimum construction surface area over surface waters necessary to meet the stated purpose of the structures.

N/A

SECTION I.XI - SHORELINE STRUCTURES - LEAST INTRUSIVE UPON PUBLIC TRUST (Env-Wt 313.03(c)(2))

Describe how the type of construction proposed is the least intrusive upon the public trust that will ensure safe docking on the frontage.

N/A

SECTION I.XII - SHORELINE STRUCTURES – ABUTTING PROPERTIES (Env-Wt 313.03(c)(3))

Describe how the structures have been designed to avoid and minimize impacts on ability of abutting owners to use and enjoy their properties.

N/A

SECTION I.XIII - SHORELINE STRUCTURES – COMMERCE AND RECREATION (Env-Wt 313.03(c)(4))

Describe how the structures have been designed to avoid and minimize impacts to the public's right to navigation, passage, and use of the resource for commerce and recreation.

N/A

SECTION I.XIV - SHORELINE STRUCTURES – WATER QUALITY, AQUATIC VEGETATION, WILDLIFE AND FINFISH HABITAT (Env-Wt 313.03(c)(5))

Describe how the structures have been designed, located, and configured to avoid impacts to water quality, aquatic vegetation, and wildlife and finfish habitat.

N/A

SECTION I.XV - SHORELINE STRUCTURES – VEGETATION REMOVAL, ACCESS POINTS, AND SHORELINE STABILITY (Env-Wt 313.03(c)(6))

Describe how the structures have been designed to avoid and minimize the removal of vegetation, the number of access points through wetlands or over the bank, and activities that may have an adverse effect on shoreline stability.

N/A

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: See Section 6.0
NAME OF CERTIFIED WETLAND SCIENTIST (FOR NON-TIDAL PROJECTS) OR QUALIFIED COASTAL PROFESSIONAL (FOR TIDAL PROJECTS) WHO COMPLETED THE ASSESSMENT: BRENDEN WALDEN
DATE OF ASSESSMENT: SPRING, 2023
Check this box to confirm that the application includes a NARRATIVE ON FUNCTIONAL ASSESSMENT: ☒
For minor or major projects requiring a standard permit without mitigation, the applicant shall submit a wetland evaluation report that includes completed checklists and information demonstrating the RELATIVE FUNCTIONS AND VALUES OF EACH WETLAND EVALUATED. Check this box to confirm that the application includes this information, if applicable: ☒ Note: The Wetlands Functional Assessment worksheet can be used to compile the information needed to meet functional assessment requirements.

SECTION 5.0

BANK/SHORELINE STABILIZATION PROJECT-SPECIFIC WORK SHEET

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.: Cobblestone Assets

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.

  Figure 4 (A,B,C&D) depict the locations of the top of bank for each section of bank erosion, while Figure 5 (A,B,C&D) depict the proposed impact areas. As seen in the photo log, the site's vegetation varies significantly. Area A is comprised of mostly grass cover with scattered trees behind the homes. Area D is of similar composition to Area A, with some additional vegetation occuring closer to the shoreline. Area B and Area C contain mostly woods cover with dense vegetation.

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

  Most of the erosion occurs from natural reasons such as surface water elevation increases on higher storm events and widening of the river over time from flow and flooding.

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

  This project incorporates mulitple bank stabilization practices in accordance with the heirarchy set forth in Env-Wt 514.02(c). Vegetative turf reinforcement mats will be used in areas where bio-engineered gabion baskets aren't being proposed for stabilization. The gabion baskets will be planted with different plantings throughout their placement. A sheet pile wall will be placed below the approximate low water shoreline.

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

  The usage of gabion baskets and turf reinforcement mats will provide adequate support to the slope to accommodate high flood waters, stream bed turbulance, and prevent the erosion of the bank into the stream bed while also providing and promoting natural vegetation.

- 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 gabion baskets and turg reinforcement mats are designed to be placed as far up the bank as the area allows to accommodate high flood waters, significantly improving 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.

SECTION 6.0

WETLANDS FUNCTION – VALUE EVALUATION FORM

GOVE ENVIRONMENTAL SERVICES, INC.

June 2, 2023

To: Paige Libbey
Jones and Beach Engineering, Inc.

From: Brenden Walden
Gove Environmental Services, Inc.

Subject: Wetland Delineation Report
Landing at Exeter River

Paige,

Per your request, this letter is to verify that Gove Environmental Services, Inc., performed a site inspection to identify Jurisdictional areas at three separate locations on the subject property located on Tax Map 104 Lot 79 in Exeter, NH. Wetlands were evaluated utilizing the following standards:

1. *US Army Corps of Engineers Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*, Technical Report ERDC/EL TR-12-1 (January 2012).
2. *Field Indicators for Identifying Hydric Soils in New England – Version 4, June 2020*. New England Hydric Soils Technical Committee.
3. *US Army Corps of Engineers National Wetland Plant List, 2018.*
4. *Classification of Wetlands and Deepwater Habitats of the United States.* USFW Manual FWS/OBS–79/31 (1979).

Brenden Walden performed two site inspection with the first on January 12, 2023 and the follow up inspection on February 7, 2023 to extend the limits of jurisdiction to meet the project requirements. The property is utilized as an over 55 residential mobile home community with a boundary of the property abutting a large stretch of the Exeter River. The three areas of interest identified for review were identified as areas that are currently seeing significant bank erosion with stabilization of the river bank in these areas impacting the mobile home community. Top of bank was established at the three areas and was demarked with a series of flagging labeled TOB. The bank in area one and area three are composed primarily of very steep slopes with mature trees directly adjacent to cleared areas for the existing mobile homes. These areas are seeing extensive undercutting from the river with areas of washout causing small landslide events. Area two is another steep area of the riverbank that has significantly less native mature established woody vegetation present as the mobile homes are significantly closer to the Exeter River in this location. This area is beginning to see undercutting as well due to the lack of stabilization from the native vegetation and the steep almost vertical slopes that are present in this area.

8 Continental Dr Unit H, Exeter, NH 03833-7507
Ph (603) 778 0644 / *Fax* (603) 778 0654
www.gesinc.biz
info@gesinc.biz

The site inspections and delineation of these three areas was done in an effort to move forward with local and state permitting to construct a proposed bank stabilization project outlined in the attached plans provided by Jones and Beach Engineering. The proposed bank stabilization will assist in managing the deficiency in stabilization associated with the existing landscape and lack of necessary mature established vegetation adjacent to the river that would otherwise help mitigate some of these washout occurrences. With this proposed work in jurisdictional areas a dredge and fill application and shoreland application will be necessary to move forward with the construction of the project. As a requirement the functions and values of the resource area, the Exeter River was evaluated using the US Army Corps Highway Methodology guidelines for the three identified wetland areas.

The US Army Corps Highway Methodology considers 13 categories of function or value within a particular wetland area:

1. **Groundwater recharge/discharge:** This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area. Recharge should relate to the potential for the wetland to contribute water to an aquifer. Discharge should relate to the potential for the wetland to serve as an area where ground water can be discharged to the surface.
2. **Floodflow Alteration:** This function considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events.
3. **Fish and Shellfish Habitat:** This function considers the effectiveness of seasonal or permanent water bodies associated with the wetland in question for fish and shell fish habitat.
4. **Water Quality—Sediment/Toxicant/Pathogen Retention:** This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants or pathogens.
5. **Water Quality—Nutrient Removal/Retention/Transformation:** This function relates to the effectiveness of the wetland to prevent adverse effects of excess nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers or estuaries.
6. **Production Export:** This function relates to the effectiveness of the wetland to produce food or usable products for human, or other living organisms.
7. **Sediment/Shoreline Stabilization:** This function relates to the effectiveness of a wetland to stabilize stream banks and shorelines against erosion.
8. **Wildlife Habitat:** This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. Both resident and or migrating species must be considered.
9. **Recreation:** This value considers the effectiveness of the wetland and associated watercourses to provide recreational opportunities such as canoeing, boating, fishing, hunting and other active or passive recreational activities. Consumptive opportunities consume or diminish the plants, animals or other resources that are intrinsic to the wetland, whereas non-consumptive opportunities do not.

10. **Educational/Scientific Value:** This value considers the effectiveness of the wetland as a site for an "outdoor classroom" or as a location for scientific study or research.
11. **Uniqueness/Heritage:** This value relates to the effectiveness of the wetland or its associated water bodies to produce certain special values. Special values may include such things as archeological sites, unusual aesthetic quality, historical events, or unique plants, animals, or geological features.
12. **Visual Quality/Aesthetics:** This value relates to the visual and aesthetic qualities of the wetland.
13. **Threatened or Endangered Species Habitat:** This value relates to the effectiveness of the wetland or associated water bodies to support threatened or endangered species

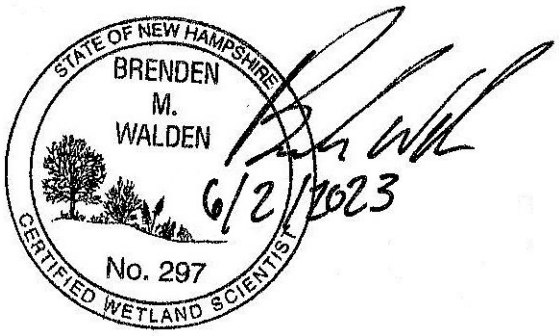
Of the functions listed above the primary resource area, the Exeter River and associated jurisdictional areas identified were determined to have seven principal functions. Those principal functions include Groundwater Recharge/Discharge, Floodflow Alteration, Fish and Shellfish Habitat, Sediment/Toxicant Retention, Production Export, Shoreline/Sediment Stabilization, and Wildlife Habitat. The primary objective with this proposed restoration is to maintain and enhance those existing functions while also ensuring the continued productive and safe use of the land. This is the least impacting and invasive alternative practicable to provide the stabilization to the bank given the unique landscape and steep terrain associated with this stretch of the Exeter River. Upon the construction completion of this proposed bank stabilization project there will be no observable negative effect to the Exeter River or the identified principal functions identified in this evaluation.

This concludes the wetland delineation report and functional assessment. If you have any questions on any of the materials provided or feel I can be of further assistance, please feel free to contact me by email bwalden@gesinc.biz or phone 207-710-7863.

Sincerely,

Brenden Walden
Business Manager & Wetland Scientist #297
Gove Environmental Services, Inc.

Enc. ACOE Function-Value Form
Plan Set



8 Continental Dr Unit H, Exeter, NH 03833-7507
Ph (603) 778 0644 / *Fax* (603) 778 0654
www.gesinc.biz
info@gesinc.biz

ACOE FUNCTION-VALUE FORM

Wetland Function-Value Evaluation Form

Total area of wetland unknown Human made? no Is wetland part of a wildlife corridor? yes or a "habitat island"? No

Adjacent land use Residential housing Distance to nearest roadway or other development 0ft

Dominant wetland systems present R2UBH 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? Lower

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

Wetland I.D. Exeter River

Latitude _____ Longitude _____

Prepared by: BMW Date 6/1/23

Wetland Impact:
Type Stablization Area _____

Evaluation based on:
Office Yes Field yes

Corps manual wetland delineation completed? Y Y N _____

Function/Value	Suitability Y / N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	y	1,2,4,7,12,15	Y	Exeter river system with large contributing wetlands associated
Floodflow Alteration	y	1,3,4,5,7,8,9,10,11,12,13,14,16	Y	the sinuosity of the Exeter river and its associated floodplain wetlands assist in floodflow alteration
Fish and Shellfish Habitat	y	1,2,3,4,6,7,8,9,10,12,14,16,17	Y	Exeter River
Sediment/Toxicant Retention	y	1,3,4,8,10,11	Y	Exeter River with variable flow changes
Nutrient Removal	y	1,2,3,4,5,7	N	Exeter River itself doesn't have the vegetation within the resource to effectively remove nutrients
Production Export	y	1,2,4,5,6,10,11	Y	Exeter River that has regular flushing occur with rain events
Sediment/Shoreline Stabilization	y	1,2,3,4,6,8,9,14	Y	Vegetation along the bank assists in stabilizing the bank of the Exeter River
Wildlife Habitat	y	5,6,7,8,12,17,18,19,20,21,23	Y	Exeter River with adjacent wetlands and upland complexes
Recreation	y	2,5	N	Potential for recreation is available on the Exeter River but not at these locations
Educational/Scientific Value	N		N	There is no access to the River from these locations
Uniqueness/Heritage				Exeter River
Visual Quality/Aesthetics				No public view points from these locations
ES Endangered Species Habitat		See NHB		
Other				

Notes:

* Refer to backup list of numbered considerations.

ACOE FUNCTION-VALUE FORM

Wetland Function-Value Evaluation Form

Total area of wetland unknown Human made? no Is wetland part of a wildlife corridor? yes or a "habitat island"? No

Adjacent land use Residential housing Distance to nearest roadway or other development 0ft

Dominant wetland systems present R2UBH 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? Lower

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

Wetland I.D. Exeter River

Latitude _____ Longitude _____

Prepared by: BMW Date 6/1/23

Wetland Impact:
Type Stablization Area _____

Evaluation based on:
Office Yes Field yes

Corps manual wetland delineation completed? Y Y N _____

Function/Value	Suitability Y / N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	y	1,2,4,7,12,15	Y	Exeter river system with large contributing wetlands associated
Floodflow Alteration	y	1,3,4,5,7,8,9,10,11,12,13,14,16	Y	the sinuosity of the Exeter river and its associated floodplain wetlands assist in floodflow alteration
Fish and Shellfish Habitat	y	1,2,3,4,6,7,8,9,10,12,14,16,17	Y	Exeter River
Sediment/Toxicant Retention	y	1,3,4,8,10,11	Y	Exeter River with variable flow changes
Nutrient Removal	y	1,2,3,4,5,7	N	Exeter River itself doesn't have the vegetation within the resource to effectively remove nutrients
Production Export	y	1,2,4,5,6,10,11	Y	Exeter River that has regular flushing occur with rain events
Sediment/Shoreline Stabilization	y	1,2,3,4,6,8,9,14	Y	Vegetation along the bank assists in stabilizing the bank of the Exeter River
Wildlife Habitat	y	5,6,7,8,12,17,18,19,20,21,23	Y	Exeter River with adjacent wetlands and upland complexes
Recreation	y	2,5	N	Potential for recreation is available on the Exeter River but not at these locations
Educational/Scientific Value	N		N	There is no access to the River from these locations
Uniqueness/Heritage				Exeter River
Visual Quality/Aesthetics				No public view points from these locations
ES Endangered Species Habitat		See NHB		
Other				

Notes:

* Refer to backup list of numbered considerations.

SECTION 7.0

PHOTOGRAPHS

PHOTOGRAPH LOG
Shoreline Stabilization Project
River Run at Exeter
Exeter, New Hampshire

Photograph 1:
Area A shoreline.

PHOTOGRAPH LOG
Shoreline Stabilization Project
River Run at Exeter
Exeter, New Hampshire

Photograph 2:
Area B shoreline.

To Be Added for Final Application

Photograph 3:
Area C shoreline.

To Be Added for Final Application

Photograph 4:
Area D shoreline.

SECTION 8.0

NH NATURAL HERITAGE BUREAU REVIEW LETTER

NHB DataCheck Results Letter
NH Natural Heritage Bureau

To: George Holt, Aries Engineering, LLC
104 Pleasant Street
Concord, NH 03301
gholt@aries-eng.com

From: NHB Review
NH Natural Heritage Bureau
Main Contact: Maddie Severance - nhbreview@dncr.nh.gov

cc: NHFG Review

Date: 06/26/2025 (valid until 06/26/2026)
Re: DataCheck Review by NH Natural Heritage Bureau and NH Fish & Game
Permits: NHDES - Shoreland Standard Permit, NHDES - Standard Dredge & Fill - Major, USACE - General Permit

NHB ID: NHB25-1796

Town: Exeter
Location: 12 SIR LANCELOT DR

Project Description: The project proposes the stabilization of four areas of eroded banks on the Exeter River that threaten existing residential buildings utilizing SCOURLOK, a vegetated engineered stabilization measure developed by Solmax. This system provides a durable, geotechnically stable structure that provides immediate erosion protection and long-term vegetative cover. The total linear impact is estimated to be approximately 1,100 feet.

Next Steps for Applicant:

NHB's database has been searched for records of rare species and exemplary natural communities. Please carefully read the comments below and the consultation requirements on the following page.

NHB Comments: Please contact NHB and indicate how the proposed project is expected to change the hydrology and flooding regime of the Exeter River.

NHFG Comments: Please refer to NHFG consultation requirements below.

NHB Consultation

If this NHB DataCheck letter includes records of rare plants and/or natural communities/systems, please contact NHB and provide any requested supplementary materials by emailing nhbreview@dncr.nh.gov.

If this NHB DataCheck letter DOES NOT include any records of rare plants and/or natural communities/systems, no further consultation with NHB is required.

NH Fish and Game Department Consultation

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

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

If the NHB DataCheck response letter does not include a threatened or endangered wildlife species but includes other wildlife species (e.g., Species of Special Concern), consultation under Fis 1004 is not required; however, some species are protected under other state laws or rules, so coordination with NH Fish & Game is highly recommended or may be required for certain permits. While some permitting processes are exempt from required consultation under Fis 1004 (e.g., *statutory permit by notification, permit by rule, permit by notification, routine roadway registration, docking structure registration, or conditional authorization by rule*), coordination with NH Fish & Game may still be required under the rules governing those specific permitting processes, and it is recommended you contact the applicable permitting agency. For projects not requiring consultation under Fis 1004, but where additional coordination with NH Fish and Game is requested, please email NHFGreview@wildlife.nh.gov, and include the NHB DataCheck results letter number and "review request" in the email subject line.
Contact NH Fish & Game at (603) 271-0467 with questions.

NHB Database Records:
The following record(s) have been documented in the vicinity of the proposed project. Please refer to this list when coordinating.

Natural Community	**State[1]**	**Federal**	**Notes**
Swamp white oak floodplain forest	--	--	

Vertebrate species	**State[1]**	**Federal**	**Notes**
Bridle Shiner (*Notropis bifrenatus*)	T	--	Contact the NH Fish & Game Dept (see above).
Redfin Pickerel (*Esox americanus americanus*)*	SC	--	Contact the NH Fish & Game Dept (see above).

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

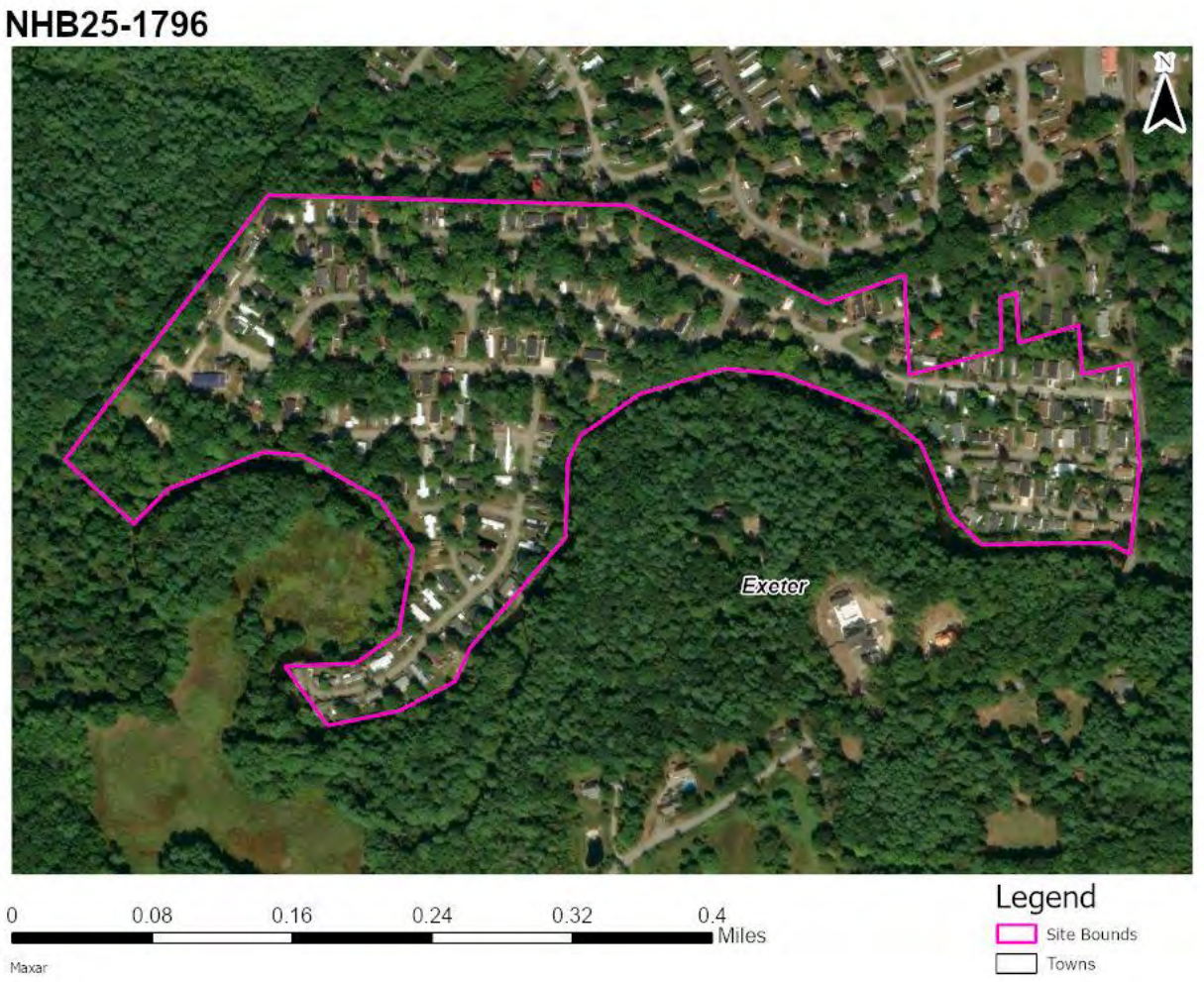
For all animal reviews, refer to 'IMPORTANT: NHFG Consultation' section above.

Disclaimer: NHB's database can only tell you of known occurrences that have been reported to NHFG/NHB. Known occurrences are based on information gathered by qualified biologists or members of the public, reported to our offices, and verified by NHB/NHFG.
However, many areas have never been surveyed, or have only been surveyed for certain species.
NHB recommends surveys to determine what species/natural communities are present onsite.

NHB DataCheck Results Letter
NH Natural Heritage Bureau

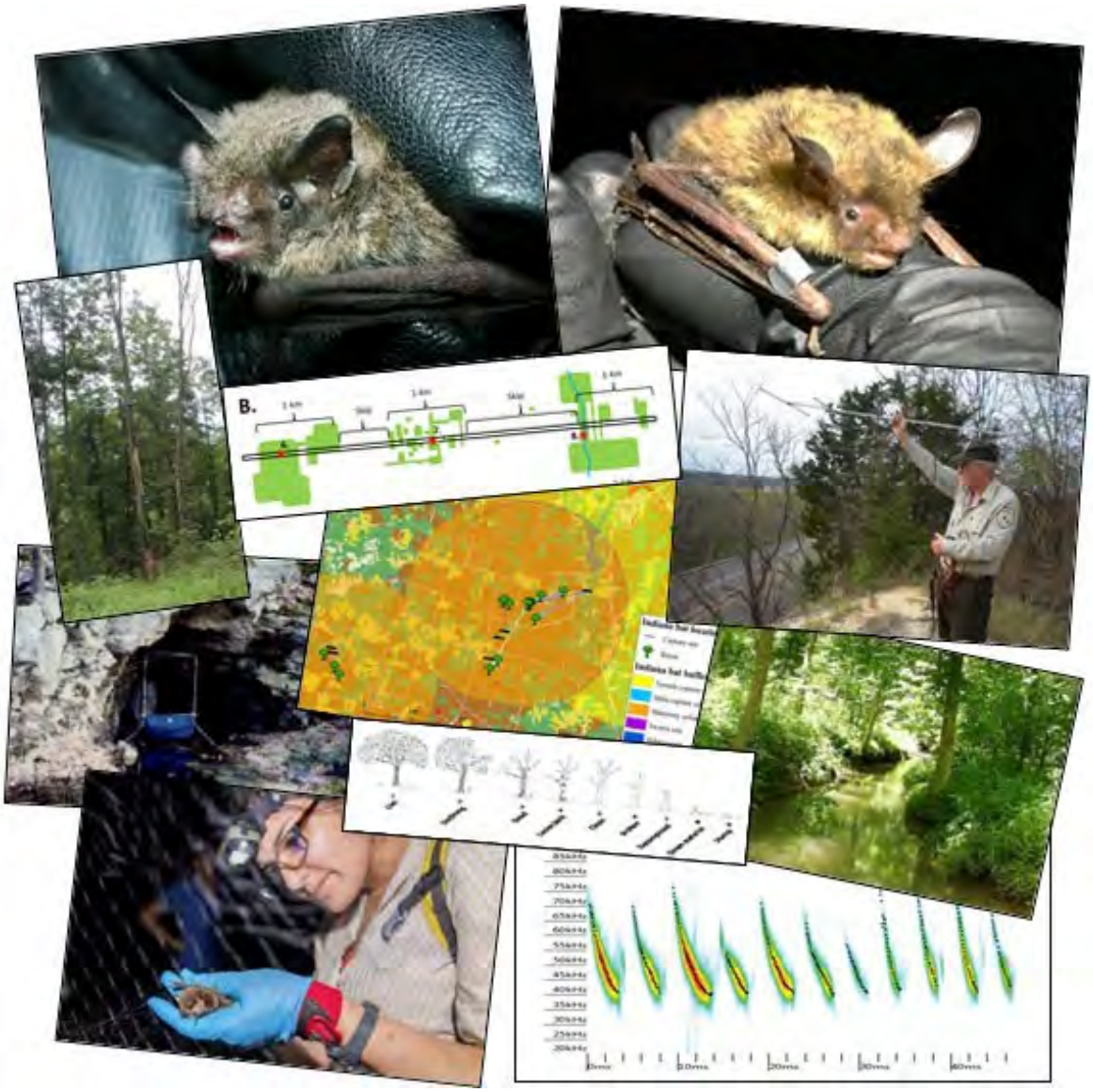
Please note: Effective June 10th, 2025, DataCheck letters will no longer include specific locations of rare species and exemplary natural communities. Changes to the map have been made to reflect this update.

Important: The list of rare species and exemplary natural communities that may be impacted by the project is included. Please refer to that list when coordinating.



U.S. Fish and Wildlife Service

RANGE-WIDE INDIANA BAT & NORTHERN LONG-EARED BAT SURVEY GUIDELINES



March 2024

Table of Contents

Recommended Citation for this Document:

U.S. Fish and Wildlife Service. 2024. Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines. U.S. Fish and Wildlife Service, Region 3, Bloomington, MN. 95 pp.

Cover Photos/Graphics: Mike Coffey/USFWS, Kyle Edmonds/USFS, Mark Ford/USFS (USGS), Andrew King/USFWS, Keith Lott/USFWS, Alex Morrison/VA Tech, and Alex Silvis/VA Tech (WV DNR).

RANGE-WIDE INDIANA BAT & NORTHERN LONG-EARED BAT SURVEY GUIDELINES

(modifications from the previous guidelines are in **blue**)

INTRODUCTION

The Indiana bat (IBAT) (*Myotis sodalis*) was originally listed as being in danger of extinction under the Endangered Species Preservation Act of 1966 (32 FR 4001, March 11, 1967), and is currently listed as endangered under the Endangered Species Act (ESA) of 1973, as amended. The northern long-eared bat (NLEB) (*Myotis septentrionalis*) was listed as threatened under the ESA on April 2, 2015, and reclassified to endangered on March 31, 2023. This survey protocol provides the U.S. Fish and Wildlife Service's (USFWS) recommended guidance on survey methods and outlines additional reporting requirements for surveyors. These guidelines provide recommendations to project proponents completing habitat assessments and presence/probable absence surveys for IBAT and NLEB. Following these recommendations streamlines project coordination with USFWS[1]. The USFWS does not require surveys for federally listed species to meet ESA compliance within Section 7 or 10 contexts. Therefore, use of these guidelines remains optional, and project proponents may discuss other options with the local USFWS Field Office (FO).

The following guidance is designed to determine whether IBAT or NLEB are present[2] or probably absent (P/A)[3] at a given site during the summer/active season (see Appendices B, C, I, or J), within bridges and culverts (see Appendix K), or during the winter (see Appendix H) (also refer to Table 1). The phased-approach includes coordination with the USFWS, habitat assessments, acoustic, mist-net, and an assortment of survey guidance appendices, and supersedes all prior survey guidance for these two species. Future changes to this document may occur and will be posted on the USFWS IBAT and NLEB survey guidance website by March 31st of each year. Before conducting surveys, please check this website to ensure use of the most current version of this document. All USFWS survey guidance documents can be found at https://www.fws.gov/library/collections/range-wide-indiana-bat-and-northern-long- eared-bat-survey-guidelines.

These protocols may be different from those designed for general bat monitoring as part of the North American Bat Monitoring Program (NABat)[4]. NABat surveys may be thought of as similar to breeding bird surveys and are not project-specific surveys in most cases. Information from NABat surveys can be considered as part of "best available" information when assessing whether there is already some existing information on presence of IBAT or NLEB in the vicinity of a given project.

NOTE: These protocols may also be used for tricolored bat (*Perimyotis subflavus*; TCB) presence/probable absence surveys using the NLEB level of effort (LOE) for the 2024 field season. We collected preliminary data from these datasets to complete an initial evaluation of LOE for TCB to ensure that deferring to the NLEB LOE for 2024 was acceptable. The unique factors and differences from NLEB protocols include:

- The definition of suitable summer habitat for tricolored bats (Appendix A);

[1] Coordinate with the appropriate state natural resource agencies and any involved federal agency(ies) whenever "USFWS" coordination is listed. USFWS FO(s) may direct project sponsors to state agencies for existing occurrence information. Coordinate with your local USFWS FO(s) to understand the process for their area of jurisdiction.
[2] The guidance is not intended to be rigorous enough to provide sufficient data to fully determine population size or structure.
[3] Recognizing protocols are not 100% likely to detect IBAT and NLEB when present and identification errors may occur.
[4] Loeb et al. 2015 available at https://www.nabatmonitoring.org

- Acoustic or combination acoustic and mist-netting surveys are required for TCB when it is the only species (IPaC species list includes TCB but not IBAT or NLEB) being surveyed for P/A (Appendix C or I);

- Manual vetting is necessary for linear projects when using an approved version of Kaleidoscope Pro if the MLE is > 0.05 for all site-nights and 10 or more passes are auto-classified as potentially belonging to TCB at any site-night. If you choose not to manually vet calls meeting these criteria, then you should assume presence of TCB for the project (Appendix C or I);

- Radio-tracking of TCB should prioritize identification of the immediate roosting area (if the exact roosting locations cannot be determined) of the transmittered bat given the frequent difficulty in locating the bats' exact roosting location (Appendix D);

- Emergence surveys of potentially suitable (versus known) roost trees for TCB is not always a viable option given the variability in roosting locations (Appendix E); and

- Internal surveys of potentially suitable hibernacula may be completed for TCB (Appendix H).

OBJECTIVES

The objectives of IBAT and NLEB survey guidelines are to: (1) standardize range-wide survey procedures; (2) maximize the potential for detection/capture of IBAT and NLEB at a minimum acceptable level of effort (LOE); (3) make accurate presence/probable absence determinations; and (4) aid in conservation efforts for the species' by identifying areas where they are present.

BACKGROUND

In 2011, the USFWS developed a multi-agency team to determine whether improvements could be made to the 2007 IBAT Mist-Net Protocols (USFWS 2007). The USFWS implemented the revised guidance in 2014. Since then, a USFWS team with support from USGS has made any necessary revisions to the guidelines each year (e.g., formally incorporated NLEB in 2022). The USGS conducted initial independent testing of automated acoustic software programs during the winter of 2014-15 and continues to provide support to USFWS testing new versions of available software using software- testing procedures updated in January 2019[5].

We considered the best available information for all aspects of the guidance. For example, see our white paper[6] and 2018 addendum outlining the methods used to determine the minimum IBAT LOE. Our 2022 addendum provided the rationale for the NLEB minimum LOE for acoustic and mist-net surveys (previously we deferred to LOE used for IBAT) as well as updating the IBAT acoustic LOE. The 2023 addendum utilized new data to provide updated mist-netting LOE recommendations for IBAT and NLEB and year-round active LOE recommendations for NLEB. As we receive additional information, we may incorporate additional survey recommendations for the IBAT, NLEB, and/or other bat species. The USFWS continues to partner with local, State, and Federal biologists; scientific and academic institutions; commercial organizations; and other interested parties to collect additional data on the distribution, ecology, and biology of the IBAT and NLEB, as well as other at- risk bat species, and looks forward to receiving any additional pertinent information from partners.

[5] Revised USFWS Software Testing Procedures are available on the USFWS website provided in the intro.
[6] The white paper, 2018, 2022 and 2023 addenda are available on the USFWS website provided in the intro.

GENERAL PROCESS

IBAT and NLEB surveys for some proposed projects will require modification (or clarification) of this guidance through coordination with the USFWS Ecological Services Field Office(s) (FOs) responsible for the state(s) in which the project occurs[7]. Before coordinating with the USFWS FO(s) on survey plan development, project proponents should submit their project through the Information for Planning and Consultation (IPaC) website (https://ipac.ecosphere.fws.gov/). If not already required by federal permit, federal action agencies and surveyors should develop a proposed survey study plan in coordination with the USFWS FO(s) so that all parties fully understand which methods will be deployed, what assumptions will be made, and what the various outcomes would be based on the results of each step. Although optional, we encourage the use of the fillable USFWS Study Plan Form for Bat Surveys and Monitoring as it will ensure all the information necessary is provided to the USFWS FO and expedite review and approval. Project proponents are encouraged to coordinate with the USFWS FO(s) regarding when they may cease survey work once an assumption or documentation of their targeted species presence occurs. Pre-survey coordination typically will preclude the need for subsequent reviews of intermediate steps by USFWS FO(s) during the busy field season. An online directory of USFWS FO(s) is available on the USFWS website (https://www.fws.gov/our-facilities). Unless otherwise agreed to by the USFWS, negative P/A survey results obtained using this guidance are valid for a minimum of five years[8] from their completion unless new information (e.g., other nearby surveys) suggest otherwise. If negative survey results are older than 5 years, coordinate with the USFWS FO(s) to discuss if additional surveys are needed. If not already required by federal permit, submit all results (negative or positive) from any phase to the USFWS FO(s) you have been in coordination with. We strongly encourage this coordination as it improves the USFWS' understanding of (1) the level of survey effort underway and (2) the distribution of the species. A single report can be submitted at the end of all phases conducted for a given project. Results of acoustic survey data collected as part of P/A surveys must also be submitted annually in Section 10 reporting spreadsheets to the USFWS.

USFWS FO-level coordination is also important during the survey planning process. USFWS Section 10 permits require FO approval for each individual survey study plan in order to be in compliance. Field Offices have the authority to deny a proposed survey if it is determined that the study plan is insufficient for Section 7 consultation requirements of the ESA. For example, radio-tracking of captured IBAT and/or NLEB may be required by individual FOs and should be discussed as part of the study plan and pre-survey coordination. The guidelines that are described in this document are designed to be implemented during acceptable survey windows (see Table 1) and in typical habitats that are conducive to the standard survey techniques described herein. However, the USFWS recognizes that occasionally there may be some site-specific conditions in summer habitats or at potential hibernacula sites that do not lend themselves to being surveyed using the standard survey options (e.g., mist nets, acoustic detectors, or harp traps) even though a site may otherwise meet the definition of suitable IBAT and/or NLEB habitat. Therefore, we strongly encourage coordination with the FO(s) prior to using methods that may not be appropriate for site-specific habitat conditions. The bat activity timeframes (see Appendix L) are intended to provide consistency across the species' ranges and aid conversations between project proponents and USFWS FOs regarding Section 7 consultations (e.g., avoidance and minimization). Similarly to other components of the guidelines, these timeframes are subject to change based on use of the best science available.

[7] For example, project sponsors for large acreage and/or landscape-scale projects that do not result in permanent habitat loss and would not pose an ongoing threat of lethal take, especially those proposed by land management agencies, may work with local USFWS FOs to apply different scales of surveys (broad vs. project-level) or different types of surveys, such as long-term monitoring results (e.g., forest-wide acoustic data) and/or targeted survey efforts (e.g., sub- sampling of large project areas), to address P/A concerns.

[8] The timeframe may be reduced if significant habitat changes have occurred in the area or increased based on local information.

Because surveys that result in the capture of IBAT and/or NLEB result in take, such surveys should only be conducted by a qualified biologist[9]. Generally, a recovery permit for the IBAT and NLEB authorizes the capture of bats for identification, and handling of bats for measurements, photography, banding, and radio transmitter attachment; some (but not all) may also authorize entry into potential hibernacula to conduct internal surveys and other study-specific collection. Following this survey guidance will meet standard USFWS Section 10 recovery permit requirements; however, surveyors also need to ensure they meet all applicable state permitting and reporting requirements. Failure to follow the survey guidance, as written, and/or failure to follow a study plan which has received concurrence from the local USFWS FO(s), may result in a USFWS FO requesting additional survey effort.

The following provides a step-by-step outline of how IBAT and/or NLEB summer surveys and/or potential hibernacula surveys should be conducted. Some of these steps can occur concurrently.

NOTE: If surveys are specifically targeting both the IBAT and NLEB, **make sure to use the higher minimum LOE for chosen survey methods (e.g., NLEB range-wide acoustic or mist-netting LOE, also see 2022 and 2023 Addendum)** to ensure it meets the needs for both species.

PHASE 1 – INITIAL PROJECT SCREENING

Step 1. Determine if your project is within the range of IBAT and/or NLEB through the U.S. Fish and Wildlife Service's Information for Planning and Consultation website (https://ipac.ecosphere.fws.gov/). Once completed, coordinate with the U.S. Fish and Wildlife Service Field Office(s)[10] regarding existing IBAT and/or NLEB summer and/or winter occurrence information. [*Projects located within known IBAT and/or NLEB summer habitat and/or known hibernacula/spring-staging/fall swarming zones will not proceed to Phase 2 of this process unless the project meets the definition of an "outer-tier project" outlined in Appendix G. "Outer-tier" guidance only applies to summer captures/detections (not hibernacula)*].

a) If a project (located within or outside of a known maternity colony home range or spring-staging/fall-swarming zone of a known hibernaculum) is already covered under an existing Endangered Species Act (ESA) incidental take authorization (e.g., HCP, BO), then no further summer and/or potential hibernacula surveys are needed, follow the procedures previously authorized by the USFWS FO(s).

b) If there are known IBAT or NLEB occurrences (e.g., known roost trees, capture locations, foraging locations or hibernacula) within the project action area[11];

OR

if there are no known IBAT or NLEB summer or spring/fall/winter occurrences within the proposed project area itself, but the project area is located within a known maternity colony

[9] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for IBAT and/or NLEB in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to net and handle IBAT and/or NLEB. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

[10] Coordinate with the appropriate state natural resource agencies and any involved Federal Action agencies whenever "USFWS" coordination is listed. USFWS FO(s) may direct project sponsors to state agencies for existing occurrence information. Coordinate with your local USFWS FO(s) to understand the process for their area of jurisdiction.

[11] 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]

home range and/or the spring-staging and fall-swarming zone of a known hibernaculum[12];

OR

if the project is located outside a known maternity colony home range and/or spring- staging and fall-swarming zone of a hibernaculum but is within the range of the IBAT and/or NLEB (note this can change over time), then proceed to Step 2.

Step 2. Conduct Habitat Assessment (Desktop or Field-based; see Appendix A, H, and K).

a) If suitable summer habitat, a potential hibernaculum(a), and/or a potential bridge/culvert roost is present within the action area, then proceed to Step 3.

b) If suitable summer and winter habitat (i.e., potential hibernaculum) and potential bridge/culvert roosts are absent within the action area, then no further P/A surveys are recommended; however, additional coordination with the USFWS FO(s) may be recommended if IBAT and/or NLEB may be present in an action area during other seasons (e.g., spring and fall migration) and may be affected by the proposed project.

Step 3. Assess potential for adverse effects to IBAT and/or NLEBs

a) If the project is not anticipated to result in adverse effects to IBAT and/or NLEB (as proposed), then no further summer, bridge/culvert roost, and/or potential hibernacula surveys are recommended, coordinate with the USFWS FO(s).

b) If the project may result in adverse effects to IBAT and/or NLEB, but impacts can be adequately assessed and conservation measures can be designed to minimize those effects without additional P/A information (this includes **all** proposed projects within known summer maternity colony home ranges and /or at known hibernacula and their surrounding spring-staging and fall-swarming zones, but may include other areas as well), then no further surveys are recommended. Coordinate with the USFWS FO(s) regarding an assessment of the project's potential effects, development of conservation measures, determination of the need for any ESA incidental take authorization, and discussion of value of additional surveys.

c) If the project does not meet the conditions of 3a or 3b, then proceed to **Phase 2, 5, and/or 6**.

PHASE 2 – SUMMER/ACTIVE SEASON P/A SURVEYS (NETTING AND/OR ACOUSTIC)[13]

Presence/probable absence (P/A) of IBAT and/or NLEB may be determined by conducting either Step 4 (mist-netting; see Appendix B or Appendix J) or Step 5 (acoustics; see Appendix C or Appendix J) as outlined below. If the project area contains habitat that is appropriate to conduct either survey method, it is the project proponent's choice as to which option to use, for each survey area unit (i.e., ≤123-acre area or 1-km section of linear project). A combined mist-netting and acoustic approach is also acceptable (see "pilot" Appendix I). Under no scenario can a project proponent use either mist-netting or acoustic Phase 2 surveys to challenge the other methods results. The USFWS accepts the results of either option and has no preference for methods. The USFWS FO(s) can discuss pros and cons of different approaches depending on project sponsor needs and project- specific habitat conditions. For example, a project area may not have suitable conditions for a mist- net survey and an acoustic survey may be the only

[12] See USFWS IBAT Section 7 and Section 10 Guidance for Wind Energy Projects (Questions 4 & 5) on the USFWS website provided in the introduction.

[13] NOTE: acoustic and/or mist-net surveys should be conducted in the best suitable habitat possible for each survey type to increase the likelihood of detecting/capturing IBAT and/or NLEB. In some cases, the most suitable habitat for effectively conducting surveys may occur outside a project site boundary and may be sampled if landowner permission is granted.

appropriate method for establishing P/A. It is up to the surveyor's professional judgment to determine whether the habitat on-site has the appropriate structure for the survey method chosen prior to the survey and to coordinate with the FO(s) if issues arise with the method chosen and need to be reconsidered.

Acoustics at the Phase 2 level of effort (LOE) (or otherwise agreed to with the USFWS FO) may be used as a coarse screening tool for conducting subsequent mist-netting at the Phase 2 LOE. For example, if NO high frequency (HF) calls (≥35 kHz) are detected, then no netting is required within that 123-acre (non-linear) or 1-km (linear) survey area due to IBAT and/or NLEB probable absence. If ANY HF calls are detected, then mist-net at the Phase 2 LOE. Any project study plan that includes use of both acoustics and netting needs to be written clearly to avoid potential misunderstandings between the project proponent and the USFWS FO.

Also, Phase 2 acoustic results should be used to inform whether, when, and where to conduct any optional Phase 3 mist-netting. In this case, acoustics is the P/A method and if presence is detected (HF screen, automated/MLE and/or manual vetting), then IBAT and/or NLEB presence is established. Negative results from follow-up mist-netting (at any LOE) does not refute a previously established positive acoustic result. The goal of Phase 3 netting is simply to verify where IBAT and/or NLEB(s) are active and to capture and track individuals to document roost trees and population size to further inform consultation or coordination under the ESA.

The summer survey season for IBAT and the hibernating[14] NLEB range is from 15 May through 15 August, unless the survey is being conducted within the year-round active portion of the NLEB range where the survey season is from 1 March through 15 October (see Appendix J). All P/A surveys should be completed by the end of the designated survey season unless otherwise indicated by USFWS FO[15]. The minimum prescribed survey level of effort for any given survey area unit (i.e., ≤123-acre area or 1-km section of linear project) **cannot** be completed in a single calendar night regardless of which survey method (netting or acoustic) is used (i.e., minimum survey effort must be spread over at least 2 calendar nights with suitable weather conditions). If netting is chosen as the preferred P/A method and an IBAT and/or NLEB is captured, then surveyors may immediately begin Phase 4/radio- tracking. Project proponents must decide whether they will proceed to Phase 4 in coordination with the USFWS FO before any mist-netting occurs. Submit Phase 2 study plans to USFWS FO prior to conducting surveys for their review and site-specific authorization.

Step 4. Conduct Mist-Netting Surveys following IBAT and/or NLEB Protocols[16] (See Figure 1, Table 2, and Appendix B, I, or J)

OR

Step 5. Conduct Acoustic Surveys[17] (see Figure 1, Table 2, and Appendix C, I, or J)

[14] The hibernating NLEB range includes the portion of the range where the species hibernates in the winter, stages and swarms outside of hibernacula in the spring and fall, and migrates to summer home ranges.
[15] With prior USFWS FO approval, a survey may be completed after the end of the designated survey season if it was initiated in time to be completed by August 15 or October 15 (year-round active portion of the NLEB range) and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15. If tracking is proposed, surveys should be scheduled so that tracking is concluded prior to August 15 or October 15.
[16] We have no recommendations for reducing the mist-netting minimum level of effort to demonstrate probable absence for projects <123 acres in size. Level of effort is based on detection probabilities and occupancy estimates that were derived from past survey efforts that used the same acreage threshold. Level of effort for mist-netting is designed to reach 90% confidence in negative survey results (see Niver et al. 2014; Armstrong et al. 2023).
[17] Acoustic surveys are available as a P/A option throughout the ranges of both species. We have no recommendations for reducing the minimum level of effort required to demonstrate probable absence for projects <123 acres in size. Level

PHASE 3. CONDUCT MIST-NETTING SURVEYS TO CAPTURE INDIANA and/or NORTHERN LONG-EARED BATS.

If mist-netting was not conducted as the P/A method, then mist-netting may be conducted in Phase 3 to capture and characterize (e.g., sex, age, reproductive condition) the IBAT and/or NLEB that are present in an area and to facilitate Phase 4 efforts. We encourage working with the FOs to develop Phase 3 netting plans based on best available information (e.g., positive acoustic locations). There are no minimum requirements for this phase as this is not a P/A phase.

a) If no IBAT and/or NLEB are captured, then coordinate with the USFWS FO.

b) If IBAT and/or NLEB are captured, then proceed to **Phase 4**.

PHASE 4. CONDUCT RADIO-TRACKING AND EMERGENCE SURVEYS (See Appendices D and E)

PHASE 5. CONDUCT POTENTIAL HIBERNACULA SURVEYS (See Appendix H)

PHASE 6. CONDUCT BRIDGE AND CULVERT ROOST SURVEYS (See Appendix K)

REFERENCES

Amelon, S.K. 2007. Multi-scale factors influencing detection, site occupancy, and resource use by foraging bats in the Ozark Highlands of Missouri. PhD Dissertation. University of Missouri – Columbia.

Armstrong, M.P., R.A. King, R.A. Niver, J. Utrup, V. Kuczynska, E.D. Thorne, J. De La Cruz, S.M. Deeley, K.M. Gorman W.M. Ford and R.E. Russell. 2022. Addendum 2 – An Update to the Indiana Bat Summer Survey Level of Effort Trigger and Inclusion of Minimum Recommended Effort for Northern Long-eared Bats. U.S. Fish and Wildlife Service, Region 3, Bloomington, MN. 17 pp. Available on the USFWS website provided in the introduction

Armstrong, M.P., R.A. King, E.D. Thorne, J. De La Cruz, J.S. Utrup, V. Kuczynska, and K. Lott. 2023. Addendum 3 – An Update to Methods to Evaluate and Develop Minimum Recommended Summer Survey Effort for Indiana Bats: White Paper [with Northern long- eared Bat Addition]. U.S. Fish and Wildlife Service, Region 3, Bloomington, MN. 4 pp. Available on the USFWS website provided in the introduction

Duchamp, J.E., M. Yates, R. Muzika, and R.K. Swihart. 2006. Estimating probabilities of detection for bat echolocation calls: an application of the double-observer method. Wildlife Society Bulletin 34(2):408-412.

of effort is based on detection probabilities and occupancy estimates that were derived from past survey efforts that used the same acreage threshold. Level of effort for acoustics is designed to reach 90% confidence in negative survey results (see Niver et al. 2014; Armstrong et al. 2022).

Loeb, S.C., T.J. Rodhouse, L.E. Ellison, C.L. Lausen, J.D. Reichard, K.M. Irvine, T.E. Ingersoll, J.T.H. Coleman, W.E. Thogmartin, J.R. Sauer, C.M. Francis, M.L. Bayless, T.R. Stanley, and D.H. Johnson. 2015. A plan for the North American Bat Monitoring Program (NABat). General Technical Report SRS-208. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 112 p.

Niver, R.A., R.A. King, M.P. Armstrong, and W.M. Ford. 2014. Methods to Evaluate and Develop Minimum Recommended Summer Survey Effort for Indiana Bats: White Paper. Accessed 13 January 2014 and available on the USFWS website provided in the introduction

Niver, R.A., R.A. King, M.P. Armstrong, and W.M. Ford. 2018. Addendum 1 - Methods to Evaluate and Develop Minimum Recommended Summer Survey Effort for Indiana Bats: White Paper. Accessed 2 February 2022 and available on the USFWS website provided in the introduction

Romeling, S., C.R. Allen, and L. Robbins. 2012. Acoustically detecting Indiana bats: how long does it take? Bat Research News 53(4):51-58.

Yates, M.D. and R.M. Muzika. 2006. Effect of forest structure and fragmentation on site occupancy of bat species in Missouri Ozark forests. Journal of Wildlife Management 70(5):1238-1248

U.S. Fish and Wildlife Service (USFWS). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 91 pp.

TABLE 1. Standard survey seasons for conducting P/A surveys for IBAT and/or NLEB.

IBAT & NLEB SURVEY SEASONS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
IBat Internal Winter Hibernacula Surveys[1,2]												
Acceptable survey window (1 Jan. - 28 Feb.)												
Traditional survey window of known sites (15 Jan. - 15 Feb.)												
IBat & NLEB Spring & Fall Surveys at Entrances of Potential Hibernacula [3,4]												
Acceptable survey window (1 - 21 Apr. & 15 Sep. - 31 Oct.)												
IBat & NLEB Summer Surveys of Suitable Summer Habitat [5]												
Acceptable survey window (15 May - 15 Aug.)												
Optimal survey window (1 Jun. - 31 Jul.) [6]												
NLEB Surveys of Suitable Habitat in Year-round Active Range												
Acceptable survey window - (1 Mar. - 15 Oct.)												
Optimal survey window (1 May - 30 Sep.) [6]												
IBat & NLEB Bridge and Culvert Surveys [7]												
Acceptable survey window (Year-round)												

[1] visual and photographic surveys conducted within known and/or potential hibernacula (if deemed safe to enter).

[2] internal winter hibernacula surveys are seldom appropriate for NLEB as they typically fail to reliably detect and accurately enumerate the species when present.

[3] conducted using harp traps or mist nets at cave/mine entrances.

[4] if State/USFWS FO approve, spring and fall survey windows can "drift" a bit earliler or later to better accommodate prevailing weather patterns and/or climate conditions in the location of the proposed survey. For example, the fall survey window in nothern portions of the IBAT or NLEB range may begin on or after 1 Sep. and end prior to 31 Oct. pending local State and FO approval. Likewise, if agencies approve, spring surveys of potential hibernacula may be pushed back/extended a few days or longer due to an extended period of unseasonably cold spring weather.

[5] conducted using mist nets or acoustic detectors deployed within suitable flight corridors and foraging areas.

[6] the middle of the maternity season is considered by many to the best or "optimal" time to capture resident bats.

[7] coordinate with your local USFWS FO to determine best time to conduct bridge or culvert surveys for your project.

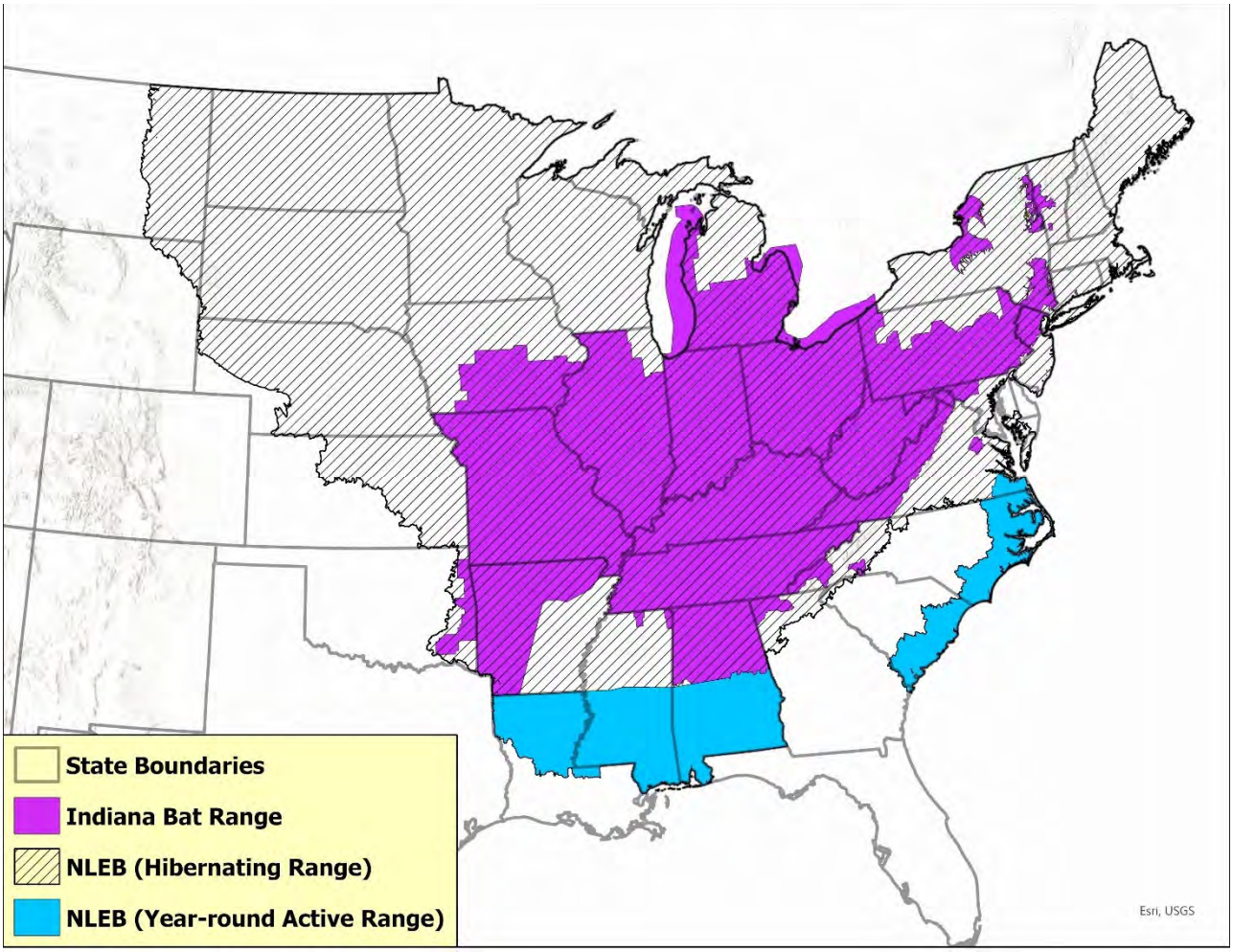


FIGURE 1. IBAT and NLEB ranges as defined for use in presence/ probable absence surveys (also see Table 2).

TABLE 2. Summary of current survey LOEs for IBAT and NLEB.

		MIST-NETTING (net nights)		ACOUSTICS (detector nights)	
Species	Region	Linear (per km)	Non-Linear (per 123 ac.)	Linear (per km)	Non-Linear (per 123 ac.)
IBAT	Range-wide	2	6	4	10
NLEB	Hibernating Range (non-coastal areas)	4	10	4	14
	Year-round Active Range (coastal areas)	2	6		

APPENDIX A: PHASE 1 HABITAT ASSESSMENTS

Summer habitat and potential hibernacula assessments are Step 2 of Phase 1- Initial Project Screening. The information below is provided to assist applicants, consultants, and/or project proponents (hereinafter termed the "applicant") in establishing whether surveys for IBAT and/or NLEB should be conducted. As a reminder, the first steps for determining presence of IBAT and/or NLEB at a given site is to 1) use the USFWS's Information for Planning and Consultation (IPaC) website (https://ipac.ecosphere.fws.gov/), and 2) determine whether there is any existing occurrence data available for the vicinity of the project from the local USFWS FO. This step can be conducted remotely via a desktop analysis (e.g., use of aerial photography to assess the potential presence of suitable summer habitat); however, on-site field assessment is always preferred. The applicant is responsible for developing and providing sufficient information as to whether suitable summer habitat and/or potential hibernacula exist within a proposed project area. If suitable habitat is present, the applicant should calculate the amount and submit this to the USFWS FO(s) and determine the need for any P/A surveys (Phase 2).

NOTE: If IBAT and/or NLEB are present or assumed to be present during any phase, more detailed habitat information may be necessary to adequately assess the potential for impacts (see attached example Bat Habitat Assessment Datasheet). If no suitable habitat is present or it is determined through discussions with USFWS FO(s) that no adverse effects are anticipated from the proposed project, no surveys are recommended to assess risk. Habitat assessments for IBAT and/or NLEB can be completed any time of year and applicants are encouraged to submit results and proposed Phase 2 study plans well in advance of survey seasons.

PERSONNEL

Habitat assessments should be completed by individuals with a natural resource degree or equivalent work experience demonstrating skills and knowledge in area-specific ecoregions, landscapes, habitats, and ecosystems.

DEFINITION FOR SUITABLE INDIANA BAT SUMMER HABITAT

Suitable summer habitat for IBAT consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats[18] such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥5 inches dbh[19] (12.7 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable

[18] Non-forested habitats typically should be excluded from acreages used to establish a minimum level of survey effort for Phase 2 surveys.

[19] While trees <5 inches (<12.7 cm) dbh that have exfoliating bark, cracks, crevices, and/or hollows may have some potential to be male IBAT summer roosting habitat, the USFWS does not consider early successional, even-aged stands of trees <5 inches dbh to be suitable roosting habitat for the purposes of this guidance. Suitable roosting habitat is defined as forest patches with trees of 5-inch (12.7 cm) dbh or larger. However, early successional habitat with small diameter trees may be used as foraging habitat by IBATs. Therefore, a project that would remove or otherwise adversely affect ≥20 acres of early successional habitat containing trees between 3 and 5 inches (7.6-12.7 cm) dbh would require coordination/consultation with the USFWS FO to ensure that associated impacts would not rise to the level of take. The USFWS may request P/A surveys if >20 acres of early successional habitat were proposed for removal.

habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat.

Indiana bats have also been observed roosting in human-made structures, such as bridges and bat houses (artificial roost structures); therefore, these structures should also be considered potential summer habitat[20]. We recommend that project proponents or their representatives coordinate with the appropriate USFWS Field Office (FO) to define suitable habitat more clearly for their region as some differences in state/regional suitability criteria may be warranted (e.g., high-elevation areas may be excluded as suitable habitat in some states).

Examples of unsuitable habitat:

- Individual trees that are greater than 1,000 feet from forested/wooded areas;
- Trees found in highly developed urban areas (e.g., street trees, downtown areas); and
- A pure stand of less than 3-inch dbh[21] trees that are not mixed with larger trees.

DEFINITION FOR SUITABLE NORTHERN LONG-EARED BAT SUMMER HABITAT

Suitable summer habitat for the NLEB consists of a wide variety of forested/wooded habitats where they roost, forage, and travel. Although they may also traverse habitat adjacent and interspersed with forest habitat, such as emergent wetlands and field edges, they are predominately found in forest/wooded habitat. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥3 inches dbh that have exfoliating bark, cracks, crevices, and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. NLEBs are nocturnal foragers and use hawking (catching insects in flight) and gleaning (picking insects from surfaces) behaviors in conjunction with passive acoustic cues (Nagorsen and Brigham 1993, p. 88; Ratcliffe and Dawson 2003, p. 851). NLEB often prefer intact mixed-type forests with small gaps (i.e., forest trails, small roads, or forest-covered creeks) in forest with sparse or medium vegetation for foraging and commuting rather than fragmented habitat or areas that have been clear cut (USFWS 2015, p.17992). Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 feet of other forested/wooded habitat[22]. The NLEB has also been observed roosting (although to a lesser degree than forested habitat) in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat[23].

NLEBs typically occupy their summer habitat from mid-May through mid-August each year[24] and the

[20] If human-made structures are present within your project area and are proposed to be removed or modified, see Appendix E (Emergence Surveys) and then coordinate with the local USFWS FO(s) regarding how to determine P/A.
[21] Suitable roosting habitat is defined as forest patches with trees of 5-inch (12.7 cm) dbh or larger. However, early successional habitat with small diameter trees may be used as foraging habitat by IBAT. Therefore, a project that would remove or otherwise adversely affect ≥20 acres of early successional habitat containing trees between 3 and 5 inches (7.6- 12.7 cm) dbh would require coordination/consultation with the USFWS FO to ensure that associated impacts would not rise to the level of take. The USFWS may request P/A surveys if >20 acres of early successional habitat were proposed for removal.
[22] This number is based on observations of bat behavior indicating that such an isolated tree (i.e., ≥1000 feet) would be extremely unlikely to be used as a roost. This distance has also been evaluated and vetted for use for the NLEB. See the "Indiana bat Section 7 and Section 10 Guidance for wind Energy Projects," question 33, found on the USFWS website provided in the intro.
[23] Trees found in highly-developed urban areas (e.g., street trees, downtown areas) are extremely unlikely to be suitable habitat.
[24] Exact dates vary by location., with NLEBs typically being found earlier in spring at lower latitudes. Also, NLEBs in

species may arrive or leave some time before or after this period. In most areas, roosting habitat is considered suitable summer habitat because NLEBs are only present in forested habitat during the summer active months. In some areas of the southern U.S., NLEBs are present in potential roosting habitat year-round. In these areas (see Figure 1 and Figure 3 in Appendix J), habits and habitat use differ significantly from the rest of the species' range.

Examples of unsuitable habitat:

- Individual trees that are greater than 1,000 feet from forested/wooded areas;
- Trees found in highly developed urban areas (e.g., street trees, downtown areas); and
- A pure stand of less than 3-inch dbh trees that are not mixed with larger trees.

DEFINITION FOR SUITABLE TRICOLORED BAT SUMMER HABITAT

Suitable TCB summer habitat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and include some adjacent and interspersed non-forested habitats such as emergent wetlands, shrublands, grasslands, and forested edges of agricultural fields, old fields, and pastures. Roosting habitat includes forests, woodlots, and linear features (e.g., fencerows and riparian corridors) containing trees with potential roost substrate (e.g., live and dead leaf clusters of live and recently dead deciduous trees, Spanish moss [*Tillandsia usneoides*], and beard lichen [*Usnea trichodea*]).[25] TCBs will roost in a variety of tree species, especially oaks (*Quercus spp.*), and often select roosts in tall, large-diameter trees, but will roost in smaller diameter trees when potential roost substrate is present (e.g., 4-inch [10-centimeter]; Leput 2004). TCBs commonly roost in the mid to upper canopy of trees although males will occasionally roost in dead leaves at lower heights (e.g., < 16 feet [5 meters] from the ground; Perry and Thill 2007) and females will occasionally roost in Spanish moss of understory trees (Menzel et al. 1999). TCBs seem to prefer foraging along forested edges of larger forest openings, along edges of riparian areas, and over water and avoid foraging in dense, unbroken forests, and narrow road cuts through forests (Davis and Mumford 1962; Kurta 1995; Lacki and Hutchinson 1999; Ford et al. 2005; Menzel et al. 2005; White et al. 2006; Thames 2020; Hantulla and Valdez 2021).

TCBs also roost in human-made structures, such as bridges and culverts, and occasionally in barns or the underside of open-sided shelters (e.g., porches, pavilions); therefore, these structures should also be considered potential summer habitat. TCBs occupy similar forest habitats in the spring, summer, and fall (i.e., non-hibernating seasons) but in the southern portion of the range, where TCBs exhibit shorter torpor bouts and remain active and feed year-round, they may roost in culverts, bridges, cavities in live trees, live and dead leaf clusters, and/or Spanish moss during the winter (Sandel et al. 2001; Newman et al. 2021). TCBs may roost and forage in forested areas near anthropogenic structures and buildings (e.g., suburban neighborhoods, parks, etc.) (Helms 2010; Shute et al. 2021). However, highly developed urbanized areas generally devoid of native vegetation (including isolated trees surrounded by expansive anthropogenic development) are considered unsuitable habitat (e.g., parking lots, industrial buildings, shopping centers).

SUBMISSION OF PHASE 1 HABITAT ASSESSMENT & PHASE 2, PHASE 5, AND/OR PHASE 6 STUDY PLAN (IF NEEDED)

the year-round active portion of the range are an exception as they utilize the same habitat in summer as they do in winter.

[25] Occasional summer roosts also include clusters of dead pine needles of large live pines (Pinus echinata), live branches of Norway spruce (Picea abies), eastern red cedar (Juniperus virginiana), abandoned gray squirrel (Sciurus carolinensis) nests, and under exfoliating birch (Betula spp.) bark (Veilleux et al. 2003; Perry and Thill 2007; WDNR 2016; WDNR 2017a; WDNR 2017b; WDNR 2018; Thames 2020; Hammesfahr et al. 2022).

If a proposed project may affect (positively or negatively) IBAT and/or NLEB and the conditions outlined in Step 3 a or b are not met, a habitat assessment report should be submitted to the appropriate USFWS FO(s) (and/or to the lead Federal Action Agency as appropriate) along with a draft study plan for the Phase 2 (acoustic or netting), Phase 5 (potential hibernaculum), and/or Phase 6 (bridge/culvert potential roost) survey(s) (if suitable habitat(s) is present). Although optional, we encourage the use of the new fillable USFWS Study Plan Form for Bat Surveys and Monitoring as it will ensure all the information necessary is provided to the USFWS FO and expedite review and approval of your study plan. If you choose not to submit the study plan form, ensure all information requested on the form applicable to your survey are included with your study plan request submittal to your local USFWS FO(s). Complete Phase 1 reports will include the following:

1. Full names and relevant titles/qualifications of individuals (e.g., John E. Smith, Biologist II, State University, B.S. Wildlife Science 2007) completing the habitat assessment and when the assessment was conducted
2. A map and latitude/longitude or UTM clearly identifying the project location (or approximate center point) and boundaries
3. A detailed project description (if available)
4. Documentation of any known/occupied spring staging, summer, fall swarming, winter habitat, and/or bridge/culvert roosts for IBAT and/or NLEB within or near the project area
5. A description of methods used during the habitat assessment
6. A summary of the assessment findings and a completed Bat Summer Habitat Assessment Datasheet (see example below; use of this datasheet is optional)
7. Other information that may have a bearing on use of the project area (e.g., presence of fall or winter habitat [caves, crevices, fissures, or sinkholes, or abandoned mines of any kind], bridges/culverts and other non-tree potential summer roosts.)
8. A Phase 1 Habitat Assessment on all potential hibernacula that could be affected by the proposed project (see Appendix H for additional instructions for completing this assessment and sample datasheet), if necessary
9. A Step 1 Initial Assessment of Suitability and Safety on all bridges and culverts that could be affected by the proposed project (see Appendix K for additional instructions for completing this assessment and sample datasheet), if necessary
10. Any other information requested by the local USFWS FO(s) related to the project

REFERENCES

Davis, W.H. and R.E. Mumford. 1962. Ecological notes on the bat *Pipistrellus subflavus*. American Midland Naturalist, 394–398.

Ford, W.M., M.A. Menzel, J.L. Rodrigue, J.M. Menzel, and J.B. Johnson. 2005. Relating bat species presence to simple habitat measures in a central Appalachian forest. Biological Conservation, 126(4):528–539.

Hammesfahr, A., C.C. Rega-Brodsky, K. Womack-Bulliner, K., and J. Whitney. 2022. Roost characteristics of a TCB *Perimyotis subflavus* in the Missouri Ozarks. Transactions of the Kansas Academy of Science, 125(3-4):159–164.

Hanttula, M.K. and E.W. Valdez. 2021. First record and diet of the tri-colored bat (*Perimyotis subflavus)* from Guadalupe Mountains National Park and Culberson County, Texas. Western North American Naturalist, 81(1):131–134.

Helms, J. S. 2010. A Little Bat and a Big City: Nocturnal Behavior of the TCB (*Perimyotis subflavus*)

Near Indianapolis Airport. Master's Thesis Indiana State University, Terre Haute, Indiana.

Kurta, A. 1995. Mammals of the Great Lakes Region. The University Michigan Press.

Lacki, M. J. and J. T. Hutchinson. 1999. Communities of Bats (Chiropter) in the Grayson Lake Region, Northeastern Kentucky. Journal of the Kentucky Academy of Science 60(1):9–14.

Leput, D.W. 2004. Eastern red bat (Lasiurus borealis) and eastern pipistrelle (Pipistrellus subflavus) maternal roost selection: Implications for forest management. Master's Thesis Clemson University, Clemson, South Carolina.

Menzel, M.A., D.M. Krishon, T.C. Carter, and J. Laerm. 1999. Notes on tree roost characteristics of the northern yellow bat (*Lasiurus intermedius*), the Seminole bat (*L. seminolus*), the evening bat (*Nycticeius humeralis*), and the eastern pipistrelle (*Pipistrellus subflavus*). Florida Scientist, 185–193.

Menzel, J.M., M.A. Menzel, J.C. Kilgo, W.M. Ford, and J.W. Edwards. 2005. Bat response to Carolina bays and wetland restoration in the southeastern US coastal plain. Wetlands 25(3):542–550.

Newman, B.A., S.C. Loeb, and D.S. Jachowski. 2021. Winter roosting ecology of TCBs (*Perimyotis subflavus*) in trees and bridges. Journal of Mammalogy, 102(5):1331–1341.

Perry, R.W. and R.E. Thill. 2007. Tree roosting by male and female eastern pipistrelles in a forested landscape. Journal of Mammalogy 88(4):974–981.

Sandel, J.K., G.R. Benatar, K.M. Burke, C.W. Walker, T.E. Lacher, and R.L. Honeycutt. 2001. Use and selection of winter hibernacula by the eastern pipistrelle (*Pipistrellus subflavus*) in Texas. Journal of Mammalogy 82(1):173–178.

Shute, K.E., S.C. Loeb, and D.S. Jachowski. 2021. Summer roosting ecology of the northern yellow bat and tri-colored bat in coastal South Carolina. Southeastern Naturalist 20(3):459–476.

Thames, D.B. 2020. Summer Foraging Range and Diurnal Roost Selection of Tri-colored bats, *Perimyotis subflavus*. Master's Thesis University of Tennessee Knoxville.

Veilleux, J.P., J.O. Whitaker, and S.L. Veilleux. 2003. Tree-roosting ecology of reproductive female eastern pipistrelles, *Pipistrellus subflavus*, in Indiana. Journal of Mammalogy, 84(3):1068– 1075.

White, J.A., P.R. Moosman Jr., C.H. Kilgore, and T.L. Best. 2006. First record of the eastern pipistrelle (*Pipistrellus subflavus*) from southern New Mexico. The Southwestern Naturalist, 51(3):420–422.

Wisconsin Department of Natural Resources (WDNR). 2016. Understanding summer day roosts of maternity colonies of northern long-eared bats and eastern pipistrelles in Wisconsin.

Wisconsin Department of Natural Resources (WDNR). 2017a. Notes on radio-tracking of two eastern pipistrelles (*Perimyotis subflavus*) during spring emergence.

Wisconsin Department of Natural Resources (WDNR). 2017b. Use of Wisconsin forests by bats: Final WDNR report for the Lake States Forest Management Bat HCP Grant Year 2.

Wisconsin Department of Natural Resources (WDNR). 2018. Use of Wisconsin forests by bats: Final WDNR Report for the Lake States Forest Management Bat HCP Grant Year 3.

BAT HABITAT ASSESSMENT DATASHEET

Project Name:_____ Date:_____

Township/Range/Section:_____

Lat Long/UTM/ Zone:_____ Surveyor:_____

Brief Project Description

Project Area

	Total Acres	Forest Acres	Open Acres
Project			

	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing
Proposed Tree Removal (ac)			

Vegetation Cover Types

Pre-Project	Post-Project

Landscape within 5 mile radius

Flight corridors to other forested areas?
Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): _____

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
Pools/Ponds (# and size)		Open and accessible to bats?		
Wetlands (approx. ac.)	Permanent	Seasonal		

Forest Resources at Sample Site				
Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81-100%
Dominant Species of Mature Trees				
% Trees w/ Exfoliating Bark				
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
No. of Suitable Snags				

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable

IS THE HABITAT SUITABLE FOR INDIANA BATS?_____

IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? _____

Additional Comments:

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations: understory/midstory/canopy, examples of potential suitable snags and live trees, water sources

APPENDIX B: PHASE 2 OR PHASE 3 MIST–NETTING

Mist-netting can be used as a P/A method (Phase 2 surveys) or it can be conducted for the purpose of attempting to capture IBAT and/or NLEB after detection during acoustic P/A surveys (Phase 3 surveys). The same recommendations (e.g., season, personnel, equipment, net placement, checking nets) apply for either use of mist-netting surveys. NOTE: Appendix B is intended for use within the IBAT range and/or NLEB hibernating range (see Figure 1); also refer to Appendix J for additional guidance on conducting mist-netting in the year-round active range of the NLEB.

SUMMER MIST-NETTING SEASON: May 15 – August 15[26]

Capture of reproductive adult females (i.e., pregnant, lactating, or post-lactating) and/or young of the year during May 15 – August 15 confirms the presence of a maternity colony in the area. Since adult males and non-reproductive females have commonly been found summering with maternity colonies, radio-tracking results will be relied upon to help determine the presence or probable absence of a maternity colony or large concentrations of bats in the area when only males and/or non-reproductive females are captured.

PERSONNEL

A qualified biologist(s)[27] must (1) select/approve mist-net sets in areas that are most suitable for capturing IBAT and/or NLEB, (2) be physically present at each mist-net site[28] throughout the survey period, and (3) confirm all bat species identifications. This biologist may oversee other biological technicians and manage mist-net sets in close proximity to one another if the net-check timing (i.e., every 10 minutes) can be maintained while **walking** between net-sets[29]. A minimum of two (2) biologists (e.g., one qualified and one technician) must be on-site for every four (4) net-sets being operated. Exceptions to on-site minimum staffing levels may be allowed under extenuating circumstances, provided written justification is included in the proposed survey study plan and subsequently approved by the local USFWS FO(s).

NOTE: The mist-netting survey protocol may also be used for determining P/A of TCBs using the NLEB LOE for the 2024 field season when the survey is also being conducted for IBAT and/or NLEB; however, an acoustic or combined acoustic/mist-net survey must be completed in portions of the range where TCBs are the only species identified by IPaC and the project proponent chooses to conduct a P/A survey.

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[26] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15. If tracking is proposed, surveys should be scheduled so that tracking is concluded prior to August 15.

[27] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for IBAT and NLEB in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to net and handle IBAT and/or NLEB. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

[28] A Net Site is defined as one or more net sets that can be efficiently walked to and checked by a survey team (typically 2 people) within a 10-minute window from a central bat-processing location. For example, a single net "site" is often composed of 4 individual net sets (separated by at least 30 m apart) that are checked every 10 minutes by a 2-person team (each person checks 2 nets for each net check).

[29] A Net-Set is defined as one mist-net deployment consisting of two poles and typically from 1-3 affixed mist-nets stacked onto one another. A typical net set is at least 5 m to 9 m high consisting of two or more nets stacked on top of one another (without gaps) and from 6 m to 18 m wide.

COORDINATION WITH USFWS FIELD OFFICES (FOs)

If not already required by federal permit, we recommend that applicants submit a draft study plan for all survey phases to the USFWS FO(s) for review and approval (See Appendix A for guidance on submitting a draft study plan).

EQUIPMENT

Use the finest, lowest visibility mesh mist-nets commercially available, as practicable. Currently, the finest net on the market is 75 denier, 2 ply, denoted 75/2 (Arndt and Schaetz 2009); however, the 50 denier nets are still acceptable for use currently. The finest mesh size available is approximately 1½ inches (38 millimeters). No specific hardware is required. There are many suitable systems of ropes and/or poles to hold nets. The systems of Gardner et al. (1989) and Chenger's BCM triple high has been widely used. See NET PLACEMENT discussion below for minimum net heights, habitats, and other netting requirements that affect the choice of hardware.

To minimize potential for disease transmission, any equipment that comes in contact with bats should be kept clean and disinfected, following approved protocols; this is particularly a concern relative to white-nose syndrome (WNS). Disinfection of equipment to avoid disease transmission (e.g., WNS) is required; protocols are posted at http://www.whitenosesyndrome.org/. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

MINIMUM P/A MIST-NETTING LEVEL OF EFFORT (PHASE 2)

The level of netting survey effort required for a non-linear project will be dependent upon the overall acreage of suitable habitat that may be impacted by the action (directly or indirectly). To determine the survey effort, quantify the amount of suitable summer habitat within the project area.

NOTE: for projects where other impacts than tree removal are likely (e.g., collision), ensure that P/A surveys are designed to cover all suitable habitat within the entire project area (where exposure to any kind of impacts may be anticipated) and NOT just the locations where tree removal is planned. Additional guidance for linear projects is in Appendix F.

Conduct Mist-Netting Surveys following IBAT and/or Hibernating NLEB Range Level-of-Effort Recommendations (See Figure 1 and Table 2)

Range-wide IBAT Mist-netting LOE:

Linear projects: a minimum of 2 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 6 net nights per 123 acres[30] (0.5 km^2) of suitable summer habitat.

After 2 consecutive nights of netting at the same location without capturing target species, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

[30] We have no recommendations for reducing the minimum level of effort required to demonstrate probable absence for projects <123 acres in size. Detection probabilities and occupancy estimates were derived from past survey efforts that used the same acreage threshold (see Niver et al. 2014).

a) If no capture of IBAT(s), then no further summer surveys are recommended[31].

b) If capture of IBAT(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO(s).

Hibernating NLEB Range Mist-netting LOE:

Linear projects: a minimum of 4 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 10 net nights per 123 acres (0.5 km^2) of suitable summer habitat.

After 2 consecutive nights of netting at the same location without capturing target species, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of NLEB(s), then no further summer surveys are recommended.

b) If capture of NLEB(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO.

MIST-NETTING SURVEYS TO CAPTURE INDIANA AND/OR NORTHERN LONG- EARED BATS AFTER ACOUSTICS WERE USED AS P/A METHOD (PHASE 3)

If netting was not conducted as the P/A method, then netting may be conducted to capture and characterize (e.g., sex, age, reproductive condition) the IBAT and/or NLEB (documented through the Phase 2 acoustic P/A survey) present in an area and to facilitate radio-tracking (Phase 4) efforts. We encourage working with the FO(s) to develop Phase 3 netting plans based on best available information (e.g., positive acoustic locations). There are no minimum requirements for this phase as this is not a P/A phase.

a) If no IBAT and/or NLEB are captured, then coordinate with the USFWS FO.
b) If IBAT or NLEB are captured, then proceed to **Phase 4** as previously decided in coordination with the FO(s).

NET PLACEMENT

Indiana and Northern long-eared bats typically forage in habitats that do not completely overlap (see species-specific habitat definitions in Appendix A) therefore, net placement should reflect these differences when targeting both species. Net placement along potential travel corridors (e.g., streams, logging trails, roads) as well as other edge habitats (e.g., other water sources, field edges) have traditionally been the most common habitats sampled due to their ease of access. However, non-traditional net placement in interior forest habitats may also be productive, especially for NLEB and IBAT (Carroll et al. 2002). Because the best survey sites for capturing bats may fall outside of a project footprint, the surveyor and project proponent should coordinate with the appropriate USFWS FO(s) to establish a project-specific maximum net placement distance from the centerline or project boundary

[31] NOTE: For Phase 2 P/A Surveys, wherever the phrase "no further summer surveys are recommended" occurs within this document, the USFWS FO(s) is in affect assuming probable absence of IBAT and/or NLEB during the summer.

prior to initiating surveys.

When sampling traditional travel corridors with defined edges, place net-sets approximately perpendicular to the edge and, ideally within bends or curves in the corridor that reduces bat reaction time to avoid capture. Net-sets should fill the corridor from side to side, extending beyond the corridor boundaries and into the interior forest to prevent bats from flying along the edges of the corridor and avoiding the nets, and from water (or ground) level up to the overhanging canopy. Surveyed corridors must have overhanging branches, most often within 9 m of the ground, that force bats to fly downward and into the nets. Net-sets of varying widths and heights may be used as the situation dictates. A typical net-set is at least 5 m to 9 m high consisting of two or more nets stacked on top one another (without gaps) and from 6 m to 18 m wide. If netting over water, ensure there is enough space between the net and the water so that captured bats will not get wet. Justification for placing net-sets perpendicular to a forest edge, or any net-set, without overhanging vegetation (i.e., no funneling effect) should be specifically provided in the survey report or ideally discussed with the FO(s) prior to sampling.

Because a) NLEB is a clutter-adapted gleaning species (see definition of suitable summer habitat in Appendix A) or b) a project area may not have well-defined travel corridors, surveyors may sample more non-traditional habitat types (e.g., small forest openings, ponds, interior forest). The typical equipment and placement described in the section above may be inadequate when netting for IBAT and NLEB in these non-traditional locations, where a travel corridor is less obvious. This would require innovation on the part of the surveyor (see Humphrey et al. 1968). For example, net placement in interior forests should be a minimum of 50 m from edge habitats and should represent a variety of understory cover and canopy closure (Carroll et al. 2002). Ponds and large water-filled road ruts can be productive places to net when other water sources are limited. See Kiser and MacGregor (2005) for additional discussion about net placement.

Mist-net sets should be spaced a minimum of 30 m apart, surveyors should attempt to evenly distribute net-sets throughout suitable habitat and not over-sample individual habitat features (e.g., three or more mist-net sets on a single travel corridor or stream). Surveyors must provide written justification in their report if net-sets were not distributed throughout suitable habitat (i.e., why were they clumped?). Surveys conducted for northern long-eared bat should include both traditional and non-traditional (as described above) net placements within suitable habitat when present. Net-sets can be repeatedly sampled throughout the project, but no more than 2 nights at a single location is recommended. In addition, changing locations within a project area may improve capture success (see Robbins et al. 2008; Winhold and Kurta 2008). Photo-document placement of net-sets.

SURVEY PERIOD

The survey period for each net shall begin at sunset[32] and continue for at least 5 hours (longer survey periods may also improve success).

CHECKING NETS

Each net-set should be checked every 10 minutes (Gannon et al. 2007). If surveyors monitor nets continuously, take care to minimize noise, lights, and movement near the nets. Monitoring the net-sets continuously with a bat detector (ideally using earphones to avoid alerting bats) can be beneficial: (a) bats can be detected immediately when they are captured, (b) prompt removal from the net decreases stress on the bat and potential for the bat to escape (MacCarthy et al. 2006), and (c) monitoring with a bat detector also allows the biologist to assess the effectiveness of each net placement (i.e., if bats are active near the

[32] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: https://sunrise-sunset.org.

net set but avoiding capture), which may allow for adjustments that will increase netting success on subsequent nights. There should be no other disturbance near the nets, other than to check nets and remove bats. Biologists should be prepared to cut the net if a bat is severely entangled and cannot be safely extracted within 3 or 4 minutes (CCAC 2003; Kunz et al. 2009). Capture and handling are stressful for bats. Emphasis should be on minimizing handling and holding bats to as short a time as possible to achieve field study objectives. Indiana and/or northern long-eared bats should not be held for more than 30 minutes after capture, unless the individual is targeted for radio-tracking. Bats targeted for radio-tracking should be released as quickly as possible, but no longer than 30 minutes[33] after capture, or as allowed in federal and state permits. See Kunz and Kurta (1988) for general recommendations for holding bats.

WEATHER, LIGHTING, AND OTHER ENVIRONMENTAL CONDITIONS

Severe weather adversely affects capture of bats. Some IBAT and NLEBs may remain active despite inclement weather and may still be captured while others in the same area become inactive. Therefore, negative surveys combined with any of the following weather conditions throughout all or most of a sampling period are likely to require an additional night of mist-netting[34]: (a) temperatures that fall below 50°F (10°C)[35]; (b) precipitation, including rain and/or heavy fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/seconds; 3 on Beaufort scale) for 30 or more minutes.

NOTE: Provided that nets are not dripping wet, surveyors can resume netting to meet the minimum 5-hour requirement after short periods of adverse weather. If nets are under good cover, light rain may not alter bat behavior. However, if no bats are being captured during marginal weather, coordinate with the USFWS FO(s).

It is typically best to place net sets under the canopy where they are out of moonlight, particularly when the moon is half-full or greater. Net sets illuminated by artificial light sources should also be avoided. The shining of lights, and noise should be kept to a minimum with no smoking around the survey sites. In addition, the use of radios, campfires, running vehicles, punk sticks, citronella candles and other disturbances will not be permitted within 300 feet of mist nets (or acoustic detectors) during surveys.

DOCUMENTATION OF INDIANA AND/OR NORTHERN LONG-EARED BAT CAPTURES

If an IBAT and/or NLEB is captured during mist-netting, protocols for radio-tracking and emergence survey requirements, as provided in Appendix D and E, respectively, should be followed. In addition, the appropriate USFWS FO(s) must be notified of the capture within 48 hours (or in accordance with permit conditions), and the sex and reproductive condition of the bat and GPS coordinates of the capture site should be provided. Ensure GPS coordinates are recorded for each individual net set on datasheets.

Several species of bats from the genus *Myotis* share common features which can make identification difficult; IBATs and little brown bats (*Myotis lucifugus)* can be particularly difficult to distinguish. Photo documentation of all bats captured and identified as IBAT and/or NLEB and the first 10 little brown bats

[33] Current standard federal Section 10 bat permit conditions require prior written approval from the Field Supervisor in the USFWS FO(s) if capture times may exceed 30 minutes.

[34] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays because of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15. If tracking is proposed, surveys should be scheduled so that tracking is concluded prior to August 15.

[35] Overnight survey temperatures may be lower in northern portions of the NLEB range, coordinate with the local USFWS FO in the northern portions of the range for any variation in temperature requirements.

per project are requested to verify the identifications made in the field.

Photo documentation should include diagnostic characteristics:

- a ¾-view of face showing ear, tragus, and muzzle
- view of calcar showing presence/absence of keel
- a transverse view of toes showing extent of toe hairs

Consider taking short video clips of the bat and its diagnostic features, as videos may also be helpful to later confirm bat identification. If a bat from the genus *Myotis* is captured during mist-netting that cannot be readily identified to the species level, then species verification may be attempted through fecal DNA analysis. Collect one or more fecal pellets (i.e., guano) from the bat in question by placing it temporarily in a holding bag (15 minutes is usually sufficient, no more than 30 minutes is recommended). The pellet (or pellets) collected should be placed in a small vial (e.g., 1.5 ml) with silica gel desiccant; pellets from each individual bat should be stored in separate vials and out of direct light. Fees charged by independent laboratories for sequencing fecal DNA samples is generally inexpensive (approx. $50 per guano sample).

BAT BANDING

Bat banding (i.e. application of any type of band to the forearm of a bat) should be limited to well-designed projects with clear objectives addressing a research question of significant importance to the species' conservation and coordinated with the appropriate USFWS FO and state agency. Bat banding should be limited to efforts that are committed to returning to the capture site or a location where marked bats have a high likelihood of being recovered (e.g., hibernacula), thus enabling meaningful data collection from marked individuals. If approved to band bats, surveyors are required to demonstrate that banding is approved on their USFWS 10(a)1(A) Recovery Permit and adhere to any State permit conditions.

Banding pliers are required for applying bands to bat forearms; securing bands by pinching a band down with fingertips is not permitted. Banding pliers should be maintained at the correct calibration to ensure proper function. Surveyors must carry needle nose pliers that can be used to safely remove a band that was either improperly placed or is causing distress to a bat.

Bats must be banded with bands that are appropriate in size for the species. TCB should receive 2.4 mm aluminum metal-lipped bands and IBAT and NLEB should receive 2.9 mm bands. Males should be banded on the right forearm and females on their left. Proposals that deviate from these standards must include written justification in the site-specific Study Plan submitted to the USFWS FO for approval. All band information needs to be included in the mist net survey report and as part of the annual Section 10 reporting spreadsheet.

Any recovered bats with bands on their forearms should be assessed for injury and their condition noted on the mist net data form, and as part of the USFWS 10(a)1(A) Permit reporting spreadsheet in the comment section of the Capture Data Worksheet. Surveyor should note (1) type of injury and (2) whether band was left on or removed. Photos and/or videos of the site of injury should be included with the report. If known, duration from time the band was applied should also be noted. Bands should be cautiously removed when bats show signs of injury, except in situations where band removal may result in additional trauma or fatality.

SUBMISSION OF MIST-NETTING RESULTS

Provide results of netting surveys to the appropriate USFWS FO(s) in accordance with previously agreed

upon[36] timeframes and formats[37]. If IBAT and/or NLEB are captured, this report should also include the results of subsequent radio-tracking and emergence counts. Reports should include the following:

1. Copy of prior phase reports (if not previously provided).
2. Explanation of any modifications from original survey plan (e.g., altered net locations)[38]
3. Description of net locations (including site diagrams), net sets (include net heights), survey dates, duration of surveys, weather conditions, and a summary of findings.
4. Map identifying netting site locations and information regarding net sets, including lat/long or UTM, individual net placement, net spacing (i.e., include mist-netting equipment in photographs of net locations), and adequate justification if net sets are not evenly distributed across suitable habitat within the project area.
5. Full names of mist-netting personnel attending each mist-net site during an operation, including the federally permitted/qualified biologist present at each mist-net site. Indicate on the field data sheet the full name of person who identified bats each night at each site.
6. Legible copies of all original mist-netting datasheets (see example datasheet below) and a summary table with information on all bats captured during the survey including, but not limited to: capture site, date of capture, time of capture, sex, reproductive condition, age, weight, right forearm measurement, band number and type (if applicable), and Reichard's wing damage index score (Reichard and Kunz. 2009).
7. Photographs of all net sets, as well as **all** IBAT and NLEB and the first 10 little brown bats captured from each project, so that the placement of netting equipment and identification of species can be verified. Photographs of bats should include all diagnostic characteristics that resulted in the identification of the bat to the species level.
8. Any other information requested by the local USFWS FO(s) related to the project.

REFERENCES

Arndt, R.J. and B.A. Schaetz. 2009. A tale of two deniers: nylon versus polyester mist nets. Bat Research News 50(3):57.

Carroll, S.K., T.C. Carter, and G.A. Feldhamer. 2002. Placement of nets for bats: effects on perceived fauna. Southeastern Naturalist 1:193-198.

Canadian Council on Animal Care (CCAC). 2003. CCAC species-specific recommendations on bats. 9pp.

Gannon, W.L., R.S. Sikes, and the Animal Care and Use Committee of the American Society of Mammologists. 2007. Guidelines of the American Society of Mammologists for the use of wild mammals in research. Journal of Mammalogy 88:809-823.

Gardner, J. E., J.D. Garner, and J.E. Hofmann. 1989. A portable mist-netting system for capturing bats

[36] As discussed in the Introduction, we encourage coordination with USFWS FO(s) prior to implementation of any surveys to ensure that all parties agree upon the need for surveys, the methods proposed, and the decisions from various survey results.

[37] In 2016, the USFWS implemented a new standardized approach for reporting of bat survey data. In addition to a traditional written report, federal permit holders are now required to submit their survey data using the standardized permit reporting spreadsheets available on the USFWS website provided in the intro.

[38] If the USFWS previously agreed upon the study plan, we need to understand whether the revised work still accomplished the agreed upon methods.

with emphasis on *Myotis sodalis* (Indiana bat). Bat Research News 30:1-8.

Ellison, Laura E. "Summary and Analysis of the U.S. Government Bat Banding Program." U.S. Geological Survey, 2008. http://pubs.usgs.gov/of/2008/1363/pdf/OF08-1363_508.pdf.

Humphrey, P.S., D. Bridge, and T.E. Lovejoy. 1968. A technique for mist-netting in the forest canopy. Bird-Banding 39(1): 43-50.

Kiser, J.D. and J.R. MacGregor. 2005. Indiana bat (*Myotis sodalis*) mist net surveys for coal mining activities. Pp. 169-172 *in* K.C. Vories and A. Harrington (eds.), The Proceedings of the Indiana bat and coal mining: a technical interactive forum Office of Surface Mining, U.S. Department of the Interior, Alton, IL.

Kunz, T.H. and A. Kurta. 1988. Capture methods and holding devices. Pp. 1-29 *in* T.H. Kunz (ed.), Ecological and behavioral methods for the study of bats. Smithsonian Institution Press, Washington, D.C.

Kunz, T.H., R. Hodgkison, and C.D. Weise. 2009. Methods of capturing and handling bats. Pp. 3-35 *in* T.H. Kunz and S. Parsons (eds.), Ecological and behavioral methods for the study of bats, second edition. The Johns Hopkins University Press, Baltimore, Maryland.

MacCarthy, K.A., T.C. Carter, B.J. Steffen, and G.A. Feldhamer. 2006. Efficacy of the mist-net protocol for Indiana bats: A video analysis. Northeastern Naturalist 13:25-28.

Reichard, J.D., and T.H. Kunz. 2009. White-nose syndrome inflicts lasting injuries to the wings of little brown myotis (Myotis lucifugus). Acta Chiropterologica 11: 457-464.

Robbins, L.W., K.L. Murray, and P.M. McKenzie. 2008. Evaluating the effectiveness of the standard mist-netting protocol for the endangered Indiana bat (*Myotis sodalis*). Northeastern Naturalist 15:275-282.

U.S. Fish and Wildlife Service (USFWS). 2015. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat With 4(d) Rule; Final Rule and Interim Rule. Federal Register 80(63): 17974–18033.

Winhold, L. and A. Kurta. 2008. Netting surveys for bats in the Northeast: differences associated with habitat, duration of netting, and use of consecutive nights. Northeastern Naturalist 15:263-274.

Sample Data Sheets for Bat Surveys

Site No.				Project/Firm:								Date:
Location:												
County:				State:	Quad:							Quadrant:
Lat/Long (DMS):	N			W		Zone:						Surveyors:

#	Time	Species	Age	Sex	Repro. Cond.*	RFA (mm)	Mass (g)	Net/ Ht	Guano/ Hair	Wing Score	Band # Type
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
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22											
23											
24											
25											
26											
27											
28											
29											
30											

Moon Phase:		%
	Rise	Set
Moon:		
Sun:		

Time	Temp	Sky	Wind	# Bats
Avg				

Sky Code	
0	Clear
1	Few Clouds
2	Partly Cloudy
3	Cloudy or overcast
4	Smoke or fog
5	Drizzle or light rain
6	Thunderstorm

Beauford Wind Code	
0	Calm (0 mph)
1	Light wind (1-3 mph)
2	Light breeze (4-7 mph)
3	Gentle breeze (8-12 mph)
4	Moderate breeze (13-18 mph)

*Repro. Cond (Reproductive Condition): (P) pregnant; (L) lactating; (PL) post-lactating; (NR) non-reproductive, (TD) testes descended

Sample Data Sheets for Bat Surveys

Net Site Diagram	Dominant Vegetation
	1
	2
	3
	4
	5

Net Site(s) by Habitat				
Habitat	A	B	C	
River				
Stream				
Pond				
Road Rut				
Corridor				
Cave/mine				
Total				

No. of Poles X Net length				
A	=		X	
B	=		X	
C	=		X	
D	=		X	

Other Species:

Comments:

APPENDIX C: PHASE 2 ACOUSTIC SURVEYS

SUMMER ACOUSTIC SURVEY SEASON: May 15 – August 15[39]

PERSONNEL[40]

Overall: Acoustic surveyors should have either completed one or more of the available bat acoustic courses/workshops put forth by various entities (e.g., Bat Conservation & Management, Bat Survey Solutions, Titley/AnaBat, Wildlife Acoustics, USFWS, Vesper Bat Detection Services) or be able to show similar on-the-job or academic experience. NOTE: Appendix C is intended for use within the IBAT range and/or NLEB hibernating range (see Figure 1); also refer to Appendix J for additional guidance on conducting acoustic surveys in the year-round active range of the NLEB.

Detector Deployment: Acoustic surveyors should have a working knowledge of the acoustic equipment and IBAT and/or NLEB ecology. Surveyors should be able to identify appropriate detector placement sites and establish those sites in the areas that are most suitable for recording high-quality IBAT and/or NLEB calls. Thus, it is highly recommended that all potential acoustic surveyors attend appropriate training and have experience in the proper placement of their field equipment.

Acoustic Analysis: Acoustic surveyors should have a working knowledge of the approved acoustic analysis programs, and any candidate acoustic analysis programs used for surveys. Thus, it is highly recommended that all potential acoustic surveyors attend appropriate training and have experience in the analysis of acoustic recordings.

Qualitative Analysis: Individuals qualified to conduct qualitative analysis of acoustic bat calls typically have experience: (1) gathering known calls as this provides a valuable resource in understanding how bat calls change and the variation present in them; (2) identifying bat calls recorded in numerous habitat types; (3) familiarity with the species likely to be encountered within the project area; and (4) individuals must have multiple years of experience and must have stayed current with qualitative ID skills. A resume (or similar documentation) must be submitted along with final acoustic survey reports for anyone making final qualitative identifications.

NOTE: The acoustic survey protocol may also be used for determining P/A of TCBs using the NLEB LOE for the 2024 field season; however, at this time, qualitative analysis is necessary for linear projects when using an approved version of Kaleidoscope Pro if the MLE is > 0.05 for all site-nights and 10 or more passes are auto-classified as potentially belonging to TCB at any site-night to reduce risk of false negatives. If you choose not to manually vet calls meeting these criteria, then you should assume presence of TCB for the project.

COORDINATION WITH USFWS FIELD OFFICES (FOs)

If not already required by federal permit, we recommend that applicants submit a draft study plan for all survey phases to the USFWS FO(s) for review and approval. Study plans should include a map/aerial photo identifying the proposed project area boundaries, suitable bat habitats and acreages within the project area, the proposed number and tentative locations of acoustic monitoring sites, and the identification of the approved (or candidate[41]) acoustic software program(s) (and version #) used for

[39] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.
[40] Coordinate with your local FO regarding any state-specific requirements.
[41] At this time, all acoustic software programs are considered 'candidate' for locations identified in Figure 2.

analysis of calls for the specific project. If a single software program is used for analysis, surveyors will not be allowed to switch programs from what was originally identified in their final study plan.

DETECTOR AND MICROPHONE REQUIRED CHARACTERISTICS

Full-spectrum (FS) and/or zero-crossing (ZC) detectors are suitable for use in this survey protocol, however, FS is preferred given that FS call files capture more detail and can be converted to ZC for analysis if desired. Detectors used during surveys must be able to retain detailed information that is important for distinguishing between bat species with overlapping echolocation characteristics (e.g. high frequency component of the call). Multiple detectors capable of recording high-quality data are available for commercial use (e.g. Anabat Swift, Wildlife Acoustics SM4BatFS, Pettersson D500×). Until further refinements and testing of the AudioMoth detector (Open Acoustic Devices) take place, use of this detector for P/A surveys is not acceptable (Starbuck et al. 2022; Kunberger and Long 2023).

Directional, hemispherical, and omnidirectional microphones are acceptable for acoustic surveys. The use of external microphones on an extension cable is the preferred deployment as it further limits degradation of call quality. Recording without directional horns on hemispherical and omnidirectional microphones is preferred as the addition of these systems may result in some signal degradation and directional microphones are commercially available.

Use recommended manufacturer detector settings for conducting IBAT and/or NLEB P/A surveys unless otherwise noted on the Service's IBAT Summer Survey Guidance webpage. For ZC detectors (as well as when converting WAV files to ZC files), the data-division ratio must be set to 8.

ACOUSTIC SAMPLING PROTOCOL

Detector/Microphone Placement

IBAT and NLEB typically forage in habitats that do not completely overlap (see species-specific habitat definitions in Appendix A); therefore, acoustic sites should reflect these differences when targeting both species. When sampling for multiple species, surveyors are expected to understand which sites are more likely to detect each species of interest and avoid oversampling habitat that only one species is likely to use. Early coordination with the FOs is highly encouraged to ensure the sampling methods are suitable. For instance, NLEB is a clutter-adapted gleaning species (see definition of suitable summer habitat in Appendix A), and therefore acoustic sites should target interior forests and forested riparian streams representing a variety of understory cover and canopy closure (Carroll et al. 2002). Ponds and large water-filled road ruts can be productive places to deploy detectors when other water sources are limited. Detectors placed on forest edges are less likely to detect NLEB.

Detector/Microphone placement is critical to the successful isolation of high-quality bat call sequences for later analysis. The following locations are likely to be suitable sites for detectors/microphones to sample for IBAT and/or NLEB, including, but not limited to: (a) forest-canopy openings; (b) near water sources; (c) wooded fence lines that are adjacent to large openings or connect two larger blocks of suitable habitat; (d) blocks of recently logged forest where some potential roost trees remain; (e) road and/or stream corridors with open tree canopies or canopy height of more than 33 feet (10 meters); and (f) woodland edges (Britzke et al. 2010). Of equal importance to acoustic site selection is the surveyor's working knowledge of the sampling volume and area of highest sensitivity within the zone of detection around a given microphone, which helps to ensure that detector placement as well as microphone selection and orientation are best suited for a particular site to ensure the detection zone is free of clutter. Detection distance, placement (e.g., location, orientation, height of microphone), and specific features (e.g., vegetation, water, and other obstructions) at the sample site should dictate whether a directional,

hemispherical, or omnidirectional microphone is used. If detectors/microphones are placed in unsuitable locations, effective data analysis may be impossible, and the results of the sampling effort will likely be invalid.

Many features (e.g., vegetation, water, wind turbines, high-tensile powerlines, micro-wave towers) can obstruct and reflect call sequences recorded in the field and thereby reduce the surveyor's ability to record high-quality bat call sequences. The following recommendations are provided to aid surveyors in their selection of acoustic sites (also see Chenger and Tyburec 2014). If surveyors choose acoustic sites outside of these recommendations, then adequate justification for doing so should be provided with the acoustic survey report provided to the USFWS FO(s); otherwise, results from these sites will not be accepted. Surveyors should deploy microphones: (a) at least 10 feet (3 meters) in any direction from vegetation or other obstructions (Hayes 2000; Weller and Zabel 2002; Chenger and Tyburec 2014, Fraser et al. 2020); (b) in areas without, or with minimal[42], vegetation within 100 feet (30 meters) of highly directional microphones or 33 feet (10 meters) from other microphones; (c) parallel to woodland edges; and (d) at least 49 feet (15 meters) from known or suitable roosts[43] (e.g., trees/snags, buildings, bridges, bat houses, cave or mine portal entrances).

Elevating a detector greater than 3 meters above ground level (AGL) vegetation may dramatically improve recording quality. Microphones can be attached horizontally to a pole to listen out into flight space, rather than just listening up from the ground. This will serve to increase the volume of airspace sampled and avoid the distortion effect of recording near the ground. However, the relationship between the zone of detection and the vegetation/clutter, not the placement of the detector is the most important consideration during site selection. Because NLEBs are a clutter- adapted gleaning species (see definition of suitable summer habitat in Appendix A), placement of detectors should be as close to clutter as possible but not in clutter.

Surveyors should distribute acoustic sites throughout the project area or adjacent habitats. In most cases, acoustic sites should be at least 656 feet (200 meters) apart. If closer spacing is determined to be necessary or beneficial (e.g., multiple suitable habitats and acoustic sites immediately adjacent to each other), sufficient justification must be provided in the acoustic study plan and survey report submitted to USFWS FO(s).

Verification of Deployment Location

It is recommended to temporarily attach GPS units to each detector (according to manufacturer's instructions) to directly record accurate location coordinates for each acoustic site that is paired with the acoustic data files. Regardless of technique used, accurate GPS coordinates must be generated and reported for each acoustic detector location.

Verification of Proper Functioning

It is highly recommended that surveyors ensure acoustic detectors are functioning properly through a periodic verification of performance to factory specifications (a service currently offered or in development by several manufacturers). It may be possible that independent service bureaus would be willing to perform this service, providing that a standard test/adjustment procedure can be developed.

[42] If necessary, surveyors can remove small amounts of vegetation (e.g., small limbs, saplings) from the estimated detection zone at a site, much like what is done while setting up mist-nets. Deployment of detectors/microphones in closed-canopy locations that typically are good for mist-netting are acceptable as long as the area sampled below the canopy does not restrict the ability of the equipment's detection zone to record high-quality calls (i.e., vegetation is outside of the detection zone).

[43] If the surveyor discovers a potential roost and wishes to document bat use, refer to Appendix E for guidance on conducting emergence surveys and contact the USFWS FO(s).

It is also recommended to ensure equipment is working during set-up in the field. This can be done simply by producing ultrasound (e.g., finger rubs, calibrator, or follow the equipment manufacturer's testing recommendations) in front of the microphone at survey start and survey finish. These tests document that the equipment was working when deployed and when picked up (and by assumption throughout the entire period). Detector field settings (e.g., sensitivity, frequency, etc.) should follow the recommendations provided by the manufacturer. Surveyors should also save files produced by detectors (e.g., log files, status files, sensor files) as an excellent way to provide documentation when equipment was functioning within the survey period. Many types of detectors allow for setting timers that initiate and end recording sessions. This saves battery life as well as reducing the number of extraneous noise files recorded. However, if the units are visited when the timer is on (i.e., unit is in standby mode), the surveyor cannot verify that the unit is functioning properly. This is particularly important in areas where no bat activity is recorded for the entire night or during the last portion of the night. In these cases, if the surveyor cannot demonstrate that the detector was indeed functioning properly throughout the survey period, then the site will need to be re-sampled, unless adequate justification can be provided to the USFWS FO(s).

Selection of acoustic sites is similarly important. Suitable set-up of the equipment should result in high-quality call sequences that are adequate for species identification. Nights of sampling at individual sites that produce no bat calls may need to be re-sampled unless adequate justification (e.g., areas with significant bat population declines due to WNS) can be provided to the USFWS FO(s). Modifications of the equipment (e.g., changing the orientation and/or microphone type) at the same location on subsequent nights may improve quantity and quality of call sequences recorded, which can be determined through daily data downloads. If modifications of the equipment do not improve call identification, then the detectors will need to be moved to a new location.

Orientation

Detectors deployed with directional microphones should be aimed to sample the majority of the identified flight path/zone to maximize the number of call pulses recorded from individual bats. Omnidirectional microphones deployed on a pole in the center of the flight path/zone should be oriented horizontally. In some circumstances, it might be desirable to aim a directional microphone straight up in smaller forest openings. As always, the goal is to sample as large a volume of likely bat flight space as possible while minimizing clutter. Hemispherical microphones should be aimed vertically, creating a dome-like detection field. Hemispherical microphones are best suited for open areas where deploying at heights greater than 3 meters AGL is problematic because of the lack of structure to hide the microphone and prevent it from becoming a novel item of interest to bats. Vertical orientation, however, precludes the use of weatherproofing for protection of the microphone. Once acoustic sites are identified, photographs documenting the orientation, detection zone (i.e., "what the detector is sampling"), and relative position of the microphone should be taken for later submittal to the USFWS FO(s) as part of the acoustic survey report (See Submission of Acoustic Survey Results for additional description).

Weather Conditions

If any of the following weather conditions exist at a survey site during acoustic sampling, note the time and duration of such conditions, and repeat the acoustic sampling effort for that night[44]: (a) temperatures fall below 50°F (10°C)[45] during the first 5 hours of survey period; (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale) for 30 minutes or more during the first 5 hours of the survey period. At a minimum, nightly weather conditions for survey sites should be checked using the nearest NOAA National Weather Service station and

[44] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

[45] Overnight survey temperatures may be lower in northern portion of the NLEB range, coordinate with the local USFWS FO in the northern portion of the range for any variation in temperature requirements.

summarized in the survey reports.

Weatherproofing

Depending on the brand and model, bat detectors may or may not be weatherproof when delivered from the factory or supplier. Recording without after-market weatherproofing is preferred as the addition of these systems may result in some signal degradation. The decision to weatherproof detectors or not should be determined nightly based on the likelihood of precipitation in the survey area. If necessary, detectors should be placed in after-market weatherproof containers and an external microphone, attached by an extension cable should be deployed greater than 3 meters AGL.

For directional microphones, the use of a polyvinyl chloride (PVC) tube[46], generally, in the form of a 45-degree elbow the same diameter as the microphone (Britzke et al. 2010) is acceptable, if the situation requires the use of after-market weatherproofing. The microphone should be placed facing the open end of the elbow and as close to the opening as is consistent with the aim of weatherproofing. The microphone should be pointing at an angle below horizontal so water will not collect in it. Corben & Livengood (2014) showed that the direction of greatest sensitivity of tubes like this varies greatly depending on details of the specific tube shape and the exact position of the microphone. Often the greatest sensitivity will be pointed up at a substantial angle (up to 45 degrees) above horizontal when the microphone itself is pointing 45 degrees below horizontal. Users should be aware of the characteristics of the setup they use so they can know what region is being sampled. Again, the preferred option for weatherproofing detectors is to detach the microphone from the detector so that the detector can be placed in a weatherproof container, but the microphone (tethered by a cable) remains unobstructed.

Other after-market weatherproofing systems may become available and approved by the USFWS provided they show that call quality and the number of calls recorded are comparable to those without weatherproofing.

MINIMUM LEVEL OF EFFORT

The level of acoustic survey effort required for a project will be dependent upon the overall acreage of suitable habitat that may be impacted by the action (directly or indirectly). To determine the acoustic survey effort, quantify the amount of suitable summer habitat within the project area.

NOTE: for projects where impacts other than tree removal are likely (e.g., collision), ensure that P/A surveys are designed to cover all suitable habitat within the entire project area and NOT just the locations where tree removal is planned.

IBAT Range-wide Acoustic LOE (See Figure 1 and Table 2)

Linear projects: a minimum of 4 detector nights per km (0.6 miles) of suitable summer habitat (See Appendix F).

At least 1 detector location for at least 2 calendar nights (can sample the same location or move within the km site).

Non-linear projects: a minimum of 10 detector nights per 123 acres (0.5 km^2) of suitable summer habitat.

At least 2 detector locations per 123-acre "site" shall be sampled over the course of at least 2 calendar nights (may be consecutive) until at least 10 detector nights has been completed.

[46] The PVC option has only been tested with AnaBat SD1/SD2 detectors and directional microphones. It may not perform as well with other detector microphone combinations.

NLEB Range-wide Acoustic LOE (See Figure 1 and Table 2)

Linear projects: a minimum of 4 detector nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

At least 1 detector location for at least 2 calendar nights (can sample the same location or move within the km site).

Non-linear projects: a minimum of 14 detector nights per 123 acres (0.5 km^2) of suitable summer habitat.

At least 2 detector locations per 123-acre "site" shall be sampled over the course of at least 2 calendar nights (may be consecutive) until at least 14 detector nights has been completed.

The acoustic sampling period for each site must begin at sunset[47] and ends at sunrise each night of sampling.

ANALYSIS OF RECORDED ECHOLOCATION CALLS

Step 5. Optional coarse screening - for high frequency (HF) or myotid calls (depending on available H/L frequency filters) or Proceed to Step 6.

a) If no positive detection of HF calls[48] (≥35 kHz) or myotid calls, no further summer/active season surveys recommended.

b) If positive detection of HF or myotid calls, then
   i) proceed to Step 6 for further acoustic analysis; **OR**
   ii) assume presence of IBAT and/or NLEB and coordinate with the USFWS FO(s); **OR**
   iii) assume presence and proceed to **Phase 3**.

Step 6. Conduct Automated Acoustic Analyses for each site that had HF or Myotid calls from Step 5 or ALL sites and ALL calls if Step 5 was not conducted.

Use **one or more** of the currently available 'approved' acoustic bat ID programs[49] (use most current approved software versions available and manufacturer's recommended settings for IBAT and/or NLEB P/A surveys) as previously identified in your Phase 2 study plan.

'Candidate' programs are not yet approved by USFWS for stand-alone use for P/A surveys but may be used in conjunction with one or more of the approved programs. At this time, no acoustic bat ID programs are 'approved' for many western states (Figure 2). Two or more of the currently available 'candidate' programs must be used for surveys conducted in these locations (always use most recent versions of software programs).

Include your plans for which specific software program(s) you will use in your survey study plan and submit for USFWS FO(s) review prior to conducting surveys. Beginning with acoustic data

[47] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: https://sunrise-sunset.org

[48] HF calls are defined as individual call pulses whose minimum frequency is ≥35 kHz.

[49] Approved and candidate programs are listed on the USFWS website provided in the intro; note all programs are considered 'candidate' for areas identified in Figure 2.

from night one at each acoustic site, run each night's data for each site through your chosen ID program(s). Review results by site by night from each acoustic ID program used[50].

a) If IBAT and NLEB presence is considered unlikely by the approved and candidate program(s) used in analysis, then no further summer surveys recommended.

b) If IBAT and/or NLEB presence is considered likely at one or more sites on one or more nights by any approved or candidate program(s) used in analysis, then

i) proceed to Step 7 for qualitative ID; **OR**
ii) assume presence of IBAT and/or NLEB and coordinate with the USFWS FO(s); **OR**
iii) assume presence and proceed to **Phase 3**.

Step 7. Conduct Qualitative Analysis of Calls.

At a minimum, for each detector site-night a program identified IBAT and/or NLEB presence likely (i.e., P<0.05), review all HF (i.e., ≥35 kHz) call files (regardless of MLE value and including no ID files) from that site-night. Qualitative analysis (i.e., manual vetting) must also include and present within a written report a comparison of the results of each acoustic ID program by site and night (see Reporting Requirements below).

a) If no visual confirmation of IBAT and NLEB, then no further summer/active season surveys recommended[51].

b) If visual confirmation of IBAT and/or NLEB, then

i) assume presence of IBAT and/or NLEB and coordinate with the USFWS FO(s); **OR**
ii) assume presence and proceed to **Phase 3**.

SUBMISSION OF ACOUSTIC SURVEY RESULTS

NOTE: All originally recorded (ZC or FS) data MUST be maintained for a period of 7 years and be made available to the USFWS FO(s), if requested. Failure to do so may result in invalidation of survey results. Results of acoustic survey data collected as part of P/A surveys must also be submitted annually in Section 10 reporting spreadsheets to the USFWS.

Provide results of acoustic surveys to the appropriate USFWS FO(s) within 30 days of completing the survey unless otherwise agreed upon with the local USFWS FO(s)[52]. Each acoustic survey report should include the following[53] (also, see checklist at end of this appendix):

[50] The approved acoustic identification programs all have implemented a maximum likelihood estimator (MLE) at this time. If the analysis of collected calls at a given site on a given night results in the presence of IBAT and/or NLEB with high levels of certainty (P<0.05), then select one of the options available in Step 6b.
[51] If you identify any suspected mis-identifications from programs, the Service will share those results with the software manufacturer(s) and the USGS to assist with future improvements and testing of software.
[52] As discussed in the Introduction, we encourage coordination with USFWS FO(s) prior to implementation of any surveys to ensure that all parties agree upon the need for surveys, the methods proposed, and the decisions from various survey results.
[53] In 2016, the USFWS implemented a new standardized approach for reporting of bat survey data. In addition to a traditional written report, federal permit holders are now required to submit their survey data using the standardized permit reporting spreadsheets available on the IBAT Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).

1. Copy of habitat assessment (if not previously provided)
2. Explanation of any modifications from original survey plan (e.g., altered site locations)[54]
3. Full names of all personnel conducting acoustic surveys, including those that selected acoustic sites and deployed detectors
4. Full name and resume of individual(s) conducting qualitative acoustic analyses (if applicable)
5. Description of acoustic monitoring sites, survey dates, duration of survey, weather conditions, and a summary of findings
6. Table with information on acoustic monitoring and resulting data, including but not limited to: detector GPS coordinates for each detector, survey dates, survey hours
7. Map identifying acoustic detector locations and a corresponding table including the GPS coordinates. Include arrow(s) showing direction(s) of microphone(s)
8. Photographs documenting the location of each detector, the orientation of the detector, and the intended sampling area. Include detector and something for scale (e.g., vehicle, person) in photographs of acoustic sites
9. Description of acoustic detector and microphone brand(s) and model(s) used, microphone type, use of weatherproofing, acoustic monitoring equipment settings (e.g., sensitivity, audio division ratios), deployment data (i.e., deployment site, habitat, date, time started, time stopped, orientation), and call analysis methods used
10. A description of how proper functioning of bat detectors was verified
11. Discussion of what software program(s) was/were used (including settings)
12. Acoustic detector log files renamed by site identifier
13. Acoustic analysis software program output/summary results by site by night (i.e., number of calls detected, species composition, MLE results, settings files)
14. Discussion for any site-nights with zero bat calls (were additional nights added? was detector functioning? was placement appropriate?)
15. If manual vetting was used, discussion of how this was done (e.g., what keys were used?)
16. If manual vetting was used, detailed analysis and results of any qualitative acoustic analysis conducted on those projects where a program(s) considered IBAT and/or NLEB presence likely, including justification for rejecting any program MLE results (if applicable). We recommend providing a table with each species ID from the program(s), suggested species ID from manual vetting, and rationale for any changes.
17. Any other information requested by the local USFWS FO(s) related to the project

[54] If the USFWS previously agreed upon the study plan, we need to understand whether the revised work still accomplished the agreed upon methods.

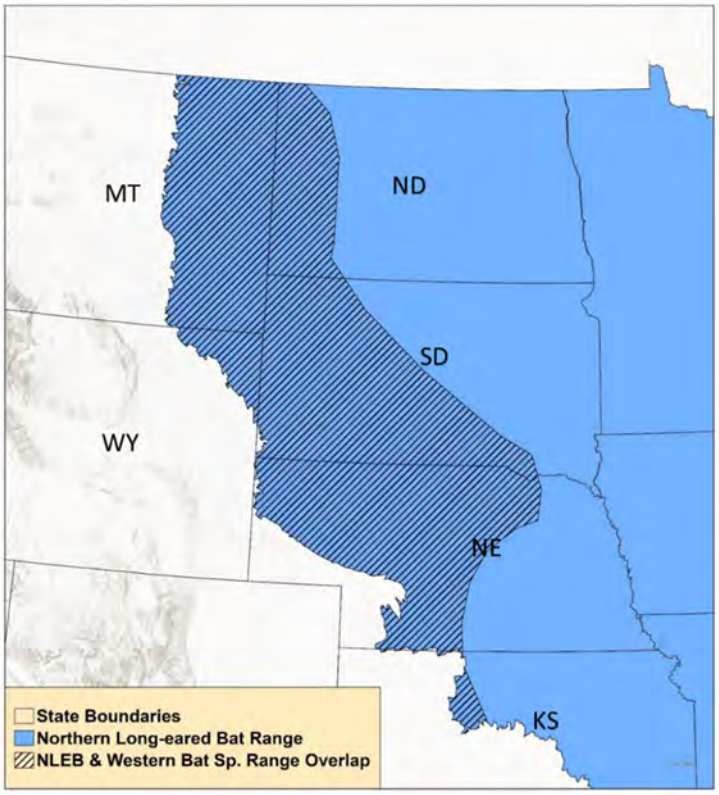


FIGURE 2. Portion of NLEB range overlapping with western bat species.

REFERENCES

Britzke, E.R, B.A. Slack, M.P. Armstrong, and S.C. Loeb. 2010. Effects of orientation and weatherproofing on the detection of bat echolocation calls. Journal of Fish and Wildlife Management 1(2):136-141.

Chenger, J.D. and J.D. Tyburec. 2014. Comparing bat detector deployments at different heights, in different orientations, and using different microphone types. Poster presentation at the Southeast Bat Diversity Network Meeting, Nacogdoches, TX. February 2014.

Corben, C., and K. Livengood. 2014. Weather protection for Anabat detectors. Poster presentation at the Southeastern Bat Diversity Network Meeting, Nacogdoches, TX. February 2014.

Fraser, E.E., A. Silvis, R.M. Brigham, and Z.J. Czenze, editors. 2020. Bat Echolocation Research: A handbook for planning and conducting acoustic studies. Second Edition. Bat Conservation International, Austin, Texas, USA. <https://www.batcon.org/wp-content/uploads/2020/09/2Bat_Echolocation_Research_2nd_Ed_20200925.pdf>.

Hayes, J.P. 2000. Assumption and practical considerations in the design and interpretation of echolocation-monitoring studies. Acta Chiropterologica 2:225-236.

Kunberger, J.M. and A.M. Long. 2023. A comparison of bat calls recorded by two acoustic monitors. Journal of Fish and Wildlife Management 14(1):171-178.

MacKenzie, D.I., and J.A. Royle. 2005. Designing occupancy studies: general advice and allocating survey effort. Journal of Applied Ecology 42:1105-1114.

Starbuck, C.A., L.M. SeSchepper, M.L. Hoggatt, and J.M. O'Keefe. 2023. Bioacoustics, DOI: https://www.tandfonline.com/doi/full/10.1080/09524622.2023.2290715

Weller, T.J., and C.J. Zabel. 2002. Variation in bat detections due to detector orientation in a forest. Wildlife Society Bulletin 30:922-930

General Checklist for Acoustic Surveys of Indiana and/or Northern Long-eared Bats

The following items should be documented and clearly presented within acoustic bat survey reports submitted to the Service

ACOUSTIC SURVEY INFO

- ☐ Project Name
- ☐ Site ID No./Name
- ☐ State and County
- ☐ Site Lat./Long. Coordinates (e.g., decimal degrees, NAD83)
- ☐ Approx. accuracy of Lat./Long. Coordinates
- ☐ Survey Date(s)
- ☐ Person who Selected Acoustic Site(s)
- ☐ Person who Deployed Detector(s)
- ☐ Detector Brand & Model
- ☐ Microphone Brand & Model
- ☐ Microphone Type: Directional/Hemispherical/Omnidirectional
- ☐ Type of Weatherproofing (if any)
- ☐ Microphone Height above Ground-level Vegetation(m)
- ☐ Distance from Nearest Vegetation or other Obstruction (m)(apart from veg. on ground)
- ☐ Horizontal Orientation of Microphone (1-360°)
- ☐ Vertical Orientation of Microphone (assuming 0° is parallel with horizon)
- ☐ Photographs of Detector Set-up at each Site
- ☐ Detector Settings and/or Log Files (all settings used for each brand/model of detector. For example, sensitivity, gain, data division, 16k high filter, sample rate, min/max duration, min trigger freq., trigger level, etc.)
- ☐ Survey Start Time (military)
- ☐ Survey End Time (military)
- ☐ Methods used to Field-test proper Functioning of Detector
- ☐ Were calls collected in Full Spectrum or Zero Crossing?
- ☐ Habitat Type and/or Feature Surveyed
- ☐ Weather Conditions during Survey Period

ACOUSTIC ANALYSIS INFO

- ☐ Program used to convert Full Spectrum to Zero Cross (if applicable)?
- ☐ Filter(s) used (if any) and parameters used (e.g., CFRead, noise, bug, etc.)
- ☐ Name of Service-approved Bat ID Software Program(s) and Version(s) used and Candidate program(s)(if used)
- ☐ Program Settings (if applicable):
  - o Min. # of pulses for species ID
  - o Min. # of pulses per group ID
  - o Min. discrim. prob. for species ID
  - o Other relevant settings affecting ID
  - o Suite of species/groups included in program analysis
- ☐ Table summarizing Number of Calls ID'd for each Species/Site/Night/Program (including MLE p-values)
- ☐ If Qualitative Analysis was conducted, include Number of Calls Confirmed through Qualitative ID for each Species/Site/Night
- ☐ Full Name of Person(s) who conducted Qualitative Analysis
- ☐ Additional Survey Reporting Requirements
- ☐ Acoustic Report Appendices:
  - o data sheets and maps,
  - o photographs of detector set-ups,
  - o computer screen captures of representative bat species identified during acoustic analyses, and
  - o resume(s) highlighting relevant qualifications of person(s) who conducted qualitative analysis (e.g., experience visually identifying *Myotis*, certificates of training, publications etc.)

APPENDIX D: PHASE 4 RADIO-TRACKING

PERSONNEL

Transmitter Attachment: A qualified biologist[55] who is experienced in handling IBAT and/or NLEB and attaching radio transmitters must perform transmitter attachments, as further explained in the protocol below.

Tracking: Biological technicians and/or a qualified biologist who is experienced in tracking transmittered bats must be present and actively involved in all tracking activities for IBAT and/or NLEB as further explained in the protocol below.

NOTE: The radio-tracking protocol may also be used for captured TCBs; however, radio-tracking of TCB should prioritize identification of the immediate roosting area of the transmittered bat given the difficulty in locating the bats exact roosting location.

METHODS

If one or more IBAT and/or NLEB are captured, the following radio-tracking protocols will be applicable:

1. Biologists should coordinate in advance with USFWS FO(s) regarding radio-tracking recommendations (e.g., number and distribution of transmitters, including prioritization of sex/age and maximum number per site) and whether foraging data would be beneficial to collect. Also, professional judgment should be used to determine whether attachment of transmitters could compromise the health of a bat. Since the maximum holding times for IBAT and/or NLEB targeted for radio-tracking is 30 minutes[56], or as allowed in federal and state permits, surveyors should be prepared to place transmitters on bats immediately following their capture to minimize holding times.

2. The radio transmitter, adhesive, and any other markings (e.g., wing bands) should weigh less than 5% of pre-attachment body weight (Aldridge and Brigham 1988, American Society of Mammalogists 1998) and must comply with any USFWS and state permits. In all cases, the lightest transmitters capable of the required task should be used, particularly with pregnant females and volant juveniles. With pregnant bats, biologists should always use the lightest transmitter possible but no more than 5% of their expected non-pregnant weight.

3. Proper application methods are paramount to the successful retention of an applied transmitter. Qualified biologists should apply commonly accepted methods. Examples of available resources include:

    - https://tccarterlab.files.wordpress.com/2017/10/application-of-transmitters-in-small-insectivorous-bats1.pdf

[55] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for IBAT and/or NLEB. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

[56] Current standard federal Section 10 bat permit conditions require prior written approval from the Field Supervisor in the USFWS FO(s) if capture times may exceed 30 minutes

- https://www.holohil.com/wp-content/uploads/2015/07/carter2009.pdf
- https://www.holohil.com/links/bat-attachment/#:~:text=Transmitters%20should%20be%20attached%20to,the%20fur%20is%20not%20clipped.

4. Adhesives (or "glues") used during radio-tracking and telemetry studies[57] to attach transmitters to bats must be included in the "Approved Adhesives for P/A Telemetry Studies" list (Table 3)[58]. The list includes commercially available latex and silicone-based cements that are known to adhere transmitters to bats for approximately 1 to 30 days. Latex-based rubber cements have a long history of use by researchers and to our knowledge have no adverse health effects to bats. Products that are likely to adhere transmitters to bats for more than 4 weeks or have been reported to have adverse reactions are not permitted (see Figure 3). For a list of examples of products that are currently not permitted, see Table 4.

TABLE 3. Approved Adhesives

Type	Active ingredients	Name	Manufacturer
Latex-based Surgical Cement[1]	Liquid latex, N-hexane, zinc oxide	Torbot	Torbot Group, Inc.
	Liquid latex, N-hexane, zinc oxide	Ostobond	Montreal Ostomy Products.
	Liquid latex, N-hexane, zinc oxide	Permatype	Perma-Type Company, Inc.
Silicone-based Surgical Adhesive[2]	Silicone solids, ethyl acetate	Uro-Bond III 5000	Urocare Products, Inc.
Butyl-cyanoacrylate Surgical Adhesives[3]	100% n-butyl cyanoacrylate	Vetbond	3M

[1] Liquid, malleable bonding cements that contain latex and take several minutes to cure. Bonds skin to skin.
[2] Liquid, malleable surgical adhesives that contain silicone and takes several minutes to cure. Bonds appliances to skin.
[3] Stiff, cyanoacrylate-based products react quickly with water to form a durable, waterproof bond.

TABLE 4. Examples of Prohibited Adhesives. (This list is not exhaustive)

Type	Active ingredients	Name	Manufacturer
Octyl-cyanoacrylate Surgical Adhesives[1]	100% 2-octyl cyanoacrylate	Dermabond	Zoetis Canada Inc
	100% 2-octyl cyanoacrylate	Surgi-Lock 2oc	Meridian Animal Health
	60% 2-octyl cyanoacrylate, 40% n-butyl cyanoacrylate	GluTure	Ethicon, Inc
	60% cyanoacrylate	Locktite 422	Henkel Adhesives

[1] Stiff, cyanoacrylate-based products react quickly with water to form a durable, waterproof bond.

[57] The Guidelines do not address recommendations for MOTUS based transmitter applications, wound closure for pit-tag studies, or other applications of adhesives. However, we strongly recommend researchers review SDS information for products prior to use to determine their safety for use on bats. Adhesives that are not recommended for use on human or animal skin should never be used to attach transmitters to bats or to close up pit tag wounds. Therefore, products such as (but not limited to) F2 Adhesive, Lash Grip, Shut Eye, and Locktite Superglues, whose Safety Data Sheets specifically state that the product is not intended for application to skin and may cause skin irritation, should be avoided.
[58] To request a specific product addition to the list of adhesives in Table 3, submit a request to FW4_Bat_Survey_Guidance@fws.gov. In the email, provide the product name, product Safety Data Sheet, manufacturer recommendations for product use, active ingredient list, whether the product was developed for human or veterinary purposes, if the product is designed for bonding appliances to skin (preferred) or for closing wounds and any other relevant information.

NOTE: Surveyors who recapture a bat after using any adhesive should observe the bat's skin for signs of irritation, infection, excessive fur loss, and take photos or a video of the area where transmitter was applied (for example, see Figure 3). Report information to the Guidelines Team (FW4_Bat_Survey_Guidance@fws.gov).

FIGURE 3. A photo of a back of an Indiana bat with significant fur loss three weeks after transmitter was attached using GluTure. In this example, the transmitter was applied using a small dab of GluTure between the scapulae.

5. Proposed radio telemetry equipment (e.g., receivers, antennas, and transmitters) and frequencies should be coordinated with the appropriate state natural resource agency and USFWS FO(s). Prior to purchasing transmitters, biologists should inquire with transmitter manufacturers about signal boosting to determine if this option would improve bat detectability in their planned work areas. Transmitters with modified signals must be built to last the duration of the telemetry study approved in the Site Study Plan (e.g., > 7 days).

   Surveyors should thoroughly test transmitter function prior to the Study. Transmitters should be new or no more than one year old at the time they are applied to a bat and should be stored as recommended by manufacturer prior to use. Transmitters more than 1 year old must be tested prior to the study to ensure function and no degradation in anticipated signal strength. To establish function, all transmitters should be temporarily activated for at least 24 hours. To determine signal strength, surveyors should temporarily activate transmitter and test receiver signal strength. Topography, ambient weather conditions, and location of the bat and direction of antenna are all examples of variables that will dictate the distance at which a signal is detectable, but in general, the signal should be consistently detectable from at least one mile away. Transmitters more than 2 years old should be refurbished before using for P/A surveys.

6. The qualified biologist or biological technician(s) should track all radio-tagged bats captured to diurnal roosts in accordance with permit requirements. We generally recommend tracking until the transmitter fails, fall off, or cannot be located for at least 7 days and should conduct a minimum of 2 evening emergence counts at each identified roost (See Appendix E for Emergence Survey Protocols). However, biologists are encouraged to continue radio-tracking efforts for the life of the transmitter. Biologists should contact the USFWS FO(s) immediately if they plan to cease tracking efforts before the 7-day tracking period ends. If landowner access is denied, approximate roost locations (i.e., coordinates) should be determined using triangulation.

7. Daily radio telemetry searches for roosts must be conducted during daylight hours and should be conducted until the bat(s) is located or for a minimum of 4 hours of ground or 1 hour of aerial-searching effort per tagged bat per day for 7 days. However, multiple bats captured at the same net location or nearby may be tracked simultaneously. Once a signal is detected, tracking should continue until the roost is located. At a minimum, biologists should document all ground and aerial-searching effort for all bats not recovered during radio- tracking for submittal with the survey report. For each roost identified during tracking, the biologist should complete a "USFWS

IBAT and/or NLEB Roost Datasheet".

8. To minimize potential for disease transmission, any equipment that comes in contact with bats should be kept clean and disinfected, following approved protocols; this is particularly a concern relative to WNS. Protocols are posted at http://www.whitenosesyndrome.org/. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

SUBMISSION OF RADIO-TRACKING RESULTS

Phase 4 radio-tracking results should be included with the Phase 2 or 3 mist-netting report and submitted to the appropriate USFWS FO(s). Each report should include the following information related to radio-tracking efforts[59]:

1. Copy of prior phase reports (if not previously provided)
2. Explanation of any modifications from original survey plan (e.g., number of transmitters used, frequency of transmitters changed)[60]
3. Map and narrative detailing all ground and aerial search effort for all bats not recovered during radio-tracking and relative to the negotiated or agreed effort as determined by the appropriate USFWS FO(s)
4. Map summarizing IBAT and/or NLEB data collected from summer surveys for the proposed project (e.g., project area boundary and results from the site habitat assessment, acoustic survey, mist-net survey, radio-tracking, and emergence surveys)
5. Full names and permit numbers of personnel who attached transmitters to IBAT and/or NLEB and full names of all personnel conducting radio-tracking efforts
6. Photographs of all roosts identified during radio-tracking
7. Legible copies of all original USFWS IBAT and/or NLEB Roost Datasheets
8. Any other information requested by the local USFWS FO(s) where work was conducted

REFERENCES

Aldridge, H., and R.M. Brigham. 1988. Load carrying and maneuverability in an insectivorous bat: a test of the 5% "rule." Journal of Mammalogy 69:379-382.

American Society of Mammalogists. 1998. Guidelines for the capture, handling and care of mammals. Journal of Mammalogy 79:1416-1431.

[59] In 2016, the USFWS implemented a new standardized approach for reporting of bat survey data. In addition to a traditional written report, federal permit holders are now required to submit their survey data using standardized permit reporting spreadsheets available on the USFWS website provided in the intro.

[60] If the USFWS previously agreed upon the study plan, we need to understand whether the revised work still accomplished the agreed upon methods.

USFWS INDIANA AND/OR NORTHERN LONG-EARED BAT ROOST DATASHEET

Biologists (Full Name):_____ Date: _____

UTM: Zone_____ Easting _____ Northing_____ *OR*

LAT_____ LONG_____

Property Owner: _____ Phone#_____

State_____ County_____ Site #_____

Roost #_____ Roost Name: _____

Roost Tree Data

Species: _____ Live __ Snag __ Other _

(if other, explain) _____

DBH (in or cm) _____ Total Height (ft or m) _____

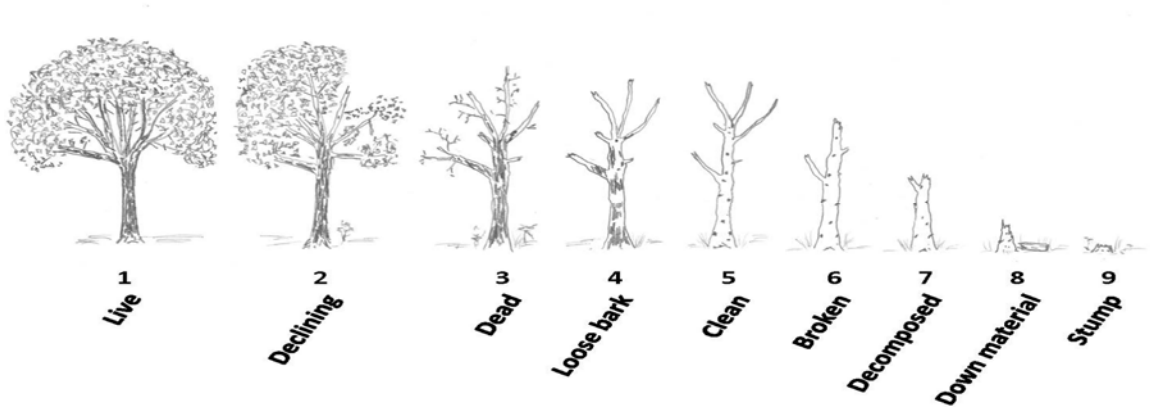
Height of roost area (if known) _____Dist. from capture site_____

Roost position aspect (deg) _____

Exfoliating bark on bole (%) _____ Describe: sloughing _ platy_ tight_

Cavities present? ____ If so, describe: _____

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



Roost tree or snag canopy position: Dominant __ Co-Dominant __ Suppressed _

Surrounding Habitat Condition

Canopy closure at roost (%) _____

Approximate woodlot size (ac or ha) _____ Distance to non-forest (ft or m) _____

Describe forest/woodlot current condition (mature, partially cut-over, burned, insect damage, etc.)

_____

_____

_____

_____

_____

_____

Additional Comments_____

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APPENDIX E: PHASE 4 EMERGENCE SURVEYS

PERSONNEL

Qualified biologists[61], biological technicians, and any other individuals deemed qualified by a local USFWS FO may conduct emergence surveys for IBAT and/or NLEB by following the protocols below.

EMERGENCE SURVEYS FOR KNOWN IBAT AND/OR NLEB ROOSTS

The following protocols should begin as soon as feasible after identification of a diurnal roost (ideally that night):

NOTE: The emergence survey protocol should not be used for radio-tracked TCBs or emergence surveys of identified potential roosts given the variability in roosting locations typically used by the species (e.g., roosting in dead leaf clusters in the canopy of live trees) and difficulty observing bats emerging. An emergence count may be attempted on the rare occasion that the surveyor is able to discover the exact roosting location of a transmittered TCB and believes he/she can observe the bat(s) emerging.

1. Bat emergence surveys should begin one half hour before sunset[62] and continue until at least one hour after sunset or until it is otherwise too dark to see emerging bats. The surveyor(s) should be positioned so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. There should be at least one surveyor per roost. Surveyors must be close enough to the roost to observe all exiting bats but not close enough to influence emergence. That is, do not stand directly beneath the roost, do not make noise or carry on a conversation, and minimize use of lights (use a small flashlight to record data, if necessary). Do not shine a light on the roost as this may prevent or delay bats from emerging. Use of an infra-red, night vision, or thermal-imaging video camera or spotting scope is encouraged but not required. Likewise, use of an ultrasonic bat detector may aid in identifying the exact timing of bats emerging and may be used to help differentiate between low- and high-frequency bats species, and therefore, is strongly recommended. If multiple roosts are known within a colony, then simultaneous emergence surveys are encouraged to estimate population size. [NOTE: If a roost cannot be adequately silhouetted, then the local USFWS FO(s) should be contacted to discuss alternative survey methods].

2. Bat activity is affected by weather; therefore, emergence surveys should not be conducted when the following conditions exist: (a) temperatures that fall below 50˚F (10˚C); (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale).

3. Surveyors should use the attached (or similar) “Bat Emergence Survey Datasheet”.

[61] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for IBAT and/or NLEB. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

[62] Surveys may need to start a little earlier or later than one half hour before official sunset times (i.e., before “dusk”) in some settings such as deep/dark forested valleys or ridge tops, respectively. Sunset tables for the location of survey can be found at: https://sunrise-sunset.org

4. Surveyors should also complete an "IBAT and/or NLEB Roost Datasheet" for each roost known to be used by one or more IBAT and/or NLEB (see Appendix D for an example).

5. Completed datasheets should be included in reports prepared for the USFWS.

EMERGENCE SURVEYS FOR POTENTIAL IBAT AND/OR NLEB ROOSTS

In some limited cases (e.g., individual hazard tree removal during the active season[63]), surveyors may have the option of conducting emergence surveys for individual potential IBAT and/or NLEB roosts to determine use prior to removal. Evaluations whether potential roosts meet the criteria to conduct emergence surveys should be for each individual tree rather than groups of trees. The following protocol applies to these surveys:

1. Consult with the local USFWS FO(s) to determine whether a tree(s) that needs to be felled/ cleared may be potential roosting habitat for IBAT and/or NLEB and whether conducting an emergence survey is an appropriate means of avoiding take of IBAT and/or NLEB[64]. In general, the USFWS only approves of conducting emergence surveys as a means of avoiding direct take of bats for projects that only affect a very small number of potential roosts (e.g., less than or equal to 10)[65] in relatively small project areas. In addition, emergence surveys are only valid if all parts of the tree (limbs and trunk) can be observed by the surveyor. Therefore, trees within woodlands that are directly adjacent to other trees and whose canopy is blocked are not suitable for emergence surveys. An online directory of USFWS offices is available at: http://www.fws.gov/offices/.

2. If the USFWS FO(s) approves/concurs with Step 1, then follow the emergence guidelines for Emergence Surveys for Known IBAT and/or NLEB Roosts (above) to determine if any bats are roosting in the tree(s).

3. At the conclusion of the emergence survey:

    a. If **no** bats were observed emerging from the potential roost(s), then it maybe felled immediately. If safety concerns dictate that a tree cannot be felled immediately (i.e., in the dark), then the tree(s) should be felled as soon as possible after sunrise on the following day. If a tree is not felled during the daytime immediately following an emergence survey, then the survey must be repeated, because bats may switch roosts on a nightly basis. Immediately after the tree is felled, a visual inspection of the downed tree must be completed to ensure that no bats were present, injured, or killed. The USFWS FO should be contacted immediately if bats are discovered during this inspection.

    b. If **1 or more** bats (regardless of species, because species identification cannot reliably be made during visual emergence counts alone) are observed emerging from the roost, then it should **not** be felled, and the USFWS FO(s) should be contacted the next working day for further guidance.

[63] The active season periods for IBat and NLEBs are available in Appendix L.
[64] If a potential bat roost tree poses an imminent threat to human safety or property, then emergency consultation procedures should be followed as appropriate. (50 CFR §402.05). If a hazard tree does not pose an imminent threat, then the USFWS requests that it be felled during the bat's inactive season. When possible, felling of potential roost/hazard trees should be avoided during the primary maternity period to avoid potential adverse effects to non-volant pups (see Appendix L for specific inactive and pup season dates for your area).
[65] Areas containing >10 hazard trees will be assessed by the USFWS on a case-by-case basis with the project proponent.

SUBMISSION OF EMERGENCE SURVEY RESULTS

Emergence survey results should be included with the mist-netting survey report, unless the survey was completed as an evaluation of potential roosts and should be submitted to the appropriate USFWS FO(s) for review. Each survey report should include the following information related to emergence survey efforts[66]:

1. Copy of prior phase reports (if not previously provided)
2. Explanation of any modifications from the Phase 4 emergence count study plan (e.g., number of potential roosts surveyed), if applicable
3. Summary of roost emergence data
4. Map identifying location of roost(s) identified during radio-tracking and/or emergence surveys for IBAT and/or NLEB(s) including GPS coordinates
5. Full names of personnel present during emergence survey efforts and who conducted emergence surveys of roosts
6. Photographs of each identified roost
7. Copies of all "Emergence Survey" and "IBAT and/or NLEB Roost" datasheets
8. Any other information requested by the local USFWS FO(s) where work was conducted
9. Copy of the pre-approved site-specific written authorization from USFWS and/or state natural resource agency (if required)

[66] In 2016, the USFWS implemented a new standardized approach for reporting of bat survey data. In addition to a traditional written report, federal permit holders are now required to submit their survey data using standardized permit reporting spreadsheets available on the USFWS website provided in the intro.

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: _____ Surveyor(s) Full Name: _____

State: _____ County: _____ Project Name: _____
Site Name/#: _____ Roost Name/# _____ Bat #:_____

Lat/Long or UTM of Roost: _____
Description of Roost/Habitat Feature Surveyed: _____

_____

Bat Species Known to be using this Roost/Feature (if not known, leave blank):

_____

Other Suspected Bat Species (explain): _____
Weather Conditions during Survey (temperature, precipitation, wind speed):

_____

Survey Start Time: _____ Time of Sunset: _____ Survey End Time: _____

NOTE: Emergence surveys should begin ½ hour before sunset and continue until at least one hour after sunset or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may prevent or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video camera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes

APPENDIX E: PHASE 4 EMERGENCE SURVEYS

Site Name/#: _____ Roost Name/#: _____

Time	Number of Bats Leaving Roost*	Comments / Notes
Total Number of Bats Observed Emerging from the Roost/Feature During the Survey:		

* If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

APPENDIX F: LINEAR PROJECT GUIDANCE

For linear projects (e.g., pipelines and roadways) >1 km in length (shorter lengths should be considered as a non-linear project), surveyors have the option to use either mist nets or acoustic detectors in any given 1-km segment of suitable habitat. A survey site may also cover other associated linear project facilities (e.g., access roads) that are located within a pre-determined distance of each segment. When possible, surveyors should seek out the best available survey sites located within the footprint of the project alignment, and directly adjacent to, or near, the alignment if no suitable sites are available within the footprint. Because the best survey sites for capturing/detecting bats may fall outside of a project footprint, the surveyor and project proponent should coordinate with the appropriate USFWS FO(s) to establish a project-specific maximum distance from the centerline or project boundary prior to initiating surveys.

Tentative survey site locations along linear projects should be included in a proposed study plan to be reviewed and approved by the USFWS FO(s). Adequate survey effort should be conducted within each approximate 1-km segment that contains suitable forested habitat along the proposed workspace. It is not appropriate to cumulatively add up each habitat block crossed until 1km of habitat has been traversed. Segments along a linear project that do not contain suitable habitat should be skipped until the next patch of suitable habitat is encountered (Figure 4). Establishing exactly how many survey sites are needed for P/A surveys along a linear project often involves some give and take particularly in fragmented habitat areas (Figure 4, rows B and C). The final number of survey sites could be greater than the minimum number of sites prescribed in the protocol to adequately cover the areas of suitable habitat to be impacted. When available, habitat quality and quantity (e.g., size and location of suitable maternity roost trees) from on-the-ground habitat assessments can be used to fine tune and guide the placement of survey sites. In some marginal habitat areas, the quality and quantity of the existing habitat may be low enough to justify skipping some survey segments (e.g., Figure 4, Site 11). Likewise, some isolated woodlots, fence lines or individual trees may be considered too isolated and/or small to independently support bats and may be skipped if the USFWS FO(s) concurs. Habitat suitability in fragmented areas should be assessed on a site-specific basis and consider habitat configuration and connectivity to other suitable habitat patches. In general, we recommend surveying a few more sites for a project than the absolute minimum required.

In instances where a mist netting survey has been proposed, but no suitable mist net sites can be found or accessed within a particular segment, biologists should contact the USFWS FO(s) for further guidance or ideally agree in advance as to how such situations will be handled when encountered in the field (e.g., an acoustic survey may be substituted). Similarly, if an area of forest habitat that seemed suitable from aerial photography appears to be unsuitable or of particularly low quality upon field inspection, then you should coordinate with the USFWS FO(s) to determine if an area may be exempted from surveys. To avoid problems, any significant departures from previously agreed to survey plans should be justified and coordinated with the USFWS FO(s) prior to leaving the field.

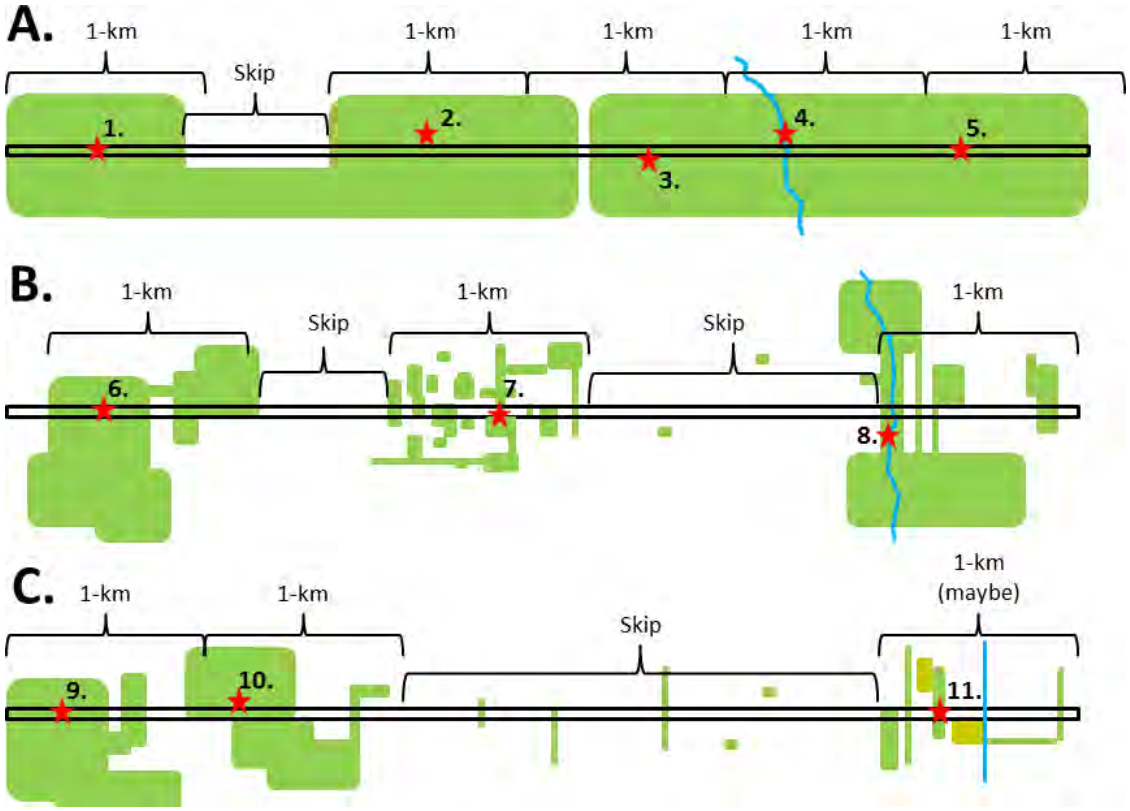

FIGURE 4. Conceptual linear project (black double lines) through relatively contiguous (A.) and fragmented (B. and C.) forested habitats (green patches) delineated into approximate 1-km survey sections. Numbered red stars represent suitable survey sites (1-11) on or near the project boundaries. Blue lines represent natural streams (A. and B.) and a ditch (C.). Yellow-green patches near Site 11 represent low-quality habitat.

APPENDIX G: THE OUTER–TIER GUIDANCE

Since early radio-tracking studies in Illinois, it has become standard practice for USFWS FOs to assume that an IBAT summer maternity colony will utilize suitable habitat within approximately 2.5 miles of its primary roost tree(s)/focal roosting area. However, if a reproductive adult female or juvenile IBAT is captured (or acoustically detected), but not radio-tracked to a roost site, then FOs typically assign its capture site a 5-mile conservation buffer and assume that its roost tree is located somewhere within 2.5 miles of the capture site. This approach is further detailed in the Service's IBAT Section 7 and Section 10 Guidance for Wind Energy Projects[67].

NOTE: The same principles used for the IBAT can be used for the NLEB using a 3-mile conservation buffer around capture/detections. Additionally, the outer-tier guidance may also be used for TCB presence/probable absence surveys using a 3-mile conservation buffer around capture/detections. "Outer-tier" guidance only applies to summer captures/detections (not hibernacula).

Because a 5-mile buffer encompasses four times more area than a 2.5-mile buffer (50,265 acres vs. 12,566 acres), it is reasonable to assume that only approximately 25% of a 5-mile buffered area is actually occupied by the documented IBAT summer maternity colony at any given time and that approximately 75% remains unoccupied or could be used by members of another yet undocumented colony(s). Therefore, if a subsequently proposed project is either ≤123 acres in size or affects ≤1% of existing suitable summer habitat within a 5-mile buffer (whichever is greater) but is situated ≥2.5 miles from the original capture/detection site, then it will have a relatively low probability of being within the true maternity colony home range (assuming suitable habitat is more or less evenly distributed in all directions from the capture site) (See Figures 5 & 6). Allowing project proponents of such "outer tier" projects to conduct a summer P/A survey for IBAT and/or NLEB using the standard survey level of effort (LOE) (as outlined in Appendix B and C) in such cases is reasonable and the additional survey data would 1) help refine the home range boundaries of the original colony, 2) confirm presence of additional colonies if present, 3) provide additional radio-tracking opportunities /roost tree locations, and 4) provide an option for project proponents to survey instead of always assuming presence.

Prior to emergence of WNS, NLEBs were widely distributed throughout much of the eastern U.S. and Canada. Although not nearly as common today, surveys show that the species continues to occur in pockets distributed throughout the WNS-impacted portion of its range. NLEB populations continue to remain stable in portions of the Southeast Coastal Plain (Virginia, North Carolina, and South Carolina) as well as in Alabama, Mississippi, and Louisiana where they are active year-round in forested or wooded habitats due to mild winter temperatures, and these populations, which are not dependent upon caves or mines for hibernation, may not be susceptible to WNS. Similarly, IBATs within the Northeast and Appalachian Recovery Units (RUs) have seen significant declines due to WNS; however, populations remain stable to increasing within the Midwest and Ozark-Central RUs (USFWS unpublished data 2023).

Due to the severity of the impact of WNS on populations across much of the hibernating NLEB and eastern IBAT RUs (i.e., Northeast and Appalachian) ranges, there is uncertainty where surviving NLEBs and IBATs are located in these portions of their ranges. To address this uncertainty, we recommend allowing project proponents whose project is either ≤123 acres in size or affects ≤1% of existing suitable summer habitat within a 5-mile (IBAT) or 3-mile (NLEB) buffer (whichever is greater) the opportunity to survey in both the inner-tier and outer-tier of known Hibernating Range NLEB buffers and IBAT buffers within the Northeast and Appalachian RUs when the buffered occurrence was prior to 2 years[68] after WNS was first confirmed in the state. We recommend coordinating with the local USFWS FO in the state where the proposed project survey is planned to determine whether inner-tier NLEB and/or IBAT

[67] Document is available on the USFWS website provided in the introduction.
[68] An alternative year may be used if the USFWS FO(s) has data to more precisely support when WNS affected abundance and distribution in their state.

buffers can be surveyed or not. Provided proponents use at least the prescribed minimum LOE for NLEBs and/or IBAT in these locations and the survey is approved by the Field Office, the USFWS would accept the results as evidence of presence/probable absence. For example, if WNS was confirmed in 2011, project proponents can survey both inner and outer tiers of a known buffer for presence/probable absence if the occurrence was in 2012 or earlier. For this example, presence/probable absence surveys could not be conducted in the inner tiers of occurrence buffers documented in 2013 and later.

NOTE: USFWS FO(s) may decide not to approve an outer-tier survey under the following circumstances: (1) If available forest habitat with a 5-mile (or 3-mile for NLEB) buffer is not more- or-less evenly distributed, but rather is highly clumped or restricted to a relatively narrow strip(s) (e.g., a riparian corridor); (2) <10% of a 5-mile (or 3-mile for NLEB) buffer contains suitable summer habitat; or (3) other site-specific reasons.

If a project proponent of an "outer-tier" project coordinates with the USFWS FO(s) upfront and conducts a valid summer mist-netting (Appendix B) or acoustic (Appendix C) survey using the appropriate LOE and does not capture/detect an IBAT and/or NLEB(s), then no IBAT or NLEB related restrictions will be required for that specific project area. However, all restrictions/ assumptions of IBAT and/or NLEB presence outside of a completed outer-tier project survey area shall remain intact indefinitely within the 5-mile (or 3-mile for NLEB) buffer zone or until additional negative survey data or discovery of roost trees indicate adjustments to a buffer are warranted by USFWS. Negative survey results from "outer-tier" projects are valid for 5 years for that project area. If an IBAT and/or NLEB(s) is captured/detected/radio-tracked during the survey, then the project area will be presumed to be occupied, restrictions will remain in place, and the USFWS FO(s) will reassess/adjust the original buffer(s) if warranted using the newly acquired bat location data.

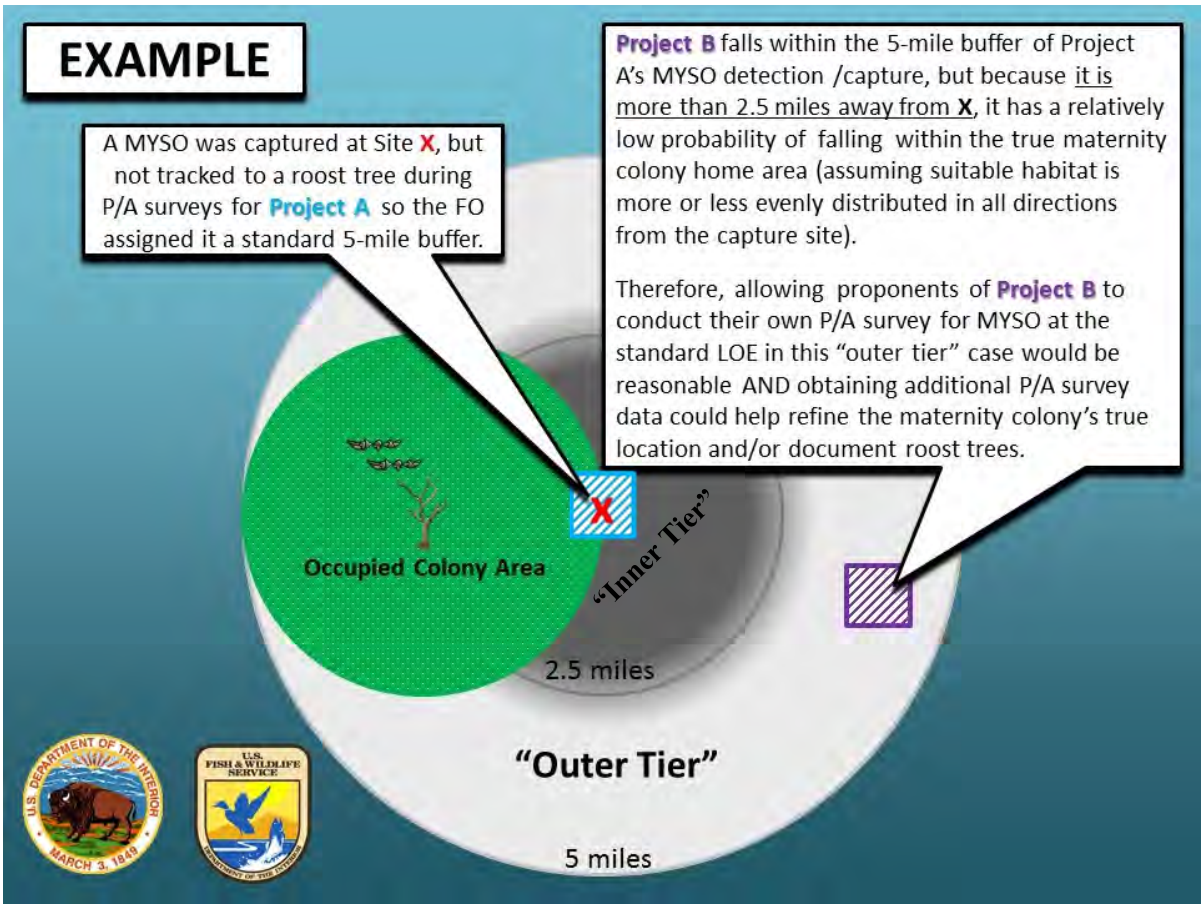

FIGURE 5. Graphical example depicting the proper application of the outer-tier guidance.

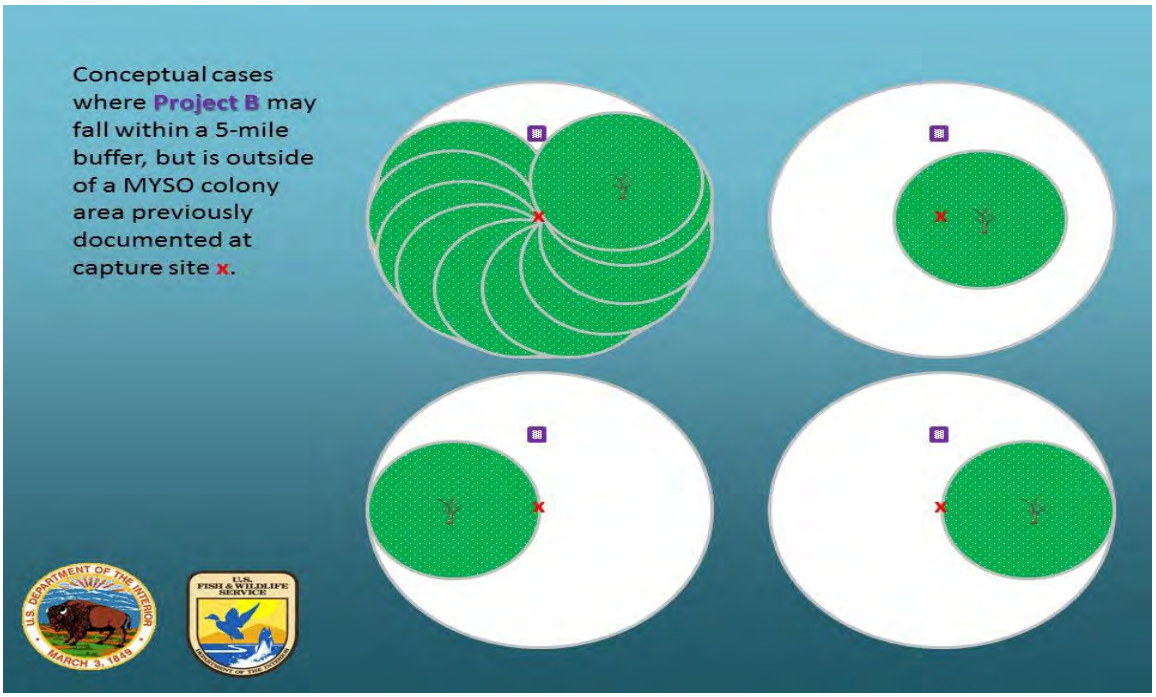

FIGURE 6. Hypothetical outer-tier scenarios where a proposed project area (depicted by a purple square) falls outside of the "true" IBAT maternity colony area(s) (depicted in green).

APPENDIX H: POTENTIAL HIBERNACULUM SURVEY GUIDANCE

Indiana and NLEBs have been documented using caves (and their associated sinkholes, fissures, and other karst features), as well as anthropogenic features such as mines and tunnels as winter hibernation habitat (i.e., hibernacula). Project proponents need to evaluate whether any potentially suitable IBAT and/or NLEB hibernacula exist within a proposed project area. This knowledge will be derived from a variety of sources. The following phased process should be followed to determine presence or probable absence of IBAT and/or NLEB in potential hibernacula:

NOTE: The potential hibernaculum survey guidance may also be used for TCB presence/probable absence surveys, including winter (internal) surveys, in portions of the TCB range that the species hibernates. TCBs use a wider variety and warmer hibernacula than what would often be considered as suitable for IBATs and NLEBs. Coordinate with the local USFWS FO(s) if you are proposing to use this guidance to survey for TCB.

PHASE 1 – INITIAL PROJECT SCREENING

Step 1. Coordinate with the USFWS FO(s) and appropriate state natural resource agencies regarding existing federally listed bat hibernaculum or other occurrence information.

Prior to initiating P/A surveys (Phase 2) of potential IBAT and/or NLEB hibernacula (as determined by the Phase 1 Habitat Assessment), the USFWS FO(s) and appropriate state natural resource agencies must be contacted to determine if any caves or other underground features have been previously documented as hibernacula or other habitat for federally listed bat species. Any proposed surveys of previously documented hibernacula must be coordinated directly with these agencies to ensure that adverse effects to listed species do not occur because of the survey.

Step 2. Desktop Analysis and Initial Field Reconnaissance.

After coordinating with the FO and appropriate state natural resource agency (when applicable), a desktop analysis and initial field reconnaissance should be completed by individuals with a natural resource degree or equivalent work experience and a solid understanding of karst topography and/or surface features associated with underground mines. These initial assessments can be completed at any time of year.

For all projects, a FO-approved field survey of all land within 0.5 miles of the edge of the project footprint (where access can be obtained) and documentation (e.g., a literature search, maps and information provided by local cave survey groups or grottos, review of aerial photography and topographical maps, previous mining records (if applicable), forest inventories, previous species survey reports, and the work of consultants or other designees) of all known caves and abandoned mines within 3 miles of the outside edge of the project footprint should be conducted. If caves or abandoned mines are found, further detail about the known or estimated underground extent of the cave/mine should be provided to the USFWS FO(s), including minimum and maximum depth of features and where those features are located on a map(s).

In general, underground openings can be deemed unsuitable as a hibernaculum and dismissed from further assessment and surveys if:

a) There is only one horizontal opening, and it is less than 6 inches (15.2 cm) in diameter;

b) Vertical shafts are < 1 foot (0.3 m) in diameter;

c) Passage continues < 50 feet (15.2 m) and terminates with no visible fissures that bats can access;

d) Openings are prone to flooding, collapsed shut and completely sealed, or otherwise are inaccessible to bats; and

e) Openings that have occurred recently (i.e., within the past 12 months) due to human activity or subsidence. (Include written documentation verifying this determination).

The results of initial field assessments should be submitted to the USFWS FO(s) and State regulatory partners (when applicable) for review and approval prior to proceeding to Step 3. FO- approved results from Step 2 will remain valid for a minimum of five years. **NOTE**: longer time frames may not be appropriate due to cave/mine dynamics.

Step 3. Conduct a Phase 1 Habitat Assessment of Potentially Suitable Hibernacula.

If underground openings are documented during field surveys in Step 2 and cannot be dismissed during initial project screening above, then a qualified biologist[69] will need to conduct a Phase 1 Habitat Assessment to determine whether bats using a potentially suitable hibernaculum within a project area could be adversely affected by the proposed project as described below (see Phase 1 Habitat Assessment Sample Data Sheet).

Habitat assessments should include all entrances or openings that will be directly or indirectly impacted by the proposed project. This would include those caves (and their associated sinkholes, fissures, and other karst features), as well as anthropogenic features such as mines and tunnels that are within the project site or that are otherwise connected (i.e., by physical passageway, airflow or hydrologically) to any underground feature that will be directly or indirectly impacted by the proposed project.

The results of a Phase 1 Habitat Assessment should be submitted to the USFWS FO(s) and State regulatory partners (when applicable) for review and approval prior to proceeding to Phase 2. FO-approved results from Step 3 will remain valid for a minimum of five years. **NOTE**: longer time frames may not be appropriate due to cave/mine dynamics.

PHASE 2 – PRESENCE/PROBABLE ABSENCE SURVEYS

Surveys to Confirm Use of Suitable Winter Habitat

If suitable winter habitat is discovered as a result of the Phase 1 Habitat Assessment above, do not alter, modify, or otherwise disturb entrances or internal passages of caves, mines, or other entrances to underground voids (potential hibernacula) within the action area before completing a Phase 2 survey. The survey protocols for determining occupancy are detailed below. Some surveys may require modification (or clarification) of these guidelines; therefore, submittal of a study plan and coordination with the USFWS FO(s) and state natural resource agency is necessary prior to initiating suitable winter habitat/hibernacula surveys. Submit results of completed summer and/or winter surveys to the appropriate FO(s) prior to clearing or altering of identified bat habitat. The USFWS FO(s) will review the results of P/A surveys conducted according to these guidelines for the purposes of determining whether IBAT and/or NLEB are occupying hibernacula in the project area and whether they may be adversely affected by any proposed actions.

[69] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for IBAT and/or NLEB in the state/region in which they are surveying. Alternatively, in States within Region 5 of the USFWS, state agencies assess qualifications and provide authorization to net, handle, and conduct hibernaculum surveys of/for IBAT and/or NLEB in that State (authorization is only valid in the State that provides the authorization). Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

WINTER (INTERNAL), FALL, AND SPRING SURVEY PROTOCOLS FOR IDENTIFYING POTENTIAL BAT HIBERNACULA

White-nose syndrome (WNS) is a devastating fungal disease that has killed unprecedented numbers of hibernating bats in eastern North America. WNS and/or *Pseudogymnoascus destructans* (Pd), the fungus causing the disease has been detected throughout the range of the IBAT, as well as most of the range of the NLEB. Users of this guidance must follow the recommendations provided in the most recent USFWS Cave Advisory[70] as they relate to reducing the potential for humans to disturb hibernating bats or inadvertently transporting Pd to uncontaminated bat habitats. All surveys conducted at caves/mines should be coordinated with the USFWS FO(s) and appropriate state natural resources agencies prior to initiation (see example USFWS Project Proposal Form).

Winter (Internal) Survey

Working near and within abandoned mines and caves can be inherently dangerous due to a variety of potential hazards (e.g., ceiling collapse and presence of toxic gases)[71]. Therefore, surveyors must thoroughly assess their work sites for any known and potential health and safety hazards and must use appropriate personal protective equipment and take proper precautions to avoid and minimize identified risks. Only sites that are deemed safe should be entered at the surveyor's discretion.

Potential hibernacula that are deemed safe to enter should be entered and all its accessible passages visually surveyed for the presence of IBAT during mid-winter (i.e., beginning January 1st and ending prior to March 1st of the same calendar year (also see Appendix 4 of the USFWS 2007 Indiana Bat Draft Recovery Plan: first revision). **NOTE:** The use of direct internal surveys is not adequate for NLEB due to the difficulty in visually detecting the species inside hibernacula (i.e., it typically roosts in deep cracks and crevices). Only properly trained and qualified individuals with the appropriate federal and/or state permits and equipment should attempt internal P/A surveys for the IBAT. If the qualified biologist, who completed the Phase 1 Habitat Assessment, does not have the necessary experience/permits to complete internal survey work, then this portion of the project should be subcontracted to another individual or group that does. If a site is unsafe or too difficult to enter or it is believed that significant portions of the underground system are inaccessible, it should be surveyed using the Fall or Spring emergence survey guidance to determine presence or probable absence of federally listed bat species, including the IBAT and/or NLEB (also see Sample Data Sheet for Fall or Spring Surveys of Potential Hibernacula).

Fall or Spring Emergence Survey

1A. Fall surveys of mine/cave entrances must be conducted between September 15 and October 31[72] and prior to any tree clearing by the project applicant. A minimum of one night of harp trap sampling per week for 6 weeks (i.e., 6 nights of sampling) is required at each suitable entrance as determined by the Phase 1 Habitat Assessment. Each night of sampling should be separated by at least one week of the survey window if weather conditions allow it. However, multiple nights of sampling per week can be accepted in the last two weeks of October if forecasted weather conditions

[70] https://www.whitenosesyndrome.org/press-release/updated-cave-advisory-recommendations-for-managing-access-to-subterranean-bat-roosts-to-reduce-the-impacts-of-white-nose-syndrome-in-bats

[71] The Service highly recommends that surveyors seek counsel from an occupational health and safety professional(s) prior to working underground or under other potentially hazardous field conditions.

[72] Timing of fall surveys may need adjustment based on location and weather conditions leading up to the survey. Coordination with local USFWS FO(s) and State regulatory partners (when applicable) during development of the study plan/project proposal form is required.

require it, at least 3 nights of sampling were completed during the first 3 weeks of the survey period, and the modification is approved by the appropriate USFWS FO(s). Survey effort may be suspended if no bats (of any species) are captured after the first 2 nights of acceptable survey effort in the fall. Surveys of a potential hibernaculum are in addition to any summer P/A surveys that may be required for a proposed project.

OR

1B. Spring surveys of mine/cave entrances must be conducted between April 1 and April 21[73] and prior to any tree clearing by the project applicant. Conducting surveys during the spring emergence is typically more complex than conducting fall surveys due to a greater number of uncontrollable factors (e.g., weather related factors). Thus, a minimum of three nights of harp trap sampling per week for three weeks (i.e., 9 nights of sampling) is required at each suitable entrance as determined by the Phase 1 Habitat Assessment. Due to the need to monitor weather conditions closely, each proposed spring mine/cave survey must be coordinated with the USFWS FO(s) and appropriate state natural resource agencies prior to surveying to ensure that adequate survey results are achieved. Surveys of a potential hibernaculum are in addition to any summer P/A surveys that may be required for a proposed project.

2. Unless otherwise approved by the USFWS FO[74], the capture of an IBAT and/or NLEB during a fall or spring mine/cave survey requires that the applicant complete three additional nights of sampling per week for three consecutive weeks (9 additional nights LOE) to determine the relative significance of the mine(s) and/or cave(s) and their associated underground workings to the IBAT and/or NLEB. If the mine/cave survey season (i.e., September 15 to October 31 for fall sampling and April 1 to April 21 for spring sampling) ends prior to the completion of the required additional sampling, then sampling must be completed the following fall or spring.

3. Harp traps are the preferred method for sampling entrances as they are less stressful on captured bats. Mist nets can also be deployed along corridors immediately adjacent to the entrance to increase survey effectiveness. Mist nets may also be used at the entrance but only when the mine or cave configurations are not suitable to harp trapping. The use of mist nets must be approved by the USFWS FO(s) and appropriate state natural resource agency prior to initiation of survey. Mist nets should be made of the finest, lowest visibility mesh commercially available. Currently, this is 2-ply, 50-denier nylon (denoted 50/2). The mesh should be approximately 1.5-inch in size. No other specific mist netting hardware is required.

4. Entrances must be entirely enclosed by the survey gear when harp trapping. If mist nets are used, entrances should not be entirely enclosed by the survey gear.

5. All entrances that are potentially inter-connected should be surveyed on the same night. In cases where one team of surveyors cannot feasibly sample all entrances in one night, a modified method could also be used; however, a minimum of 100 feet should separate surveyed vs un-surveyed entrances in cases where numerous entrances to a potential hibernaculum exist. This method should only be used in situations where the entrances are known to be interconnected. In this modified method, half of the interconnected entrances are surveyed on the first night, and the other half of the entrances are completely blocked using bird- exclusion netting, plastic sheets, or other impervious material. On the second night, survey efforts are reversed. Any materials used to block the entrances must be removed each night immediately after conducting the survey. No entrances should be left blocked over-night.

[73] Timing of spring surveys may need adjustment based on location and weather conditions leading up to the survey. Coordination with local USFWS FO(s) and State regulatory partners (when applicable) during development of the study plan/project proposal form is required.

[74] Additional survey effort may not be recommended in cases where a project proponent agrees to modify their project to completely avoid adverse impacts to newly documented hibernacula and if abandoned mine openings can be closed with a USFWS FO approved bat friendly gate design.

Plastics or other materials used to block the entrances should be removed each night immediately after conducting the survey. Entrances that are not connected (e.g., as determined by existing mine maps) do not have to be surveyed simultaneously.

6. The sampling period should begin at sunset and continue for at least 5 hours each night. During this time, harp traps (most preferable method) and/ or mist nets (acceptable method, but less preferable from a bat-handling perspective) should be monitored for captured bats on 30- and 10-minute intervals, respectively, to minimize the number of bats that escape while limiting disruption of the swarm in the fall or emergence in the spring. Surveyors monitoring set-ups must minimize noise, lights and movement near the traps or nets. Monitoring with night vision or thermal cameras can be beneficial: (a) bats can be detected when they are captured, (b) any evidence of bats escaping the trap or net can be documented, and (c) monitoring with night vision or thermal camera also allows the biologist to assess the effectiveness of each trap/net placement (i.e., if bats are active near the set-up but avoiding capture), which may allow for adjustments that will increase capture success on subsequent nights. There should be no other disturbance near the set-up, other than to check traps/nets and remove bats. Biologists should be prepared to cut the net if a bat is severely entangled and cannot be safely extracted within 3 or 4 minutes or reduce harp trap check intervals to less than 30 minutes when capture rates are high. Capture and handling are stressful for bats. Emphasis should be on minimizing handling and holding bats to as short a time as possible to achieve field study objectives. Bats should not be held for more than 30 minutes after capture or as allowed in federal and state permits.

7. If captures increase during the survey or if 6 or more bats of any species were captured during the last hour of monitoring, the survey effort must continue until activity declines or fewer than 6 bats are captured per hour. A total of 30 (fall) or 45 (spring) hours of sampling should take place for a mine/cave survey to be approved.

8. Severe weather adversely affects the activity levels of bats. If any of the following weather conditions exist during the fall or spring mine/cave survey, the time and duration of such conditions must be noted on the data sheets and in the survey report, and the survey effort for that night must be repeated: (a) winds sufficiently strong and variable enough to move equipment (i.e., traps or nets) more than 50 percent of the time; and (b) precipitation, including rain and/or fog, that does not stop within 30 minutes or continues intermittently during the survey period; and (c) temperatures that are less than 50° F (10° C) for the first 2 hours, and that drop below 40° F (4.4° C) at any point during the survey.

9. All bats captured during fall or spring surveys must be temporarily marked with a USFWS FO-approved non-toxic material that will last for the remainder of the survey period to identify any recaptures during subsequent survey nights.

10. If IBAT and/or NLEB (or other federally listed species) are captured during fall or spring mine/cave surveys, notification to the local USFWS FO(s) is required within 48 hours (or in accordance with permit conditions), and the sex and reproductive condition of the bat and GPS coordinates of the capture site should be provided.

11. A bat detector/roost logger should be deployed at each entrance during sampling to monitor bat activity when trapping or netting. Bat passes should be monitored and tallied hourly. Bat tallies should be reported along with the time sampled. Report the beginning time and number of bat passes in hour blocks. Analysis of recorded bat calls to attempt species identification should not be completed as these calls are not expected to be foraging calls.

12. Noise, the use of lights, or other potential disturbances should be kept to, at a minimum, no closer than 300 feet (91.4 m) of the sampling site.

13. At least one member of each survey crew must hold, and have in his or her possession, a valid endangered species collection permit issued by USFWS[7581] and/or the appropriate state natural resource agency that allows the qualified biologist to collect bats, including federally listed species. All activities must be carried out with strict adherence to permit conditions and authorizations specified in your federal permit, as well as any State authorizations. A qualified biologist(s) must (1) select/approve harp trap/mist-net sets, (2) be physically present at each site throughout the survey period, and (3) confirm all bat species identifications. This biologist may oversee other biological technicians and manage set-ups near one another as long as the traps/nets are being monitored as defined in bullet 6 above.

14. All survey efforts must follow the most recent USFWS decontamination protocols regarding WNS.

[75] Surveyors working in States within Region 5 of the USFWS only require a permit from the State where the survey is taking place.

Phase I Habitat Assessment Sample Data Sheet

Location _____

Observers (include permit numbers) _____

Latitude _____ **Longitude**[76] _____

Date ___ **Time** _____ **Temp (outside)** _____

	Opening #1	Opening #2	Opening #3	Opening #4
Opening Type (e.g., cave, portal, shaft)				
Opening vertical or horizontal				
Opening Size: Height x Width (or Diameter)				
Internal Dimensions: Height x Width				
Slope (up or down from entrance)				
Entrance Stable?				
Direction of Airflow (In or out?)				
Amount of Airflow (e.g., none, slight, heavy)				
Internal air warmer or cooler than outside temp.?				
Evidence of collapse?				
Ceiling Condition				
Amount of water in opening				
Evidence of past flooding?				
Observed length of internal passage				
Distance to nearest water source				
% Canopy Cover at entrance				
Foraging Signs? (e.g., moth wings)				

Are any portals suspected or known to be connected? Which ones?

Any observable side passages?

Additional comments:

Entry of abandoned mine portals, quarries, or caves can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The FWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter any cave, quarry, or mine portal.

[76] Provide coordinates for each opening.

Sample Data Sheet for Fall or Spring Surveys of a Potential Hibernaculum

DATE:	TEMPERATURE	Start:	End:
PRECIPITATION*:		WIND*:	
MOONLIGHT:	TIME	Start:	End:
PERSONNEL (include permit numbers):		LOCATION (lat/long):	

Time	Species	Age	Sex	Repro Cond.	RFA (mm)	Mass (g)	Flight Direction (in or out)	Notes and General Comments

***Precipitation and Wind should be measured hourly**

****Repro. Cond (Reproductive Condition): (P) pregnant; (L) lactating; (PL) post-lactating; (NR) non-reproductive, (TD) testes descended**

APPENDIX I: CALCULATING LOE FOR A COMBINED ACOUSTIC AND MIST-NETTING SURVEY

Numerous publications discuss the general advantages of using acoustics and mist-netting in tandem for inventorying bat communities (Kunz and Brock 1975, Kuenzi and Morrison 1998, Murray et al. 1999, O'Farrell and Gannon 1999, Flaquer et al. 2007). One of the stated objectives of the IBAT and NLEB survey guidelines is to maximize the potential for detection/capture of these species at a minimum acceptable LOE. The USFWS has long recognized that offering a combination acoustic and mist-netting option has advantages over the current single technique options presented in Appendices B and C; however, developing the methodology to calculate an acceptable LOE for a combined approach is challenging because our recommended LOE approaches were calculated based exclusively on either mist-netting or acoustic datasets.

Some advantages of a combined approach are that it provides flexibility to address challenging survey conditions (e.g., situations where mist-net set-ups are limited or the reverse). These situations are not uncommon, especially for linear projects which can pass through highly variable habitats. A combined approach provides project proponents with the ability to reduce overall survey time and cost while still providing for a suitable LOE. Finally, a combined approach alleviates challenges associated with number of sites/acoustic locations and limits on number of survey nights per net-site for projects impacting smaller acreages of suitable habitat.

To calculate the mist-netting and acoustic LOE using the combined approach the surveyor must consider survey LOE as a percent, and then balance the netting percent against the acoustic percent, which is what the guidance inherently does in setting the existing sole mist-netting and acoustic LOE standards.

- X mist-net nights of effort/123 acres = Y acoustic nights of effort/123 acres

First, determine the proportion of effort that will be applied using either the mist-netting or acoustic method. The decision to use mist-netting or acoustic should be made with consideration to the project area and the total number of high-quality survey sites of each survey method available for the species (i.e., IBAT and/or NLEB) the survey is being conducted for. Next, refer to Table 2 of the guidance and identify the highest LOE for the selected method and species' being surveyed. Finally, use the information above to calculate the total survey LOE that would be accomplished by the previously selected method at high-quality mist-net sets or acoustic locations for the proposed P/A survey.

Proportion of Effort (PoE) for combined LOE should be calculated as follows:

A. PoE using mist-netting x highest mist-netting LOE for surveyed species' = Total survey LOE in nights accomplished by mist-netting

   – or –

   PoE using acoustics x highest acoustic LOE for surveyed species' = Total survey LOE in nights accomplished by acoustics

Once the number of nights of the total survey LOE to be conducted by either method is known, then it can be used to determine the minimum required LOE for the other survey method. To calculate the necessary LOE for the second survey method, simply subtract the calculated PoE (see A, above) from 1 and multiply that proportion by the highest overall LOE for the second method for the species' being surveyed from Table 2.

B. (1 - PoE used in A, above) x highest overall species LOE prescribed for the method not used in

A = Total number of survey nights necessary to meet the recommended LOE using the second method.

C. Round nights calculated in A and B up to nearest whole number.

EXAMPLE: The construction of a new bourbon distribution center (non-linear project) in KY falls within the range of IBAT and NLEB according to IPaC. A Phase 1 Habitat Assessment (see Appendix A) determined that 95 acres of suitable habitat for both species would be permanently removed to construct the project. The permitted bat biologist contracted to complete the P/A survey calculated that 35% of the project area could be surveyed with high-quality mist-netting set-ups.
Using the simple equation in A above, a total of 3 nights of mist-netting effort (0.35 x 6 = 2.1; rounded up) are recommended for this project impacting under 123 acres of suitable habitat. Using equation B above, the proposed project would need a total of 10 nights of acoustic effort ([1 – 0.35] x 14 = 9.10; rounded up) for the proposed project.

For the USFWS to approve a combined mist-netting and acoustic survey, the survey must be completed as described below:

1) There must be a minimum of two mist-net sets and two acoustic locations proposed in the study plan and surveyed to be accepted by the USFWS FO(s).
2) Each mist-netting set may only be surveyed two nights (either consecutive or otherwise) if a combined mist-netting/acoustic survey is proposed.
3) Surveyors should distribute mist-netting sets and acoustic locations throughout the project area or adjacent habitats. In most cases, net sets and acoustic locations should be at least 656 feet (200 meters) apart. If closer spacing is determined to be necessary or beneficial (e.g., multiple suitable habitats and acoustic sites immediately adjacent to each other), sufficient justification must be provided in the study plan, approved by the USFWS FO(s), and submitted as part of the survey report to the USFWS FO(s).
4) The combined mist-netting and acoustic survey, including the calculation of LOEs for each method, must be proposed and submitted for approval to the USFWS FO(s) with the study plan. The study plan must also include written justification for the use of the mixed effort including how the proposal will lead to improved survey quality. The mixed LOE may be adjusted before the beginning of the survey with written approval from the USFWS FO(s); however, no modifications are allowed once the survey has started.
5) Because the combined approach represents a single LOE for individual project areas, under no scenario can a surveyor use either mist-netting or acoustic Phase 2 surveys to challenge the other methods results. If a species is documented to be present with one method but not the other, then the USFWS FO(s) will still consider it present in the context of a subsequent consultation or other decision-making process.
6) Except for 1-5 above, all other guidance provided in Appendices B and C apply to individual mist-netting sets and acoustic locations under this combined survey approach.

REFERENCES

Flaquer, C., I. Torre, and A. Arrizabalaga. 2007. Comparison of sampling methods for inventory of bat communities. Journal of Mammalogy 88:526-563.

Kuenzi, A.J., and M.L. Morrison. 1998. Detection of bats by mist-nets and ultrasonic sensors. Wildlife Society Bulletin 26(2):307-311.

Kunz, T.H., and C.E. Brock. 1975. A comparison of mist nets and ultrasonic detectors for monitoring flight activity of bats. Journal of Mammalogy 56:907-911.

Murray, K.L., E.R. Britzke, B. Hadley, and L.W. Robbins. 1999. Surveying bat communities: a comparison between mist nets and the Anabat II bat detector system. Acta Chiropterologica 1(1):105-111.

O'Farrell, M.J., and W.L. Gannon. 1999. A comparison of acoustic versus capture techniques for the inventory of bats. Journal of Mammalogy 80(1):24-30.

APPENDIX J: GUIDANCE FOR SURVEYING YEAR-ROUND ACTIVE NLEBs

A portion of the NLEB's range overlaps with coastal areas of the eastern and southern U.S. where NLEB behavior, habits and habitat use differ significantly from the rest of the species' range. Bats may be active in these areas (see Figure 7) at any time of year and have not been documented utilizing traditional hibernation strategies found in the rest of the species range. Because of this, the USFWS collated and analyzed mist-netting data from local partners and worked with USGS and Virginia Tech to calculate year-round active NLEB minimum recommended LOE for mist-net surveys to provide expanded survey opportunities where allowed (also see Armstrong et al. 2023). Both acoustic and mist-netting techniques may be used in this region as a presence/probable absence method (Phase 2 surveys). Alternatively, mist-netting can be conducted for the purpose of attempting to capture NLEBs after detection during acoustic presence/probable absence surveys (Phase 3 surveys). The same recommendations (e.g., habitat assessments, personnel, coordination with USFWS FOs, nightly survey period, equipment, net/detector placement, checking nets, weather and other environmental conditions (temperature and precipitation), analysis of recorded echolocation calls, radio-tracking, emergence surveys, linear project guidance, outer-tier guidance, etc.) provided in other guidance appendices apply for either use of mist-netting or acoustics in the year-round active portion of the NLEB's range unless specifically addressed below.

NOTE: Where we consider the TCB active year-round (see Appendix L, Figure 9), surveyors can use these survey protocols applying the year-round active NLEB level of effort (LOE) with the following limitations: (1) an acoustic or combined acoustic/mist-net survey must be completed in portions of the range where IPaC identifies TCB as the only species; and (2) qualitative analysis is necessary for linear projects when Kaleidoscope Pro software produces an MLE > 0.05 for all site-nights and 10 or more passes are auto-classified as potentially belonging to TCB at any site-night. If you choose not to manually vet calls meeting these criteria, then you should assume presence of TCB for the project. Coordinate with the local USFWS FO(s) if you are proposing to use this guidance to survey for TCB to determine which LOE is appropriate for the specific project area.

SURVEY SEASON FOR YEAR-ROUND ACTIVE NLEBs: March 1 – October 15

While NLEBs may be captured in every month of the year in occupied coastal plain regions, the late fall/early winter is not an optimal time to conduct surveys because of lower and inconsistent temperatures as well as reduced availability of insect prey. Capture of reproductive adult females[77] (i.e., pregnant, lactating, or post-lactating) and/or young of the year between March 1 – October 15 confirms year-round presence of NLEB and the presence of a maternity colony in the area. Since adult males and non-reproductive females have commonly been found summering with maternity colonies, radio-tracking results will be relied upon to help determine the presence or absence of a maternity colony or large concentrations of bats in the area when only males and/or non-reproductive females are captured.

[77] We recognize that the reproductive condition of captured female NLEBs in early spring may not be possible; however, available data indicates NLEBs are not migrating to different areas from summer to winter so it is likely many of those adult females are indicative of the presence of maternity colonies.

Likewise, detection of NLEBs using acoustic equipment and approved[78] software program(s) confirms year-round presence in the project area.

MINIMUM PRESENCE/ABSENCE LEVEL OF EFFORT

The level of mist-netting or acoustic survey effort required for a project in the year-round active portion of the NLEB range will be dependent upon the overall acreage of suitable habitat that may be impacted by the action (directly or indirectly). To determine the survey effort, quantify the amount of suitable habitat within the project area. For projects where impacts other than tree removal are likely (e.g., collisions with infrastructure), ensure that presence/probable absence surveys are designed to cover all suitable habitat within the entire project area (where exposure to any kind of impacts may be anticipated) and NOT just the locations where tree removal is planned. Additional guidance for linear projects is available in Appendix F.

Year-Round Active NLEB Mist-netting LOE: (also see Figure 1 and Table 2)

Linear projects: a minimum of 2 net nights per km (0.6 miles) of suitable habitat (see Appendix F).

Non-linear projects: a minimum of 6 net nights per 123 acres (0.5 km2) of suitable habitat.

After 2 consecutive nights of netting at the same location without capturing target species, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of NLEB(s), then no further surveys are recommended.

b) If capture of NLEB(s), then stop or proceed to Phase 4 as previously decided in coordination with the FO.

Range-wide NLEB Acoustic LOE: (also see Figure 1 and Table 2)

Linear projects: a minimum of 4 detector nights per km (0.6 miles) of suitable habitat (see Appendix F).

Non-linear projects: a minimum of 14 detector nights per 123 acres (0.5 km2) of suitable habitat.

A minimum of 2 detector locations per 123 acre "site" shall be sampled until at least 14 detector nights has been completed over the course of at least 2 calendar nights (may be consecutive).

[78]For surveyors planning optional TCB P/A acoustic surveys in western states where the TCB range overlaps with western bat species and TCBs are year-round active for 2024, note that no acoustic ID software programs are approved for this portion of the TCB range. Refer to optional TCB survey guidance (see FAQ) and use of candidate software programs for 2024.

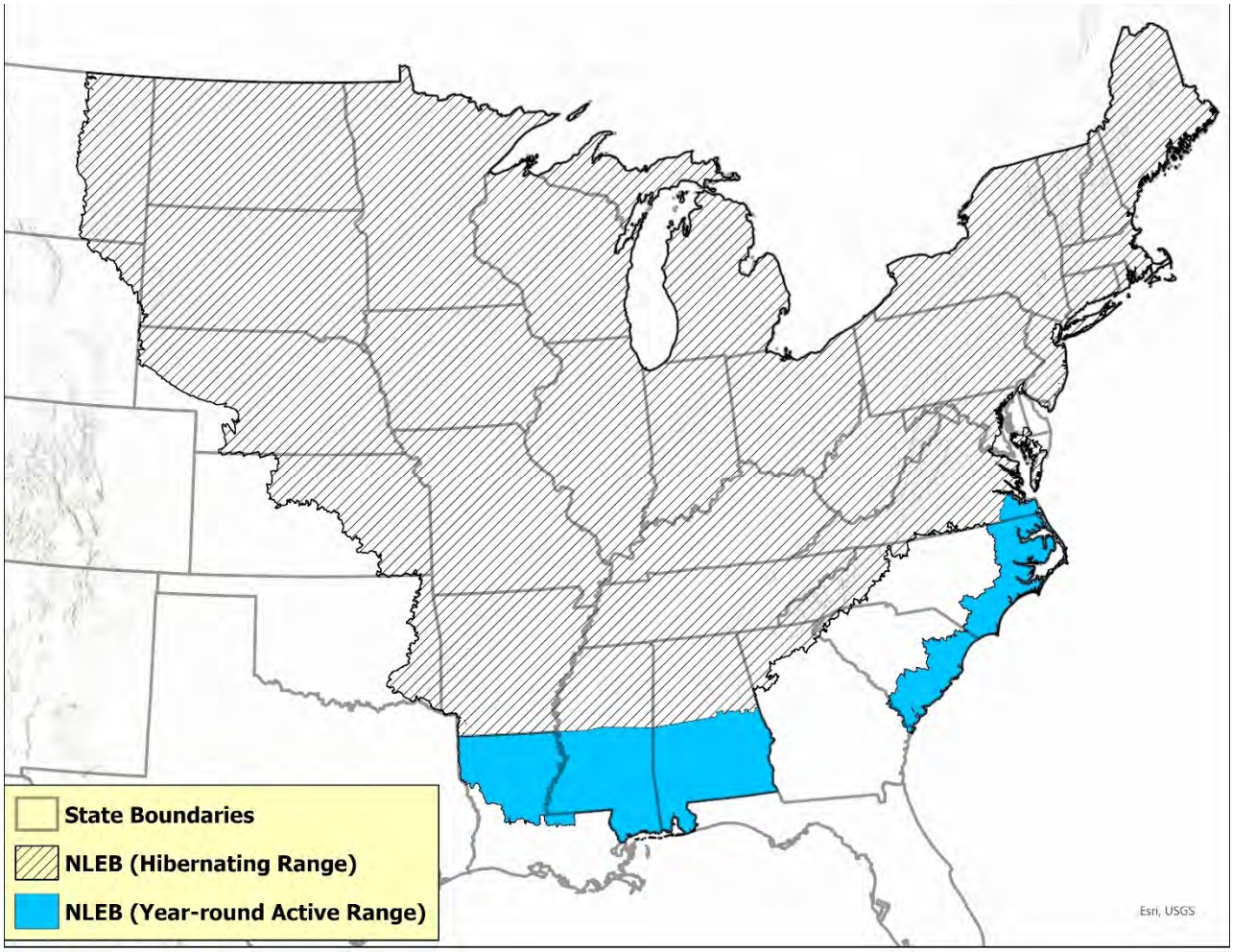

FIGURE 7. Areas delineated for use of year-round active NLEB survey guidance.

APPENDIX K: ASSESSING AND SURVEYING BRIDGES AND CULVERTS FOR BAT USE

Roadway transportation structures, specifically bridges and culverts, can provide suitable roosting habitat for bats. At least 24 North American bat species have been documented using bridges and culverts as roosting sites (Keeley and Tuttle 1999) and our understanding of the frequency of use improves as efforts increase to consider transportation structures as potential bat habitat. Georgia Department of Natural Resources reports presence of bats or guano at 20% of surveyed bridges and > 30% of surveyed culverts (GADNR, unpublished data 2023). Detweiler and Bernard (2023). conducted a literature review of 75 published studies finding that the use of bridges varies greatly across the landscape due to climatic factors, availability of natural roosts, and structural design. NLEBs and IBATs have been found using bridges and/or culverts throughout their ranges, as well as other species of conservation concern, such as the proposed endangered TCB. Use of this protocol is acceptable for TCB in 2024. Bats have been documented throughout the United States using bridges and culverts as maternity sites, hibernation sites, temporary resting sites during foraging, and during periods of staging and swarming. Often bridges are documented as important roosting locations during the active seasons (staging, maternity, and swarming; Detweiler and Bernard 2023, Keeley and Tuttle 1999) whereas culverts are often recorded as winter roost sites in areas where suitable cave habitat may be lacking, especially in the southern United States (USFWS 2022). However, there are exceptions to these generalizations and bats may use bridges or culverts at various times throughout their life histories.

A culvert[79] is a round or rectangular-shaped structure hydraulically and structurally designed to convey water, sediment, debris, and, in many cases, aquatic and terrestrial organisms through roadway embankments (Figure 8). Roadway culverts are usually composed of concrete or corrugated metal but can also be constructed of timber or PVC piping. Bridges[80] are vehicular or pedestrian structures that are larger and more structurally open than culverts and may span over waterways, various uplands, or urban areas. Bridges are constructed in numerous designs and are often composed of concrete, metal, wood, or a combination of these materials (Figure 9).

These guidelines describe who and what is needed to conduct surveys, and when and how to determine if bats, including IBAT, NLEB, and/or TCB, are using bridges and/or culverts as habitat. Bats' use of bridges and culverts as roosts varies considerably and depends on numerous factors such as structure type (including design and structural condition), area geography, surrounding habitat, availability of natural bat roosts in the

[79] The Federal Highway Administration (FHWA) defines a culvert as a structure comprised of one or more barrels or cells, beneath an embankment and designed structurally to account for soil-structure interaction. These structures are hydraulically and structurally designed to convey water, sediment, debris, and, in many cases, aquatic and terrestrial organisms through roadway embankments. Culvert barrels have many sizes and shapes and have inverts that are either integral or open, i.e., supported by spread or pile-supported footings. A culvert typically has soil materials (i.e., backfill) between the travel way (e.g., road or rail or trail) and actual culvert structure (i.e., barrels, cells). To support dead loads and live loads (e.g., cars, trucks, trains, pedestrians, etc.), the culvert consists of those barrels or cells (typically concrete, metal, or plastic material), backfill, and soil bedding underneath the culvert. In comparison, a bridge typically uses structural components and elements in the deck, superstructure and substructure (abutments and piers) to support those dead and live loads.

[80] FHWA defines a bridge as a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads. A bridge typically uses structural components and elements in the deck, superstructure and substructure (abutments and piers) to support dead and live loads. Bridges typically have an opening of more than 20 feet (measured along the centerline of the roadway) between under copings of abutments, spring lines of arches, or extreme ends of openings for multiple boxes.

vicinity, and seasonality of activity (e.g., year-round active range vs. hibernating range).Due to the numerous factors influencing bat use of bridges and culverts, both seasonally and geographically, the appropriate time of year for assessments should be coordinated with your local USFWS FO(s) and respective state wildlife agency(ies). Surveys resulting in probable absence for IBAT and NLEB are valid for two years[81] if this guidance is followed and the survey report is approved by the local USFWS FO(s). Validity timeframes for other bat species should be coordinated with your local USFWS FO(s) and respective state wildlife agency(ies). Those practitioners utilizing the Programmatic Biological Opinion in conjunction with Federal Highway Administration, Federal Railroad Administration, and Federal Transit Administration for Transportation Projects in the Range of the IBAT and NLEB, should follow these guidelines for completing assessments of bridges or culverts.

PERSONNEL

Before performing assessments for bats on bridges or culverts, surveyors should coordinate with their local USFWS FO(s) and respective state wildlife agency(ies) regarding potential field training opportunities that may be required. At a minimum, surveyors should view the USFWS's virtual bat and transportation structures training[82] before conducting field assessments. Additional trainings may be available in specific states.[83] We recommend individuals conducting reviews for bats use the included sample data form at the end of this Appendix to submit with your survey report as it will ensure all the necessary information is provided to the USFWS FO(s) and expedite review of your study plan and survey report. If you choose to submit a different data form with your survey report, please ensure, at a minimum, it includes all information requested in the sample data form. We also encourage the incorporation of the minimum data field requirements for contributing bridge and culvert assessment data into the North American Bat Monitoring (NABat) database; however, it is not required. Individuals assessing bridges and culverts should employ appropriate safety measures in conducting these reviews and avoid touching any bats.

EQUIPMENT

The following equipment is highly recommended at a minimum to complete bridge or culvert assessments for bats.

- A high-powered flashlight, headlamp, or spotlight (> 600 lumens)
- Binoculars and/or spotting scope
- Digital camera with video recording capability
- Data forms and writing utensil
- Sturdy footwear. Depending on conditions, waders or muck boots may be preferred
- Decontamination[84] equipment if within white-nose syndrome positive area
- Personal protective equipment, according to organizational or agency requirements

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[81] The timeframe of two years is to remain consistent with the Programmatic Biological Opinion for Transportation Projects in the Range of the IBAT and NLEB

[82] Virtual Training available at: https://www.youtube.com/watch?v=w3g9HDQFi3A

[83] In Georgia: To express interest in annual field training or additional online materials, please contact the USFWS Georgia Field Office or the Georgia Department of Natural Resources Nongame Conservation Section
In New Jersey: To express interest in field training, please contact the USFWS New Jersey Field Office or the New Jersey Department of Environmental Protection's Endangered and Nongame Species Program
In Indiana: Online training required by Indiana Department of Transportation is available here.

[84] Please refer to the White-nose Syndrome Decontamination Protocol available here.

APPENDIX K: ASSESSING & SURVEYING BRIDGES & CULVERTS FOR BAT USE

The following equipment may be beneficial or advisable depending on conditions at the site, level of difficulty in completing a thorough assessment, safety requirements of your institution, or other site-specific factors.

- Mirror with telescoping handle for viewing tight spaces
- Acoustic bat detectors
- Dust mask or KN95/N95 mask
- Cellular phone
- Handheld GPS
- Easily removed, protective coveralls and change of clothes if access requires crawling
- Guano sample collection materials
- Endoscope, borescope, or similar camera and light, perhaps attached to a telescoping pole. It is recommended to choose a camera with the option to view live footage in real time
- Specialized equipment such as ladders, kayaks or other floating equipment, or under bridge inspection vehicles, etc. may be useful in some circumstances

FIGURE 8. Representative culvert structures of various types, including a box culvert in Indiana (top; photo by USFWS); a round, concrete pipe culvert design in Georgia (bottom left; photo provided by Georgia Department of Natural Resources); and a corrugated metal pipe culvert design in Missouri (bottom right; photo provided by L. Droppelman).

FIGURE 9. Representative bridges with documented bat use, including a bridge with metal struts in Indiana (top; photo provided by Indiana Department of Transportation) and a concrete bridge in North Carolina (bottom; photo provided by North Carolina Wildlife Resources Commission).

ASSESSING BRIDGES/CULVERTS FOR BATS

Bridges and culverts can have many characteristics suitable for bat occupation. Many bat species will take advantage of cracks, crevices, voids, and other openings within structures. These can include cracks and openings caused by structural deterioration (e.g., cracking in concrete, rusted metal, etc.) and typical spaces existing via structural design (e.g., expansion joints). Bats may also roost in the open on rough surfaces or within drain or weep holes, along guardrails, and within jersey barriers or other voids. Additionally, many bridges and culvert designs create artificial “cave-like” environments where conditions are generally stable, thus allowing bats to use for extended periods of torpor, particularly in areas where natural cave-like habitats may be limited.

Step 1. Initial Assessment of Suitability and Safety

Prior to conducting any bridge or culvert assessment, a thorough safety assessment of each structure should be conducted to identify any potential health or safety hazards to surveyors and bystanders. Road traffic, unstable surfaces (e.g., riprap, deep sediment, ice, and swift moving water), or enclosed spaces are examples of some potential safety concerns. Surveyors should use appropriate personal protective equipment and take proper precautions to avoid and minimize identified risks according to their own comfort level and following the safety recommendations and guidelines required by their organization and local authorities. Only structures that are deemed safe should be entered at the surveyor's discretion.

Upon determining that a site is safe to enter, the bridge or culvert should be evaluated to determine whether it is generally suitable for bat roosting. Because most bridges will contain cracks and crevices that are of suitable size for bat roosting, any bridge that is safe to assess should be considered potential habitat for IBAT and NLEB, as well as TCB. Culvert suitability may vary by species. Table 5 includes the minimum diameter measurements for each species for consideration (adapted from USFWS 2022). The minimum length culvert that any of the species of interest has been documented is 23 feet (N. Anderson, personal communication), and should generally be considered the minimum suitable length for all three species. However, for safety reasons we do not recommend entry of any site less than 3 feet in diameter at the entrance, regardless of whether the site is greater than 23 feet in length. Practitioners should coordinate with local USFWS FO(s) and respective state wildlife agency(ies) to determine if local guidance deviates from these minimums when additional species may need to be considered. Additionally, culverts that are fully enclosed or blocked (e.g., under roadway or soil), enclosed with grills or grates, or fully obstructed in any other manner should not require an assessment. Partially enclosed or obstructed structures may be suitable and should be inspected if of the appropriate size. Uncertainties in suitability should be coordinated with the local USFWS FO(s) and respective state wildlife agency(ies).

TABLE 5. Suggested minimum culvert dimensions for determining IBAT, NLEB, and TCB suitability. If a site meets 1) the minimum entrance height/diameter for a particular species and 2) is 23 feet or greater in length*, it may be considered suitable to survey.

Species	Minimum Culvert Entrance Height/Diameter (feet)	Source
IBAT	4	L. Pattavina & E. Ferrall, personal communication, Georgia 2022
NLEB	4.5	N. Anderson, personal communication, Louisiana 2014
TCB	3*	USFWS 2022

* TCBs have been documented in culverts as small as 2 feet in diameter as reported in USFWS 2022; however, instances of TCB in culverts this small are expected to be rare. We do not recommend entry of sites less than 3 feet in height/diameter, regardless of length.

Step 2. Inspections of Bridges/Culverts and Indicators of Bat Presence

After an initial assessment if the bridge/culvert would be suitable for bats, surveyors should submit a completed USFWS Project Proposal Form or Study Plan to the local USFWS FO(s) for approval before they begin inspecting it for evidence of bat occupancy. The most ideal vertical crevices for bats are those that are 0.5 – 1.25 inches wide and > 4 inches deep (if sealed at the top) or >12 inches deep if not sealed. Although these characteristics represent the most ideal size of cracks and crevices for bat roosting, bats may be found in spaces that are larger and smaller than this range. Assessments should identify and inspect all cracking, crevices, spaces, and voids along the under deck of the bridge and support beams and inner walls, such as

below a fillet (a concrete filling between ceiling and vertical beam). Additionally, expansion joints that are unobstructed by debris or other blockages should be identified and inspected. Additional features to inspect include vertical spaces between end walls and bridge deck, areas of spall repair, guardrails and gaps in concrete parapet, plugged drainpipes, and weepholes. During the assessment, individuals should use high-powered flashlights, headlamps, or spotlights to examine all accessible parts of the bridge or culvert. Cave-like areas, recesses, and other similar features inside bridges or culverts (e.g., deck in the case of a bridge; see photos) should be searched in a similar fashion, although these areas may require the use of specialized equipment such as endoscopes. There are numerous indicators that can be used to determine bat use and presence within a bridge/culvert.

Visual

- ***Roosting Bats:*** Upon entry of the bridge/culvert, check for bats roosting out in the open. Open-roosting bats will typically be near the ceiling or on the ceiling itself of a culvert or similarly along the underdeck of a bridge. Bats will occasionally roost on or within bird nests, such as those composed of dried mud and created by various species of swallow (CBWG 2022). Bats may also take flight when disturbed and can be quickly accounted for during the assessment. Use binoculars/spotting scopes when attempting to locate bats roosting in higher areas of the bridge/culvert. If bats are present, record species (if determinable), total number, a description of the respective roosting locations, and representative photographs of the individuals (see Figure 10). Additionally, provide a sketch map, if possible, showing the locations of where the bat roosts exist on the bridge/culvert (use the bridge/culvert plan sheet as base for sketch). If any dead or injured bats are observed, take photographs and promptly notify the local USFWS FO(s) and respective State Agency(ies).

Figure 10 A TCB roosting on the ceiling of a culvert in Georgia (left; photo provided by Georgia Department of Natural Resources) and IBATS roosting in an expansion joint in Indiana (right; photo provided by USFWS).

- ***Urine and/or Body Staining:*** Urine or body oil stains may appear wet when bats have recently used the structure as a roost and are usually found in dark places. When dry, urine staining may have light-colored mineral deposits, but it can be difficult to differentiate from water staining (the latter often has presence of green algae). Dry urine staining can also be difficult to differentiate from concrete efflorescence (a deposit of soluble salts and bases, usually white in color, that sometimes

appears along cracks in concrete or masonry). For body oil staining, look for 4-6 inches-wide dark stains located on concrete support beams and walls immediately below the underdeck of the bridge, and beneath joints (Figure 11). It's important to note that staining on bridges and culverts can be caused by a wide variety of things other than bat presence. Guano deposits almost always accompany bat urine or body staining at structures, so "suspect" staining alone may not be sufficient evidence of bat presence (with the notable exception of structures with roost locations situated over waterways, where guano deposits would be washed away).

Figure 11. Open-roosting Indiana bats (*Myotis sodalis*) and associated urine staining on the underside of a bridge in Indiana (photo provided by R. Yaeger).

- ***Presence of Guano (bat droppings):*** Guano deposition is a relatively quick visual indicator of recent bat use of a structure. Individual bat guano pellets are small, brown/black in color, and unlike fibrous rodent droppings are more easily crushed and contain notable insect parts[85](Figure 12). Older droppings may be gray in color. These droppings will accumulate on the ground, floor of a covered bridge, pier caps, or on other horizontal structural components below where bats roost (Figure 13). Droppings may also adhere to vertical surfaces (e.g., support beams and walls) below roosts. Searches for bat droppings should be performed via the use of a high-powered flashlight. Surveyors should wear a dust mask (e.g., N95), and rubber boots are recommended for traversing

[85] Insect parts may be difficult to see without magnification. Low magnification handheld field microscopes or hand lenses are recommended for those practitioners regularly conducting guano sampling as part of bridge and culvert assessments.

through large guano deposits. All accessible cracks, cave-like areas, and expansion joints should be checked for the presence of guano. Confirmed and suspected bat droppings should be noted and their location within the bridge/culvert should be documented. Additionally, representative photographs should be taken of guano deposits in-situ, with a ruler or other object for scale, prior to crush-testing or collecting any guano samples (note: if guano samples are intended to be collected, refer to the guano sampling section of this Appendix). It is notable that in many cases, guano accumulation in culverts or at bridges over water will be minimal due to the regular inflow and outflow of water. In these situations, urine and body staining may be a more important indicator of bat use than guano accumulation.

Figure 12. Examples of guano accumulations on bridges. (photos provided by Georgia Department of Natural Resources (top) and Indiana Department of Transportation (bottom)).

Figure 13. Examples and comparative sizes and characteristics of bat guano from little brown bat (*Myotis lucifugus*) and big brown bat (*Eptesicus fuscus)* (left; photo provided by Vermont Fish and Wildlife Department)*;* Guano deposit from colony of Yuma bats (*M. yumanensis*) on horizontal bridge structure (right; photo provided by P. Crawford/ Oklahoma Department of Transportation).

Sound and Smell

Bats occupying bridges/culverts may audibly vocalize when approached, thus high-pitched squeaking or chirping can be a quick indicator of current use. Surveyors that have difficulty hearing high pitch noises may find an acoustic detector with an external speaker or headphone jack helpful for detecting bat chatter, but use of this equipment during visual inspections is not required. Guano deposits, especially large amounts, also have an ammonia odor that can be apparent in some situations.

Step 3. Inaccessible Areas and Additional Assessment Options

In some situations, there will be portions of a bridge/culvert that may be inaccessible or unsafe for thorough inspections. In these instances, we recommend coordinating with the USFWS FO, State Agency(ies), and/or local Department of Transportation to determine if any of the following inspection methods or alternate assessment methods included here are recommended.

- ### Acoustic Surveys

  Note: In some circumstances, acoustic surveys can be used to assist in assessing and characterizing bat colony use of a bridge or culvert. However, acoustic surveys should be conducted with caution and only by experienced practitioners. Detectors may also need to be placed further back from the structure to avoid ultrasonic noise associated with vehicle traffic, powerlines, and other nearby infrastructure. Acoustic collections should only be used as a supplement to a larger suite of structural survey/assessment approaches and cannot be used to determine species identification as a

stand-alone method (refer to Appendix C for performing acoustic surveys to determine P/A of IBAT and NLEB). An example scenario where an acoustic survey at a bridge or culvert may be appropriate includes the use of acoustic equipment to assist in an emergence survey for a structure that has been determined to be unsafe to enter or inspect using traditional methods.

- **Emergence Surveys**

  Emergence surveys may be used as a supplementary tool to determine use of a structure and can only be used once IBAT and/or NLEB colony presence has been confirmed. If emergence surveys are planned for the structure for TCB, contact the local USFWS FO(s) and respective State Agency(ies) to determine if Appendix E of the Survey Guidelines is applicable, or if a modified approach is appropriate for the situation.

- **Alternative Techniques**

  Assessments from kayak/boat with binoculars to inspect areas over deep water, as well as ladders or construction equipment (cherry pickers, snooper truck, etc.; Figure 14) to access high areas of structures or areas over deep water may be necessary in certain situations.

Figure 14. Biologists use a snooper truck to assess expansion joints and concrete caps over deep water (photo provided by Georgia Department of Transportation).

SPECIES IDENTIFICATION

Visual Identification

Visual identification of species may be possible by experienced practitioners, such as those individuals that have Section 10(a)(1)(A) permits to conduct bat surveys. However, voucher photos should be taken with high-quality cameras for inclusion in survey reports regardless of the experience of the surveyor. If species identification cannot be verified visually, in photographs, or by other methods when bats are known to use a structure, it may be appropriate to assume presence of IBATs or NLEBs. Please coordinate with the local USFWS FO for guidance about assuming presence.

Acoustic Identification

Species identification may not be reliable using acoustic detectors to confirm occupancy at a bridge. Bats just emerging from roosts are often making social calls, which cannot always be reliably identified to species. Detectors may need to be set further back from suspected roost locations to record "search phase" calls that bats make while navigating/foraging. Automatic or qualitative acoustic identifications from bridges or culverts should only be performed following coordination with and approval from the local USFWS FO. Surveyors can use timestamps of acoustic recordings to glean insight into whether the recorded bats may have been made by bats emerging from the roost, but caution should be used in interpreting acoustic data as the detector may have also recorded bats not using the structure.

Guano Collection & Analysis

Genetic material in bat guano can be analyzed to determine which species deposited the pellet(s). However, samples must be collected in a manner that minimizes contamination and maintains their integrity for lab analysis. If possible, guano should be collected in sufficient amounts to maximize the ability for species to be properly identified.

Recommended standard equipment for performing guano sampling includes a high-powered flashlight (> 600 lumens, preferably a headlamp), hard hat, dust mask, digital camera, writing utensil(s) (e.g., fine- to medium-point permanent marker or pen; pencil for sketches), disposable latex gloves, collection vials (*e.g.*, 1.5 or 15 ml in size), and a collection utensil (e.g., plastic spoon).

Guano collections should only be performed after coordinating with the local USFWS FO(s) and respective State Agency(ies) to develop a collection plan, which may be included in the overall survey Study Plan. The primary goal of a guano collection plan is to obtain samples that provide a full representation of bat use of the structure. Additionally, it should include the following elements: 1) number of distinct areas of guano present in the structure; 2) guano condition (e.g., old vs. fresh), 3) map of guano locations within structure and collection sample points (see Figure 15); 4) photographs of structure, guano deposits, on the ground at the time of sample collection; 5) time of year[86] that samples will be obtained; 6) equipment that will be used to safely collect and curate guano (*e.g.*, sample collection vials, gloves, collection utensils, writing utensils, camera, etc.).

The following protocols* should be followed when collecting guano samples (**check with the institution, lab, or entity you are using to perform guano analysis for any additional protocols, if needed*). Collect the freshest guano possible (freshest guano is likely on walls/sides of the structure, as well as piers vs. the ground). Old guano deposits may be too degraded to be identifiable.

1) Obtain a minimum sample size of 6 pooled samples or 10 individual samples. However, additional pellets and/or more samples covering each location is ideal (for smaller sample sizes, coordinate with local USFWS FO(s) and respective State Agency(ies)). Each sample must be labeled with a unique identifier to link it to the specific location where it was collected.
2) Number of vials collected should be proportional to the surface area of guano under a bridge; 10-20 pellets per ft^2 is ideal. For a linear line of guano, collect 10 pellets per 15feet or collect a few pellets every 5 feet, depending on the length of the guano deposit. For individual guano piles, collect pellets off the top and around the entire surface of the pile (NOTE: If possible, fill an entire sample

[86] It is recommended to obtain guano samples during bridge and structure use or as close to movement to hibernacula (if applicable) as possible to avoid sample degradation.

vial per single guano pile; do not combine multiple, separate guano pile samples into one vial so that specific roost sites of federally listed bats can be identified.)

3) Per the guano collection plan, work with your local USFWS FO(s) and respective State Agency(ies) to determine which institution or entity will analyze the guano results for species identification.

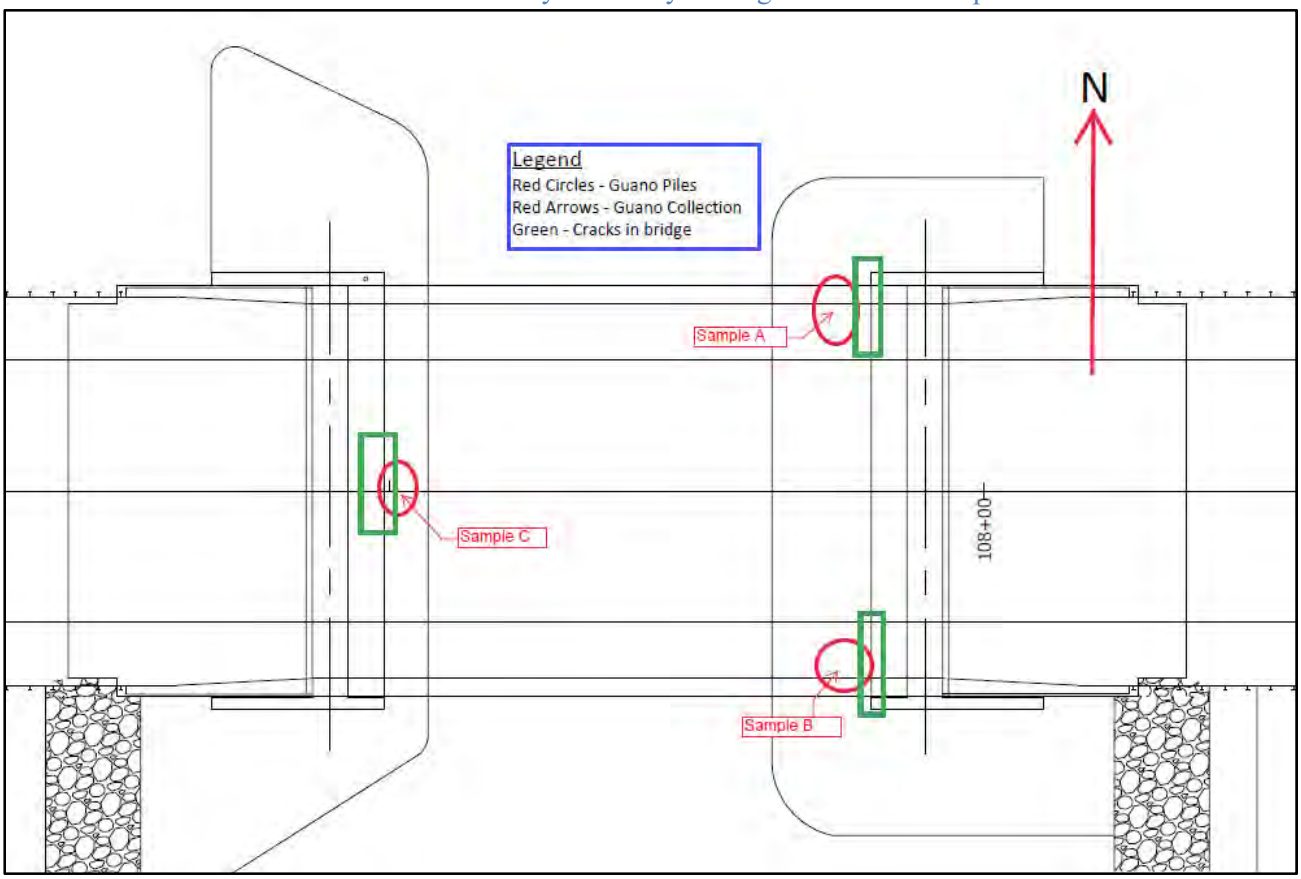

Figure 15. Example map for a guano collection plan, showing top-down view of a bridge, showing linear guano piles located along the abutment walls (underneath the structure's expansion joins). Arrows indicate proposed sample collection locations (Photo provided by Indiana Department. of Transportation).

NEXT STEPS—WHAT TO DO IF BATS ARE FOUND

Findings of bridge or culvert assessments should be submitted to the local USFWS FO(s) and respective State Agency(ies) in a survey report. If IBAT, NLEB, or TCB are positively identified during a bridge or culvert assessment or if species identification cannot be verified at a bridge or culvert with evidence of use, coordinate with your local USFWS FO within 24 hours to determine next steps. For other species, coordinate with your appropriate state agency(ies) (e.g., state wildlife and transportation agencies).

SURVEY REPORTING CHECKLIST

- Completed survey data form
- Annotated photo log w/representative images of surveyed structure (including areas with no indication of bat presence)
- Detailed information on location(s) where roosting bats and/or signs of bat use (e.g., staining, guano, etc.) was documented
- Information pertaining to any guano samples collected and locations within the structure where samples were obtained.

Additional information, photos, results, etc. relevant to any other previously agreed upon survey methods for the structure (e.g., emergence surveys, mist-netting, harp-trapping, acoustics).

DATA MANAGEMENT[87]

USFWS FOs and respective state wildlife agency(ies) may prefer that bridge and culvert assessment data be submitted electronically, in hard copy survey reports, or both. An example data form that can be printed is available on the next page [8889].

REFERENCES

California Bat Working Group (CBWG). 2022. Bats in Swallow Nests (rev. 4 April 2022). Accessed 1 February 2024. Available: https://www.calbatwg.org/resources/

Detweiler, L.W. and Bernard, R.F. 2023. Wildlife Use of Anthropogenic Structures: A Comprehensive Review of Bridge Use by Bats, Acta Chiropterologica 25(1), 135-157,

Georgia Department of Natural Resources (GADNR). 2023. Unpublished data. Referenced in email exchange with E Ferrall and M Hunt, dated 18 March 2024.

Indiana Department of Transportation (INDOT). 2021. INDOT Protected Species Guidance. Environmental Policy Office, Environmental Services Division, INDOT. Indianapolis, IN. 37 pp.

Keeley, B. W. and M. D. Tuttle. 1999. Bats in American Bridges. Bat Conservation International, Inc. Austin, TX. Resource Publication No. 4. 41 pp.

U.S. Fish and Wildlife Service (USFWS). 2018. Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat. Midwest Regional Office, Bloomington, Minnesota. February. https://www.fws.gov/midwest/endangered/section7/fhwa/pdf/BORevised02052018forIbatNLEB_FHWA_FRA_%20FTA.pdf

U.S. Fish and Wildlife Service (USFWS). 2022. WHITE PAPER: Recommended Minimum Culvert Dimensions for Bat Roost Surveys in Western North Carolina. USFWS, Asheville Field Office, Asheville, NC. 11 pp.

U.S. Fish and Wildlife Service (USFWS). 2019. New Jersey Guidance on Surveying Transportation Structures for Bat Occupancy. September 2019. 3 pp.

[87] The submission procedures are not required to be used under the Guidance but are highly recommended. Use of these forms will ensure all the necessary information is provided to the USFWS FO and expedite review of your study plan and survey report. Regardless of the form that is used, please ensure that the necessary data is submitted to the local USFWS FO and appropriate state wildlife agency(ies).

[88] Data submission from bridge and culvert assessments to the North American Bat Monitoring Program (NABat) database is encouraged but not required. The minimum required fields for submission to NABat are highlighted on the sample form.

[89] A template electronic data form that incorporates the minimum fields required for submission to NABat is found at: https://drive.google.com/drive/folders/1U3wCk6EIb8ZtWXSXUlBhkfANOHMJytW4?usp=sharing

Walker, F. and D. Sanchez. 2021. Standard Operating Procedure – Fecal Collection for Genetics. Northern Arizona University, College of Engineering, Forestry, and Natural Resources. Available at: https://in.nau.edu/wp-content/uploads/sites/51/2021/02/Fecal-Collection-SOP_NAU-Bat-Team_January-2021.pdf

Bridge/Culvert Bat Assessment Form

Date & Time of Assessment	DOT Project Number or IFaC Code	Route/Facility Carried	County
Federal Structure ID	Structure Coordinates (latitude and longitude)	Structure Height (approximate)	Structure Length

Structure Type (check one)

Bridge Construction Style

	Cast-in-place		Pre-stressed Girder
	Flat Slab/Box		Steel I-beam
	Truss		Covered
	Parallel Box Beam		Other

Culvert Type

	pipe		
	Pipe/round		
	Other		

Other Structure

Structure Material (check all that apply)

Deck Material	*Beam Material*	*End/Back Wall Material*
Metal	None	Concrete
Concrete	Concrete	Timber
Timber	Steel	Stone/Masonry
Open grid	Timber	Other
Other	Other	

Creosote Evidence

Yes	No
Unknown	

Culvert Material

Metal
Concrete
Plastic
Stone/masonry
Other

NOTES:

Crossings Traversed (check all that apply)

	Bare ground		Open vegetation
	Rip-rap		Closed vegetation
	Flowing water		Railroad
	Standing water		Road/trail - Type:
	Seasonal water		Other:

Surrounding Habitat (check all that apply)

	Agricultural		Grassland
	Commercial		Ranching
	Residential-urban		Riparian/wetland
	Residential-rural		Mixed use
	Woodland/forested		Other

Areas Assessed (check all that apply)

Check all areas that apply. If an area is not present in the structure, check the "not present" box.
Document all bat indicators observed during the assessment. Include the species present, if known, and provide photo documentation as indicated.

Area (check if assessed)	Assessment Notes	Evidence of Bats (include photos if present)		
☐ All crevices and cracks. **Bridges/culverts:** rough surfaces or imperfections in concrete **Other structures:** soffits, rafters, attic areas	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Concrete surfaces (open roosting on concrete)	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Spaces between concrete end walls and the bridge deck	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Crack between concrete railings on top of the bridge deck (Gap / Railing)	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Vertical surfaces on concrete I-beams	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Spaces between walls, ceiling joists	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ Weep holes, scupper drains, and inlets/pipes	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ All guiderails	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species
☐ All expansion joints	☐ Not present	☐ Visual - live # dead # ☐ Guano ☐ Staining	☐ Audible ☐ Odor ☐ Photos	☐ Species

Name:	Signature:

APPENDIX L. BAT ACTIVITY PERIODS TABLE FOR IBAT, NLEB, AND TCB

State	Hibernation	Winter Torpor[90]	Spring Staging[91]	Summer Occupancy	Pup Season	Fall Swarming[92]
	Timeframe when most bats are hibernating (i.e., inactive[93] season)	Timeframe when mean winter temperatures fall below 40° F and bats roosting in trees are in torpor[94]	Timeframe when most bats are emerging from hibernation, roosting near hibernacula, and preparing for migration to summer home range	Timeframe when bats are present on their summer home range and/or roosting in colonies[95]	Timeframe during late pregnancy and when most young are born until they can fly and forage independently	Period of increased activity near hibernacula (including foraging, roosting in trees, and mating) prior to hibernation
Alabama: Hibernating Range	Nov 16 – Mar 14	N/A	Mar 15 – Apr 30	Mar 15 – Sept 30	May 15 – July 31	Sept 1 – Nov 15
Alabama: Year-round Active Range (Zone 1)[96]	N/A	Dec 15 – Feb 15	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Alabama: Year-round Active Range (Zone 2)	N/A	N/A	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Arkansas	Nov 16 – Mar 14	N/A	Mar 15 – Apr 30	Mar 15 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Colorado	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Connecticut	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31

[90] Only applies in Zone 1 of the year-round active range (see Figure 16).
[91] We currently have no information to inform spring staging timeframe near winter roosts within the year-round active portion of the NLEB or TCB range; consequently, the Service will consider new information in the future that may inform spring staging timeframe.
[92] We currently have no information to inform fall swarming timeframe near winter roosts within the year-round active portion of the NLEB or TCB range; consequently, the Service will consider new information in the future that may inform fall swarming timeframe.
[93] The "active season" is the inverse of the hibernation period. If no hibernation period is listed, bats in this area are active year-round.
[94] State of lowered body temperature and metabolic activity.
[95] IBAT (rangewide) and NLEB (hibernating range) often remain in colonies until the end of Summer Occupancy. TCB (rangewide) and NLEB (year-round active range) roost singly once young can fly and forage independently (i.e., the end of the pup season).
[96] If your project falls within suitable summer IBAT habitat and IBATs are assumed or confirmed present, then default to using the more protective activity periods (AL: hibernating range).

APPENDIX L: BAT ACTIVITY TABLE

State	Hibernation	Winter Torpor[90]	Spring Staging[91]	Summer Occupancy	Pup Season	Fall Swarming[92]
	Timeframe when most bats are hibernating (i.e., inactive[93] season)	Timeframe when mean winter temperatures fall below 40° F and bats roosting in trees are in torpor[94]	Timeframe when most bats are emerging from hibernation, roosting near hibernacula, and preparing for migration to summer home range	Timeframe when bats are present on their summer home range and/or roosting in colonies[95]	Timeframe during late pregnancy and when most young are born until they can fly and forage independently	Period of increased activity near hibernacula (including foraging, roosting in trees, and mating) prior to hibernation
Delaware	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
District of Columbia	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Florida	N/A	N/A	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Georgia: Hibernating Range	Nov 16 – Mar 14	N/A	Mar 15 – Apr 30	Mar 15 – Sept 30	May 15 – July 31	Sept 1 – Nov 15
Georgia: Year-round Active Range (Zone 1)	N/A	Dec 15 – Feb 15	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Georgia: Year-round Active Range (Zone 2)	N/A	N/A	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Illinois	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Indiana	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Iowa	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Kansas	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Kentucky	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Oct 15	May 15 – July 31	Aug 16 – Nov 15
Louisiana: Year-round Active Range (Zone 1)	N/A	Dec 15 – Feb 15	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Louisiana: Year-round Active Range (Zone 2)	N/A	N/A	N/A	Mar 15 – July 15	May 1 – July 15	N/A

APPENDIX L: BAT ACTIVITY TABLE

State	Hibernation	Winter Torpor[90]	Spring Staging[91]	Summer Occupancy	Pup Season	Fall Swarming[92]
	Timeframe when most bats are hibernating (i.e., inactive[93] season)	Timeframe when mean winter temperatures fall below 40° F and bats roosting in trees are in torpor[94]	Timeframe when most bats are emerging from hibernation, roosting near hibernacula, and preparing for migration to summer home range	Timeframe when bats are present on their summer home range and/or roosting in colonies[95]	Timeframe during late pregnancy and when most young are born until they can fly and forage independently	Period of increased activity near hibernacula (including foraging, roosting in trees, and mating) prior to hibernation
Maine	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Maryland	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Massachusetts (Inland)	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Massachusetts (Coastal)[97]	Dec 1 – Mar 14		Mar 15 – May 14	Mar 15 – Sept 30	June 1 – Aug 15	Aug 16 – Nov 30
Michigan (Outside Indiana Bat Range)	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Michigan (Within Indiana Bat Range)	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Minnesota	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Mississippi: Hibernating Range	Nov 16 – Mar 14	N/A	Mar 15 – Apr 30	Mar 15 – Sept 30	May 15 – July 31	Sept 1 – Nov 15
Mississippi: Year-round Active Range (Zone 1)	N/A	Dec 15 – Feb 15	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Mississippi: Year-round Active Range (Zone 2)	N/A	N/A	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Missouri	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Oct 15	May 15 – July 31	Aug 16 – Nov 15
Montana	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Nebraska	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15

[97] Coastal Massachusetts includes Martha's Vineyard, Nantucket, and Cape Cod.

APPENDIX L: BAT ACTIVITY TABLE

State	Hibernation	Winter Torpor[90]	Spring Staging[91]	Summer Occupancy	Pup Season	Fall Swarming[92]
	Timeframe when most bats are hibernating (i.e., inactive[93] season)	Timeframe when mean winter temperatures fall below 40° F and bats roosting in trees are in torpor[94]	Timeframe when most bats are emerging from hibernation, roosting near hibernacula, and preparing for migration to summer home range	Timeframe when bats are present on their summer home range and/or roosting in colonies[95]	Timeframe during late pregnancy and when most young are born until they can fly and forage independently	Period of increased activity near hibernacula (including foraging, roosting in trees, and mating) prior to hibernation
New Hampshire	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
New Jersey	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
New Mexico: Hibernating Range	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Sept 1 – Nov 15
New Mexico: Year-round Active Range (Zone 1)	N/A	Dec 15 – Feb 15	N/A	Apr 1 – July 15	May 1 – July 15	N/A
New Mexico: Year-round Active Range (Zone 2)	N/A	N/A	N/A	Apr 1 – July 15	May 1 – July 15	N/A
New York (Inland)	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
New York (Long Island)	Dec 1 – Feb 28		Mar 1 – May 14	Mar 1 – Sept 30	June 1 – Aug 15	Aug 16 – Nov 30
North Carolina: Hibernating Range	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
North Carolina: Year-round Active Range (Zone 1)	N/A	Dec 15 – Feb 15	N/A	Apr 1 – July 15	May 1 – July 15	N/A
North Dakota	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Ohio	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Oklahoma	Nov 16 – Mar 14	N/A	Mar 15 – Apr 30	Mar 15 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Pennsylvania	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15

APPENDIX L: BAT ACTIVITY TABLE

State	Hibernation	Winter Torpor[90]	Spring Staging[91]	Summer Occupancy	Pup Season	Fall Swarming[92]
	Timeframe when most bats are hibernating (i.e., inactive[93] season)	Timeframe when mean winter temperatures fall below 40° F and bats roosting in trees are in torpor[94]	Timeframe when most bats are emerging from hibernation, roosting near hibernacula, and preparing for migration to summer home range	Timeframe when bats are present on their summer home range and/or roosting in colonies[95]	Timeframe during late pregnancy and when most young are born until they can fly and forage independently	Period of increased activity near hibernacula (including foraging, roosting in trees, and mating) prior to hibernation
Rhode Island	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
South Carolina: Hibernating Range	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Sept 1 – Nov 15
South Carolina: Year-round Active Range (Zone 1)	N/A	Dec 15 – Feb 15	N/A	Apr 1 – July 15	May 1 – July 15	N/A
South Dakota (Plains)	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
South Dakota (Black Hills)	Oct 1 – April 30	N/A	May 1 – June 1	May 1 – Aug 31	June 15 – Aug 31	Aug 16 – Sept 30
Tennessee	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Texas: Hibernating Range	Nov 16 – Mar 14	N/A	Mar 15 – Apr 30	Mar 15 – Sept 30	May 15 – July 31	Sept 1 – Nov 15
Texas: Year-round Active Range (Zone 1)	N/A	Dec 15 – Feb 15	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Texas: Year-round Active Range (Zone 2)	N/A	N/A	N/A	Mar 15 – July 15	May 1 – July 15	N/A
Vermont	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Virginia: Hibernating Range	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15
Virginia: Year-round Active Range (Zone 1)	N/A	Dec 15 – Feb 15	N/A	Apr 1 – July 15	May 1 – July 15	N/A
West Virginia	Nov 16 – Mar 31	N/A	Apr 1 – May 14	Apr 1 – Sept 30	May 15 – July 31	Aug 16 – Nov 15

APPENDIX L: BAT ACTIVITY TABLE

State	Hibernation	Winter Torpor[90]	Spring Staging[91]	Summer Occupancy	Pup Season	Fall Swarming[92]
	Timeframe when most bats are hibernating (i.e., inactive[93] season)	Timeframe when mean winter temperatures fall below 40° F and bats roosting in trees are in torpor[94]	Timeframe when most bats are emerging from hibernation, roosting near hibernacula, and preparing for migration to summer home range	Timeframe when bats are present on their summer home range and/or roosting in colonies[95]	Timeframe during late pregnancy and when most young are born until they can fly and forage independently	Period of increased activity near hibernacula (including foraging, roosting in trees, and mating) prior to hibernation
Wisconsin	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Wyoming (Plains)	Nov 1 – Apr 14	N/A	Apr 15 – May 14	Apr 15 – Sept 30	June 1 – Aug 15	Aug 16 – Oct 31
Wyoming (Black Hills)	Oct 1 – April 30	N/A	May 1 – June 1	May 1 – Aug 31	June 15 – Aug 31	Aug 16 – Sept 30

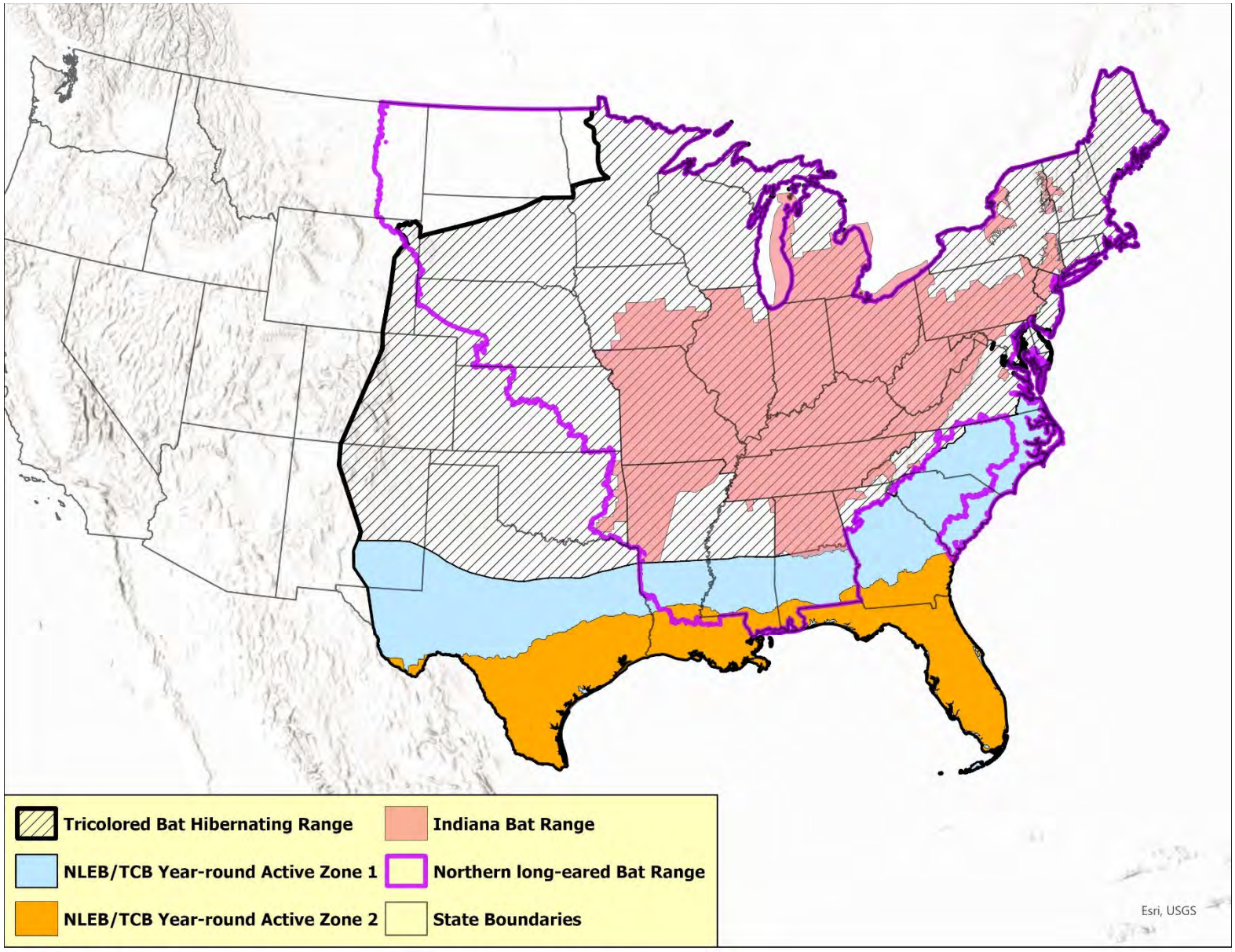

FIGURE 16. Hibernating and/or year-round active ranges of IBAT, NLEB, and TCB.

APPENDIX M: GLOSSARY OF TERMS

Above ground level (AGL) – height at which an acoustic detector microphone is elevated above the top of ground-level vegetation present at the detector deployment location.

Acoustic bat survey – bat sampling conducted through recording and analyzing echolocation calls.

Acoustic location – actual site where an acoustic detector and microphone is deployed; multiple acoustic locations may be used for a full acoustic bat survey.

Approved software program - bat acoustic program (see also *automated bat call ID software*) approved through the USFWS software testing procedures for stand-alone use in presence/probable absence surveys for Indiana bat and/or northern long-eared bat.

Automated bat call ID software – a form of echolocation identification in which recorded files are filtered and identified within a software program; the program compares the statistical properties of a recorded call to a library of known calls to classify to species.

Bat detector – equipment capable of detecting ultrasonic echolocation calls of bats that are above the range of human hearing.

Call quality – how closely the sequence matches typical search-phase behavior for the species.

Call sequence – a series of bat echolocation call pulses.

Candidate software program – bat acoustic program (see also *automated bat call ID software*) submitted to USFWS for software testing, but not yet approved for stand-alone use in presence/probable absence surveys for Indiana bat and/or northern long-eared bat.

Clutter –obstacles present in an area that can affect recording of bat echolocation calls; may be caused by either scattering echolocation calls from sound bouncing off obstacles (thereby reducing call quality) or by bats adjusting their normal search phase calls in response to additional obstacles resulting in changed bat echolocation call parameters.

Detection probability – the likelihood of detecting the presence of a species when that species is present.

Detector sensitivity – measures the ability of a bat detector to detect an echolocation call.

Detector - see *bat detector*.

Directional microphone – a microphone that is more sensitive to sound arriving from certain directions; compared to omni-directional, may detect sounds from a further distance away, but within a narrower cone of detection.

Echolocation – use of ultrasound and the returning echoes to orient and navigate in the environment.

Emergence survey – a survey method that involves visually counting bats that emerge from a known or suspected roost; usually conducted in early evening (e.g., 30 minutes before sunset) when bats exit to forage.

False negative – the failure to detect a bat species when it is present in the area; statistically a type II error in hypothesis testing.

Forest canopy openings – gaps in the continuous forest cover formed by tree crowns, where sunlight

reaches the forest floor.

Forest corridor – Three-dimensional corridors that bats use to travel within forests (also known as flyways).

Forest interior – forest areas surrounded by forest edge, typically 50-300 feet inside from an outer edge.

Forest strip – narrow area with trees. Examples include visual buffers or forest fragments dominated by edge effects.

Forest/woodland edge – transition area between forest and open spaces. Edges create edge effects impacting the species communities and growth of vegetation extending into the forest from the edge. Edge can occur whenever there is a 30-foot break in canopy cover.

Forest/woodland gap – area between intact forest areas that form small open areas. These areas are partially shaded by forest areas and natural regeneration will likely fill the gap.

Frequency filter – pre-programmed range of sound frequencies (in kHz) set for acoustic bat detectors to record.

Full-spectrum detector – bat detectors in which all desirable information about the recorded sound is preserved, including time, frequency, and amplitude.

Harp-trapping – capture method by which a device (harp-trap) composed of a metal frame, multiple strands of equally-spaced nylon strings, and a catch bag at the bottom, is deployed near the entrances of caves, cave-like openings, and mines. Bats are captured as they exit a restricted opening to forage.

Hemispherical microphone – see *omni-directional microphone*.

Hibernaculum (*pl.* "hibernacula") – a thermally-stable roost used by bats for extended periods of torpor during winter. Typically, a cave, natural cave-like feature (e.g., sinkhole, fissure, talus opening, etc.), or anthropogenic structure (e.g., mine, tunnel, bridge, etc.).

High-frequency calls – a general classification of calls that refers to those with minimum frequencies >35 - 40 kilohertz.

Kilohertz (kHz) – a unit of measure of the frequency of sound; one thousand hertz.

Level-of-effort (LOE) – Minimum number of survey nights required (using a particular survey methodology) to determine probable absence of a target bat species; statistically set at a particular confidence level (e.g., 90%, 95%, etc. – depending upon species and region) by USFWS.

Linear project – a project with a footprint greater in length than width (e.g., pipeline, roadway, or right-of-way) with ≥ 1 km (0.6 mi) of suitable habitat; may contain contiguous and fragmented patches of suitable habitat, but only segments at least ≥ 1 km in length can be considered for presence/probable absence survey sites.

Manual-vetting – see *qualitative call identification*.

Maximum-Likelihood Estimate (MLE) – a statistical method of estimating the parameters of a statistical model. For our purposes, the MLE is a statistical method that can be used to determine species presence or probable absence at a particular site on a particular night by means of a classification matrix.

Microphone sensitivity – the minimal amplitude required at a given frequency for a microphone to

detect a sound.

Microphone orientation – the direction in which the microphone is pointing' thereby affecting the cone of detection.

Mist-netting – survey technique that uses low-visibility, mesh nets affixed between two poles to capture foraging bats in areas of increased activity (e.g., travel corridors, ponds, etc.)

Net set – one mist-net deployment consisting of two poles and typically from 1-3 affixed mist-nets stacked onto one another. A typical net set is at least 5 m to 9 m high consisting of two or more nets stacked on top of one another (without gaps) and from 6 m to 18 m wide.

Net site – see *site*.

Noise – unwanted or extraneous environmental sound or electronic interference detected by a bat detector.

Non-linear project – any project generally not linear in nature or linear and < 1 km in length; may contain contiguous and fragmented patches of suitable habitat, but only blocks ≤ 123 acres can be considered for presence/probable absence survey sites.

North American Bat Monitoring Program (NABat) – A multi-national, multi-agency coordinated bat monitoring program across North America that was created to monitor bats at local to rangewide scales. It incorporates winter hibernaculum counts, maternity colony counts, mobile acoustic surveys, and stationary acoustic surveys (https://www.nabatmonitoring.org).

Omni-directional microphone – a microphone that can detect equally in all directions (e.g., has a spherical cone of detection). Hemispherical microphones are a type of omni-directional microphone.

Out-tier project guidance – a USFWS discretionary survey guidance scenario that can be applied when an Indiana and/or northern long-eared bat has been captured or acoustically-detected, but no known roosting areas have been identified. Under "out-tier" guidance, 2.5 and 5-mile or 1.5 and 3.0- mile buffers are placed around the Indiana bat or northern long-eared bat capture or detection location. Surveyors are allowed to perform a standard P/A survey to help refine a maternity colony's true location and/or document roost trees if the project area is more than 2.5 or 1.5 (for NLEB) miles away from the Indiana bat capture/detection site, but within the 5- or 3-mile (for NLEB) buffer.

Pass – a single crossing of a bat through a bat detector's cone of detection; see *call sequence*.

Probable absence – using the appropriate Level of Effort (LOE), a determination that survey protocols are not 100% likely to detect IBAT or NLEB when present and that identification errors may occur.

Pulse – a brief, continuous emission of sound; see *call sequence*.

Qualified biologist – For activities involving the handling of bats, an individual who holds a USFWS Section 10(a)(1)(A) Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying. For qualitative analysis of acoustics, an individual that has completed one or more of available bat acoustics trainings/workshops and/or able to show similar on-the-job or academic experience; furthermore, have demonstrated multiple years of experience in 1) gathering known calls of the target species, 2) have identified bat calls recorded in numerous habitat types, 3) are familiar with species likely to be encountered within the project area, and 4) must have stayed current with qualitative identification of bat calls.

Qualitative call identification (manual vetting) – identification of call sequences through visual comparison with a known call library. Qualitative analysis must also include and present within a written

report a comparison of the results of each acoustic ID program by site and night. Qualitative analysis of each acoustic site and night with probable detections of IBAT and/or NLEB should include the entire night's high frequency call data, including "no ID" files, and not just those files making it through the acoustic analysis tools as probable IBAT and/or NLEB; accuracy can be highly variable based on researcher experience; also referred to by some as manual vetting (see *qualified biologist*).

Roost tree – A live or dead standing tree (snag) occupied by one or more bats. Throughout most of the IBAT and NLEB range, trees are typically occupied by bats outside of the hibernation period (spring, summer, fall), although see Appendix J regarding year-round active populations.

Roost – see *roost tree*.

Site – an area containing one or more individual net sets or harp traps in relatively close proximity that can be efficiently walked to and checked by a survey team (typically two people) within a 10- minute window from a central bat-processing location.

Site-night – The standard unit of time for operating an acoustic detector at one site for one calendar night during an acoustic P/A survey. The MLE should be assessed for a target species on a site-night basis.

Ultrasonic/ultrasound – sounds made of frequencies that are beyond the range of human hearing (often arbitrarily set at 20 kilohertz, although most adults have trouble hearing sounds above 15 kHz.)

Weather proofing – various methods/materials used to protect a bat detector/microphone from the elements (primarily rain).

Winter habitat – see *hibernaculum*.

Zero-crossing detector – a detector type that calculates frequencies by measuring the time between moments of zero sound pressure, which corresponds to the period of the wave.

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: 06/17/2025 14:46:20 UTC
Project Code: 2025-0110264
Project Name: River Run at Exeter Riverbank Stabilization

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

To Whom It May Concern:

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

About Official Species Lists

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

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

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested by returning to an existing project's page in IPaC.

Endangered Species Act Project Review

Please visit the "**New England Field Office Endangered Species Project Review and Consultation**" website for step-by-step instructions on how to consider effects on listed

species and prepare and submit a project review package if necessary:

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

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

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

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

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

Additional Info About Section 7 of the Act
Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/service/section-7-consultations

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Please contact NEFO if you would like more information.

Candidate species that appear on the enclosed species list have no current protections under the ESA. The species' occurrence on an official species list does not convey a requirement to

consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

Migratory Birds

In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity 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: 2025-0110264
Project Name: River Run at Exeter Riverbank Stabilization
Project Type: Shoreline Stabilization
Project Description: The project proposes the stabilization of four areas of eroded banks on the Exeter River that threaten existing residential buildings utilizing SCOURLOK, a vegetated engineered stabilization measure developed by Solmax. This system provides a durable, geotechnically stable structure that provides immediate erosion protection and long-term vegetative cover. The total linear impact is estimated to be approximately 1,100 feet.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.962708750000004,-70.97270023046357,14z

Counties: Rockingham County, New Hampshire

ENDANGERED SPECIES ACT SPECIES

There is a total of 3 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
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

INSECTS

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

CRITICAL HABITATS

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

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

IPAC USER CONTACT INFORMATION

Agency: Aries Engineering, LLC
Name: George Holt
Address: 104 Pleasant Street
City: Concord
State: NH
Zip: 03301
Email gholt@aries-eng.com
Phone: 6032280008

Drawn Action Area & Overlapping S7 Consultation Areas

Area of Interest (AOI) Information

Area : 3,100.57 acres

Jun 17 2025 10:19:01 Eastern Daylight Time

Summary

Name	Count	Area(acres)	Length(mi)
Site_Boundary	1	48.67	N/A
Atlantic Sturgeon	0	0	N/A
Shortnose Sturgeon	0	0	N/A
Atlantic Salmon	0	0	N/A
Sea Turtles	0	0	N/A
Atlantic Large Whales	0	0	N/A
In or Near Critical Habitat	0	0	N/A

Site_Boundary

#	FID	OBJECTID	ParcelOID	NH_GIS_ID	OID_1	PID	TownID	Town
1	0	86889	2377209	08072-104-079-0000	*No Data*	104-079-0000	072	Exeter

#	Name	U_ID	DisplayId	CountyId	SLU	SLUC	SLUM	NBC
1	CamaID: 104-079-0000	072-5041	104-079-0000	8	33	33	*No Data*	6

#	LocalNBC	StreetAddr	Shape_Leng	Shape_Area	Acres	type	Area(acres)
1	50	12 SIR LANCELOT DR	10535.8505259	2120057.68474	0	0	48.67

SECTION 9.0

USACE PROGRAMMATIC GENERAL PERMIT (PGP) - APPENDIX B

US Army Corps of Engineers ®
New England District

Appendix B

New Hampshire General Permits (GPs)
Required Information and Corps Secondary Impacts Checklist

In order for the Corps of Engineers to properly evaluate your application, applicants must submit the following information along with the New Hampshire DES Wetlands Bureau application or permit notification forms. Some projects may require more information. For a more comprehensive checklist, go to https://www.nae.usace.army.mil/Missions/Regulatory/ "Useful Documents, Forms and Publications" and then "Corps Application Form and Guidance." Check with the Corps at (978) 318-8832 for project-specific requirements. For your convenience, this Appendix B is also attached to the State of New Hampshire DES Wetlands Bureau application and Permit by Notification forms.

All Projects:

- New Hampshire Department of Environmental Services (DES) Wetlands Permit Application.
- Request for Project Review Form by the New Hampshire Division of Historical Resources (DHR) https://www.nh.gov/nhdhr/review/rpr.htm.
- Photographs of wetland/waterway to be impacted.
- Purpose of the project.
- Legible, reproducible plans no larger than 11"x17" with bar scale. Provide locus map and plan views of the entire property.
- Typical cross-section views of all wetland and waterway fill areas and wetland replication areas.
- In navigable waters, show mean low water (MLW) and mean high water (MHW) elevations. Show the high tide line (HTL) elevations when fill is involved. In other waters, show ordinary high water (OHW) elevation.
- On each plan, show the following for the project:
    - Vertical datum and the NAVD 1988 equivalent with the vertical units as U.S. feet. In coastal waters this may be mean higher high water (MHHW), mean high water (MHW), mean low water (MLW), mean lower low water (MLLW) or other tidal datum with the vertical units as U.S. feet. MLLW and MHHW are preferred. Provide the correction factor detailing how the vertical datum (e.g., MLLW) was derived using the latest National Tidal Datum Epoch for that area, typically 1983-2001.
    - Horizontal state plane coordinates in U.S. survey feet based on the Traverse Mercator Grid system for the State of New Hampshire (Zone 2800) NAD 83.
    - Project limits with existing and proposed conditions.
    - Limits of any Federal Navigation Project in the vicinity of the project area and horizontal State Plane Coordinates in U.S. survey feet for the limits of the proposed work closest to the Federal Navigation Project;
    - Volume, type, and source of fill material to be discharged into waters and wetlands, including the area(s) (in square feet or acres) of fill in wetlands, below the OHW in inland waters and below the HTL in coastal waters.
    - Delineation of all waterways and wetlands on the project site,:
- Use Federal delineation methods and include Corps wetland delineation data sheets (GC 2).
- For activities involving discharges of dredged or fill material into waters of the U.S., include a statement describing how impacts to waters of the U.S. are to be avoided and minimized, and either a statement describing how impacts to waters of the U.S. are to be compensated for (or a conceptual or detailed mitigation plan) or a statement explaining why compensatory mitigation should not be required for the proposed impacts. Please contact the Corps for guidance.

US Army Corps of Engineers ®
New England District

New Hampshire General Permits (GPs)
Appendix B - Corps Secondary Impacts Checklist
(for inland wetland/waterway fill projects in New Hampshire)

1. Attach any explanations to this checklist. Lack of information could delay a Corps 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 5, regarding single and complete projects.
4. Contact the Corps at (978) 318-8832 with any questions.

1. Impaired Waters	Yes	No
1.1 Will any work occur within 1 mile upstream in the watershed of an impaired water? See http://des.nh.gov/organization/divisions/water/wmb/section401/impaired_waters.htm to determine if there is an impaired water in the vicinity of your work area.*	X	
2. Wetlands	Yes	No
2.1 Are there are streams, brooks, rivers, ponds, or lakes within 200 feet of any proposed work?	X	
2.2 Are there proposed impacts to SAS, special wetlands. 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://www2.des.state.nh.us/nhb_datacheck/. The book Natural Community Systems of New Hampshire also contains specific information about the natural communities found in NH.	X	
2.3 If wetland crossings are proposed, are they adequately designed to maintain hydrology, sediment transport & wildlife passage?	X	
2.4 Would the project remove part or all of a riparian buffer? (Riparian buffers are lands adjacent to streams where vegetation is strongly influenced by the presence of water. They are often thin lines of vegetation containing native grasses, flowers, shrubs and/or trees that line the stream banks. They are also called vegetated buffer zones.)		X
2.5 The overall project site is more than 40 acres?	X	
2.6 What is the area of the previously filled wetlands?	0	
2.7 What is the area of the proposed fill in wetlands?	0	
2.8 What is the % of previously and proposed fill in wetlands to the overall project site?	0	
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://www2.des.state.nh.us/nhb_datacheck/ USFWS IPAC website: https://ecos.fws.gov/ipac/location/index	X	

3.2 Would work occur in any area identified as either "Highest Ranked Habitat in N.H." or "Highest Ranked Habitat in Ecological Region"? (These areas are colored magenta and green, respectively, on NH Fish and Game's map, "2010 Highest Ranked Wildlife Habitat by Ecological Condition.") Map information can be found at: • PDF: https://wildlife.state.nh.us/wildlife/wap-high-rank.html. • Data Mapper: www.granit.unh.edu. • GIS: www.granit.unh.edu/data/downloadfreedata/category/databycategory.html.		X
3.3 Would the project impact more than 20 acres of an undeveloped land block (upland, wetland/waterway) on the entire project site and/or on an adjoining property(s)?		X
3.4 Does the project propose more than a 10-lot residential subdivision, or a commercial or industrial development?		X
3.5 Are stream crossings designed in accordance with the GC 21?	N/A	
4. Flooding/Floodplain Values	Yes	No
4.1 Is the proposed project within the 100-year floodplain of an adjacent river or stream?	X	
4.2 If 4.1 is yes, will compensatory flood storage be provided if the project results in a loss of flood storage?		N/A
5. Historic/Archaeological Resources		
For a minimum, minor or major impact project - a copy of the Request for Project Review (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 11 GC 8(d) of the GP document**	X	

*Although this checklist utilizes state information, its submittal to the Corps is a Federal requirement.
** If your project is not within Federal jurisdiction, coordination with NH DHR is not required under Federal law.

SECTION 10.0

ABUTTER NOTIFICATION DOCUMENTATION

Certified Mail Labels.com

Mailer Name & Address:
Aries Engineering, LLC
104 Pleasant Street
Concord, NH 03301

MAIL MANIFEST REPORT

Postmark Date	Company	Name	Address	Address2	City	State	ZIP	Mail Class/ Service	USPS Certified Tracking#	Total	Reference	User
07/28/2025		Boston & Maine Railroad Corp	500 Water Street J-910		Jacksonville	FL	32202	Certified with Electronic Delivery Confirmation	9407111898765 443650978	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Exeter River MHP	201 Loudon Road		Concord	NH	03301	Certified with Electronic Delivery Confirmation	9407111898765 443650381	$7.19	2025-028 Abutter Notification	78178
07/28/2025		White, Bruce Rev Trust	126 Linden Street		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443650480	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Martel Family Rev Living Trust	115 Linden Street		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443658899	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Dasilva, Flavio	113 Linden Street		Exeter	NE	03533	Certified with Electronic Delivery Confirmation	9407111898765 443658660	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Michael Warobel	111 Linden Street		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443657205	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Cobblestone II Lex LLC	17 W 220 22nd Street	Suite 220	Oakbrook Terrace	IL	60181	Certified with Electronic Delivery Confirmation	9407111898765 443657649	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Powder House	56 Deep Meadows Lane		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443657090	$7.19	2025-028 Abutter Notification	78178
07/28/2025		TPJP Invest LLC	PO Box 924		Raymond	NH	03077	Certified with Electronic Delivery Confirmation	9407111898765 443656468	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Arnheim E Dianne Revocable Trust	114 Linden St		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443651777	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Hanson Family 2004 Rev Trust	137 Linden Street		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443651531	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Keith, Frederick M	135 Linden Street		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443663107	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Peirce, James B	133 Linden Street		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443663466	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Burton Living Trust	131 Linden Street		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443664463	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Scolamiero Gerard & Cynthia Irrev Trust	59 Deep Meadows		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443660908	$7.19	2025-028 Abutter Notification	78178
07/28/2025		Town of Exeter	10 Front Street		Exeter	NH	03533	Certified with Electronic Delivery Confirmation	9407111898765 443686892	$7.19	2025-028 Abutter Notification	78178

MAIL MANIFEST REPORT

Total Pieces in this mailing: 16
Total postage and fees for this mailing: $115.04

Postmaster, PER:_____
(Signature of receiving employee)

Total pieces received:_____

ARIES ENGINEERING
Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Boston & Maine Railroad Corp
500 Water St J-910
Jacksonville FL 32202

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at Arbor Street (Lot 073-047-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Exeter River MHP
201 Loudon Road
Concord, NH 03301

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 8 Wayland Circle (Lot 095-064-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

White Bruce Revocable Trust
126 Linden St
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 126 Linden Street (103-001-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Martel Family Rev Living Trust
115 Linden St
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 115 Linden St (Lot 103-003-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Dasilva Flavio A
113 Linden Street
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 113 Linden Street (Lot 103-004-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Worobel Michael
111 Linden St
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 111 Linden St (Lot 103-005-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Cobblestone II Lex LLC
17W220 22nd Street Suite 220
Oakbrook Terrace IL 60181

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your properties, located at Linden Street (Lot 103-006-0000), 12 Sir Lancelot Drive (104-079-0000), 109 Linden Street (104-080-0000) 107 Linden Street (104-081-0000), Dow Street (104-083-0000), Linden Street/Sher Frst (103-009-0000) and Dow Street (103-008-0000)

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
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Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING
Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Powder House
56 Deep Meadows Lane
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at Linden Street (Lot 103-013-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

TPJP-Invest LLC
PO Box 924
Raymond NH 03077

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 110 Linden Street (Lot 104-076-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Arnheim E Dianne Revocable Trust
114 Linden St
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 114 Linden Street (Lot 104-077-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Hanson Family 2004 Rev Tr
137 Linden Street
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your properties, located at 137 Linden Street (Lot 112-009-0000) and 52 Powder Mill Road (Lot 113-002-000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING
Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Keith Frederick M
135 Linden Street
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 135 Linden Street (Lot 112-010-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Peirce James B
133 Linden Street
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 133 Linden Street (Lot 112-012-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Burton Living Trust
131 Linden Street
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 131 Linden Street (112-013-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Scolamiero Gerard & Cynthia Irrev Trust
59 Deep Meadows
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your property, located at 11 Dow Street (Lot 103-007-0000).

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

ARIES ENGINEERING

Environmental & Geotechnical
Engineers & Hydrogeologists

CERTIFIED MAIL

July 28, 2025
File No. 2025-028

Exeter Town of
10 Front Street
Exeter NH 03533

Re: Notice of Wetlands Permit Application
River Run at Exeter
Exeter, New Hampshire

To Whom It May Concern:

On behalf of Cobblestone Assets, Aries Engineering, LLC (Aries) is providing this letter to notify you that a wetlands permit application is being submitted to the Town of Exeter for filing with the New Hampshire Department of Environmental Services (NHDES) regarding the above-referenced project. Under state law, 482-A:3 I (d)(1), all abutters must be notified by certified mail regarding the submission of a state wetlands permit application, which proposes work abutting your properties, located at Linden Street (Lot 112-011-0000) and 48 Powder Mill Road (113-001-0000)

The permit application and all materials accompanying the application, including plans and drawings of the proposed project, will be available for review at the Exeter Town Clerk's Office, or at the NHDES offices at 29 Hazen Drive in Concord, New Hampshire by scheduling a file review by calling (603) 271-8808 or emailing at: filereview@des.nh.gov.

Sincerely,
Aries Engineering, LLC

George C. Holt, P.G.
Principal Hydrogeologist

Jay P. Johonnett, P.E.
Principal Engineer

GCH:pj

SECTION 11.0

ABUTTERS LIST

ABUTTER LIST
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NH

Parcel ID	Street Address	Owner Name	Owner Address	Owner City	Owner State	Owner Zip	Book/Page
073-047-0000	ARBOR ST	BOSTON & MAINE RAILROAD CORP	500 WATER ST J-910	JACKSONVILLE	FL	32202	N/A
095-064-0000	8 WAYLAND CIR	EXETER RIVER MHP	201 LOUDON RD	CONCORD	NH	03301	4786/1005
103-001-0000	126 LINDEN ST	WHITE BRUCE REVOCABLE TRUST	126 LINDEN ST	EXETER	NH	03533	5422/0725
103-003-0000	115 LINDEN ST	MARTEL FAMILY REV LIVING TRUST	115 LINDEN ST	EXETER	NH	03533	6613/1051
103-004-0000	113 LINDEN ST	DASILVA FLAVIO A	113 LINDEN ST	EXETER	NH	03533	6537/1294
103-005-0000	111 LINDEN ST	WOROBEL MICHAEL	111 LINDEN ST	EXETER	NH	03533	6627/1633
103-006-0000	LINDEN ST	COBBLESTONE II LEX LLC	17W220 22ND ST SUITE 220	OAKBROOK TERRACE	IL	60181	6408/1401
103-007-0000	11 DOW ST	SCOLAMIERO GERARD & CYNTHIA IRREV TRUST	59 DEEP MEADOWS	EXETER	NH	03533	5914/2053
103-008-0000	DOW ST	COBBLESTONE II LEX LLC	17W220 22ND ST SUITE 220	OAKBROOK TERRACE	IL	60181	6350/0270
103-009-0000	LINDEN ST/SHER FRST	COBBLESTONE II LEX LLC	17W220 22ND ST SUITE 220	OAKBROOK TERRACE	IL	60181	6350/0270
103-013-0000	LINDEN ST	POWDER HOUSE	56 DEEP MEADOWS LANE	EXETER	NH	03533	4962/2774
104-076-0000	110 LINDEN ST	TPJP-INVEST LLC	PO BOX 924	RAYMOND	NH	03077	6413/0521
104-077-0000	114 LINDEN ST	ARNHEIM E DIANNE REVOCABLE TRUST	114 LINDEN ST	EXETER	NH	03533	5447/2136
104-079-0000	12 SIR LANCELOT DR	COBBLESTONE II LEX LLC	17W220 22ND ST SUITE 220	OAKBROOK TERRACE	IL	60181	6350/0270
104-080-0000	109 LINDEN ST	COBBLESTONE II LEX LLC	17W220 22ND ST SUITE 220	OAKBROOK TERRACE	IL	60181	6408/1401
104-081-0000	107 LINDEN ST	COBBLESTONE II LEX LLC	17W220 22ND ST SUITE 220	OAKBROOK TERRACE	IL	60181	6408/1401
104-083-0000	DOW ST	COBBLESTONE II LEX LLC	17W220 22ND ST SUITE 220	OAKBROOK TERRACE	IL	60181	6408/1401
112-009-0000	137 LINDEN ST	HANSON FAMILY 2004 REV TR	137 LINDEN ST	EXETER	NH	03533	4399/2885
112-010-0000	135 LINDEN ST	KEITH FREDERICK M	135 LINDEN ST	EXETER	NH	03533	3304/2780
112-011-0000	LINDEN ST	EXETER TOWN OF	10 FRONT STREET	EXETER	NH	03533	2363/0897
112-012-0000	133 LINDEN ST	PEIRCE JAMES B	133 LINDEN ST	EXETER	NH	03533	5494/0740
112-013-0000	131 LINDEN ST	BURTON LIVING TRUST	131 LINDEN ST	EXETER	NH	03533	5089/2459
113-001-0000	48 POWDER MILL RD	EXETER TOWN OF	10 FRONT STREET	EXETER	NH	03533	1500/0347
113-002-0000	52 POWDER MILL RD	HANSON FAMILY 2004 REV TR	137 LINDEN ST	EXETER	NH	03533	4399/2887

ARIES ENGINEERING

SECTION 12.0

PROPERTY TAX CARDS

12 SIR LANCELOT DR

Location	12 SIR LANCELOT DR	**Mblu**	104/ / 79/ /
Acct#	B7225R	**Owner**	COBBLESTONE II LEX LLC
Assessment	$12,642,200	**Appraisal**	$12,642,200
PID	5041	**Building Count**	3

Current Value

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2025	$9,082,400	$3,559,800	$12,642,200
Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2025	$9,082,400	$3,559,800	$12,642,200

Parcel Addreses

Additional Addresses
No Additional Addresses available for this parcel

Owner of Record

Owner COBBLESTONE II LEX LLC
Co-Owner ATTEN: ERIK HAGEN
Address 17W220 22ND ST SUITE 220
OAKBROOK TERRACE, IL 60181

Sale Price $24,000,000
Certificate
Book & Page 6350/0270
Sale Date 10/28/2021
Instrument 21

Ownership History

Ownership History					
Owner	**Sale Price**	**Certificate**	**Book & Page**	**Instrument**	**Sale Date**
COBBLESTONE II LEX LLC	$24,000,000		6350/0270	21	10/28/2021
SHERWOOD FOREST	$0		2821/0422	00	02/10/1982

Building Information

Building 1 : Section 1

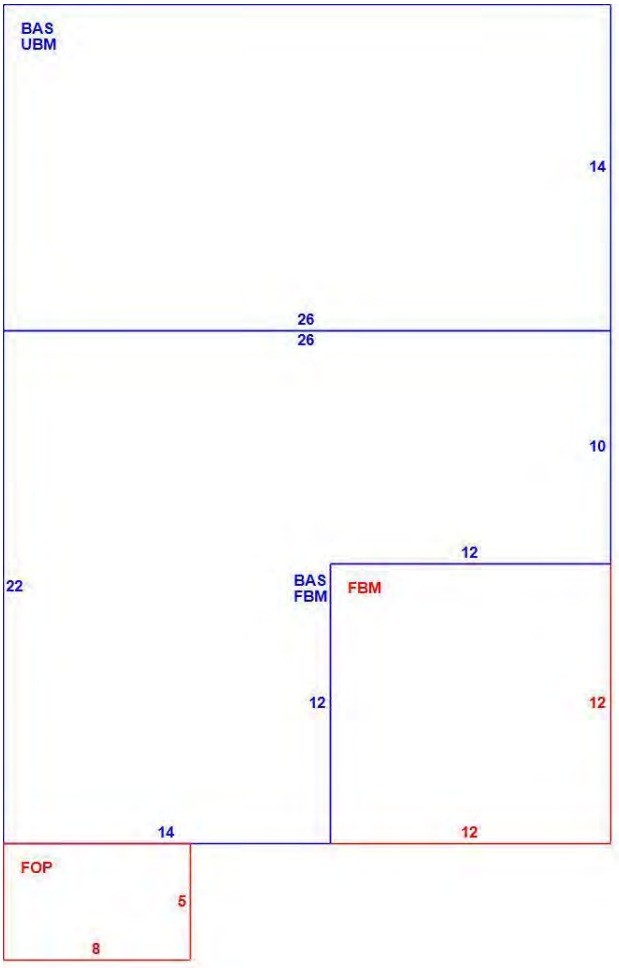
Year Built: 1972
Living Area: 792
Replacement Cost: $225,299
Building Percent Good: 50
Replacement Cost Less Depreciation: $112,600

Building Attributes	
Field	**Description**
Style:	Office Bldg
Model	Commercial
Grade	Average +10
Stories:	1
Occupancy	1.00
Exterior Wall 1	Cedar or Redwd
Exterior Wall 2	
Roof Structure	Gable/Hip
Roof Cover	Asph/F Gls/Cmp
Interior Wall 1	Drywall/Sheet
Interior Wall 2	
Interior Floor 1	Carpet
Interior Floor 2	
Heating Fuel	Oil
Heating Type	Hot Water
AC Type	Central
Bldg Use	OFFICE BLD MDL-94
Total Rooms	
Total Bedrms	00
Total Baths	1
%Taxable	1
1st Floor Use:	3400
Heat/AC	NONE
Frame Type	WOOD FRAME
Baths/Plumbing	AVERAGE
Ceiling/Wall	CEIL & WALLS
Rooms/Prtns	AVERAGE
Wall Height	8.00
% Comn Wall	0.00

Building Photo

(https://images.vgsi.com/photos/ExeterNHPhotos//\00\01\94\67.jpg)

Building Layout



(ParcelSketch.ashx?pid=5041&bid=5041)

Building Sub-Areas (sq ft)			Legend
Code	**Description**	**Gross Area**	**Living Area**
BAS	First Floor	792	792
FBM	Basement, Finished	572	0

FOP	Porch, Open, Finished	40	0
UBM	Basement, Unfinished	364	0
		1,768	792

Building 2 : Section 1

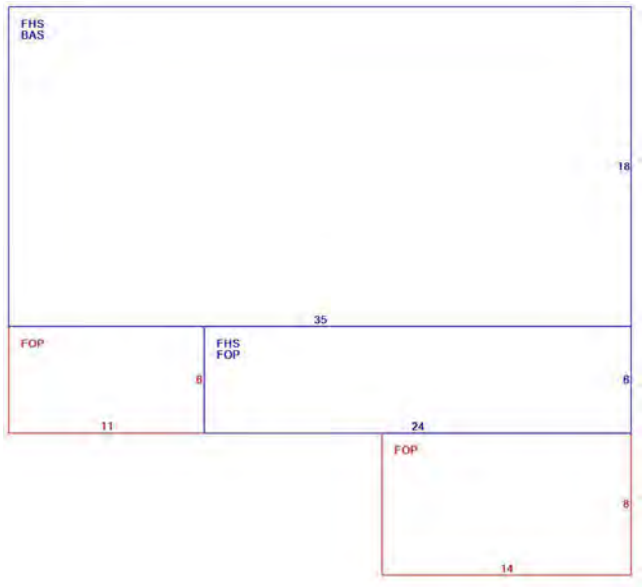
Year Built: 1994
Living Area: 1,017
Replacement Cost: $109,680
Building Percent Good: 68
Replacement Cost Less Depreciation: $74,600

Building Attributes : Bldg 2 of 3	
Field	**Description**
Style:	Clubs/Lodges
Model	Commercial
Grade	Average +10
Stories:	1.5
Occupancy	1.00
Exterior Wall 1	Cedar or Redwd
Exterior Wall 2	
Roof Structure	Gable/Hip
Roof Cover	Asph/F Gls/Cmp
Interior Wall 1	K PINE/A WD
Interior Wall 2	
Interior Floor 1	Concr-Finished
Interior Floor 2	Carpet
Heating Fuel	Gas
Heating Type	Forced Air-Duc
AC Type	None
Bldg Use	DEVEL LAND MDL-94
Total Rooms	
Total Bedrms	00
Total Baths	0
%Taxable	1
1st Floor Use:	390C
Heat/AC	NONE
Frame Type	WOOD FRAME
Baths/Plumbing	AVERAGE
Ceiling/Wall	CEIL & WALLS
Rooms/Prtns	AVERAGE
Wall Height	8.00
% Comn Wall	0.00

Building Photo

(https://images.vgsi.com/photos/ExeterNHPhotos//\00\00\53\33.jpg)

Building Layout



(ParcelSketch.ashx?pid=5041&bid=5721)

Building Sub-Areas (sq ft)			Legend
Code	**Description**	**Gross Area**	**Living Area**
BAS	First Floor	630	630
FHS	Half Story, Finished	774	387
FOP	Porch, Open, Finished	322	0
		1,726	1,017

Building 3 : Section 1

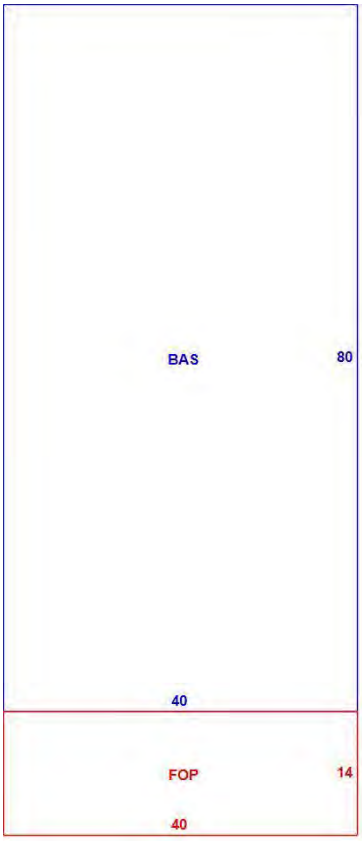
Year Built: 2022
Living Area: 3,200
Replacement Cost: $207,681
Building Percent Good: 96
Replacement Cost Less Depreciation: $199,400

Building Attributes : Bldg 3 of 3	
Field	**Description**
Style:	Clubs/Lodges
Model	Commercial
Grade	Average
Stories:	1
Occupancy	1.00
Exterior Wall 1	Pre-finsh Metl
Exterior Wall 2	
Roof Structure	Gable/Hip
Roof Cover	Metal/Tin
Interior Wall 1	Drywall/Sheet
Interior Wall 2	
Interior Floor 1	Concr Abv Grad
Interior Floor 2	
Heating Fuel	Gas
Heating Type	Forced Air-Duc
AC Type	None
Bldg Use	DEVEL LAND MDL-94
Total Rooms	
Total Bedrms	
Total Baths	
%Taxable	1
1st Floor Use:	
Heat/AC	HEAT/AC PKGS
Frame Type	STEEL
Baths/Plumbing	AVERAGE
Ceiling/Wall	CEIL & WALLS
Rooms/Prtns	AVERAGE
Wall Height	8.00
% Comn Wall	

Building Photo

(https://images.vgsi.com/photos/ExeterNHPhotos///0021/DSC00611_2181(

Building Layout



(ParcelSketch.ashx?pid=5041&bid=114537)

Building Sub-Areas (sq ft)			Legend
Code	**Description**	**Gross Area**	**Living Area**
BAS	First Floor	3,200	3,200
FOP	Porch, Open, Finished	560	0
		3,760	3,200

Extra Features

Extra Features	Legend
No Data for Extra Features	

Land

Land Use

Use Code	3400
Description	OFFICE BLD MDL-94
Zone	M
Neighborhood	50
Alt Land Appr	No
Category	

Land Line Valuation

Size (Acres)	49.28
Frontage	0
Depth	0
Assessed Value	$3,559,800
Appraised Value	$3,559,800

Outbuildings

Outbuildings						Legend
Code	**Description**	**Sub Code**	**Sub Description**	**Size**	**Assessed Value**	**Bldg #**
WDK	WOOD DECK			1560.00 S.F.	$10,900	2
WDK	WOOD DECK			1590.00 S.F.	$11,100	3
MH2	MOBILE HOME SITE A			257.00 UNITS	$8,673,800	1

Valuation History

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2024	$9,082,400	$3,559,800	$12,642,200
2023	$5,195,800	$3,559,800	$8,755,600
2022	$5,155,700	$3,559,800	$8,715,500

Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2024	$9,082,400	$3,559,800	$12,642,200
2023	$5,195,800	$3,559,800	$8,755,600
2022	$5,155,700	$3,559,800	$8,715,500

SECTION 13.0

COPY OF RECORDED DEED PHOTOGRAPHS

Book: 6350 Page: 270

E # 21069715 11/04/2021 12:15:12 PM
Book 6350 Page 270 Page 1 of 4
Register of Deeds, Rockingham County

LCHIP	ROA593049	25.00
TRANSFER TAX	RO111067	360,000.00
RECORDING		22.00
SURCHARGE		2.00

WARRANTY DEED

Exeter River Landing, Inc., a New Hampshire corporation (formerly known as Sherwood Forest Realty, Inc.) with a mailing address of 317 Exeter River Landing, Exeter, New Hampshire 03833 for consideration paid, grants to **COBBLESTONE II LEX LLC**, a Delaware limited liability company with an address of 17W220 22nd Street, Suite 220, Oakbrook Terrace, Illinois 60181, Attn: Erik Hagen, with WARRANTY covenants:

The following tracts or parcels of land, with the buildings thereon situated in Exeter, Rockingham County, New Hampshire:

Parcel I:

A certain tract or parcel of land, with the buildings; thereon, situated in the Town of Exeter, County of Rockingham and Stole of New Hampshire, as shown on a plan entitled, "Linden Street, Exeter, NH 03833, ALTNACSM Land Title Survey Tax Map 104, Lot 79, & Tax Map 103, Lots 8 & 9, for: Sherwood Forest Realty Inc." prepared by Jones & Beach Engineers, Inc., dated May 22, 1988 and recorded at the Rockingham County Registry of Deeds as Plan D-26305, bounded and described as follows:

Beginning at a point S 17° 03' 35" W 100.00 feet from on iron pipe at the northeast corner of land now or formerly of Johnson on the Westerly line of Linden Street, so-called, said point being the northeasterly corner of the properly herein described; thence running along said Lindon Street crossing Dow Street (a private way) S 17° 03' 35" W a distance of 71.71 feet to an iron pipe: thence turning and running along the southerly line of Dow Street, land now or formerly of EAB Realty Trust and land now or formerly of Beech Hill Management Services N 89° 26' 08" W a distance or 349.03 feet to a point; thence turning and running along land now or formerly of Beech Hill Management Services S 16° 35' 08" W a distance of 149.31 feet to a point; thence turning and running along land now or formerly or Beech Hill Management Services S 89° 05' 56" E for a distance of 200 .00 feet to an iron pipe; thence turning and running along land now or formerly of Beech Hill Management Services S 12° 46' 35" W a distance of 52.20 feet to on iron pipe; thence turning and running along land now or formerly of Beech Hill Management Services S 10° 20' 09" W for a distance of 100.00 feet to a point; thence turning and running along land of Beech Hill Management Services N 89° 23' 52" E distance of 150.00 feet to an iron pipe; thence turning and running along the westerly line of Linden Street S 09° 32' 44" W a distance of 231.77 feet; thence

miming on a curve to the right with a radius of 500.00 feet a distance or 113.95 feet; thence turning and running along Linden Street S 22° 36' 12" W a distance of 157.93 feet; thence turning and running along Linden Street S 26° 10' 34" W a distance of 64.76 feet, more or less, to a point on the Exeter River; thence turning end running along the edge of the Exeter River for a distance of 5229 feet, more or less, to a point at land now or formerly of Hanson with a lie course between the last two points of N 73° 05' 23" W a distance of 2996.03'; thence turning and running N 39° 15' 04" W a distance of 25.34 feet to an iron pipe at land now or formerly of the Town of Exeter; thence running along said Town land N 39° 15' 04" W a distance of 255.43 feet to a point on the southerly line of land now or formerly of B&M Railroad ; thence turning and running along said Railroad land N 56° 22' 47" E distance of 117.47 foot to a point; thence running along said Railroad land along a curve to the left of radius 5762.65 feet a distance of 461.84 feet to a point; thence turning and running N 51° 47' 16" E a distance of 461.99 feet to a point at land now or formerly of Kaufman; thence turning and running along said Kaufman land S 73° 07' 08" E distance of 1086.31 feet to on iron pipe at land now or formerly of Burt; thence turning and running along said Bert land S 48° 12' 36" E distance of 663.22 feet to an iron pipe; thence turning and running along said Burt land N 85° 20' 42" E distance of 250.66 feet to a point at land now or formerly of Sherwood Forest, Inc.; thence turning and running along land now or formerly of Sherwood Forest S 12° 05' 46" W a distance of 99.02 feet to on iron pipe on the northerly line of Dow Street thence turning and running along the northerly line of Dow Street N 88° 01' 02" E distance of 150.00 feet to a point at the land now or formerly of Mullavey; thence turning and running along the northerly line of Dow Street N 88° 01' 02" E a distance of 548.11 feet along land now or formerly of Mullavey land nor or formerly of Morin, land now or formerly of Anderson, and land now or formerly of Johnson to the point of beginning.

Excepting and reserving from this description those certain parcels of land situated on Dow Street, in Exeter, Rockingham County, New Hampshire being shown as Map 103, Lot 7, Map 103 Lot 8, and Map 103 Lot 9 on a plan entitled "Lindon Street, Exeter, NH 03833, ALTNACSM Land Title Survey Tax Map 104, Lot 79, & Tax Map 103, Lots 8 & 9, for Sherwood Forest Realty Inc." prepared by Jones & Beach Engineers, Inc., dated May 22, 1988 and recorded at the Rockingham County Registry of Deeds as Plan D-26305.

Parcel II:

A certain tract or parcel of land, with the buildings thereon, situated in Exeter, Rockingham County, New Hampshire, as shown on Map 103 Lot 8 on a plan entitled, "Linden Street, Exeter, NH 03833, ALTNACSM Land Title Survey Tax Map 104, Lot 79, & Tax Map 103, Lots 8 & 9, for: Sherwood Forest Realty Inc." prepared by Jones & Beach Engineers, Inc., dated May 22, 1988 and recorded at the Rockingham County Registry of Deeds as Plan D-26305, bounded and described as follows:

Beginning at a point on the southerly line of Dow Street approximately 500 feet from the intersection of Dow Street and Linden Street, thence running S 17° 09' 11" E a distance of 150.00 feet to a point; thence S 88° 01 '02" W a distance of 200.00 feet; thence N 17° 09' 11" E a distance of 150.00 feet; thence along the southerly edge of Dow Street N 88° 01' 02" E a distance of 200.00 feet to the point of beginning.

Parcel III:

A certain tract or parcel of land, with the buildings thereon, situated in Exeter, Rockingham County, New Hampshire, as shown Map 103, Lot 9 on a pion entitled, "Linden Street, Exeter, NH 03833, ALTNACSM Land Title Survey for Map 104, Lot 79, & Tox Map 103, Lots 8 & 9, for: Sherwood Forest Realty Inc." prepared by Jones & Beach Engineers, Inc., dated Moy 22, 1988 and recorded at the Rockingham County Registry of Deeds as Plan D·26305, bounded and described as follows:

Beginning at a point on the northerly line of Dow Street approximately 548.11' from the intersection of Dow Street and Linden Street, thence running N 88° 01' 02" W a distance or 150.00 feet; thence N 12° 05' 46" E a distance of 99.02 feet; thence N 86° 13' 44" E a distance of 150.00 feet to a point; thence S 11° 25' 37" W a distance of 103.55 feet to a point.

Reservation of Easement:

Excepting and reserving an easement for the purposes of above and below ground access for passage, utilities, communications, water and sewer in and to the following described portion of Dow Road for to access to Linden Street:

Beginning at a point S 17° 03' 35" W 100.00 feet from on iron pipe at the northeast corner of land now or formerly of Johnson on the Westerly line of Linden Street, so-called, said point being the northeasterly corner of the properly herein described; thence running along said Lindon Street crossing Dow Street (a private way) S 17° 03' 35" W a distance of 71.71 feet to an iron pipe: thence turning and running along the southerly line of Dow Street, land now or formerly of EAB Realty Trust and land now or formerly of Beech Hill Management Services N 89° 26' 08" W a distance or 349.03 feet to a point; thence turning and running in a southwesterly direction to the northeast corner of Lot 103-7; thence turning and running along the northerly line of Lot 103-7 a distance of 100.00 feet to the northeast corner of Lot 103-8; thence turning and running across Dow Street in a northwesterly direction to the southeast corner of Lot 103-9; thence turning and running along the northerly line of Dow Street N 88° 01' 02" E a distance of 548.11 feet along land now or formerly of Mullavey land nor or formerly of Morin, land now or formerly of Anderson, and land now or formerly of Johnson to the point of beginning.

Such easement shall run in favor of the grantor, its successors and assigns, as well as Lots 103-6, 104-80, 104-81, 104-81.1, 104-82, 104-82.1,104-82, their successors and assigns, all as shown on Rockingham County Registry of Deeds as Plan D·26305. This easement shall be exclusive to all others including but not limited to the grantee. The parties agree that this document shall not affect the access rights of Lots 103-7, 103-10, 103-11, 103-12.

IN WITNESS WHEREOF, the undersigned has executed this Warranty Deed on Oct 30, 2021.

Exeter River Landing, Inc.

By: _____
Name: Daniel E. Britton
Title: Vice President

COMMONWEALTH OF MASSACHUSETTS
COUNTY OF Norfolk

On this 30 day of October ,2021, before me, the undersigned notary public, personally appeared **Daniel E. Britton**, in his capacity as vice president of Exeter River Landing, Inc. and duly authorized, known to ~~me~~ or satisfactorily proved to me through satisfactory evidence of identification, which is ☑ state issued photo identification ☐ personal knowledge, to be the person whose name is signed on the preceding or attached document in my presence, and who swore or affirmed to me that he executed the same as his free and voluntary act for all purposes intended.

_____
Notary Public/ Justice of the Peace
Comm. Exp. Apnl 1st, 2027

MARIA PAULA BAUTISTA CUELLAR
Notary Public
Commonwealth of Massachusetts
My Commission Expires April 1, 2027

FIGURES

2,000 1,000 0 2,000 4,000 Feet

Legend

Site Boundary

Aries Project # 2025-028
File # 2025-028(1)7.25.mxd

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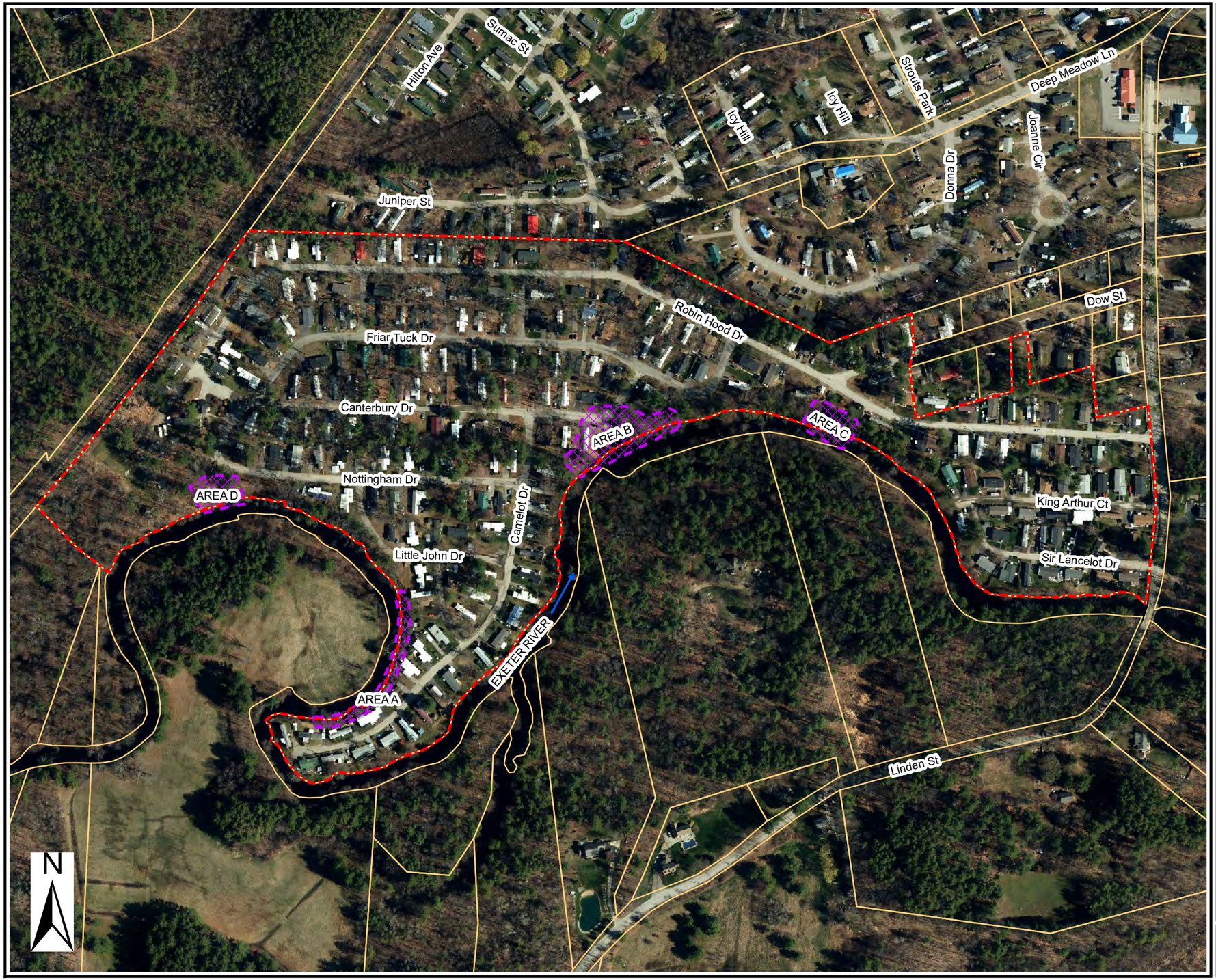
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

LOCUS PLAN

JULY 2025 FIGURE 1



NOTES

1. Plan prepared from: an Overview Existing Conditions Plan, dated February 6, 2025, and prepared by Jones & Beach Engineers, Inc. of Stratham, New Hampshire; and Geographic Information System (GIS) data provided by the New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT) maintained by University of New Hampshire and the NH Office of Strategic Initiatives.

2. Site boundary locations are based on an overlay of the site features on NH GRANIT GIS data. Therefore, all site features are approximately located.

3. This plan is not to be used for construction, survey or boundary purposes.

4. 2021/2022 aerial orthophotographic coverage obtained from NH GRANIT.

Legend

- Site Boundary
- Erosion Area
- Property Boundary

0 150 300 600 900 1,200 Feet

Aries Project # 2025-028
File # 2025-028(2)7.25.MXD

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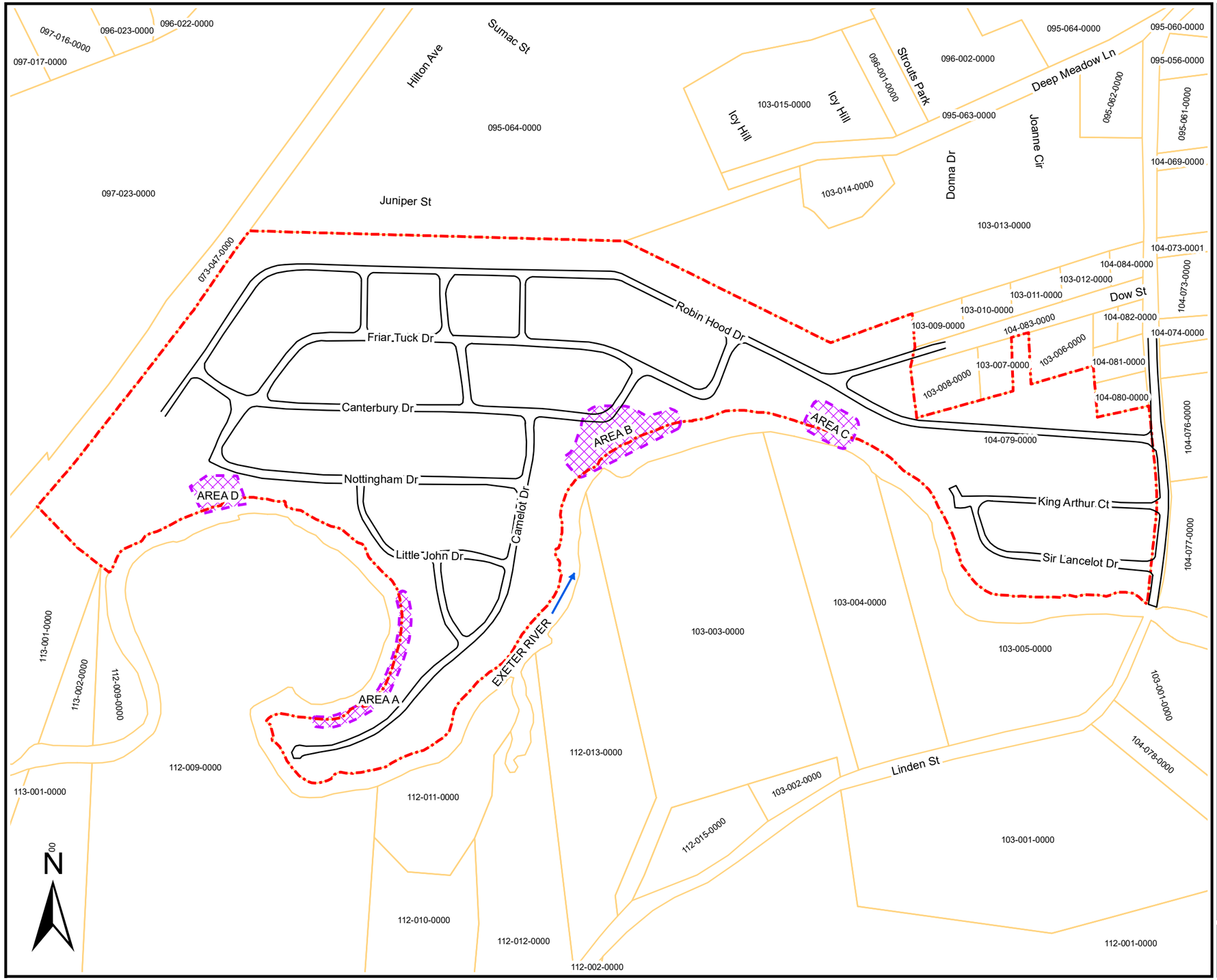
SITE PLAN

JULY 2025 FIGURE 2



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5. Ground surface elevation contours generated from 2019-2020 Light Detection and Ranging (LiDAR) Bare Earth Digital Elevation Model (DEM) imagery obtained from NH GRANIT and field survey by Aries.

Legend

- Site Boundary
- Erosion Area
- Property Boundary

0 150 300 600 900 1,200

Feet

Aries Project # 2025-028
File # 2025-028(3)7.25.MXD

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WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

TAX MAP OVERLAY PLAN

JULY 2025

FIGURE 3

NOTES

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Legend

- Top of Bank/ Edge of Wetlands
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area
- Property Boundary

0 25 50 100 150 200 Feet

Aries Project # 2025-028
File # 2025-028(4A)EC7.25.MXD

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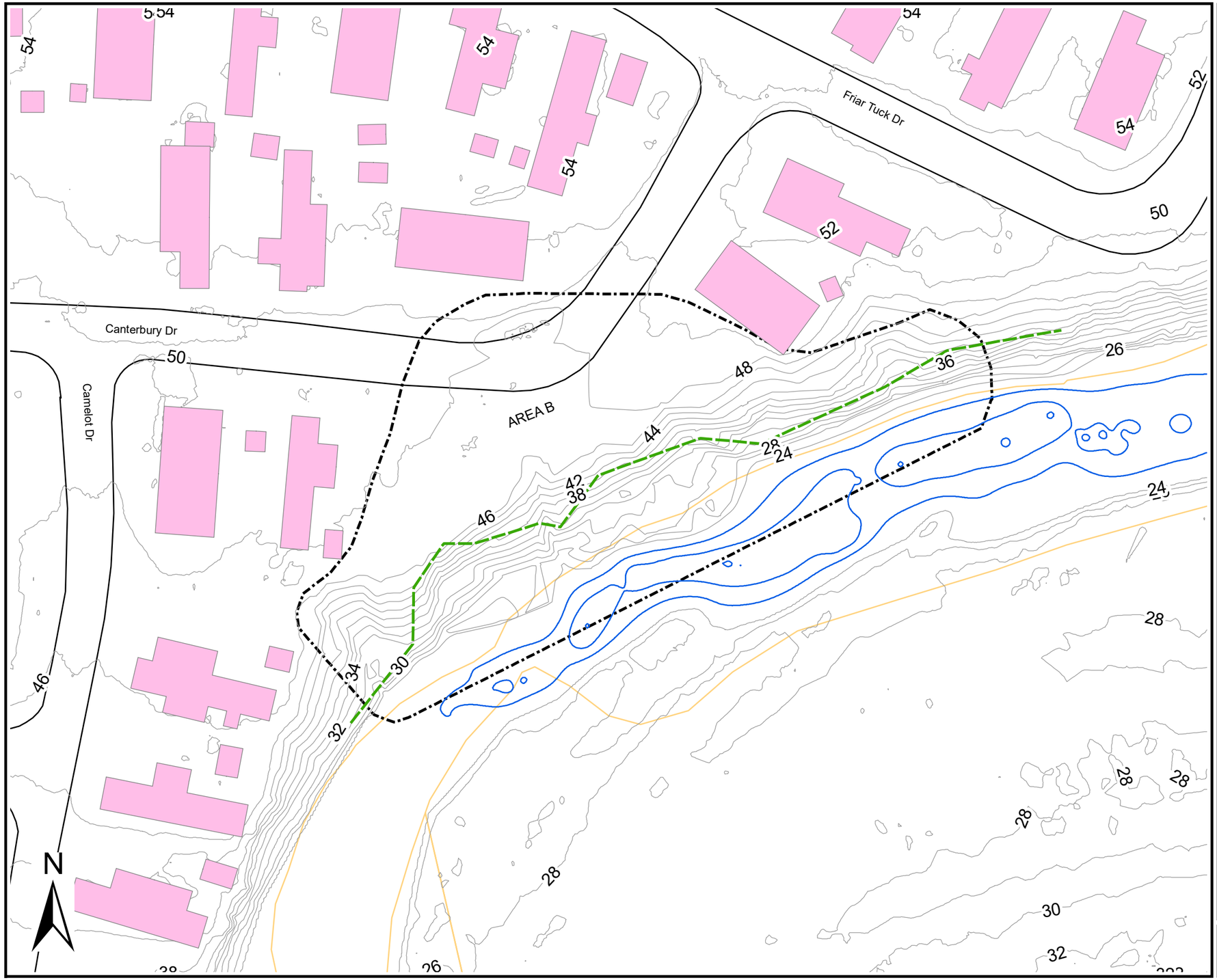
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

EXISTING CONDITIONS PLAN
AREA A

JULY 2025

FIGURE 4A



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Legend

- Top of Bank/ Edge of Wetlands
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area
- Property Boundary

0 25 50 100 150 200 Feet

Aries Project # 2025-028
File # 2025-028(4B)EC7.25.MXD

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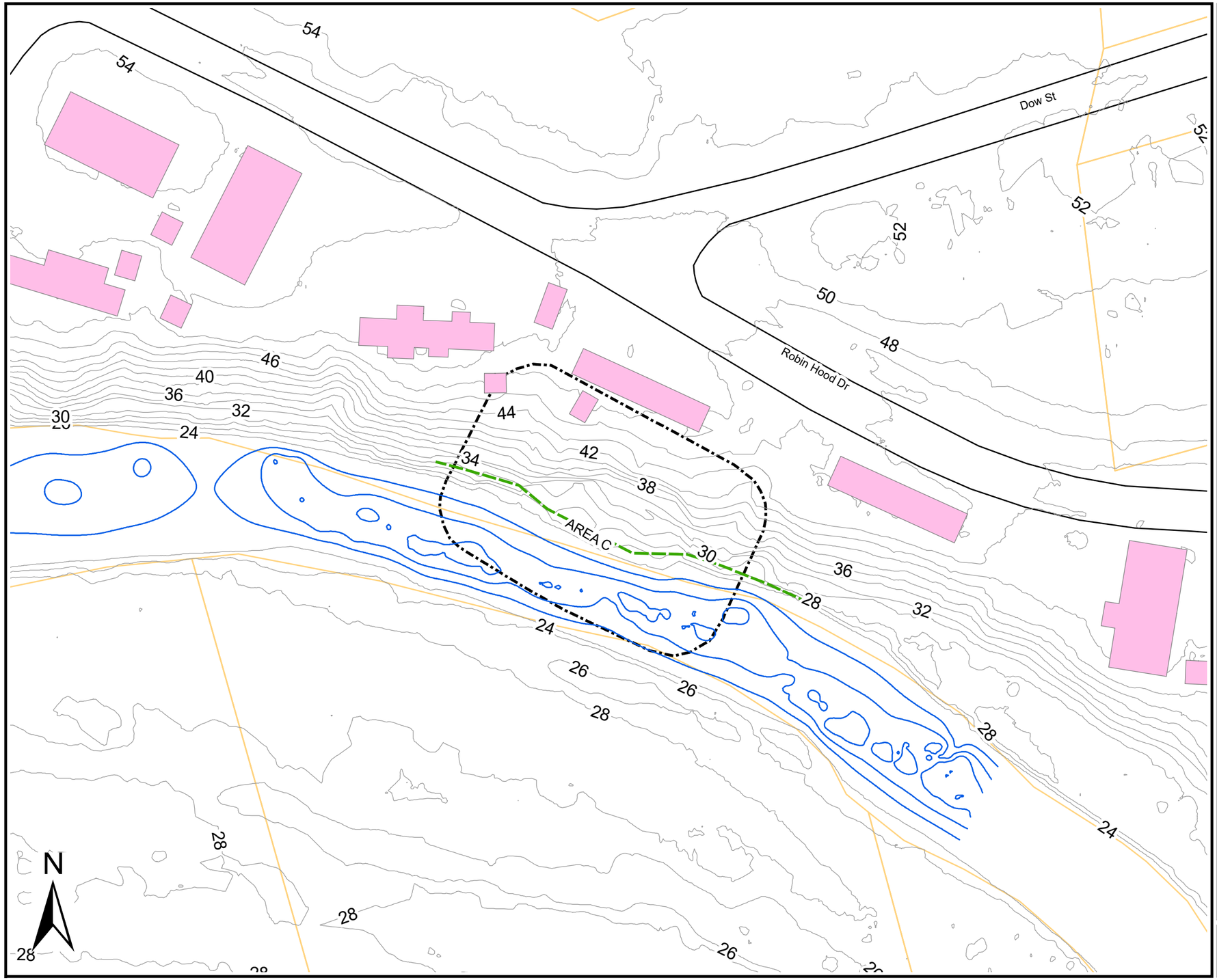
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

EXISTING CONDITIONS PLAN
AREA B

JULY 2025

FIGURE 4B



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Legend

- Top of Bank/ Edge of Wetlands
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area
- Property Boundary

0 25 50 100 150 200 Feet

Aries Project # 2025-028
File # 2025-028(4C)EC7.25.MXD

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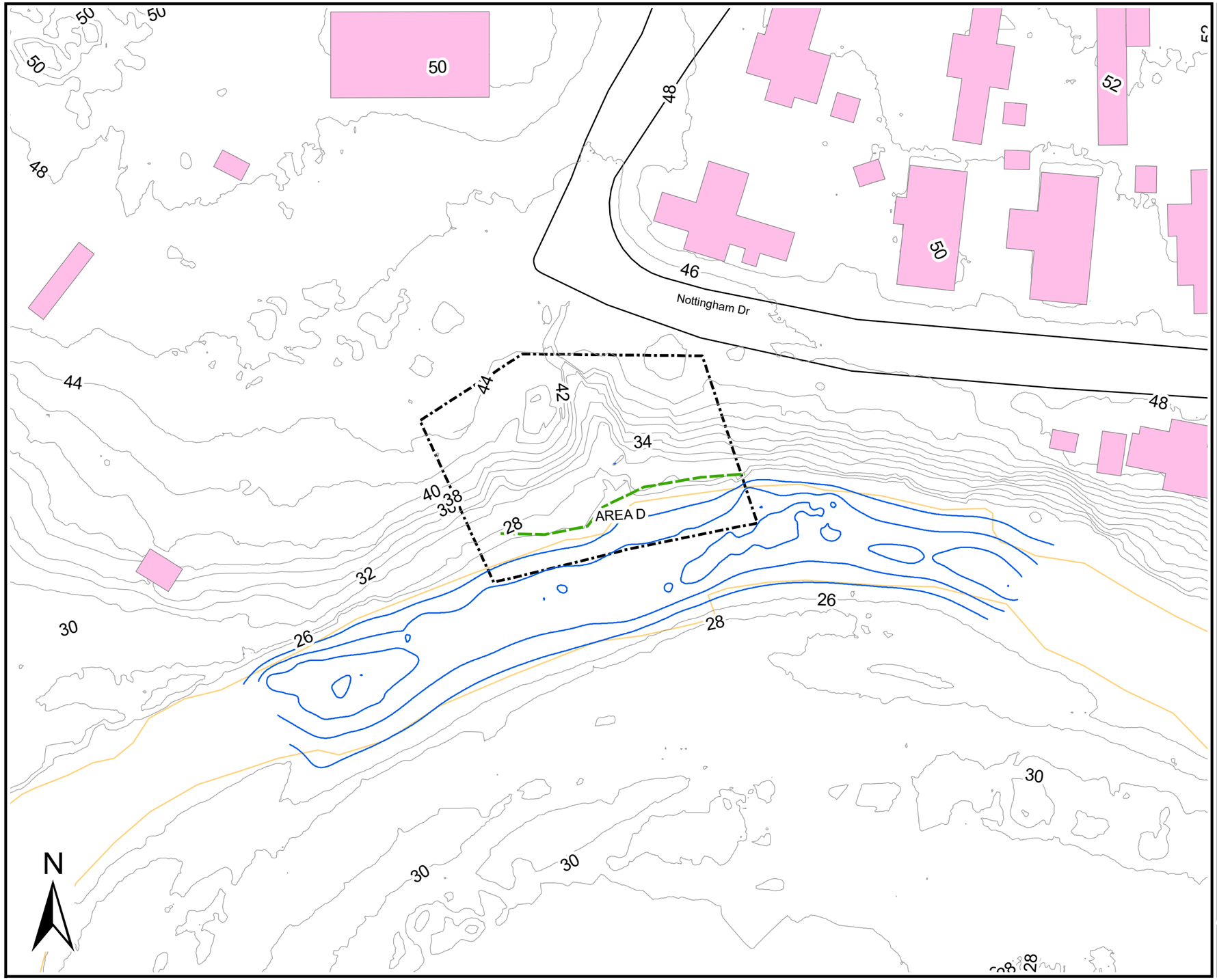
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

EXISTING CONDITIONS PLAN
AREA C

JULY 2025

FIGURE 4C



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Legend

- Top of Bank/ Edge of Wetlands
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area
- Property Boundary

0 25 50 100 150 200 Feet

Aries Project # 2025-028
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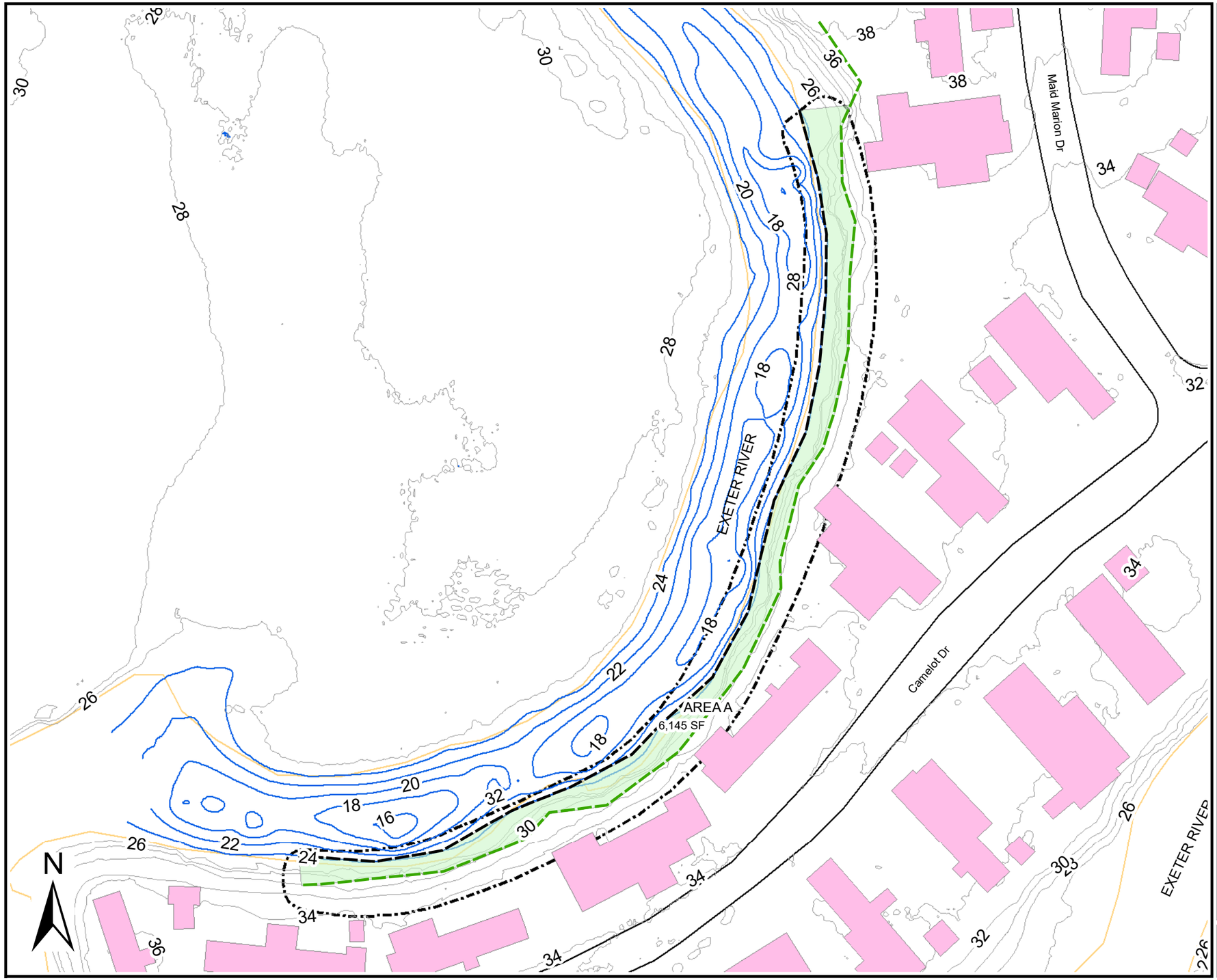
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

EXISTING CONDITIONS PLAN
AREA D

JULY 2025 FIGURE 4D



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Legend

- X-Section Line
- Top of Bank/ Edge of Wetlands
- Proposed Sheet Pile Wall
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area
- Property Boundary

0 25 50 100 150 200 Feet

Aries Project # 2025-028
File # 2025-028(5A)7.25.MXD

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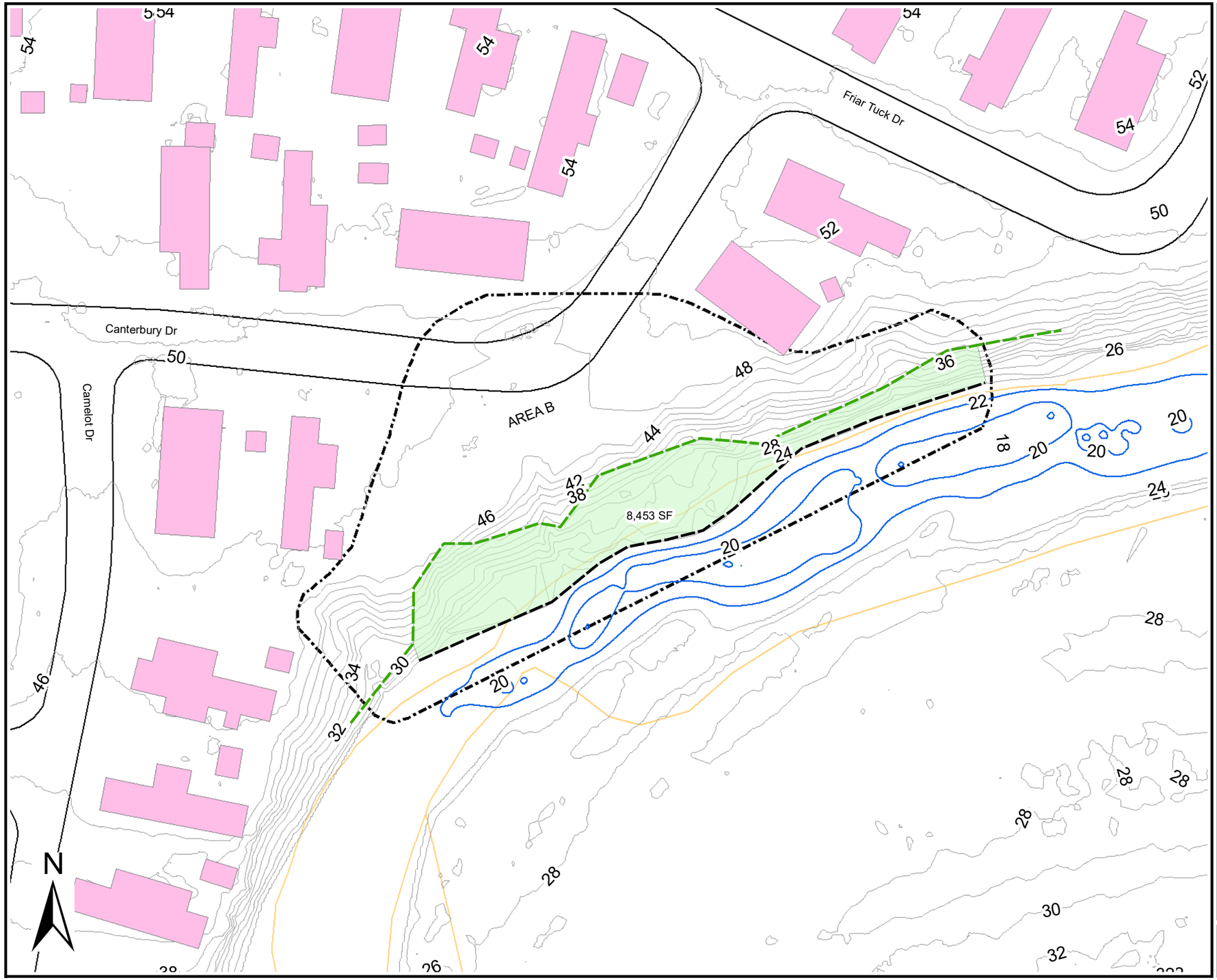
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

PROPOSED IMPACT AREA PLAN
AREA A

JULY 2025

FIGURE 5A



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Legend

- X-Section Line
- Top of Bank/ Edge of Wetlands
- Proposed Sheet Pile Wall
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area
- Property Boundary

0 25 50 100 150 200 Feet

Aries Project # 2025-028
File # 2025-028(5B)7.25.MXD

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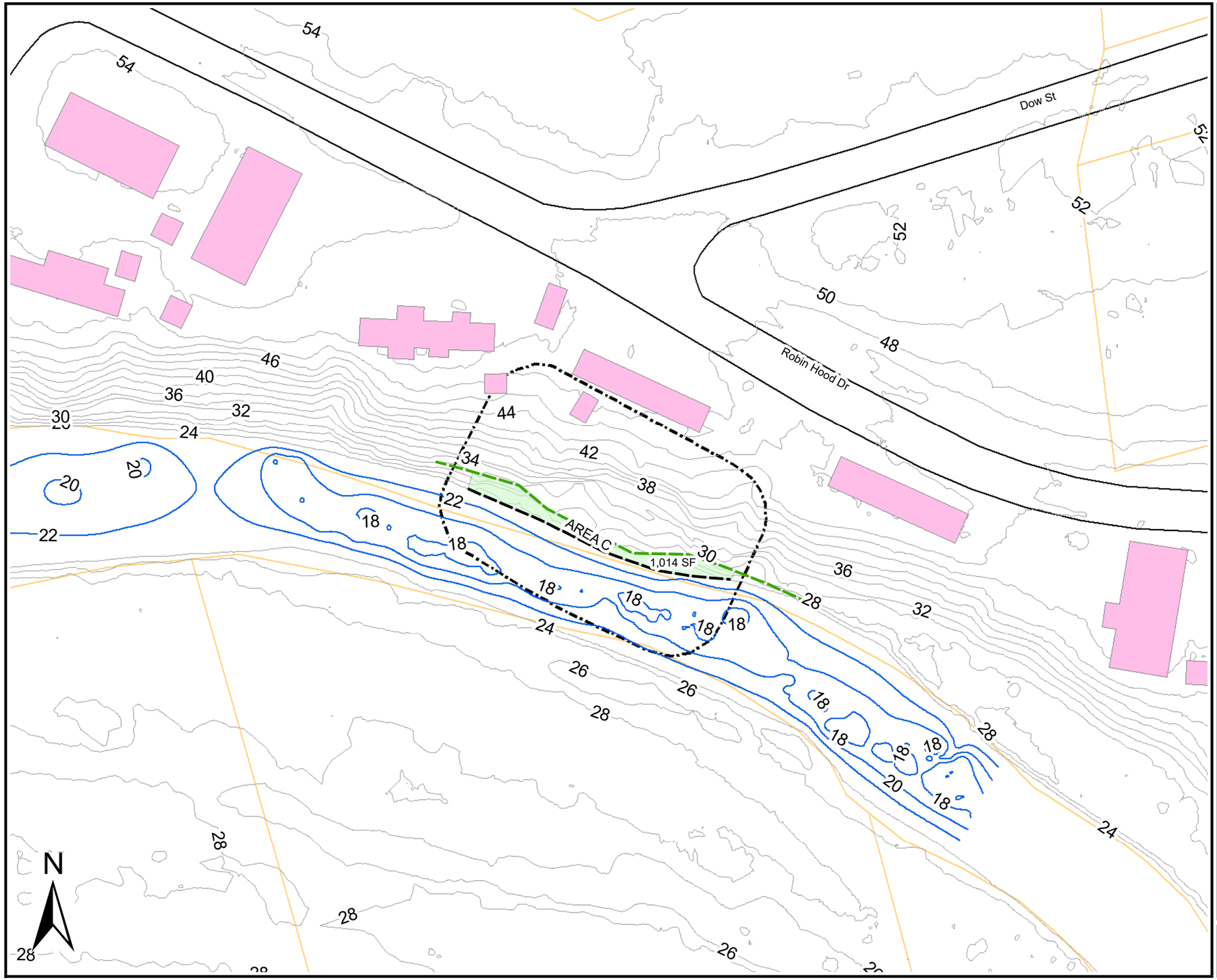
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

PROPOSED IMPACT AREA PLAN
AREA B

JULY 2025

FIGURE 5B



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Legend

- X-Section Line
- Top of Bank/ Edge of Wetlands
- Proposed Sheet Pile Wall
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area
- Property Boundary

0 25 50 100 150 200 Feet

Aries Project # 2025-028
File # 2025-028(5C)7.25.MXD

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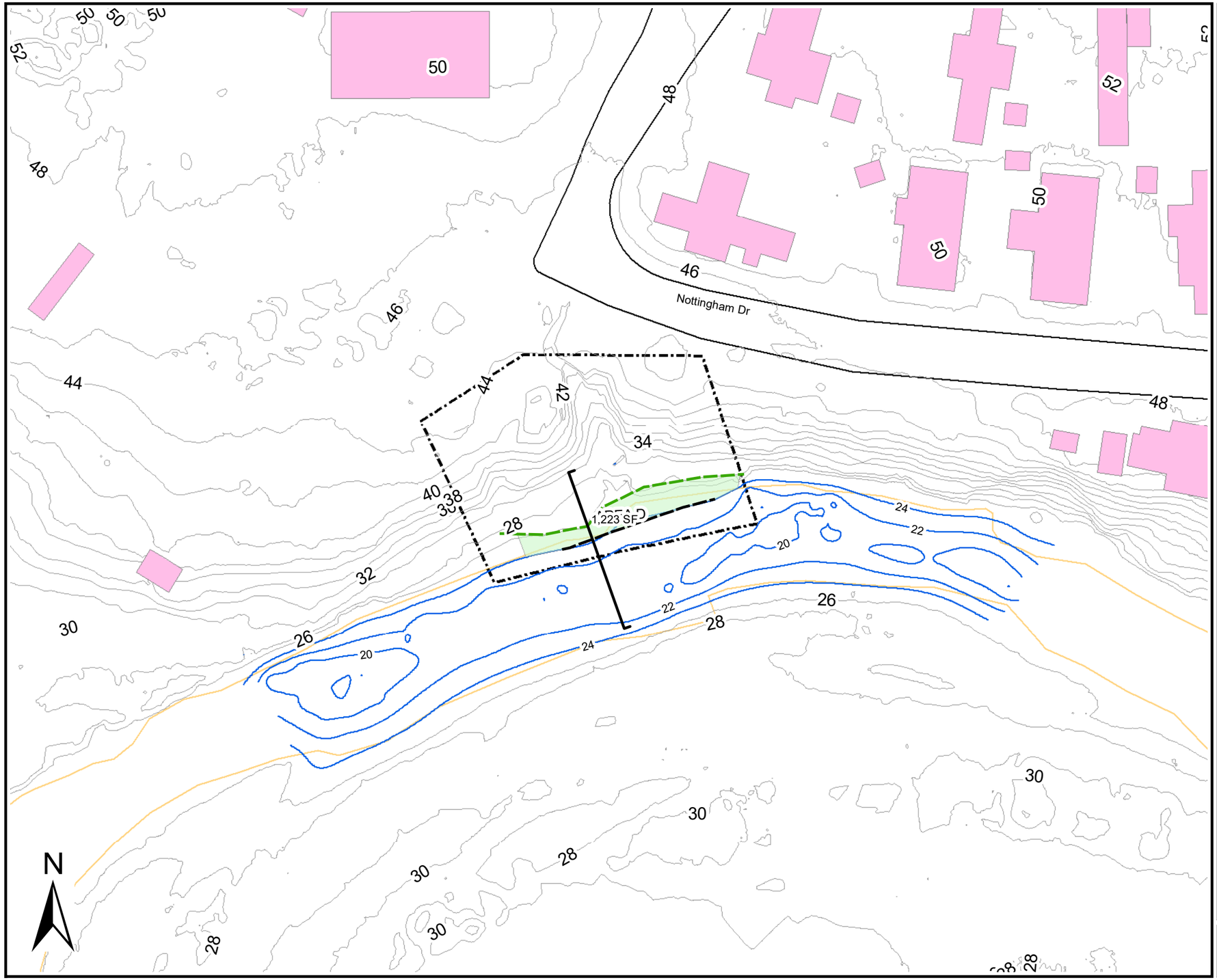
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

PROPOSED IMPACT AREA PLAN
AREA C

JULY 2025 FIGURE 5C



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Legend

- X-Section Line
- Top of Bank/ Edge of Wetlands
- Proposed Sheet Pile Wall
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area
- Property Boundary

0 25 50 100 150 200 Feet

Aries Project # 2025-028
File # 2025-028(5D)7.25.MXD

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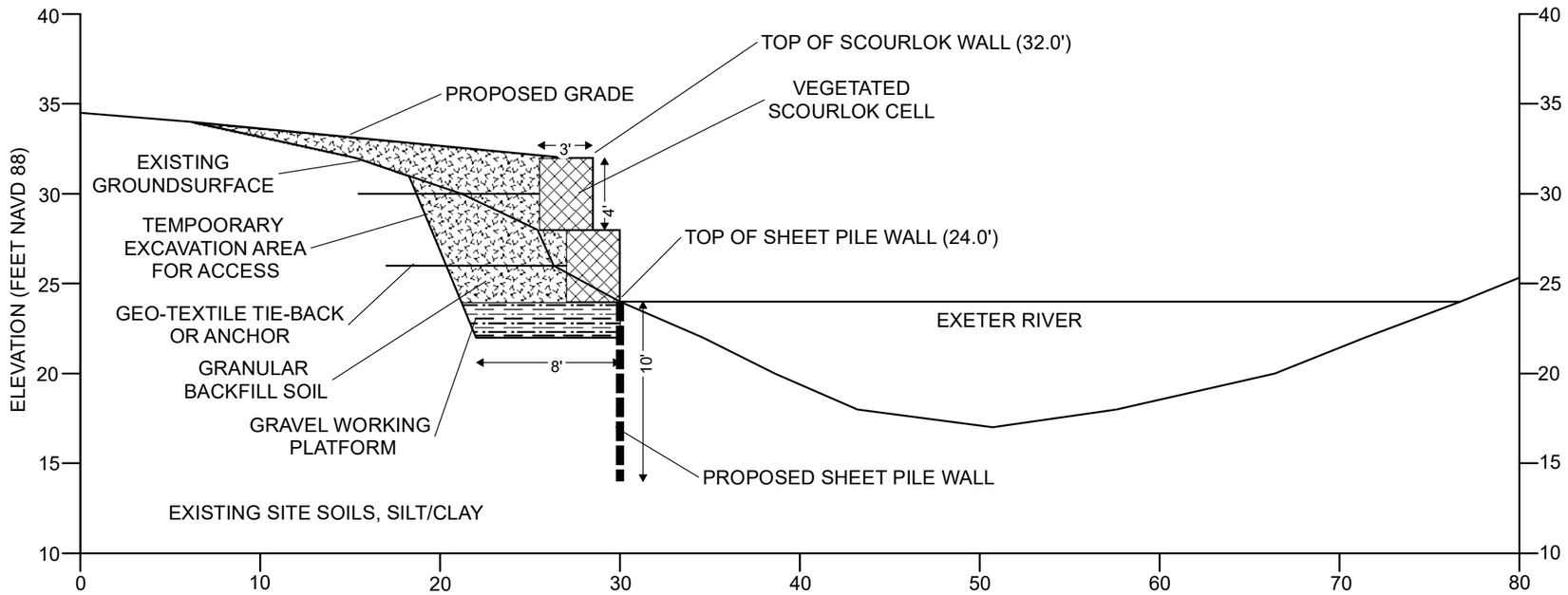
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

PROPOSED IMPACT AREA PLAN
AREA D

JULY 2025 FIGURE 5D



NOTES

1. Plan prepared from: Ground surface elevation contours developed from field survey by Fieldstone Land Consultants, PLLC, of Milford, New Hampshire; ground surface contours generated from 2019-2020 Light Detection and Ranging (LiDAR) Bare Earth Digital Elevation Model (DEM) imagery obtained from the New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT) maintained by University of New Hampshire and the NH Office of Strategic Initiatives; and field survey by Aries.

2. This plan is not to be used for construction, survey or boundary purposes.

Legend

Sheet Pile Wall

SCOURLOK® Cell

0 4 8 16 24 32 Feet

Aries Project # 2025-028
File # 2025-028(6)7.25.MXD

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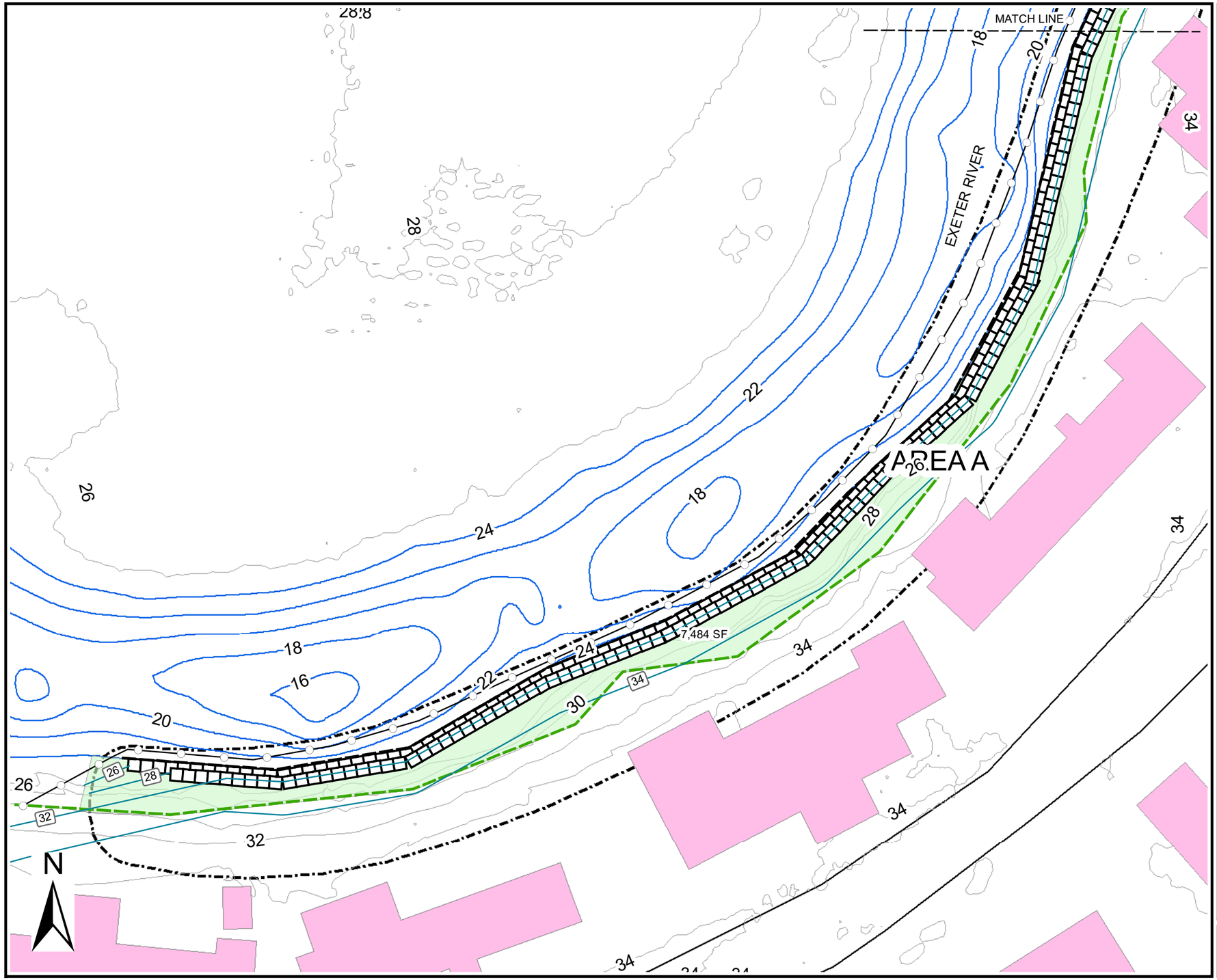
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

CONCEPTUAL CROSS-SECTION

JULY 2025

FIGURE 6



NOTES

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Legend

- Silt Fence
- Silt Curtain
- Proposed Contour
- X-Section Line
- Top of Bank/ Edge of Wetlands
- Match Line
- Proposed Sheet Pile Wall
- Scourlok
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area

0 12.5 25 50 75 100 Feet

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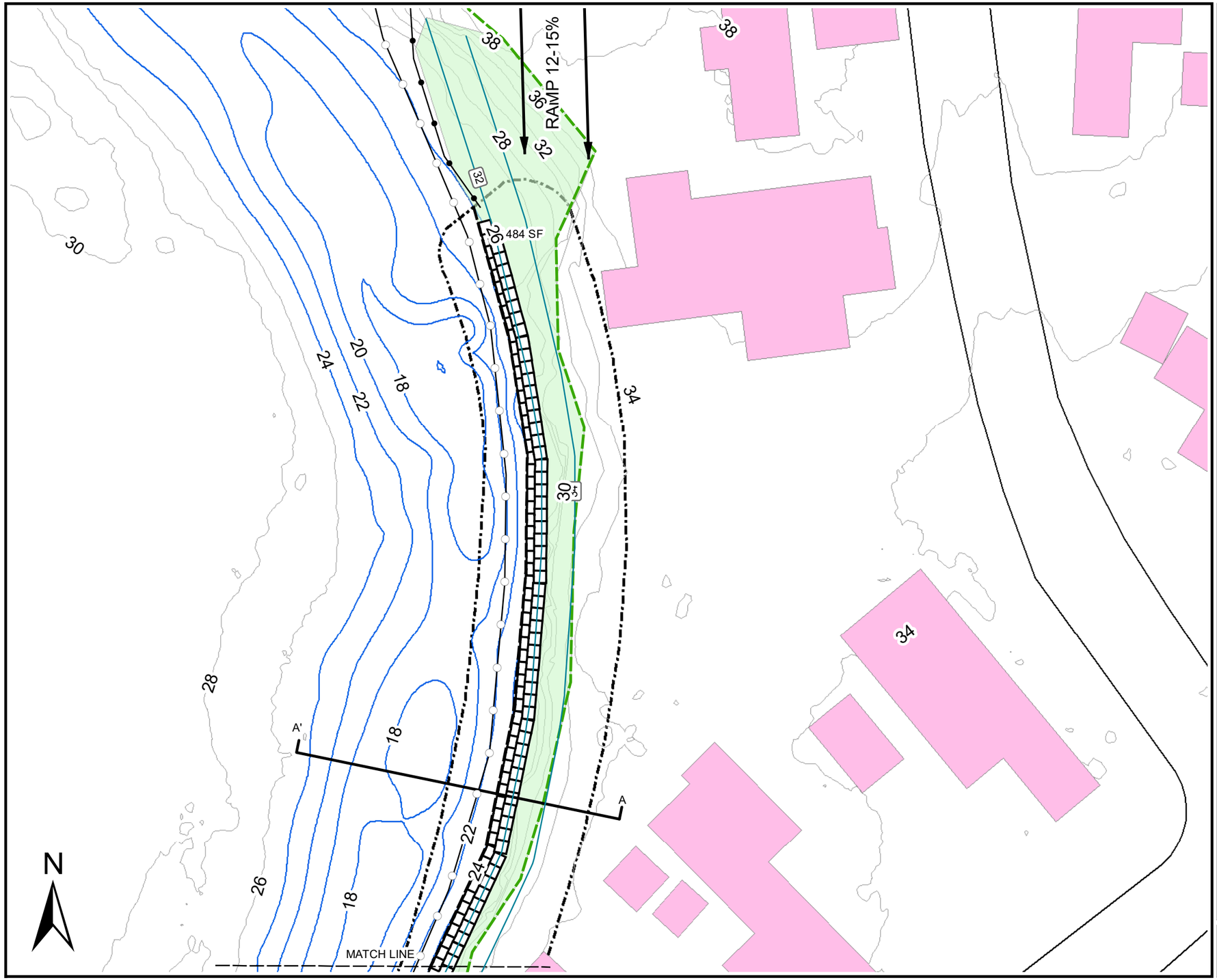
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

CONSTRUCTION DETAIL PLAN
AREA A-1

JULY 2025

FIGURE 7A-1



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Legend

- Silt Fence
- Silt Curtain
- Proposed Contour
- X-Section Line
- Top of Bank/ Edge of Wetlands
- Match Line
- Proposed Sheet Pile Wall
- Scourlok
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area

0 12.5 25 50 75 100 Feet

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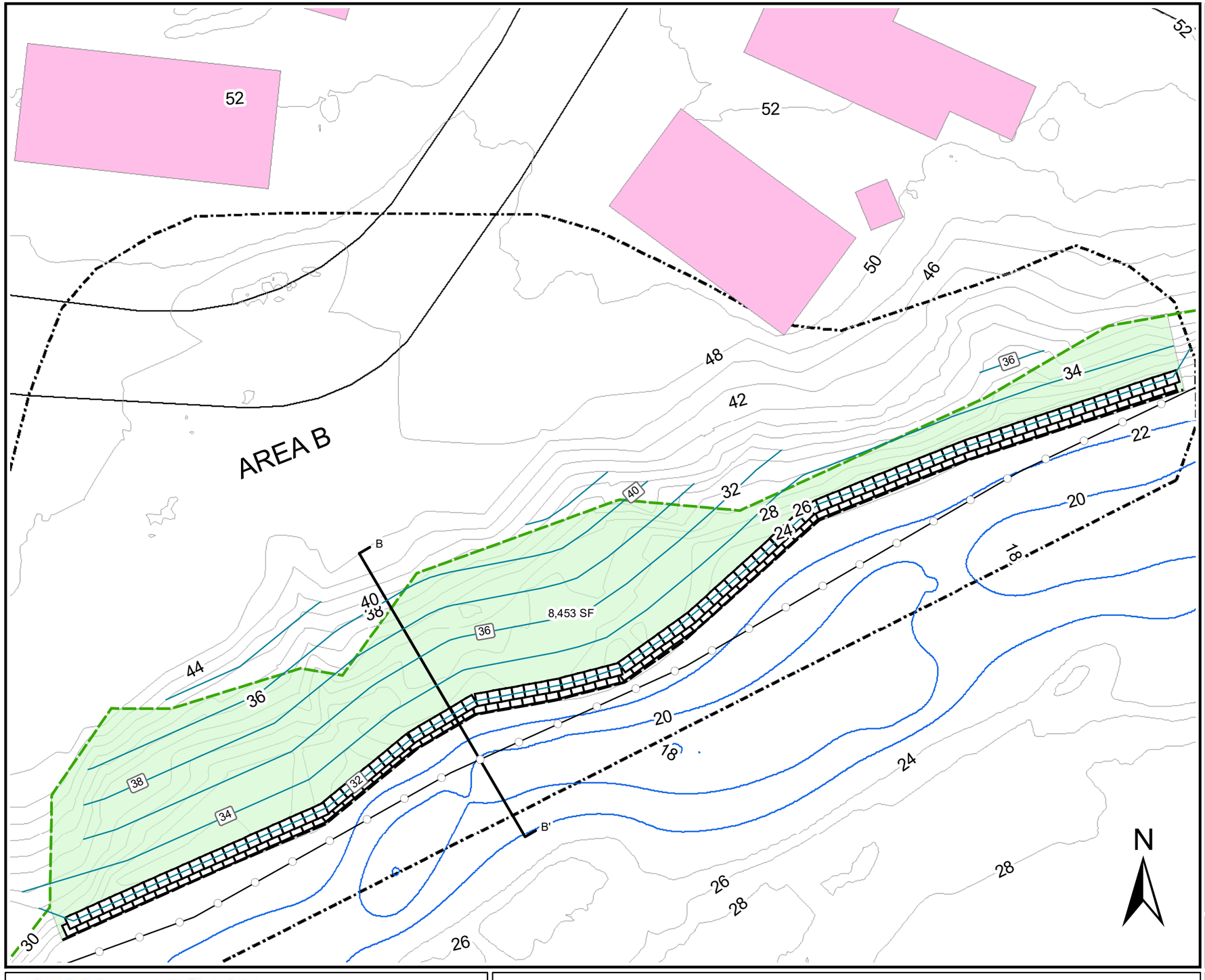
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

CONSTRUCTION DETAIL PLAN
AREA A-2

JULY 2025

FIGURE 7A-2



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Legend

- Silt Fence
- Silt Curtain
- Proposed Contour
- X-Section Line
- Top of Bank/ Edge of Wetlands
- Match Line
- Proposed Sheet Pile Wall
- Scourlok
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area

0 12.5 25 50 75 100 Feet

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File # 2025-028(7B)7.25.MXD

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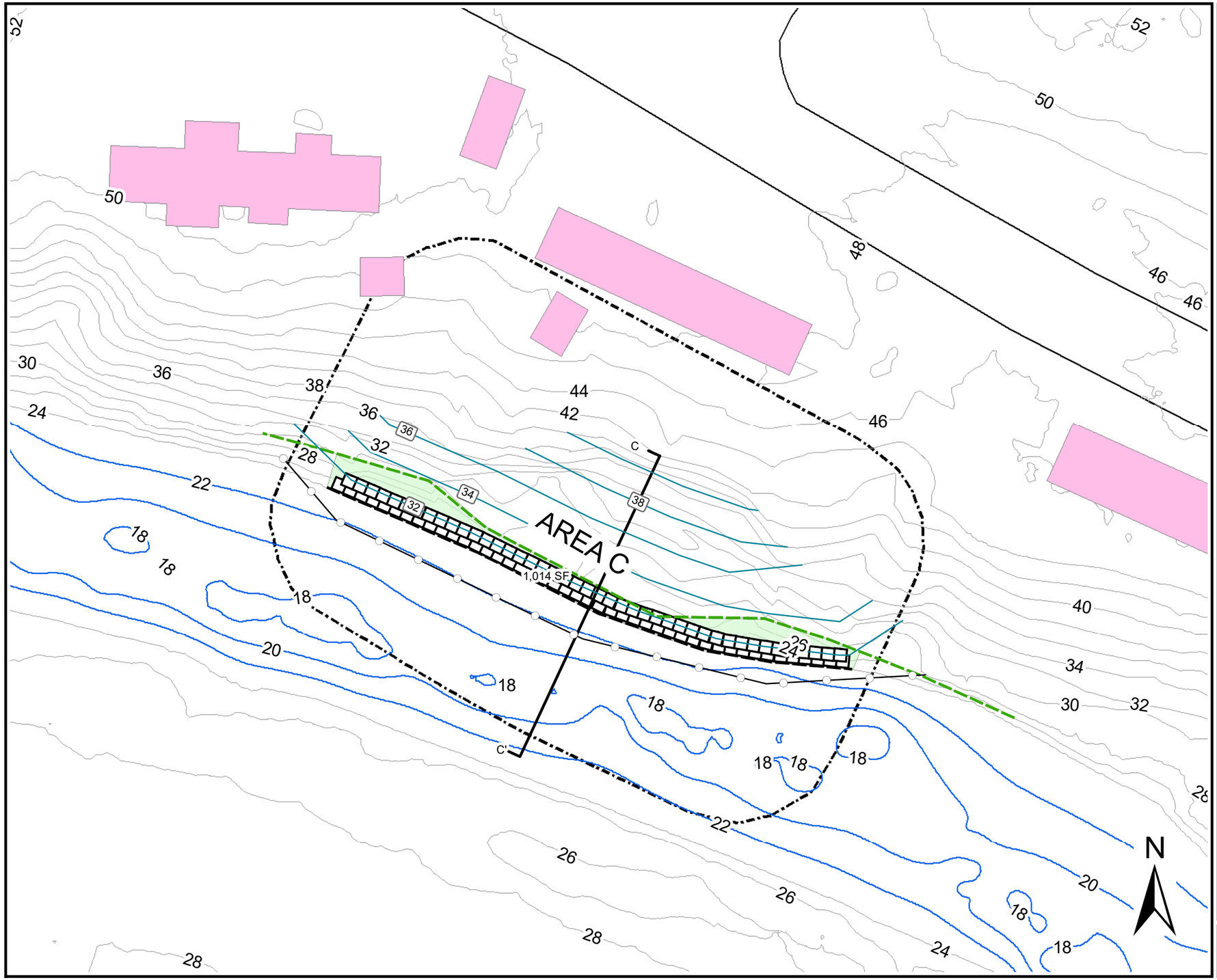
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

CONSTRUCTION DETAIL PLAN
AREA B

JULY 2025

FIGURE 7B



NOTES

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Legend

- Silt Fence
- Silt Curtain
- Proposed Contour
- X-Section Line
- Top of Bank/ Edge of Wetlands
- Match Line
- Proposed Sheet Pile Wall
- Scourlok
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area

0 12.5 25 50 75 100 Feet

Aries Project # 2025-028
File # 2025-028(7C)7.25.MXD

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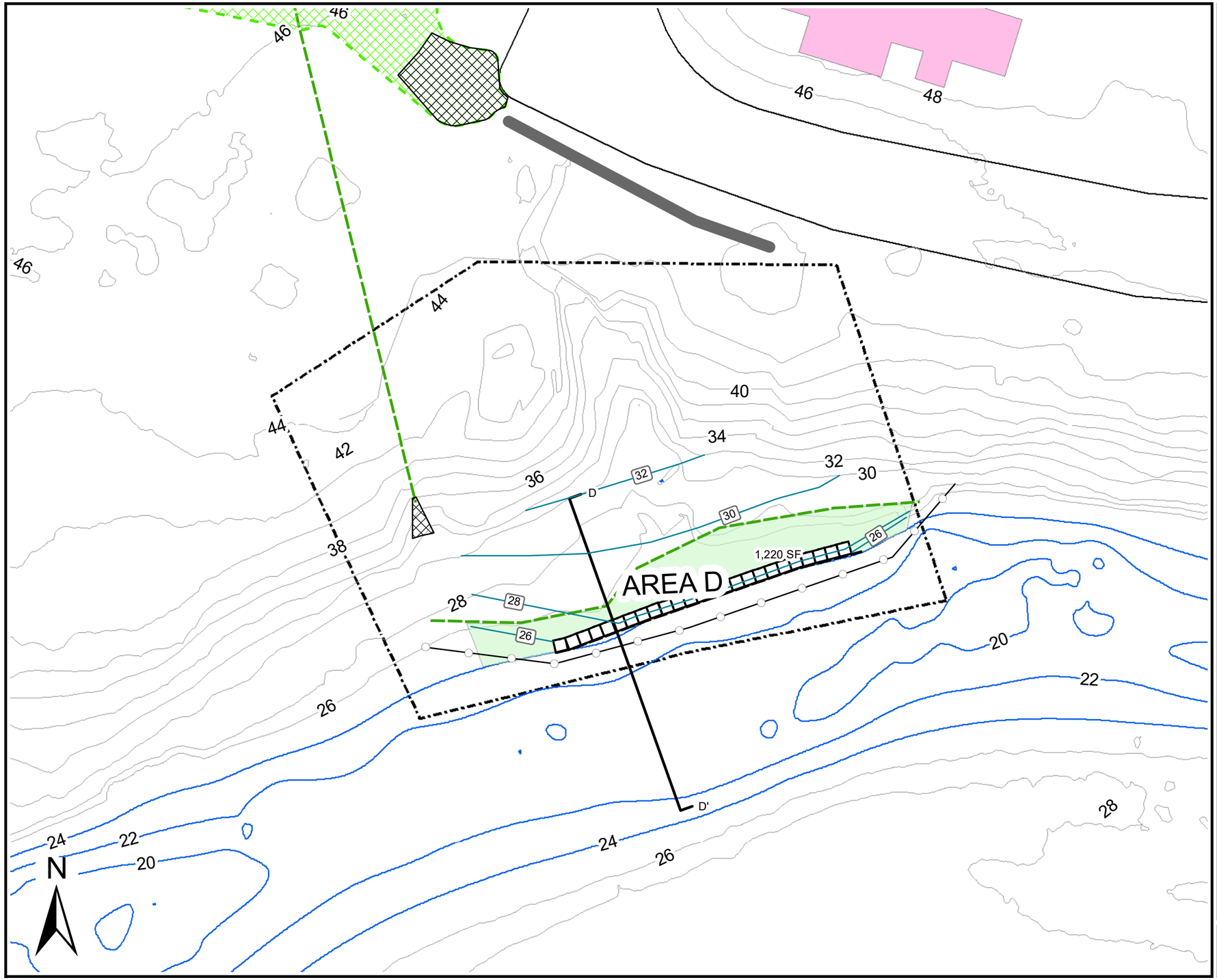
WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

CONSTRUCTION DETAIL PLAN
AREA C

JULY 2025

FIGURE 7C



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Legend

- Silt Fence
- Silt Curtain
- Existing Diversion Berm
- Proposed Contour
- X-Section Line
- Top of Bank/ Edge of Wetlands
- Proposed Sheet Pile Wall
- Rip Rap
- Bioretention SMP
- Bioretention SMP Drain
- Scourlok
- Proposed Impact Area
- Building
- 2-Foot Contours
- Bathymetric Contours
- Erosion Area

0 12.5 25 50 75 100 Feet

Aries Project # 2025-028
File # 2025-028(7D)7.25.MXD

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WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

CONSTRUCTION DETAIL PLAN
AREA D

JULY 2025

FIGURE 7D

A) GENERAL NOTES

1. ARIES ENGINEERING, LLC (ARIES) DEVELOPED THIS STANDARD WETLAND PERMIT APPLICATION FOR INSTALLATION OF RIVERBANK STABILIZATION MEASURES TO BE CONSTRUCTED ALONG FOUR REACHES OF THE EXETER RIVER ON THE RIVER RUN AT EXETER (SITE) LOCATED IN EXETER, NEW HAMPSHIRE.

B) ENVIRONMENTAL PERMITTING

THE PROPOSED CULVERT INSTALLATIONS ARE ANTICIPATED TO BE LIMITED TO LESS THAN ONE ACRE OF LAND AREA. THEREFORE, ACCORDING TO THE NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PHASE II CONSTRUCTION GENERAL PERMIT (CGP) SECTION 1.1, THE PROPOSED CONSTRUCTION WORK WILL NOT REQUIRE FILING OF A NOTICE OF INTENT (NOI) FOR COVERAGE UNDER THE CGP. SIMILARLY, THE PROPOSED SITE CONSTRUCTION WORK DOES NOT REQUIRE SUBMISSION OF AN ALTERATION OF TERRAIN (AOT) PERMIT APPLICATION TO THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES (NHDES). A STANDARD WETLAND PERMIT APPLICATION IS REQUIRED BY NHDES BECAUSE THE PROJECT WORK INVOLVED INSTALLATION OF SHORELINE STABILIZATION MEASURES THAT ARE SITUATED ON A THIRD-ORDER OR HIGHER RIVER AND NEW HAMPSHIRE DESIGNATED RIVER.

C) SHORELINE STABILIZATION MEASURE CONSTRUCTION SPECIFICATIONS

1. THE PROJECT PROPOSES THE STABILIZATION OF FOUR AREAS OF ERODED BANKS ON THE EXETER RIVER THAT THREATEN EXISTING RESIDENTIAL BUILDINGS UTILIZING SCOURLOK, A VEGETATED ENGINEERED STABILIZATION MEASURE DEVELOPED BY SOLMAX.

2. THIS SYSTEM PROVIDES A DURABLE, GEOTECHNICALLY STABLE STRUCTURE THAT PROVIDES IMMEDIATE EROSION PROTECTION AND LONG-TERM VEGETATIVE COVER WHILE PROVIDING SUITABLE NATURAL HABITATS. THE TOTAL LINEAR IMPACT IS ESTIMATED TO BE APPROXIMATELY 1,100 FEET.

3. THE PROPOSED EROSION STABILIZATION MEASURES INCLUDE INSTALLATION OF SHEET PILE WALLS AT THE APPROXIMATE LOW WATER SHORELINE TO PROVIDE A BASE FOR CONSTRUCTION OF VEGETATED SCOURLOK GABIONS WITH ANCHORED TURF REINFORCEMENT MATS ABOVE TO STABILIZE THE ERODED SHORELINE.

4. THE STABILIZATION MEASURES WILL BE REPLACED DURING LOW-FLOW CONDITIONS. THE PROJECT WILL UTILIZE SHEET PILE WALLS TO PROVIDE SEPARATION AND SEDIMENT CONTROL FROM THE PROPOSED WORK / DISTURBANCE AREAS AND THE SURFACE WATER IN THE EXETER RIVER.

5. THE PROPOSED WORK IS INTENDED TO MAINTAIN NORMAL FLOWS AND PREVENT WATER QUALITY DEGRADATION.

D) CONSTRUCTION SEQUENCE

THE FOLLOWING GENERAL CONSTRUCTION SEQUENCE IDENTIFIES THE PROPOSED SOIL EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT MEASURES THAT ARE TO BE IMPLEMENTED PRIOR TO AND DURING CONSTRUCT DURING ANY GIVEN PROJECT PHASE:

1. THE CONSTRUCTION WILL BE PERFORMED DURING LOW-FLOW CONDITIONS.

2. INSTALL DOWNSLOPE TEMPORARY SILT FENCE AND SEDIMENT TRAP AND UPSLOPE STORMWATER ATTENUATION MEASURES PRIOR TO DISTURBANCE OF ANY SOIL.

3. INSTALL PERIMETER CONTROLS PRIOR TO EARTH MOVING OPERATIONS.

4. WORK AREA AND ACCESS RAMPS WILL BE ESTABLISHED AT EACH PROPOSED STABILIZATION AREA. TEMPORARY SILT FENCES ARE TO BE INSTALLED AT THE TOE OF THE SLOPE BELOW EACH RAMP AREA.

4. THE RAMP AND WORK AREAS ARE TO BE PROTECTED FROM SURFACE WATER RUNOFF AND WILL REQUIRE BERMS AND/OR STRAW WATTLES TO DIRECT STORMWATER RUNOFF AWAY FROM THE WORK AREA. STRAW WATTLE ARE TP BE STAKED EVERY 5 FEET, OR AS RECOMMENDED BY THE MANUFACTURE.

5. UPON THE INSTALLATION OF THE ACCESS RAMP, A PERMANENT SHEET PILE WALL IS TO BE INSTALLED TO AN APPROXIMATE DEPTH OF 10 FEET BELOW GRADE AT THE APPROXIMATE LOW WATER SHORELINE TO PROVIDE A BASE FOR CONSTRUCTION OF THE VEGETATED SCOURLOK GABIONS. THE TOP OF THE SHEET PILE WALL SHALL BE INSTALLED TO AN ELEVATION OF 24 FEET ABOVE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) IN EACH WORK AREA.

6. EXCAVATE RIVERBANK SOIL TO ESTABLISH A WORKING AREA PLATFORM BEHIND THE SHEET PILE WALL AND PREPARE FOR PLACEMENT OF THE SCOURLOK GABIONS. CRUSHED STONE MAY BE USED TO PROVIDE STRUCTURE IN THE WORK AREA BASE. PREVENT CRUSHED STONE FROM SPILLING INTO THE RIVERBED, AND REMOVE ALL NON-NATIVE MATERIALS FROM THE RIVERBED DURING INSTALLATION OF THE STABILIZATION MEASURES

7. INSTALL THE SCOURLOK GABIONS ON THE WORKING PLATFORM, FLUSH WITH THE SHEET PILE WALL TOP.

8. FILL GABIONS WITH EXCAVATED MATERIAL AND / OR IMPORTED SOILS. BACKFILL AND COMPACT IN ONE-FOOT LIFTS THE AREAS BEHIND GABIONS TO PROPOSED GRADE.

9. INSTALL ANCHORED TURF REINFORCEMENT MATS ABOVE TO STABILIZE THE ERODED SHORELINE BEHIND AT NEEDED.

10. THE AREA OF UNSTABILIZED SOIL SHALL NOT EXCEED A MAXIMUM OF 1 ACRE AT ANY TIME AND SHALL TYPICALLY BE LIMITED TO LESS THAN 1 ACRE.

11. EXCAVATION WILL BE CONDUCTED SUCH THAT EXCESS MATERIAL IS NOT GENERATED AT THE SITE. EXCAVATED HYDRIC AND HIGHLY-ORGANIC WETLAND SOILS FROM WETLANDS AREAS WILL BE STOCKPILED SEPARATELY TO BE RELOCATED TO FILL THE SHOREWARD GABION SOIL POCKETS.

12. CONDUCT FINAL GRADING AND ROUGHEN SOIL SURFACE IN WORK AREA.

13. UPON COMPLETION OF THE CONSTRUCTION WORK, ALL DISTURBED AREAS WILL BE SEEDED WITH A MIXTURE OF WETLAND CONSERVATION MIX SEED, FERTILIZED AND MULCHED IN ORDER TO MINIMIZE EROSION AND STABILIZE THE SITE WORK AREA.

14. INSTALL PERMANENT SOIL STABILIZATION MEASURES INCLUDING SEED, HAY, MATTING, ETC. AS SOON AS PRACTICABLE, BUT NO LATER THAN THREE DAYS AFTER FINAL GRADING.

15. REFRESH TEMPORARY EROSION CONTROL MEASURES AS NEEDED.

16. INSPECT ALL EROSION CONTROLS ON A WEEKLY BASIS AND AFTER EVERY ½ INCH OF RAINFALL UNTIL STABILIZED.

17. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURRED:
A. A MINIMUM OF 85 PERCENT VEGETATED GROWTH AS BEEN ESTABLISHED;
B. A MINIMUM OF 3 INCHES OF NON-EROSIVE MATERIAL SUCH AS STONE OR RIPRAP HAS BEEN INSTALLED; OR
C. EROSION CONTROL BLANKETS HAVE BEEN PROPERLY INSTALLED.

18. REPAIR OR MAINTAIN MEASURES AS NECESSARY.

E) ADDITIONAL SPECIFICATIONS FOR SHORELINE SIMULATION CONSTRUCTION

1. WHENEVER POSSIBLE, ALL WORK SHOULD BE CONDUCTED FROM THE STREAM BANKS AND HEAVY MACHINERY SHOULD BE KEPT OUT OF THE CHANNEL.

2. MINIMIZE THE EXTENT AND DURATION OF THE HYDROLOGICAL DISRUPTION.

3. BEGIN CONSTRUCTION FROM THE DOWNSTREAM END WORKING UPSTREAM, WHERE FEASIBLE.

4. CHANGES TO CONSTRUCTION FLOW WILL BE ALLOWED, MAKING ALLOWANCES FOR ON A CASE-BY-CASE BASIS DUE TO UNKNOWN SITE CONDITIONS, TRAFFIC REQUIREMENTS, LIMITED ACCESS, AND PRESERVATION OF EXISTING TREES REINFORCING THE BANKS.

5. DEVIATION FROM CONSTRUCTION FLOW (DOWNSTREAM TO UPSTREAM) MUST BE REQUESTED AND APPROVED BY THE ENGINEER OF RECORD OR THEIR DESIGNEE IN ADVANCE OF CONSTRUCTION.

6. NATIVE MATERIAL REMOVED FROM THE STREAMBED SHOULD BE STOCKPILED SEPARATELY AND REUSED TO EMULATE THE NATURAL RIVERBANK, AND ANY NEW MATERIALS USED MUST BE AS SIMILAR TO THE NATURAL RIVER SUBSTRATE AS PRACTICABLE. MATERIALS USED TO EMULATE
7. SALVAGE AQUATIC ORGANISMS (FISH, SALAMANDERS, CRAYFISH, MUSSELS) STRANDED.

8. NOTIFY THE ENGINEER OF RECORD AT LEAST 48 HOURS IN ADVANCE OF THE GABION INSTALLATION.

F) DURATION OF CONSTRUCTION

1. LIMITING THE DURATION OF INSTREAM WORK IS THE BEST WAY TO AVOID POTENTIAL IMPACTS.
2. HAVE THE NEW STRUCTURE, EQUIPMENT, AND CONSTRUCTION MATERIALS ONSITE AND/OR CRANE AND DELIVERY SCHEDULED BEFORE THE START OF WORK.

3. ADJUST WORK SCHEDULES TO MINIMIZE DURATION OF VULNERABILITY TO INCLEMENT WEATHER.

G) IN STREAM WORK

1. WHENEVER POSSIBLE, ALL WORK SHOULD BE CONDUCTED FROM THE STREAM BANKS AND HEAVY MACHINERY SHOULD BE KEPT OUT OF THE CHANNEL.

2. MINIMIZE THE EXTENT AND DURATION OF THE HYDROLOGICAL DISRUPTION.

3. SALVAGE AQUATIC ORGANISMS (FISH, SALAMANDERS, CRAYFISH, MUSSELS) STRANDED.

H) POLLUTION CONTROL

1. WASH EQUIPMENT PRIOR TO BRINGING TO THE WORK AREA TO REMOVE LEAKED PETROLEUM PRODUCTS AND AVOID INTRODUCTION OF INVASIVE PLANTS.

2. WHEN POSSIBLE, REPLACE HYDRAULIC OILS WITH VEGETABLE BASED OILS IN CASE A LINE IS BROKEN NEAR THE STREAM.

3. TO AVOID LEAKS, REPAIR EQUIPMENT PRIOR TO CONSTRUCTION.

4. BE PREPARED TO USE PETROLEUM ABSORBING “DIAPERS” IF NECESSARY.

5. LOCATE REFUELING AREAS AND HAZARDOUS MATERIAL CONTAINMENT AREAS AWAY FROM STREAMS AND OTHER SENSITIVE AREAS.

6. ESTABLISH APPROPRIATE AREAS FOR WASHING CONCRETE MIXERS; PREVENT CONCRETE WASH WATER FROM ENTERING RIVERS AND STREAMS.

7. TAKE STEPS TO PREVENT LEAKAGE OF STOCKPILED MATERIALS INTO STREAMS OR OTHER SENSITIVE AREAS. LOCATE AWAY FROM WATER BODIES AND OTHER SENSITIVE AREAS, PROVIDE SEDIMENT BARRIERS AND TRAPS, AND COVER STOCKPILES DURING HEAVY RAINS.

Aries Project # 2025-028
File # 2025-028(8)10.22.mxd

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WETLANDS PERMIT APPLICATION
RIVER RUN AT EXETER
EXETER, NEW HAMPSHIRE

NOTES AND DETAILS

JULY 2025

FIGURE 8

APPENDIX A

LIMITATIONS

LIMITATIONS

Aries prepared this Wetlands Permit Application (application) on behalf of and for the exclusive use of Cobblestone Assets (Client) solely for use at the Shoreline Stabilization Project at River Run in Exeter, New Hampshire. This application shall not be transmitted to any other party, or relied upon by any other party, without Aries' written consent. However, Aries acknowledges the application may be conveyed to the NH Department of Environmental Services.

Aries made the reported observations under the conditions stated herein. Aries based the application conclusions solely on the services described herein, and not on scientific tasks or procedures beyond the scope of described services.

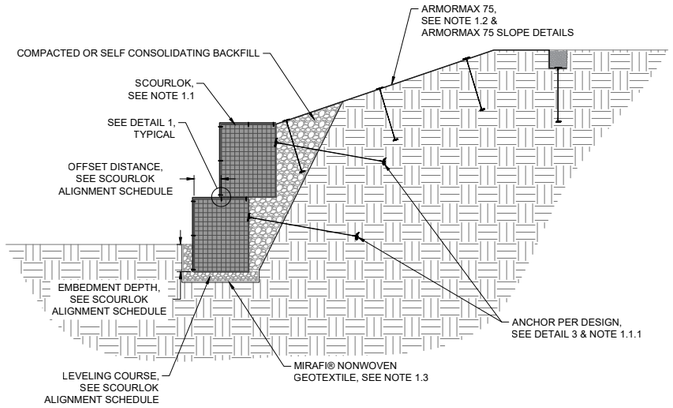
In preparing this report, Aries relied on certain information provided by the Client, state officials, federal officials and other parties referenced herein, and on information contained in the files of federal, state and local agencies available to Aries at the time of the application. Although there may have been some degree of overlap in the information provided by these various sources, Aries did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this report.

Aries' conclusions are based solely on the site observations made during the site reconnaissances. If variations or other latent conditions later appear evident, Aries may need to reevaluate and may change the application conclusions and/or recommendations.

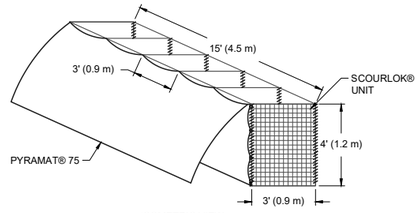
Aries conducted this report in general accordance with accepted consulting practices. Aries makes no warranty, either expressed or implied.

APPENDIX B

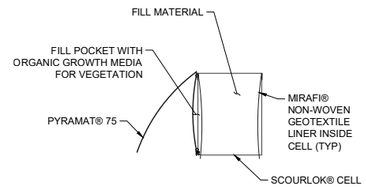
BIOENGINEERED STABILIZATION MEASURE SPECIFICATIONS



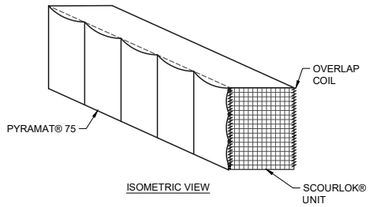
ELEVATION 1: INSTALLATION OF SCOURLOK



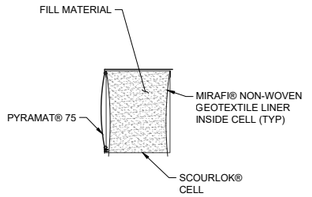
ISOMETRIC VIEW



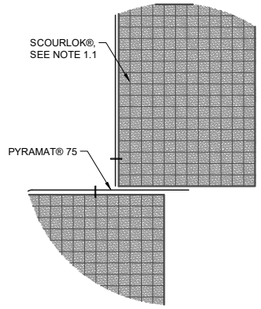
SCOURLOK® (BEFORE FILL)



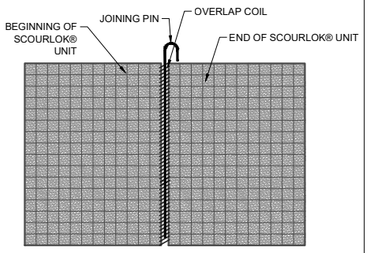
ISOMETRIC VIEW



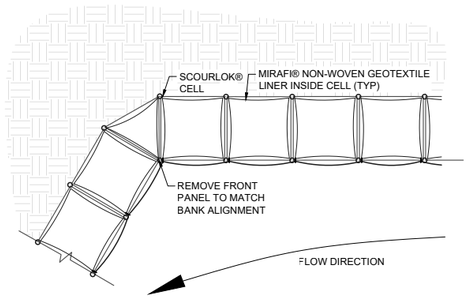
SCOURLOK® (AFTER FILL)



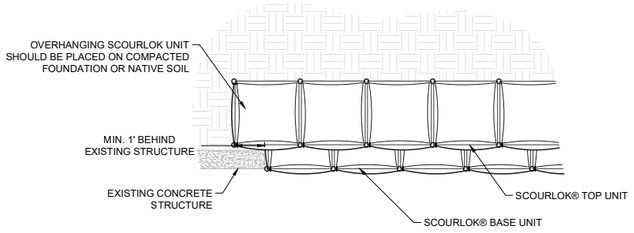
DETAIL 1: SCOURLOK®
TIER PLACEMENT



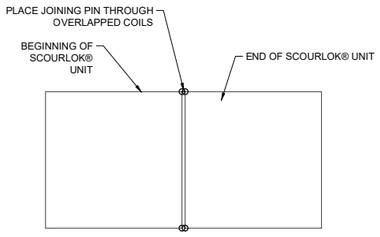
DETAIL 2: CONNECTING
SCOURLOK® UNITS



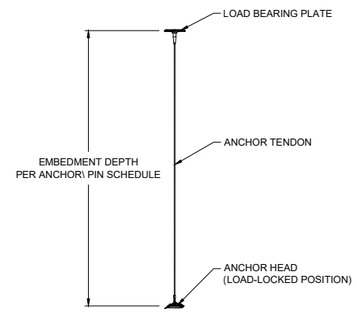
PLAN VIEW: CONCAVE CURVE



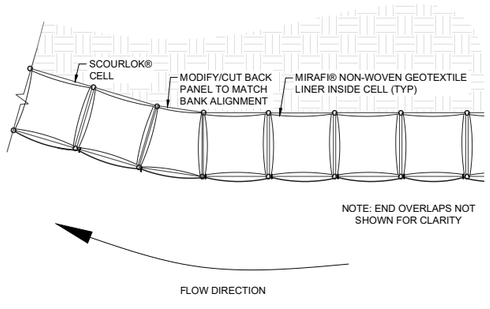
PLAN VIEW: SCOURLOK® TRANSITION TO EXISTING
CONCRETE STRUCTURE - 2 UNITS



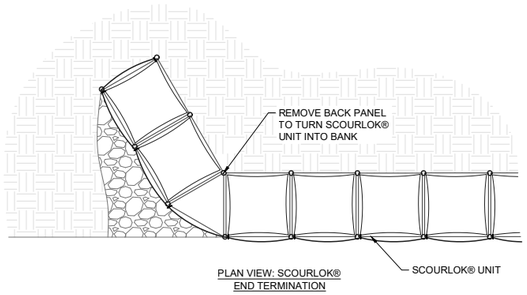
DETAIL 2B: CONNECTING
SCOURLOK® UNITS-PLAN VIEW



DETAIL 3: ENGINEERED EARTH
ANCHOR



PLAN VIEW: CONVEX CURVE



PLAN VIEW: SCOURLOK®
END TERMINATION

SCOURLOK ALIGNMENT SCHEDULE	
SCOURLOK OFFSET DISTANCE	PER MANUFACTURER'S RECOMMENDATION
SCOURLOK EMBEDMENT DEPTH	PER MANUFACTURER'S RECOMMENDATION
LEVELING COURSE DEPTH	PER MANUFACTURER'S RECOMMENDATION

SCOURLOK® ENGINEERED BANK STABILIZATION GENERAL INSTALLATION GUIDELINES

GENERAL NOTES

1.1. SCOURLOK® Engineered Bank Stabilization provides a durable, geotechnically stable structure that provides immediate erosion protection and long-term vegetative cover if desired. SCOURLOK is constructed of rigid cells armored with PYRAMAT® 75 High Performance Turf Reinforcement Mat (HPTRM) and internally lined with MIRAFI® 160N nonwoven geotextile. PYRAMAT is fastened to the rigid cells to provide a flexible exterior, control erosion, and improve system durability and forms pockets that can be filled with organic growth media to promote and sustain vegetation. The durable geotextile lining allows the rigid cell to be filled with earth, sand, gravel, crushed rock and other granular material.

1.1.1. The B2/B3 Anchor model is used for permanent erosion protection applications and has a working load of up to 1,500 to 2,000 lbs. The B2/B3 Anchor consists of an aluminum anchor head, galvanized steel cable, aluminum ferrules, aluminum load-locking mechanism, and an aluminum top plate. The bullet nose design of the anchor head allows the anchor to penetrate HPTRM resulting in minimal installation damage. The B2/B3 Anchor is also designed with a recessed cavity so the top of the cable can be cut below the surface being protected.

1.2. ARMORMAX® 75 is an engineered solution used for permanent erosion protection or surficial slope stability in vegetated and unvegetated applications. It is composed of two components: PYRAMAT® 75 High Performance Turf Reinforcement Mat (HPTRM) and Engineered Earth Anchors. ARMORMAX® 75 is available in green or tan to provide for an aesthetically pleasing solution with proven performance.

1.3. MIRAFI® 160N is a polypropylene, staple fiber, needle-punched nonwoven geotextile and is resistant to ultraviolet degradation and to biological and chemical environments normally found in soils.

BEFORE INSTALLATION BEGINS

- Coordinate with a Solmax Representative: A pre-construction meeting is suggested with the construction team and a representative from Solmax. This meeting should be scheduled by the contractor with at least a two week notice.
- Gather the Tools Needed: Tools that you will need to install SCOURLOK® include a pair of industrial shears to cut PYRAMAT® 75, tape measure, level, percussion hammer (sized appropriately for the anchors), drive rod compatible with the percussion hammer, drive steel compatible with the anchor, setting tool to set and load-lock the anchor, hog ring gun to fasten PYRAMAT 75 to the SCOURLOK unit, and wire cutters to cut the cable tendon of the anchor. Available for purchase from Solmax are drive steel, setting tools, and wire cutters.
- Determine how to Establish Vegetation: The method of vegetation establishment should be determined prior to the start of installation. Different vegetation establishment methods require different orders of installation.
- Please consult the Solmax Website for the most up to date installation guidelines.

SOLMAX

NOTE: THE STANDARD DETAILS ILLUSTRATED IN THESE DRAWINGS ARE FOR INFORMATION AND EVALUATION PURPOSES ONLY AND ARE NOT FOR CONSTRUCTION. PROJECT SPECIFIC CALCULATIONS, SHOP DRAWINGS AND SPECIFICATIONS, SIGNED AND SEALED BY A REGISTERED LICENSED ENGINEER, ARE REQUIRED FOR CONSTRUCTION.

CONCEPTUAL INSTALLATION DETAILS

SCOURLOK® FOR BANK PROTECTION

DATE:	SCALE:	SHEET	OF
08/01/2024	NTS	1	1

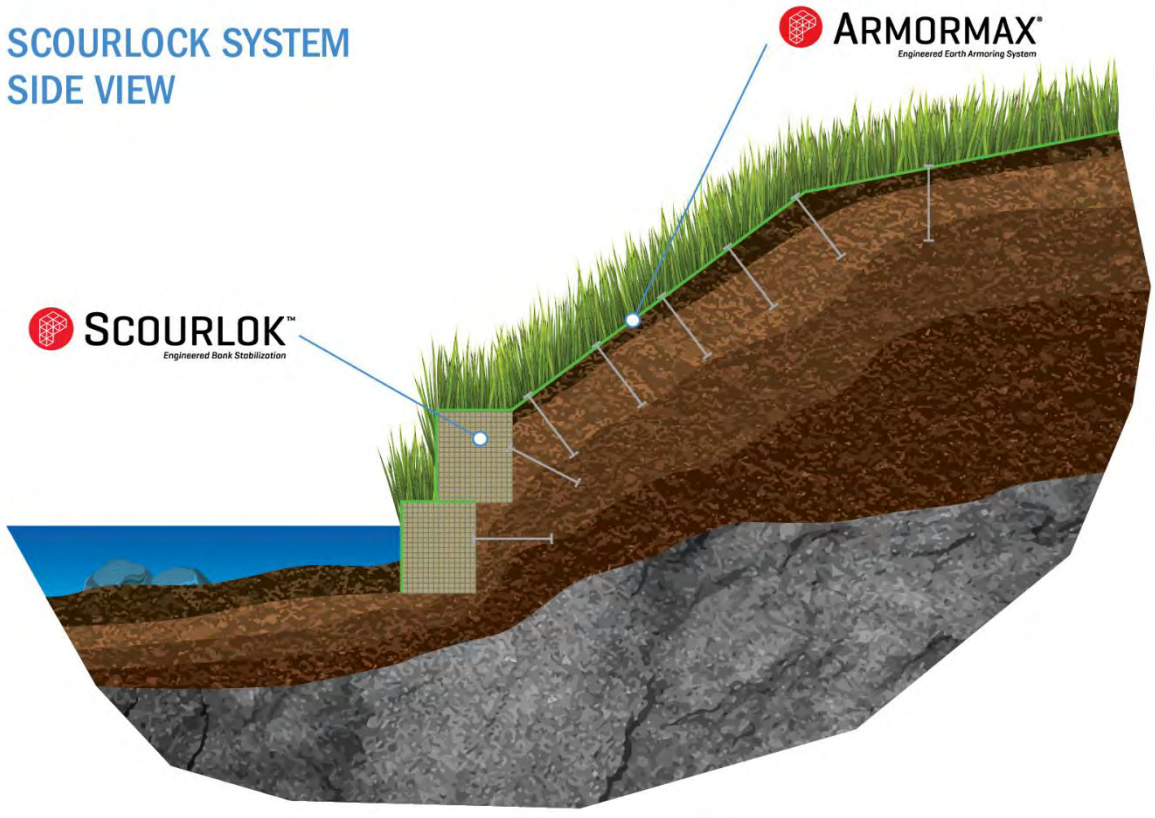
SCOURLOK™

Engineered Bank Stabilization

Product Data

SCOURLOK® is an Engineered Bank Stabilization system designed to resist extreme hydraulic stresses and protect shorelines. SCOURLOK is ideal for applications that need below water scour protection in addition to slope stabilization and erosion control. SCOURLOK is constructed of rigid cells armored with PYRAMAT® 75 High Performance Turf Reinforcement Mat (HPTRM) and internally lined with GEOTEX® nonwoven geotextile. PYRAMAT is fastened to the rigid cells to provide a flexible exterior, control erosion, and improve system durability and forms pockets that can be filled with mulch or other media to promote and sustain vegetation. The durable geotextile lining allows the rigid cell to be filled with earth, sand, gravel, crushed rock and other granular material.

SCOURLOK provides permanent erosion protection from time of initial construction. SCOURLOK has superior strength and durability to withstand the most demanding environments. SCOURLOK is manufactured at a Propex facility with ISO 9001:2008 certification and has property values listed below[1]. Propex also performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP).



Propex GEOSOLUTIONS

ENGINEERED EARTH ARMORING SOLUTIONS™

www.propexglobal.com

Propex Operating Company, LLC · 4019 Industry Drive · Chattanooga, TN 37416 · ph 800 621 1273 · ph 423 855 1466

SCOURLOK™

Engineered Bank Stabilization

Product Data

PYRAMAT® 75 PROPERTIES	TEST METHOD	ENGLISH	METRIC
PHYSICAL			
Thickness [2]	ASTM D-6525	0.40 in	10.2 mm
Light Penetration (% Passing) [3]	ASTM D-6567	10%	10%
Color	Visual	Green or Tan	
MECHANICAL			
Tensile Strength [2]	ASTM D-6818	4000 x 3000 lbs/ft	58.4 x 43.8 kN/m
Elongation [2]	ASTM D-6818	40 x 35 %	40 x 35 %
Resiliency [2]	ASTM D-6524	80%	80%
Flexibility [4]	ASTM D-6575	0.534 in-lb	616,154 mg-cm
ENDURANCE			
UV Resistance % Retained at 3,000 hrs [4]	ASTM D-4355	90%	90%
UV Resistance % Retained at 6,000 hrs [4]	ASTM D-4355	90%	90%
PERFORMANCE			
Velocity (Vegetated) [4, 5]	Large Scale	25 ft/sec	7.6 m/sec
Shear Stress (Vegetated) [4, 5]	Large Scale	16 lb/ft²	766 Pa
Manning's n (Unvegetated) [4, 6]	Calculated	0.028	0.028

GEOTEXTILE PROPERTIES	TEST METHOD	ENGLISH	METRIC
PHYSICAL			
Mass Per Unit Area	ASTM D-5261	6.5 oz/yd²	220 g/m²
Thickness	ASTM D-5199	57 mils	1.37 mm
Color	Visual	Tan	
MECHANICAL			
Grab Tensile Strength	ASTM D-4632	210 lbs	934 N
Grab Tensile Strength Elongation	ASTM D-4632	80%	80%
Trapezoidal Tear	ASTM D-4533	80 lbs	356 N
CBR Puncture	ASTM D-6241	550 lbs	2447 N
Apparent Opening Size (AOS)	ASTM D-4751	0.004 in - 0.007 in	0.11 mm - 0.18 mm
Permittivity	ASTM D-4491	1.1 sec^{-1}	1.1 sec^{-1}
ENDURANCE			
UV Retention % Retained @ 1000 hrs	ASTM D-4355	80%	80%
PERFORMANCE			
Chemical Exposure (Diesel fuel and	MIL-STD-810 Method 504.1	90%	90%
Acid and Alkali Exposure (Sulfuric Acid)	MIL-STD-810 Method 504.1	90%	90%
Acid and Alkali Exposure (Calcium	MIL-STD-810 Method 504.1	80%	80%
High Temperature Exposure	MIL-STD-810 Method 501.5	90%	90%
Low Temperature Exposure	MIL-STD-810 Method 502.5	90%	90%
Blowing Sand Abrasion	MIL-STD-810 Method 510.5	85%	85%
Burn Propagation when filled		No Flame Spread	

NOTES:

1. The property values listed above are effective 01/01/2019 and are subject to change without notice. Values represent testing at time of manufacture.
2. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Maximum Average Roll Value (MaxARV), calculated as the typical plus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will meet to the value reported.
4. Typical Value.
5. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
6. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

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SCOURLOK™

Engineered Bank Stabilization

Product Data

TYPE B2 ANCHOR PROPERTIES			
Component Materials	**Material Composition**	**Physical Properties**	
Anchor Head	Aluminum	5.01 in x 1.75 in x 1.64 in (127.3 mm x 44.5 mm x 41.7 mm) Bearing Area: 6.92 in² (44.6 mm²)	
Cable Tendon	Galvanized Steel	Diameter: 0.1875 in (4.8 mm)	
Lower Termination	Aluminum	Length: 0.65 in (16.5 mm), Wall Thickness: 0.11 in (2.8 mm)	
Load Bearing Plate	Aluminum	5.98 in x 6.6 in x 0.75 in (151.9 mm x 167.6 mm x 19.1 mm) Bearing Area: 17.43 in² (112.5 mm²)	
Top Termination	Aluminum	Circumferential Tripple Wedge Grip Assembly to Eliminate Cable Pinch Points Grip to Cable Contact Surface Area: 0.505 in² (325.8 mm²) Grip to Cable Contact Ratio: 97% of Cable Diameter	
Performance Properties			
Ultimate Assembly Strength	2600 lb (11.57 kN)	Typical Working Load	1500 lb (6.67 kN)
Ultimate Cable Strength	3700 lb (16.46 kN)	Embedment Depth	6-12 ft (1.83-3.66 m)

RIGID CELL PROPERTIES	TEST METHOD	ENGLISH	METRIC
MECHANICAL			
Ultimate Tensile Strength	ASTM E8/E8M	99,350 psi	685 Mpa
Ultimate Tensile Elongation	ASTM E8/E8M	7%	7%
Weld Shear Strength	ASTM E8/E8M	70%	70%
DEMINSIONS			
Rigid Cell		4 ft x 3 ft x 15 ft	1.2 m x 0.9 m x 4.5 m
Wire Diameter		0.157 inches	4 mm
SCOUROK can be connected and/or stacked to accommodate most projects size, shape and site condition.			

NOTES:

1. The property values listed above are effective 01/01/2019 and are subject to change without notice. Values represent testing at time of manufacture.

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SOLMAX

INSTALLATION GUIDELINE

PROPEX Armormax for slopes

Contents

1. INTRODUCTION

Thank you for purchasing **PROPEX** Armormax® for Erosion Control or Slope Stability by Solmax. This document provides installation and maintenance guidelines for **PROPEX** Armormax used as slope armoring to improve earthen slope resiliency and slope stability. The **PROPEX** Armormax system provides permanent erosion protection of an earthen slope, promotes vegetation, improves slope stability, and consists of two components:

- **PROPEX** PYRAMAT® 75 - High Performance Turf Reinforcement Mat (HPTRM)
- Engineered Earth Anchor (Anchor)

Temporary securing pins (pins) are used during installation to hold **PROPEX** Armormax in place while installing anchors. Pins also promote vegetation establishment keeping the system in intimate contact with the soil.

PROPEX Armormax is an Engineered Earth Armoring Solution™ with a unique design for each specific project. While Solmax has made every effort to ensure general validity, this information should not be used for a specific application without independent professional examination and verification of its suitability, applicability, and accuracy. The information provided herein is for general information only, and is intended to present installation guidance. Project specific contract documents take precedence when pin and anchor placements are different than what is represented in this document. Depending upon the critical nature of the structure to be armored, work restrictions may be in place such as limiting work based on growing seasons, weather patterns, etc. Work should be performed under the provisions set forth for the specific project. Solmax Engineering Services is available for support during installation to consult for solving constructability issues encountered in specific applications. Please feel free to contact our technical support team at smatch@solmax.com.

2. BEFORE INSTALLATION

1. Coordinate with a Solmax representative:
A pre-construction meeting is suggested with the construction team and a representative from Solmax prior to installation. This meeting should be scheduled by the contractor with at least a two week notice.

2. Gather the tools needed: Tools that you will need to install **PROPEX** Armormax include a pair of industrial shears, tape measure, percussion hammer (sized appropriately for the anchors), ground rod driver compatible with the percussion hammer, drive steel compatible with the anchor, setting tool to set and load-lock the anchor, and wire/bolt cutters to cut the cable tendon of the anchor. If anchors will be load tested during construction, additional testing equipment may be necessary. Consult the “Anchor Load Test Manual” from Solmax for further guidance. Available for purchase from Solmax are drive steel, JackJaw® Setting Tools, wire cutters, and a gas powered anchor driver.

3. Determine how to establish vegetation: The method of vegetation establishment should be determined prior to the start of installation. Different vegetation establishment methods require different orders of installation. Refer to Vegetation Establishment for further guidance.

3. INSTALLATION: SITE PREPARATION

It is recommended during all stages of site preparation that disturbed soils remain unprotected for not more than a single day. Depending on project size this may require progressive site preparation during installation.

1. Grade and compact the area on the slope where **PROPEX** Armormax will be installed. The slope surface should be uniform and smooth, having all rocks, clods, vegetation or other objects removed so that during laydown, the HPTRM comes in direct, intimate contact with the slope surface.
2. Whether placing new fill or addressing a sloughed slope, appropriate placement and compaction is critical for the long term performance of the slope. In order to promote continuity of the slope and improve overall stability, any loose soil placed should be keyed into the existing slope and compacted in horizontal lifts per the engineer of record. To ensure compaction at the face of the slope, it is common practice to over-build the slope face, compact in lifts, and then regrade or trim the slope to the final grade.

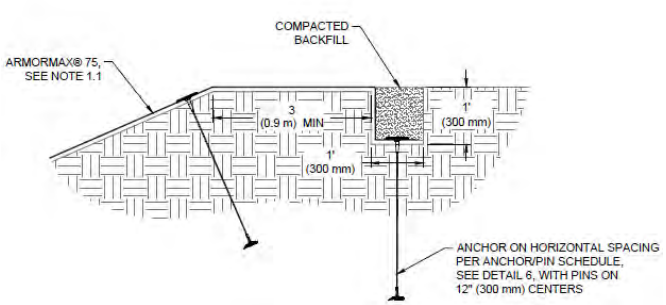


Figure 1A: Crest of Slope (COS) Trench

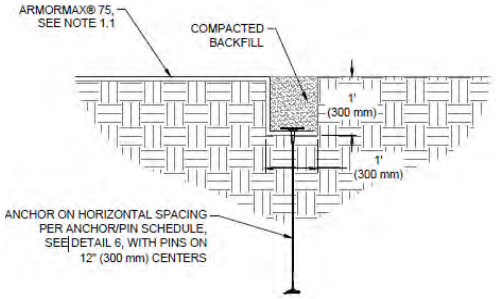


Figure 1B: Side/Perimeter Trench

3. Prepare the area to be armored with **PROPEX** Armormax by loosening the topsoil to promote better vegetation establishment. This may be accomplished with a rotary tiller on slopes 3:1 or flatter. For slopes greater than 3:1, prepare topsoil in a safe manner.

4. Excavate a Crest of Slope (COS) trench 12 in x 12 in (300 mm x 300 mm) minimum at a distance of 3 ft (900 mm) from the crest of the slope. (Figure 1a).

5. Excavate a Toe of Slope (TOS) trench 12 in x 12 in (300 mm x 300 mm) minimum at a minimum distance of 5 ft (1.5 m) from the toe of the slope. (Figure 2)

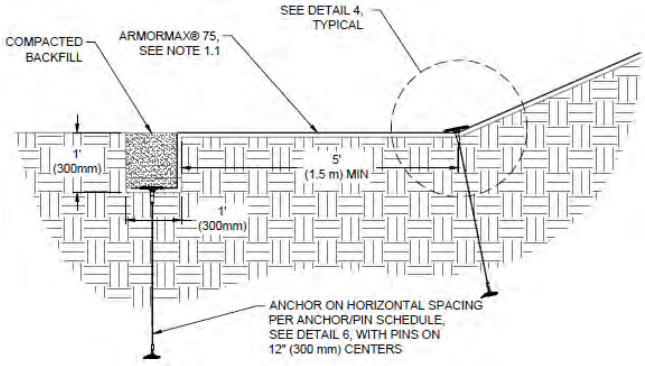


Figure 2: Toe of Slope (TOS) Trench

6. In some scenarios, a perimeter trench may be needed along the side of the installation. As needed, excavate the side/perimeter trench 12 in x 12 in (300 mm x 300 mm) minimum along the extents of the protected area.

7. If seeding, refer to vegetation establishment for additional considerations during site preparation.

4. PROPEX ARMORMAX LAYDOWN

1. Begin the **PROPEX** Armormax laydown process by starting with the downstream / downwind end of the site. To ensure proper anchoring of the overlapped areas the proceeding roll width must be laid out before the current roll width can be anchored with exception to the final roll width. For straight sections of a slope, the HPTRM panel lengths should be long enough to construct COS and TOS trenches while also covering the surface of the slope being armored (Figure 12). Panel edges should rest approximately perpendicular to the slope center line. For best results, panels of the HPTRM should be continuous and free from seams or roll end overlaps that are parallel to the centerline of the slope. Panel edge overlapping should follow a pattern of placing each proceeding panel's edge overtop the previous panel edge, shingling the panels in the direction of the water flow or prevailing wind.

2. Starting at the COS trench, lay **PROPEX** Armormax roll so that the roll ends point towards the crest of the slope (Figure 3), with a 3 in (75 mm) overlap created at adjacent panel edge locations. Ensure that adjacent panel edges maintain a minimum 3 in (75 mm) overlap during **PROPEX** Armormax laydown (Figure 8).

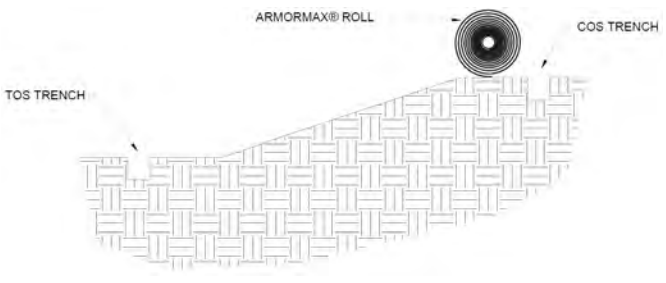


Figure 3: Crest of Slope (COS) Trench Alignment

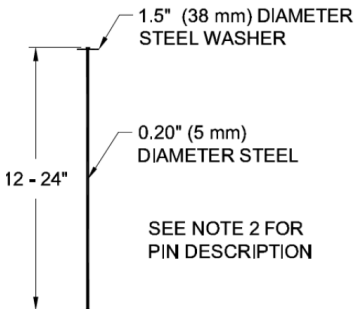


Figure 4: Securing Pin

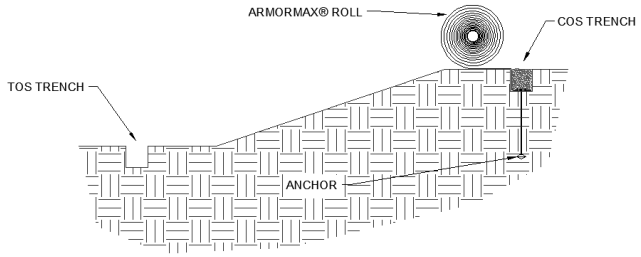


Figure 5: Crest of Slope (COS) Trench Placement

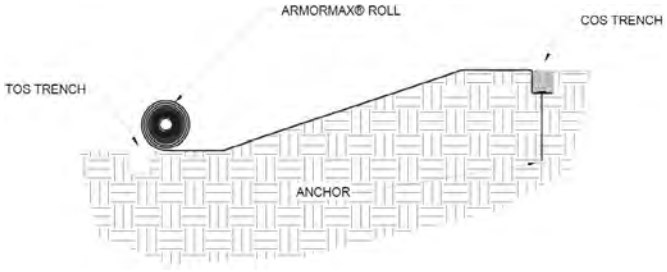


Figure 6: Placement of PROPEX Armormax across Slope

3. Secure **PROPEX** Armormax with pins and secondary anchors in the COS trench. Pins should be made of steel with a 0.20 in (5 mm) minimum diameter, having a 1.5 in (38 mm) diameter washer at the head, and a length between 12 in and 24 in (300-600 mm) with sufficient ground penetration to resist pullout (Figure 4). Longer pins may be required for looser soils. Heaver metal stakes may be required in rocky soils. Suggested placement of pins and Secondary anchors for the COS trench is along the bottom of the trench with pins on 12 in (300 mm) centers in between Secondary anchors on 4 ft (1.2 m) centers. Secondary anchors should also be installed on panel edge overlaps in the COS trench.
4. Backfill and compact the COS trench in the location of the first **PROPEX** Armormax panel only (Figure 5).
5. Unroll the **PROPEX** Armormax roll on the slope surface in the area to be armored (Figure 6). Ensure that the HPTRM has intimate contact with the ground and all irregular surfaces beneath the material are removed.
6. Secure HPTRM panels in place using pins, primary anchors, and anchors across the slope surface according to the project's engineered design. Pin and anchor placement should reflect a staggered checkerboard pattern across the slope surface for best results (Figure 7 and Figure 8).

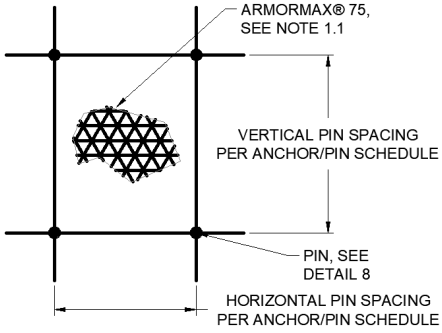


Figure 7: Example Pin Pattern

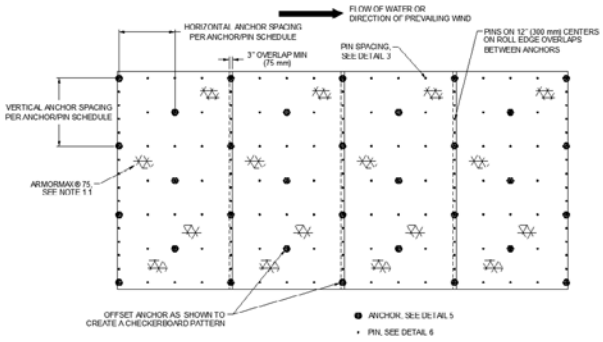


Figure 8: Example of Anchor Pattern - 0.5 Anchors/yd²

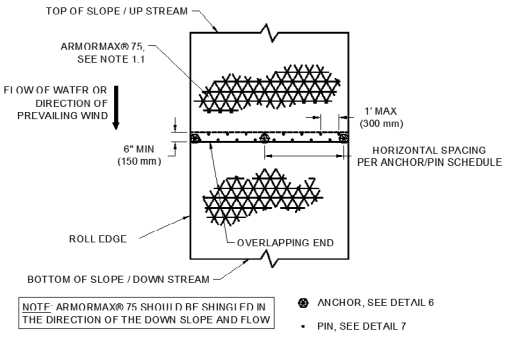


Figure 9: Roll End Overlap

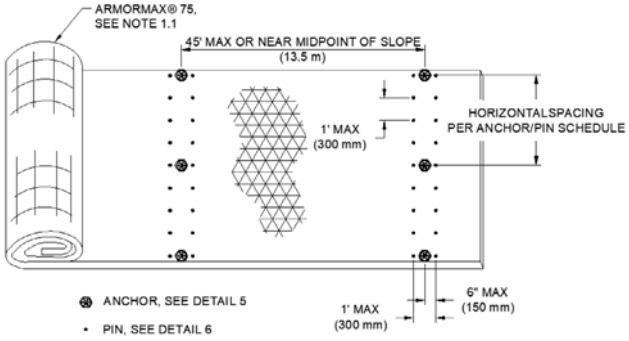


Figure 10: Simulated Check Slot

- The leading edge of the first **PROPEX** Armormax panel should be secured on the Slope Armoring Edge (SAE) with pins on 12 in (300 mm) centers in between anchors on intervals based on the slope stability analysis.
- Roll edges shall be overlapped a minimum of 3 in (75 mm) and a maximum of 6 in (150mm) with pins placed on 12 in (300 mm) centers in between anchors on intervals based on the slope stability analysis (Figure 8).
- Roll ends shall be overlapped a minimum of 6 in (150 mm) with upstream/upwind panel on top. Secure roll end overlaps with two rows of pins staggered 6 in (150 mm) apart on 12 in (300 mm) centers and with one row of anchors on intervals based on the slope stability analysis (Figure 9)
- For slope lengths greater than 45 ft (13.7 m), install simulated check slots. This method includes placing two rows of pins 12 in (300 mm) apart on 12 in (300 mm) centers and one row of anchors between the rows of pins on 4 ft (1.2 m) centers at 45 ft (13.7 m) maximum intervals or across the midpoint of the slope for slope lengths less than 60 ft (18.2 m) (Figure 10).
- At the break in slope interface towards the TOS, it is suggested that anchors be installed on intervals based on the slope stability analysis (Figure 11).

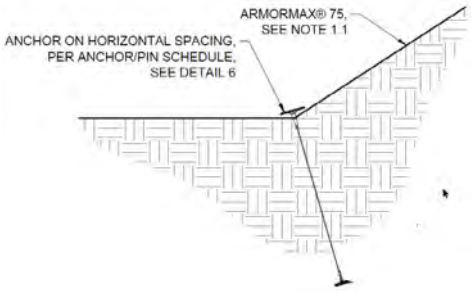


Figure 11: Break in Slope Interface

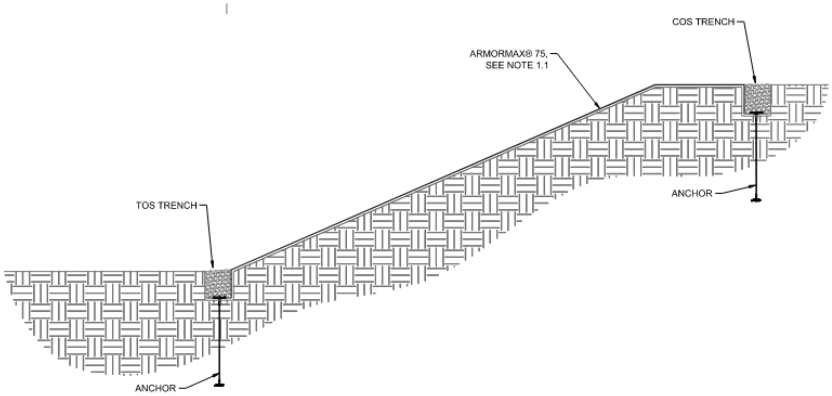


Figure 12: Crest of Slope (COS) Trench and Toe of Slope (TOS) Trench Complete

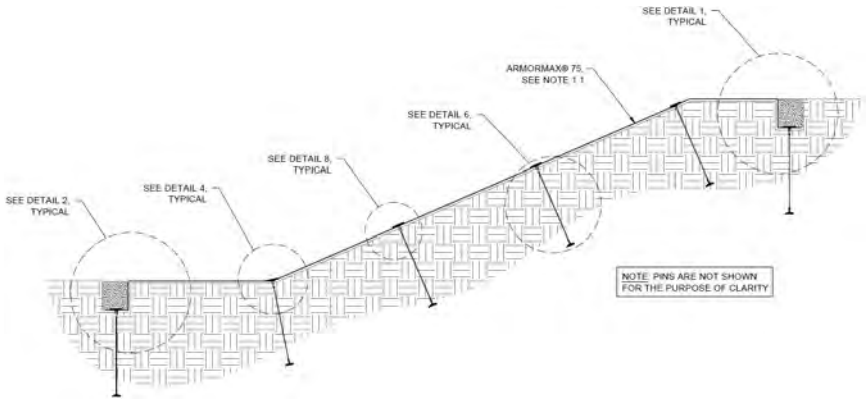


Figure 13: Completed Slope Isometric View

7. Secure **PROPEX** Armormax with pins and anchors in the TOS trench. Suggested placement of pins and anchors for the TOS trench is along the bottom of the trench with pins on 12 in (300 mm) centers in between anchors on 4 ft (1.2 m) centers (Figure 12).
8. Backfill and compact the TOS trench. (Figure 12)
9. Continue to work down the length of the slope by repeating steps 1 through 8 overlapping each adjacent HPTRM panel by 3 in (75 mm) (Figure 8). The last **PROPEX** Armormax panel should terminate on the Slope Armoring Edge (SAE) with pins on 12 in (300 mm) centers in between anchors on intervals based on the slope stability analysis. At a minimum, HPTRM panels should be pinned entirely across the slope surface, pins and anchors should be installed in the trenches, and the trenches should be backfilled and compacted at the end of each day to minimize rework in the case of a major rain event. Specific project conditions may warrant further evaluation of installation order for ease. An example elevation view (Figure 13) of a slope armored with **PROPEX** Armormax can be seen below for overall reference. Consult Solmax Engineering Services at (800) 621-1273 with any questions that you may have.

5. INSTALLING ANCHORS

The **PROPEX** Armormax anchor typically consists of an anchor head, a flexible cable tendon, and a load bearing plate. For quality control purposes and warranty claims, anchors should be delivered to the jobsite fully assembled and ready for installation.

Anchors are to be installed in locations specified for the project, and are typically installed in conjunction with **PROPEX** Armormax laydown. There are several options available from Solmax for different types of anchors. For optimal performance with the greatest risk reduction, it is important to select the proper anchor and perform the installation in accordance with the pattern designed for required resiliency and long term durability of the slope. Understanding the mechanics behind installing the anchor component of **PROPEX** Armormax will result in a quality **PROPEX** Armormax installation.

1. Engineered Earth Anchors

The installation of our Engineered Earth Anchors (Anchors) (Figure 14) is described below. The tools that you will need are a percussion hammer, a ground rod driver and drive steel compatible with the anchor and percussion hammer, a JackJaw setting tool, and wire cutters.

1. Use one piece drive steel or assemble segmental drive steel to the appropriate length in order to drive the anchor to the specified embedment depth.
2. Insert the tapered end of the drive steel into the hollow cavity of the anchor head. Position the anchor head/ drive steel tip above the ground at the drive location (Figure 15 and Figure 16).
3. Using a percussion hammer, guide the drive steel into the ground perpendicular to the slope surface at a smooth pace. Continue driving until the desired embedment depth is reached (Figure 17).

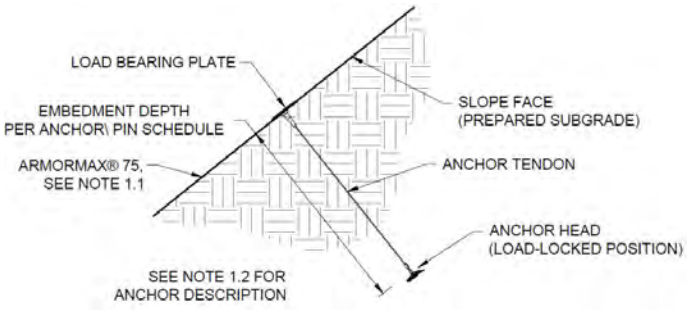


Figure 14: Anchor Detail

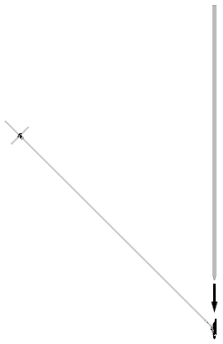


Figure 15: Insert Drive Steel into Anchor

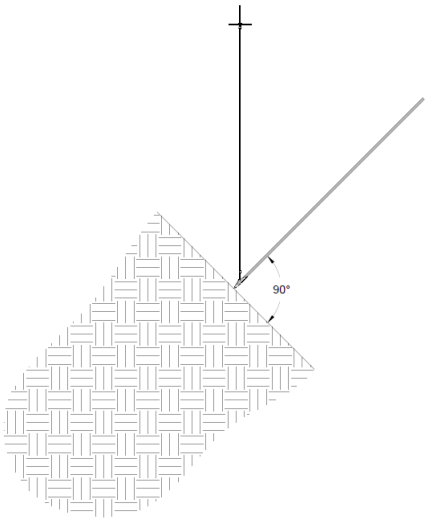


Figure 16: Position Anchor Head/Drive Steel Tip

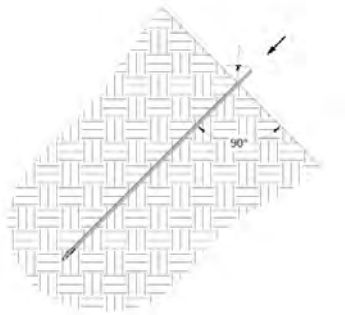


Figure 17: Drive Steel to Drive the Anchor into the Ground

4. Remove the drive steel from the ground. (Figure 18) Depending on soil conditions, this may require the use of a setting tool or leverage device.

5. Slide the load bearing plate down the anchor tendon towards the slope surface using your hands (Figure 19).

6. Once the plate is close to the slope surface, place the JackJaw Setting Tool on the anchor plate and place the top of the anchor tendon into the grips, keeping the anchor tendon perpendicular to the slope surface (Figure 20). With gentle force, slowly start to press down on the JackJaw lever – towards the slope surface - causing the anchor tendon to start to move out of the ground (displace). During this step, the anchor head will turn in the ground – a process known as “anchor setting”. The change in embedment depth of our Anchors can vary depending on the soil conditions and anchor type. When the anchor is set, there will be a noticeable change in the amount of force needed to displace the anchor any further. This is a good indication that the anchor head is now perpendicular to the anchor tendon and the anchor is ready to be load-locked.

7. To load-lock an anchor, continue to apply tension to the anchor tendon using the JackJaw Setting Tool creating a slight depression on the slope surface.

8. Once anchors have been load-locked, cut off the excess anchor tendon flush to the plate at the slope surface using wire cutters (Figure 21 and Figure 22).

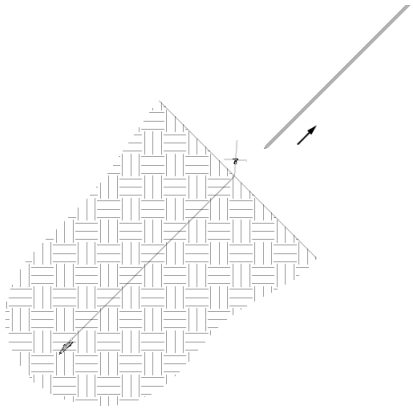


Figure 18: Remove Drive Steel from Ground

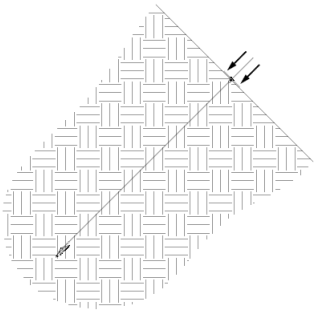


Figure 19: Slide Plate

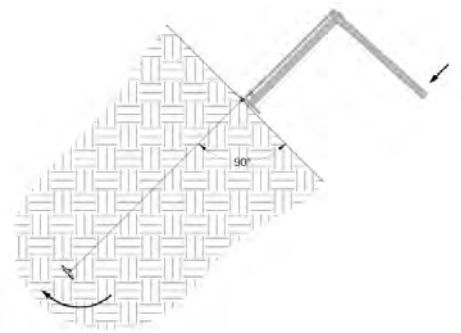


Figure 20: Use JackJaw Setting Tool to Set Anchor

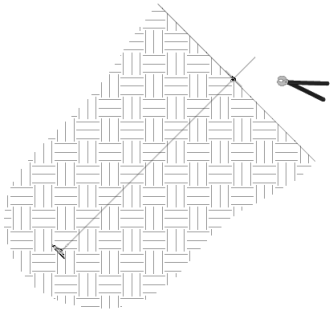


Figure 21: Trim Extra Cable Flush to Plate

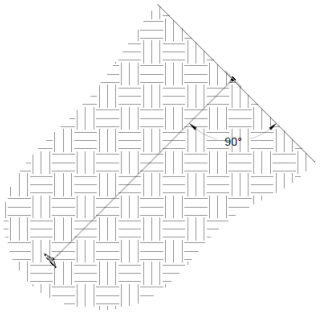


Figure 22: Complete Anchor Installation

6. VEGETATION ESTABLISHMENT

Vegetation can be established with **PROPEX** Armormax by broadcast seeding, hydraulic seed application (hydroseeding), or sodding. Seed application rate, seed type, sod type, and irrigation rate should be selected based on local or site specific knowledge and time of year. For best results, consider having a site specific soil test performed to help determine what soil amendments, such as lime and fertilizer, need to be incorporated into the soil to promote healthy vegetation.

Broadcast seed

1. After conducting a site specific soil test, select and apply recommended soil amendments to the soil surface and then loosen/scarify the top 2 in to 3 in (50 to 75 mm) of the soil surface.
2. Sow 25%-35% of the total permanent seed mixture to prepared seedbed. Note this seed amount is in addition to the 100% total seed mixture being applied in Step 5.
3. Install the **PROPEX** Armormax.
4. Soil-fill the **PROPEX** Armormax with 1 in to 2 in (25-50 mm) of amended topsoil or fill with a biotic soil media. Do not place excessive soil above the **PROPEX** Armormax material.
5. Sow 100% of the permanent seed mixture and rake into place to ensure good contact between seed and soil.
6. Install surficial protection with **PROPEX** Landlok® S2 Erosion Control Blanket (ECB).

SOD

1. After conducting a site specific soil test, select and apply recommended soil amendments to the soil surface and then loosen/scarify the top 2 in to 3 in (50 to 75 mm) of the soil surface prior to installation of the **PROPEX** Armormax
2. Install the **PROPEX** Armormax on the scarified surface.
3. Place sod on top of the **PROPEX** Armormax. Sod should be pinned/stapled into place to prevent displacement.
4. Optional: If there is less than 1 in (<25 mm) of topsoil included with the sod, it is recommended that a ½ in (12 mm) to 1 in (25 mm) of additional amended topsoil should be placed on top of the **PROPEX** Armormax prior to placement of the sod.

Hydroseed

1. After conducting a site specific soil test, select and apply recommended soil amendments to the soil surface and the loosen/scarify the top 2 in to 3 in (50 to 75 mm) of the soil surface.
2. Sow 25%-35% of the total permanent seed mixture to prepared seedbed. Note this seed amount is in addition to the 100% total seed mixture being applied in Step 5.
3. Install the **PROPEX** Armormax.
4. Soil-fill the **PROPEX** Armormax with 1 in to 2 in (25-50 mm) of amended topsoil or fill with a biotic soil media. Do not place excessive soil above the **PROPEX** Armormax material.
5. Apply 100% of the total permanent seed mixture onto the topsoil/ biotic media with a hydroseed mixture that contains the soil amendments and a tackifier or with a bonded fiber matrix mixture per manufacturer's recommendations.
6. Optional Step for additional protection: Install surficial protection with **PROPEX** Landlok ECB.

Irrigate as necessary to establish and maintain vegetation until the desired vegetated density has been achieved. Frequent, light irrigation will need to be applied to seeded areas if natural rain events have not occurred within two weeks of seeding. When watering seeded areas, use a fine spray to prevent erosion of seeds or soil. Do not over irrigate. Proper irrigation guidance is provided under the Maintenance portion of this document.

7. PROJECT SPECIFIC CONSIDERATIONS

1. For applications that require special transitions (i.e. connections to riprap, concrete, T-walls, etc.), refer to the project specific drawings or consult with technical support at smatch@solmax.com or 706-693-2226

2. A deeper terminal trench and/or hard armoring may be required when slopes have severe scour potential at the toe location.

3. For installing **PROPEX** Armormax panels around curved sections of a slope, trim panels at an angle so that no more than two layers of HPTRM overlap at any point in time. Additional pins and anchors may be needed to secure panel edges towards the toe of the slope depending upon the radius of the curved slope. Install pins or anchors as necessary to securely fasten **PROPEX** Armormax to the ground.

4. Allowable Vehicle Traffic:

   A. If using equipment on **PROPEX** Armormax, it should be of the rubber-tired type and should avoid sharp turns. Tracked equipment is not permitted to drive over the **PROPEX** Armormax without vegetation at any time.

   B. Avoid any traffic over **PROPEX** Armormax if loose or wet soil conditions exist.

5. Disturbed areas should be reseeded. If ruts or depressions develop for any reason, rework soil until smooth and reseed such areas.

8. SHORT-TERM AND LONG-TERM MAINTENANCE

The purpose of this section is to provide some general guidelines for performing short-term and long-term maintenance of **PROPEX** Armormax with respect to maintaining vegetation reinforced with **PROPEX** Armormax and patching of **PROPEX** Armormax (in the event it needs to be removed or replaced). These procedures are to be considered minimum guidelines for proper maintenance, and further maintenance techniques may be appropriate considering local practices and procedures.

1. PROPEX Armormax protected slopes

For **PROPEX** Armormax to be most effective, it is important to ensure that it is properly maintained both during construction and after construction. Identifying trouble areas is easy, and it can make identifying potential threats much simpler and manageable. Look for areas with sparse, dying, or no vegetation as these are obvious signs that the HPTRM is losing intimate contact with the slope surface. If loss of ground surface occurs, **PROPEX** Armormax will need to be removed and reinstalled as described in Patching and Repairs section after the eroded area is backfilled with compacted soil that is similar to material of the slope. After **PROPEX** Armormax is reinstalled, re-establish vegetation on the newly installed **PROPEX** Armormax and disturbed areas. Monitor the sites to determine if frequent watering may be required to establish vegetation.

To minimize exposure to unwanted maintenance and repair, **PROPEX** Armormax armored slopes should be free of unauthorized vehicular traffic. Routine maintenance and slope inspections should be performed with rubber tired vehicles. Tracked equipment such as skid steers, excavators, or dozers should only be allowed to traffic over **PROPEX** Armormax in times of emergency after vegetation establishment is complete. Failure to control unauthorized traffic can result in **PROPEX** Armormax being damaged resulting in erosion below **PROPEX** Armormax during storm events. In addition, routine mowing maintenance should be used to keep the protected area free of unwanted brush, saplings, and trees. Selective herbicides that target only the unwanted plants can be used as long as the vegetation established with **PROPEX** Armormax is not impaired. Failure to control the sapling and tree growth can result in the trees being uprooted during a flood.

2. Maintaining vegetation

good vegetative cover will ensure maximum performance of **PROPEX** Armormax. Vegetative cover care starts before a project is complete and is ongoing until all **PROPEX** Armormax is installed. Vegetative cover should be given every opportunity to grow and establish well. This will require that a contractor periodically fertilize, water, and mow the grasses as needed until a project is complete in the short-term, with the owner of the slope fulfilling the maintenance of the slope in a similar fashion for the long-term. For the entire lifecycle of **PROPEX** Armormax, every effort must be made to prevent unauthorized encroachments, grazing, vehicle traffic, the misuse of chemicals, or burning during inappropriate seasons.

1. After the installation of vegetation is complete, immediately water and soak the entire area using a fine spray to prevent erosion and loss of seeds. A suggested amount of water is identified below. Prior to installation if using sod, the sod pads in storage should be kept moist at all times and not stored for more than 24 hours from site arrival to installation. Warmer weather will necessitate more frequent applications than listed below.

    A. For each reach/segment of installed vegetation, watering shall be conducted immediately after each installation or the day's work.

    B. For initial vegetation establishment, water vegetation in a manner consistent with best practices for vegetation type and location.

    C. Establish a watering schedule and follow until vegetation is well established and will thrive in the absence of manual watering.

    D. Avoid excessive application of water, so that surface runoff does not occur. Runoff should be prohibited. However, additional watering may be required for repaired or damaged areas.

2. Fertilizer should be applied as needed to address any nutrient deficiencies revealed in soil testing.

3. Implement best practices for mowing over **PROPEX** Armormax. While **PROPEX** Armormax is designed to withstand non-hydraulic stresses such as mowing, there are procedures to minimize exposure to unwanted damage.

    A. Immediately after installation, signage and post shall be installed stating that "Vehicles and Pedestrians are Prohibited from Access" on the slopes and the newly installed vegetation. Signage shall be posted every 1,500 lineal feet.

    B. Vegetated areas should be mowed to a height no less than 6 in (152 mm) and no greater than 12 in (305 mm) from natural ground after a period of 60 days of growth. The excessive grass clippings created from mowing shall be evenly spread on the slope section outside of the armored area. Periodic and final grass mowing should be performed until final inspection and acceptance of slope work. Monitor the vegetated areas throughout winter months and generate reports as needed, noting any issues that should be addressed. Minimum mowing heights will depend on the vegetation density and should be as follows:
        i. 6" with 0 – 30% vegetation establishment
        ii. 4" with 30 – 70% vegetation establishment
        iii. 3" with 70 – 100% vegetation establishment

    C. To prevent damage to the newly established vegetation, the mowing tractor should be fitted with 3-rib agriculture tires. Note that tractors with 8 ft (2.4 m) flail mowers provide best results. Tractors with 15 ft (4.6 mm) brush hogs should avoid sharp turns up the slope to prevent damage to vegetation.

    D. Mowing should not take place for a minimum of 48 hours after a rainfall event of 2 in (55 mm) or more to minimize the potential for rutting and/or damage to the slope surface. Maintenance mowing of the slope should be done on a consistent basis to prevent vegetation growing to more than 3 ft (0.9 m) in height. This will minimize thatch thickness and potential damage to **PROPEX** Armormax. If turn-around pads are present, operate mowing equipment utilizing the turn-around pads to the fullest extent. The mowing blade height over **PROPEX** Armormax should be a minimum of 8 in (203 mm). However, should vegetation grow to more than 3 ft (0.9 m) in height, the mowing blade height for the condition should be a minimum of 12 in (305 mm).

4. Some special circumstances may exist. When mowing the crown of a slope with a crown or crest equal to or exceeding 20%, it should be mowed with an articulating arm mower to minimize the potential for the mower blades to catch **PROPEX** Armormax at the slope surface. The articulating arm mower should be level on the surface with the articulating arm extending over the crown. Pay close attention to areas where the slope changes. The mower blades should be set at a minimum height of 8 in (203 mm). If **PROPEX** Armormax is damaged by the mowing blades at any time, mowing should stop immediately and further direction should be obtained to continue activity. Repair the damaged area as described in the Patching and Repairs section below.

5. **PROPEX** Armormax protected slopes are not as susceptible to animal burrowing due the tenacity of the **PROPEX** Armormax; however, inspections to detect the presence of burrowing animal activity are generally most effective immediately after the slope has been mowed. Animal burrows that are identified should be thoroughly excavated and inspected, backfilled with compacted soil that is similar to material of the slope, and vegetation re-established. This will avoid the possibility of water piping through unfilled portions of the burrows. Should **PROPEX** Armormax be damaged, it is to be repaired as described Patching and Repairs section below.

3. Patching and repairs

PROPEX Armormax may require localized repair at times. For emergency repairs, an adequate supply of **PROPEX** Armormax should be maintained in inventory with the necessary tools to install. This will allow for a timely, initial repair of the system.

1. In order to identify areas in need of repair, the site should be patrolled immediately after mowing and after rain events of 2 in (51 mm) or more. When patrolling look for areas of sparse vegetation, exposed edges of **PROPEX** Armormax, and areas where direct contact between **PROPEX** Armormax and the slope surface is compromised. **PROPEX** Armormax should be rated as Acceptable, Minimally Acceptable, or Unacceptable during inspection.

    A. Acceptable (A) - The rated area is in satisfactory, acceptable condition, and will function as designed and intended during the rain event. **PROPEX** Armormax has no exposed edges, is installed tightly by maintaining direct contact to the slope surface with no rilling beneath, and has over 90% vegetation cover. There is no noticeable damage present.

    B. Minimally Acceptable (M) - The rated area has a minor deficiency that needs to be corrected. The minor deficiency will not seriously impair the functioning of the area during the next rain event; however, the overall reliability of the project will be lowered because of the minor deficiency. **PROPEX** Armormax has 75% vegetation cover with un-vegetated patches as large as one square yard. Edges of **PROPEX** Armormax are exposed with noticeable damage. Minimal erosion has occurred underneath **PROPEX** Armormax.

    C. Unacceptable (U) - The rated area is unsatisfactory. The deficiency is so serious that the area will not adequately function in the next rain event. **PROPEX** Armormax has been physically torn, ripped, or lifted from the slope surface. Less than 75% vegetation cover is present with un-vegetated patches being greater than 1 y^2 (0.9 m^2), and there is evidence that erosion is occurring beneath **PROPEX** Armormax.

2. Repair any raised or exposed edges of **PROPEX** Armormax by driving existing and additional pins or anchors along the edges as necessary to securely fasten to the ground. Inspect areas where the vegetation is not growing on top of **PROPEX** Armormax. Many times this is an indicator that **PROPEX** Armormax has lost contact with the ground beneath. Check for voids beneath **PROPEX** Armormax and fill any holes, gullies, etc. with compacted fill material if possible. Replace **PROPEX** Armormax as described below.

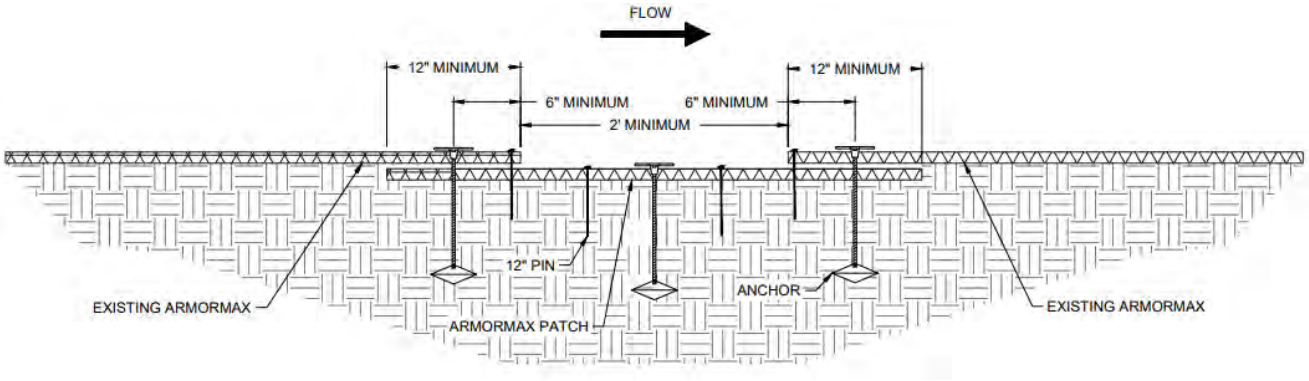


Figure 23: PROPEX Armormax Patch Cross Section

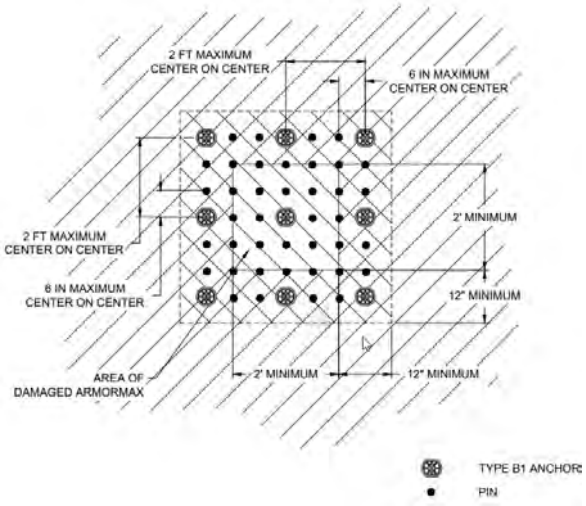


Figure 24: PROPEX Armormax Patch Plan View

3. To repair **PROPEX** Armormax, cut out and remove damaged areas in a square configuration a minimum size of 2 ft by 2 ft (0.6 m x 0.6 m). Remove all vegetation and debris atop of **PROPEX** Armormax. Loosen the top 1 in to 2 in (25 mm - 50mm) of soil in the patch area then seed. The subgrade of area to be patched shall be prepared to be smooth and uniform and transition smoothly into the in-situ area. Cut a square **PROPEX** Armormax patch a minimum of 12 in (305 mm) greater than the damaged area for all four sides of the patch. Overlap the patch area in all directions a minimum of 12 in (305 mm). The patch overlaps shall be tucked under the existing damaged **PROPEX** Armormax material (Figure 23 and Figure 24).

4. Install anchors on 2 ft (600 mm) (max) centers, and pins on 6 in (150 mm) (max) centers. For larger areas of damage, anchors should be installed to match existing anchor pattern and type. Once **PROPEX** Armormax is in place, vegetate per project specifications.

4. Summary

Maintenance should consist of watering and weeding, repair of all erosion, and any re-seeding as necessary to establish a uniform stand of vegetation during construction and beyond. A minimum of 70% of the armored area should be covered with no bare or dead spots greater than 10 ft^2 (1 m^2). Establishing vegetation should not be mowed prior to 70% vegetative density and a minimum grass growth of 4 in (100 mm). Throughout the duration of the project, the contractor should be responsible for mowing to facilitate growth and should not let the vegetation in the armored areas exceed 18 in (450 mm). In addition, the Contractor should water all grassed areas as often as necessary to establish satisfactory growth and to maintain its growth throughout the duration of the project. After the project is complete, it is the responsibility of the Owner to maintain and upkeep all **PROPEX** Armormax installed areas for long term performance and best results as described herein for superior slope armoring.

About Solmax

Solmax is a world leader in sustainable construction solutions, for civil and environmental infrastructure. Its pioneering products separate, contain, filter, drain and reinforce essential applications in a more sustainable way – making the world a better place. The company was founded in 1981, and has grown through the acquisition of GSE, TenCate Geosynthetics and PROPEX. It is now the largest geosynthetics company in the world, empowered by more than 2,000 talented people. Solmax is headquartered in the province of Quebec, Canada, with subsidiaries and operations across the globe.

Uncompromised quality

Our products are manufactured to strict international quality standards. All our products are tested and verified at our dedicated and comprehensive laboratories which maintain numerous accreditations. We offer our partners a wide scope of testing according to published standards to ensure products delivered to sites meet specified quality requirements.

Let's build infrastructure better

SOLMAX.COM

REV 0724

PROPEX Armormax

Engineered earth armoring system

SOLMAX

The most advanced and resilient technology for preventing severe erosion and stabilizing surficial slopes is **PROPEX®** Armormax®.

PROPEX Armormax is composed of High Performance Turf Reinforcement Mat (HPTRM) and Engineered Earth Anchors that work together to lock soil in place and protect against hydraulic stresses.

High performance turf reinforcement mat

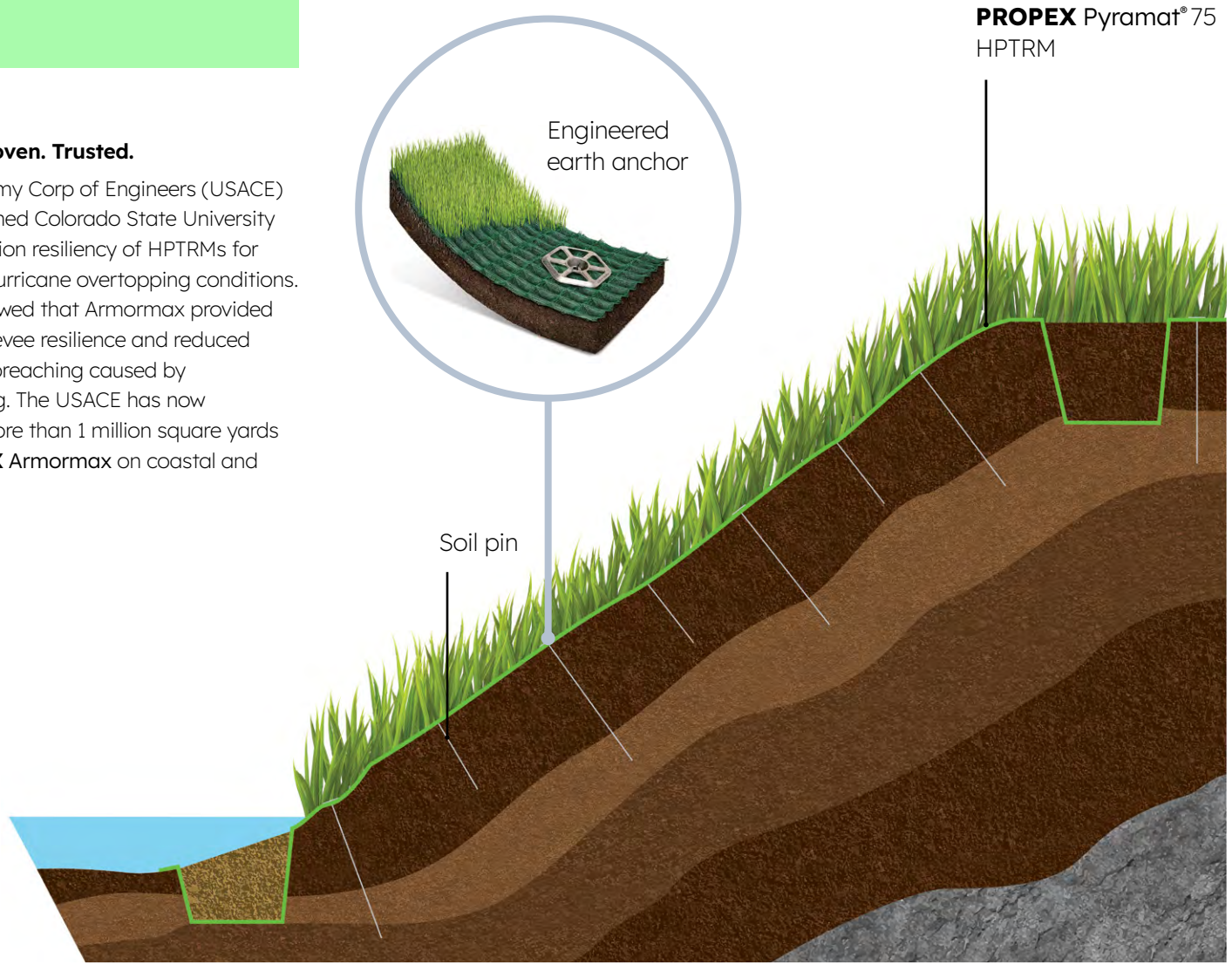
Solmax's HPTRM technology features patented ultraviolet stabilization and high tensile strength to provide up to 75 years of slope protection and erosion mitigation, even in environments with direct exposure to sunlight. Additionally, the HPTRM is designed to accelerate vegetative growth, exhibit high resiliency, and feature strength and elongation properties to limit stretching in saturated conditions.

Engineering earth anchors

Corrosion resistant Engineered Earth Anchors™ (EEA) secure the HPTRM to the ground. EEAs are designed to provide resistance to shear and lateral forces, and embed beyond the predicted plane of failure. The **PROPEX** Armormax system uses either a B1, B2, or B3 anchor depending on the application and environment.

Tested. Proven. Trusted.

The U.S. Army Corp of Engineers (USACE) commissioned Colorado State University to test erosion resiliency of HPTRMs for 500-year hurricane overtopping conditions. Testing showed that Armormax provided increased levee resilience and reduced the risk of breaching caused by overtopping. The USACE has now installed more than 1 million square yards of **PROPEX** Armormax on coastal and river levees.



FEATURES AND BENEFITS

Design and performance

- Provides permanent erosion protection for up to 75 years
- Withstands extreme hydraulic stresses
- Provides temporary shoring and stabilization for constructed slopes
- Resistant to non-hydraulic stresses from debris and mowing and maintenance equipment
- Resistant to fire using non-halogen fire retardant technology
- Highly UV stabilized for applications with little or no vegetation
- Outlasts other slope reinforcement methods yielding significant cost savings
- Ease of installation reduces time and labor costs
- Lightweight and easily transported into areas with access challenges
- Reduces the amount of space needed for a right-of-way

Environmental

- Recognized by the EPA as Best Management Practice (BMP) for improving water quality
- Verified carbon footprint is up to 30 times smaller than traditional hard armor
- Recognized by FEMA as a nature-based solution
- Filters sediment and pollutants to improve water quality
- Encourages infiltration of water back into the ground water table
- Proven to reduce erosion and reinforce vegetation for low-impact, sustainable design
- Yields a vegetated solution that is more aesthetically pleasing than traditional hard armoring solutions
- Maintains cooler water temperature than traditional hard armoring, which is healthier for aquatic habitats

APPLICATIONS

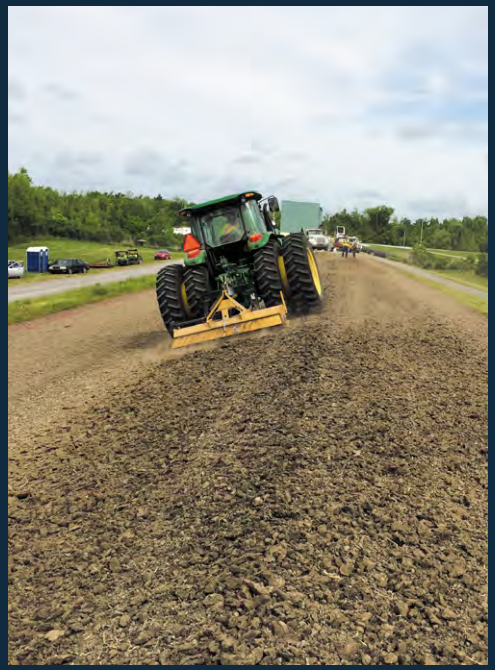
- Arid and semi-arid environments where vegetation densities of <30% are anticipated
- Earthen dams and spillways
- Roadway embankments
- Canals/stream banks
- Steepened slopes
- Channels
- Levees
- Areas prone to wild fires
- Defensible spaces

INSTALLATION COMPARISON: PROPEX Armormax VS. RIPRAP

Typical placement of 1 acre, or approxamitely 5,000 SY, of erosion protection

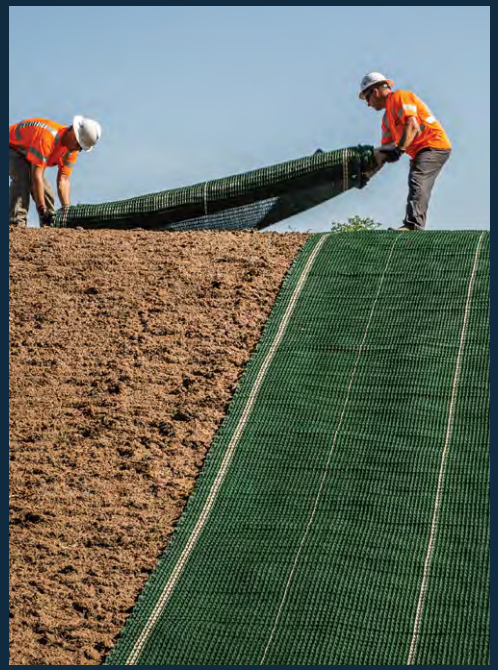
PROPEX Armormax		**RIPRAP**
5 days		**11** days
	Based on a 4-person crew with equipment operator, working 8hrs per day	
1/2 container van		**250** dump trucks
	Based on 6” stone size at 18” depth and 15 tons per dump truck	
$28 dollar per SY		**$65** dollar per SY
	Assuming $25/ton for material, average fuel and equipment costs, and labor as specified above	

PROPEX Armormax INSTALLATION DETAILS



Step 1:
Site preparation

Grade and compact the failed slope and remove objects that would prevent **PROPEX** Armormax from making direct contact with the soil. Excavate a trench at the crest and toe of the slope.



Step 2:
HPTRM laydown

Unroll the HPTRM on the prepared soil ensuring material has intimate contact the soil.

Step 3:
Anchor installation

Anchors should be installed in locations specified for the project.

Step 4:
Vegetation establishment

Vegetation can be established by broadcast seeding, hydraulic seed application (hydroseeing), or sodding.

About us

Solmax is a world leader in sustainable construction solutions, for civil and environmental infrastructure. Its pioneering products separate, contain, filter, drain and reinforce essential applications in a more sustainable way – making the world a better place. The company was founded in 1981, and has grown through the acquisition of GSE, TenCate and Propex. It is now the largest geosynthetics company in the world, empowered by more than 2,000 talented people. Solmax is headquartered in the province of Quebec, Canada, with subsidiaries and operations across the globe.

Uncompromised quality

Our products are manufactured to strict international quality standards. All our products are tested and verified at our dedicated and comprehensive laboratories which maintain numerous accreditations. We offer our partners a wide scope of testing according to published standards to ensure products delivered to sites meet specified quality requirements.

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APPENDIX C

EROSION AND SEDIMENT CONTROL DETAILS

SILT FENCE

General Description

Silt fence is a temporary sediment barrier consisting of filter fabric attached to supporting posts and entrenched into the soil. This barrier is installed across or at the toe of a slope, to intercept and retain small amounts of sediment from disturbed or unprotected areas.

Silt fences have a useful life of one season. They function primarily to slow and pond the water and allow soil particles to settle. Silt fences are not designed to withstand high heads of water, and therefore should be located where only shallow pools can form. Their use is limited to areas where overland sheet flows are expected.

Silt fence is a sediment control practice, not an erosion control practice. It is intended to be used in conjunction with other practices that do prevent or control erosion. Improperly applied or installed silt fence will increase erosion.

Silt fences should not be used across streams, channels, swales, ditches or other drainage ways. Silt fences are not capable of effectively filtering the high rates and volumes of water associated with channelized flow. Silt fences should not be designed to impound sediment or water more than 18 inches high. Silt fences installed across a concentrated flow path are subject to undercutting, end cutting, and overtopping. This frequently not only results in the bypass of sediment laden-water, but also in the complete failure of the fence. Such failures typically release the sediment accumulated on the upgradient side of the fence, and severe erosion of the channel both upstream and downstream of the fence.

Considerations

- Silt fence barriers are used where:
    - Flow to the silt fence from a disturbed area occurs as overland sheet flow.
    - Sedimentation can pollute or degrade adjacent wetlands or watercourses.
    - Sedimentation will reduce the capacity of storm drainage systems or adversely affect adjacent areas.
    - The contributing drainage area is less than 1/4 acre per 100 feet of barrier length, the maximum length of slope above the barrier is 100 feet, and the maximum gradient behind the barrier is 50 percent (2:1). If any of these conditions are exceeded, other measures may be necessary to control erosion and to intercept and treat the sediment load.
    - Sediment barriers should not be used in areas of concentrated flows. Under no circumstances should silt fences be constructed in streams or in swales where there is the possibility of a washout.
- Silt fences (synthetic filter) can be used for 60 days or longer depending on ultraviolet stability and manufacturer's recommendations. However, silt fences generally have a useful life of one season, and should be periodically replaced on longer duration construction projects.
- Silt fencing generally is a better barrier than hay bale barriers.
- Potential causes of silt fence failure include:
    - Improper placement on the site;
    - Allowing excessive drainage area to the silt fence structure;
    - Inadequate trenching depth and improper backfill and compaction of the bottom of the silt fence fabric;
    - Improper attachment to posts;
    - Inadequate maintenance of the silt fence after installation;

- Installing silt fence with a descending grade along the fence alignment, resulting in the diversion or concentration of runoff.
- Placement of fence at mid-slope of a cut or fill embankment. Because a silt fence works by impounding water, it should be placed at the toe of such slopes, to allow for this function, and to avoid potential diversion or concentration of flows.

Maintenance Requirements

- Fences should be inspected and maintained immediately after each rainfall and at least daily during prolonged rainfall;
- Sediment deposition should be removed, at a minimum, when deposition accumulates to one-half the height of the fence, and moved to an appropriate location so the sediment is not readily transported back toward the silt fence.
- Silt fences should be repaired immediately if there are any signs of erosion or sedimentation below them. If there are signs of undercutting at the center or the edges of the barrier, or impounding of large volumes of water behind them, sediment barriers should be replaced with a temporary check dam.
- Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still is necessary, the fabric should be replaced promptly.
- Any sediment deposits remaining in place after the silt fence is no longer required should be dressed to conform to the existing grade, prepared and seeded.
- If there is evidence of end flow on properly installed barriers, extend barriers uphill or consider replacing them with other measures, such as temporary diversions and sediment traps.
- Silt fences have a useful life of one season. On longer construction projects, silt fence should be replaced periodically as required to maintain effectiveness.

Specifications

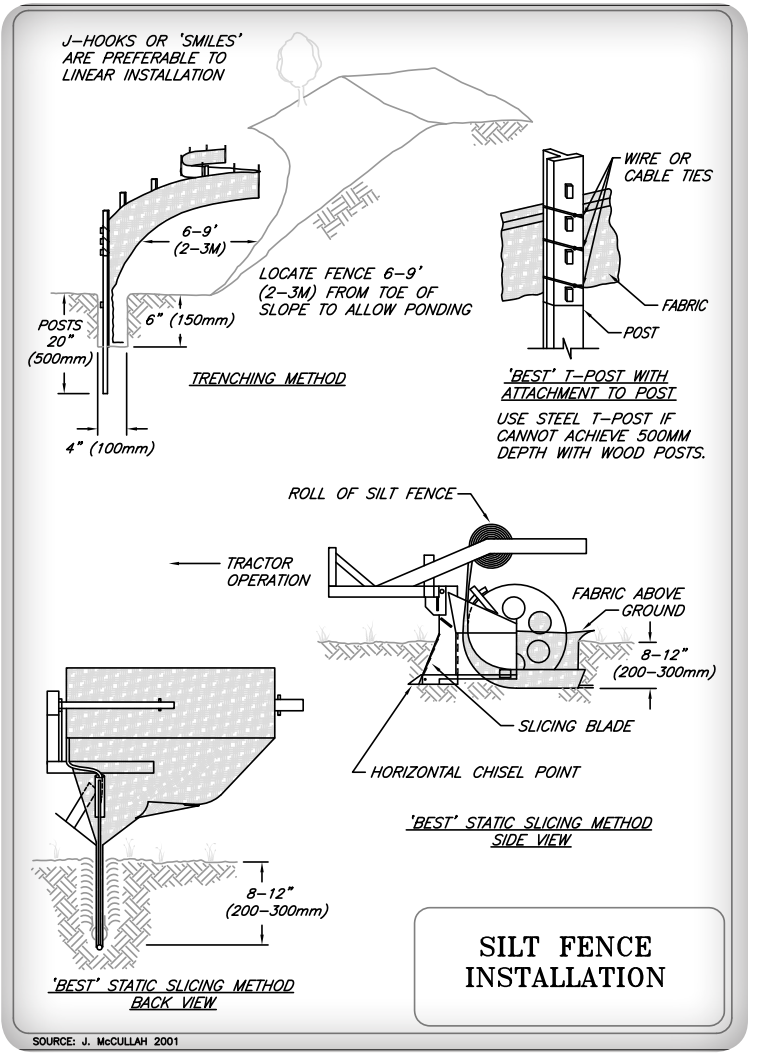
Fences should be used in areas where erosion will occur only in the form of sheet erosion and there is no concentration of water in a channel or drainage way above the fence. Sediment barriers should be installed prior to any soil disturbance of the contributing drainage area above them.

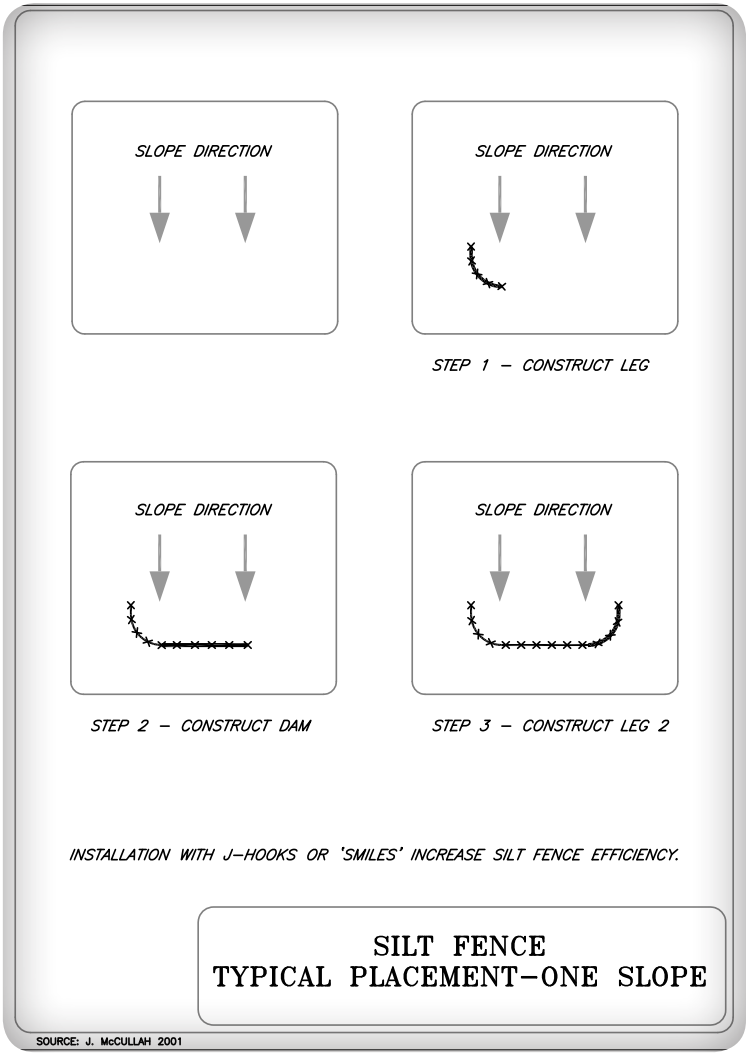
- The maximum contributing drainage area above the fence should be less than ¼ acre per 100 linear feet of fence;
- The maximum length of slope above the fence should be 100 feet;
- The maximum slope above the fence should be 2:1;
- Fences should be installed following the contour of the land as closely as possible, and
    - The ends of the fence should be flared upslope;
    - The fabric should be embedded a minimum of 4 inches in depth and 4 inches in width in a trench excavated into the ground, or if site conditions include frozen ground, ledge, or the presence of heavy roots, the base of the fabric should be embedded with a minimum thickness of 8 inches of ¾-inch stone;
    - The soil should be compacted over the embedded fabric;
    - Support posts should be sized and anchored according to the manufacturer's instructions with maximum post spacing of 6 feet;
    - Adjoining sections of the fence should be overlapped by a minimum of 6 inches (24 inches is preferred), folded and stapled to a support post. If metal posts are used, fabric should be wire-tied directly to the posts with three diagonal ties.
- Silt fencing should not be stapled or nailed to trees.
- The filter fabric should be a pervious sheet of propylene, nylon, polyester or ethylene yarn and should be certified by the manufacturer or supplier.

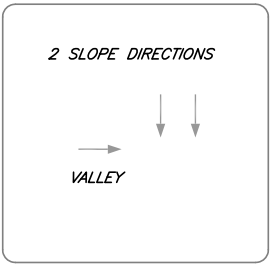
- The filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 degrees Fahrenheit to 120 degrees Fahrenheit.
- Posts for silt fences should be either 4-inch diameter wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steel posts should have projections for fastening wire to them. Posts should be placed on the downslope side of the fabric.
- The height of a silt fence should not exceed 36 inches as higher fences may impound volumes of water sufficient to cause failure of the structure.
- The filter fabric should be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter cloth should be spliced together only at support post, with a minimum 6-inch overlap, and securely sealed.
- A manufactured silt fence system with integral posts may be used.
- Post spacing should not exceed 6 feet.
- A trench should be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upgradient from the barrier.
- The standard strength of filter fabric should be stapled or wired to the post, and 8 inches of the fabric should be extended into the trench. The fabric should not extend more than 36 inches above the original ground surface.
- The trench should be backfilled and the soil compacted over the filter fabric.
- Silt fence may be installed by "slicing" using mechanical equipment specifically designed for this procedure. The slicing method uses an implement towed behind a tractor to "plow" or slice the silt fence material into the soil. The slicing method minimally disrupts the soil upward and slightly displaces the

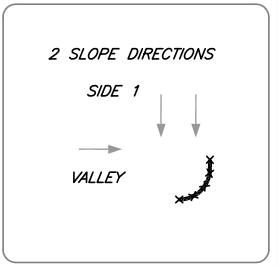
soil, maintaining the soil's profile and creating an optimal condition for subsequent mechanical compaction.

- Silt fences should be installed with "smiles" or "J-hooks" to reduce the drainage area that any segment will impound (see diagrams).
- The ends of the fence should be turned uphill.
- Silt fences placed at the toe of a slope should be set at least 6 feet from the toe to allow space for shallow ponding and to allow for maintenance access without disturbing the slope.
- Silt fences should be removed when they have served their useful purpose, but not before the upslope areas have been permanently stabilized.

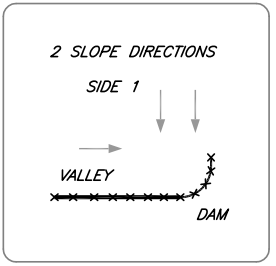

J–HOOKS OR 'SMILES' ARE PREFERABLE TO LINEAR INSTALLATION
6–9' (2–3M)
LOCATE FENCE 6–9' (2–3M) FROM TOE OF SLOPE TO ALLOW PONDING
POSTS 20" (500mm)
6" (150mm)
4" (100mm)
TRENCHING METHOD
WIRE OR CABLE TIES
FABRIC
POST
'BEST' T–POST WITH ATTACHMENT TO POST
USE STEEL T–POST IF CANNOT ACHIEVE 500MM DEPTH WITH WOOD POSTS.
ROLL OF SILT FENCE
TRACTOR OPERATION
FABRIC ABOVE GROUND
8–12" (200–300mm)
SLICING BLADE
HORIZONTAL CHISEL POINT
'BEST' STATIC SLICING METHOD SIDE VIEW
8–12" (200–300mm)
'BEST' STATIC SLICING METHOD BACK VIEW
SILT FENCE INSTALLATION
SOURCE: J. McCULLAH 2001


SLOPE DIRECTION
SLOPE DIRECTION
STEP 1 – CONSTRUCT LEG
SLOPE DIRECTION
SLOPE DIRECTION
STEP 2 – CONSTRUCT DAM
STEP 3 – CONSTRUCT LEG 2
INSTALLATION WITH J–HOOKS OR 'SMILES' INCREASE SILT FENCE EFFICIENCY.
SILT FENCE
TYPICAL PLACEMENT–ONE SLOPE
SOURCE: J. McCULLAH 2001

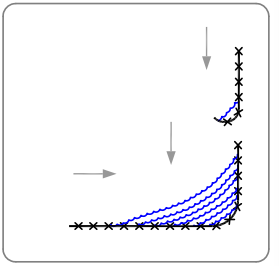




STEP 1 – CONSTRUCT A DAM



STEP 2 – CONSTRUCT SIDE 2

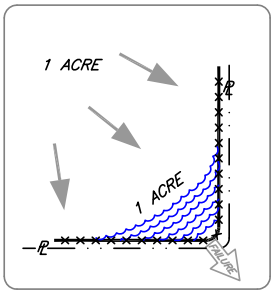


STEP 3 – CONSTRUCT J–HOOKS AS NEEDED

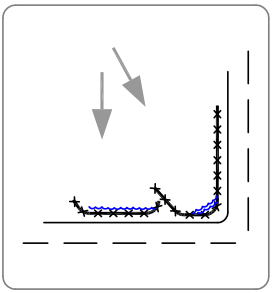
INSTALLATION WITH J–HOOKS WILL INCREASE SILT FENCE EFFICIENCY AND REDUCE EROSION–CAUSING FAILURES.

SILT FENCE
TYPICAL PLACEMENT–TWO SLOPES

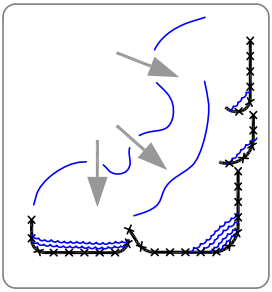
SOURCE: J. McCULLAH 2001

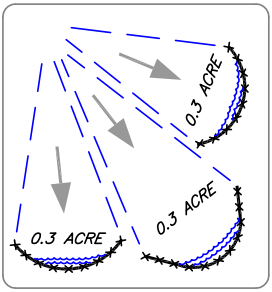


Incorrect – Do Not layout "perimeter control" silt fences along property lines. All sediment laden runoff will concentrate and overwhelm the system.



Correct – Install J–hooks





Discreet segments of silt fence, installed with J–hooks or 'smiles' will be much more effective.

SILT FENCE PLACEMENT FOR PERIMETER CONTROL

SOURCE: J. McCULLAH 2001

EROSION CONTROL MIX BERMS

General Description

An erosion control mix berm is a trapezoidal berm that intercepts sheet flow and ponds runoff, allowing sediment to settle, and filtering sediment as well. They are an environmentally sensitive and cost-effective alternative to silt fence. An alternative to a simple erosion control mix berm is a "continuous contained berm", consisting of erosion control mix compost encapsulated in a mesh fabric (or "filter sock").

This barrier is installed across or at the toe of a slope, to intercept and retain small amounts of sediment from disturbed or unprotected areas.

Erosion control mix berms and socks sometimes offer a better solution than silt fence and other sediment control methods, because the organic material does not require any special trenching, construction, or removal, unlike straw bales, silt fence or coir rolls. This makes the technique very cost-effective.

The erosion control mix is organic, biodegradable, renewable, and can be left onsite. This is particularly important below embankments near streams, as re-entry to remove or maintain a synthetic barrier can cause additional disturbance. Silt fence has to be disposed of as a solid waste, and is often left abandoned on job sites.

Erosion control mix berms can be easily and quickly fixed, if they are disturbed in the course of construction activity.

Considerations

The berm is used where:

- Sedimentation can pollute or degrade adjacent wetland and/or watercourses.
- Sedimentation will reduce the capacity of storm drainage systems or adversely affect adjacent areas.
- The contributing drainage area is less than 1/4 acre per 100 feet of barrier length, the maximum length of slope above the barrier is 100 feet, and the maximum gradient behind the barrier is 5 percent. If the slope length is greater, other measures such as diversions may be necessary to reduce the slope length.
- Sediment barriers should not be used in areas of concentrated flows. Under no circumstances should erosion control mix barriers be constructed in live streams or in swales where there is the possibility of a washout.
- Sediment barriers are effective only if installed and maintained properly.
- Sediment barriers should be installed prior to any soil disturbance of the contributing drainage area above them.
- Frozen ground, outcrops of bedrock and very rooted forested areas are locations where berms of erosion control mix are most practical and effective.
- Other BMPs should be used at low points of concentrated runoff, below culvert outlet aprons, around catch basins and closed storm systems, and at the bottom of steep perimeter slopes.

Maintenance Requirements

- Filter berms should be inspected immediately after each rainfall and at least daily during prolonged rainfall. They should be repaired immediately if there are any signs of erosion or sedimentation below them. If there are signs of breaching of the barrier, or impounding of large volumes of water behind them, then they should be replaced with other measures to intercept and trap sediment (such as a diversion berm directing runoff to a sediment trap or basin).
- Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-third of the height of the barrier.
- Filter berms should be reshaped or reapplied as needed.
- Any sediment deposits remaining in place after the barrier is no longer required should be dressed to conform to the existing grade, prepared and seeded.

Specifications

Erosion control mix can be manufactured on or off the project site. It must consist primarily of organic material, separated at the point of generation, and may include shredded bark, stump grindings, composted bark, or acceptable manufactured products. Wood and bark chips, ground construction debris or reprocessed wood products will not be acceptable as the organic component of the mix.

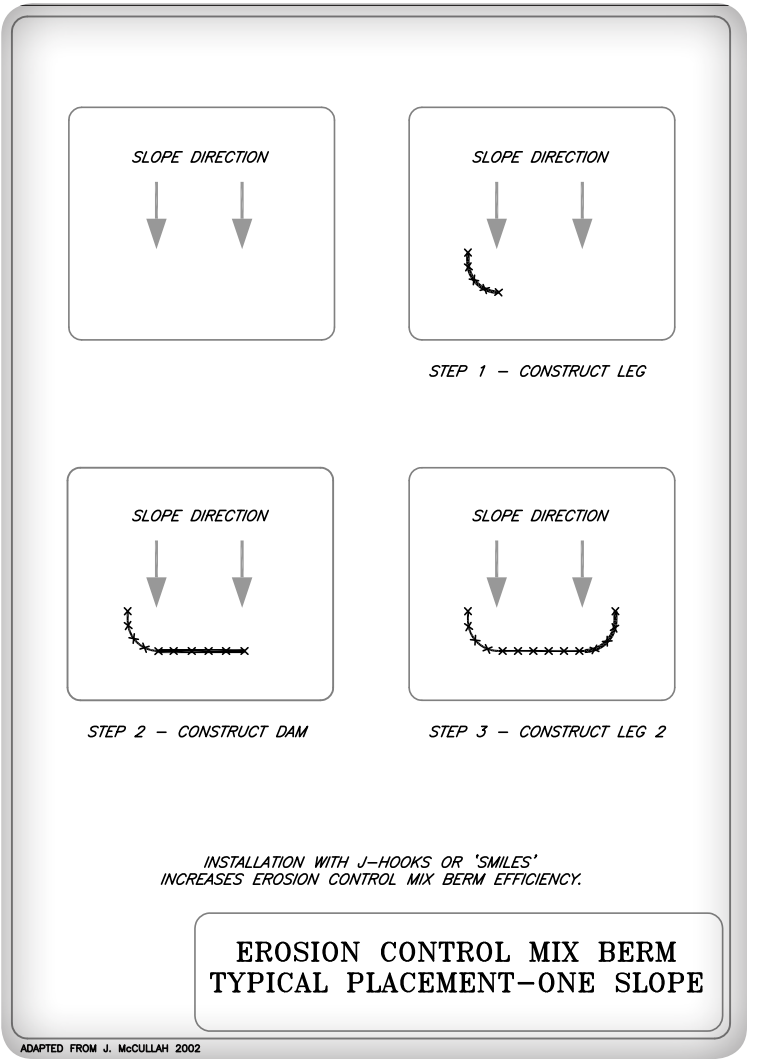
- Composition of the erosion control mix should be as follows:
    - Erosion control mix should contain a well-graded mixture of particle sizes and may contain rocks less than 4" in diameter. Erosion control mix must be free of refuse, physical contaminants, and material toxic to plant growth. The mix composition should meet the following standards:
    - The organic matter content should be between 25 and 65%, dry weight basis.

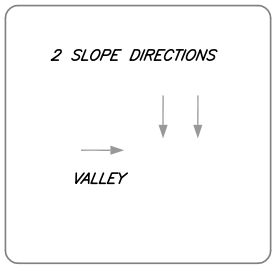
- Particle size by weight should be 100% passing a 3“ screen, 90% to 100% passing a 1-inch screen, 70% to 100% passing a 0.75-inch screen, and a maximum of 30% to 75%, passing a 0.25-inch screen.
- The organic portion needs to be fibrous and elongated.
- The mix should not contain silts, clays or fine sands.
- Soluble salts content should be < 4.0 mmhos/cm.
- The pH should be between 5.0 and 8.0.

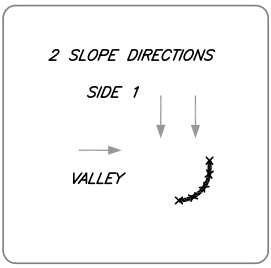
- The barrier must be placed along a relatively level contour. It may be necessary to cut tall grasses or woody vegetation to avoid creating voids and bridges that would enable fines to wash under the barrier through the grass blades or plant stems.
- The barrier must be a minimum of 12” high, as measured on the uphill side of the barrier, and a minimum of two feet wide.

Continuous Contained Berms

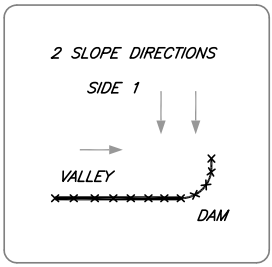
An alternative product, the continuous contained berm (or “filter sock”), can be an effective sediment barrier as it adds containment and stability to a berm of erosion control mix. The organic mix is placed in the synthetic tubular netting and performs as a sturdy sediment barrier that is highly durable. It especially works well in areas where trenching is not feasible such as over frozen ground or over pavement. See the detail drawing in this section for the installation of continuous contained berms. Seeds may be added to the organic filler material and can permanently stabilize a shallow slope. The containment will provide stability while vegetation is rooting through the netting.


SLOPE DIRECTION
SLOPE DIRECTION
STEP 1 – CONSTRUCT LEG
SLOPE DIRECTION
SLOPE DIRECTION
STEP 2 – CONSTRUCT DAM
STEP 3 – CONSTRUCT LEG 2
INSTALLATION WITH J–HOOKS OR 'SMILES'
INCREASES EROSION CONTROL MIX BERM EFFICIENCY.
EROSION CONTROL MIX BERM
TYPICAL PLACEMENT–ONE SLOPE
ADAPTED FROM J. McCULLAH 2002

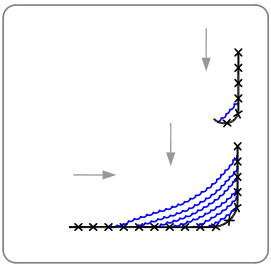




STEP 1 – CONSTRUCT A DAM



STEP 2 – CONSTRUCT SIDE 2

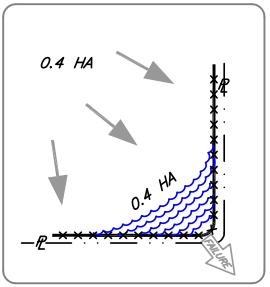


STEP 3 – CONSTRUCT J–HOOKS AS NEEDED

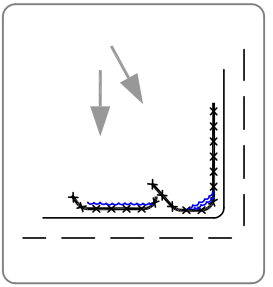
INSTALLATION WITH J–HOOKS WILL INCREASE EROSION CONTROL MIX BERM EFFICIENCY AND REDUCE EROSION–CAUSING FAILURES.

EROSION CONTROL MIX BERM
TYPICAL PLACEMENT–TWO SLOPES

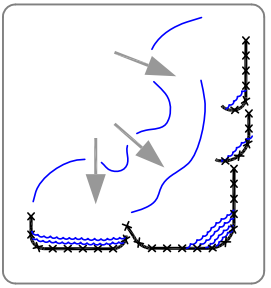
ADAPTED FROM J. McCULLAH 2002

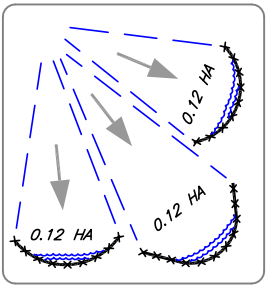


Incorrect – Do Not layout "perimeter control" erosion control mix berms along property lines. All sediment laden runoff will concentrate and overwhelm the system.



Correct – Install J–hooks

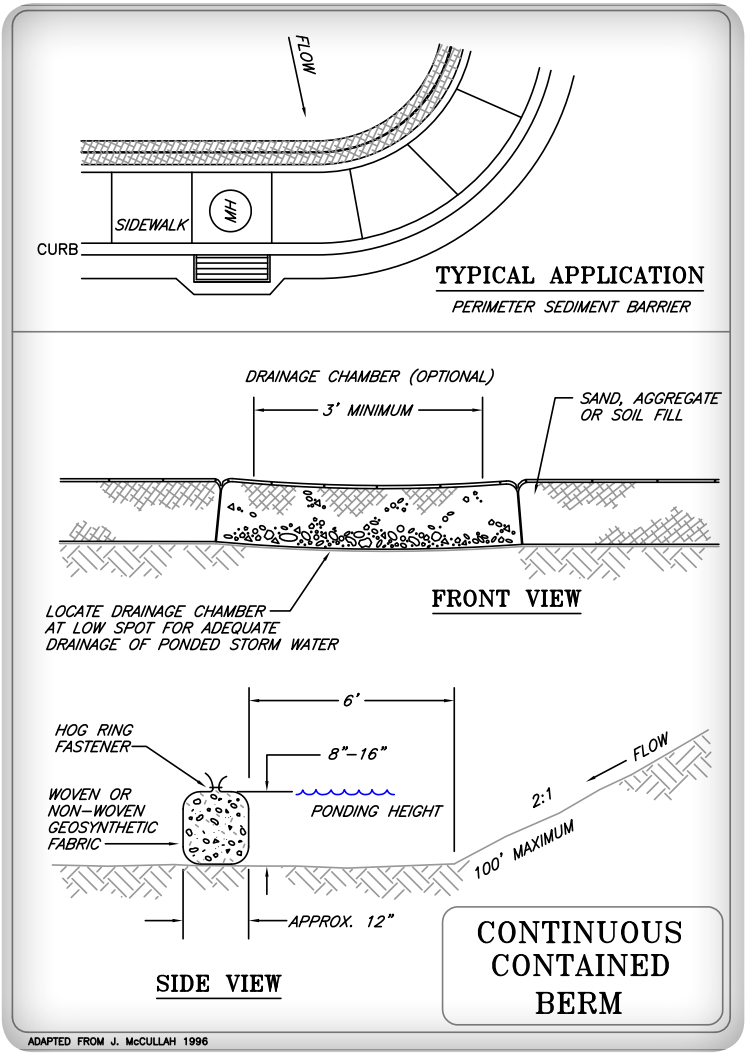




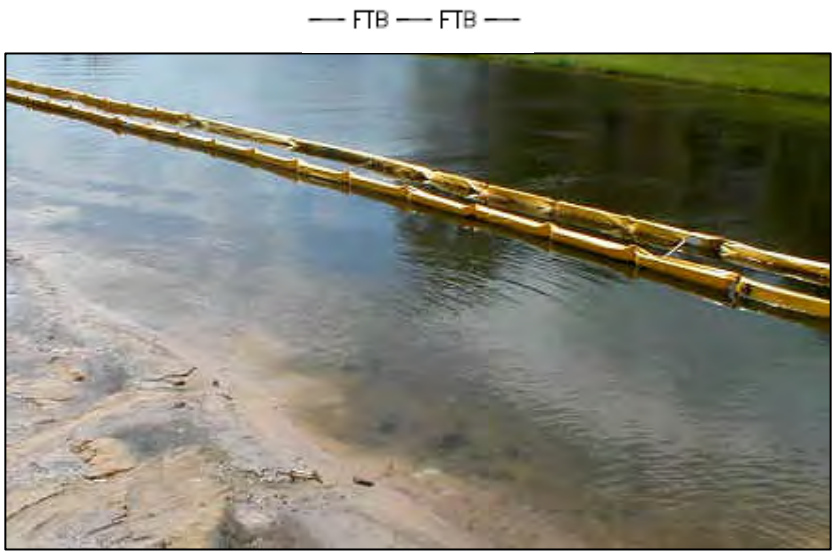
Discreet segments of compost berms, installed with J–hooks or 'smiles' will be much more effective.

EROSION CONTROL MIX
BERM PLACEMENT
FOR PERIMETER CONTROL

ADAPTED FROM J. McCULLAH 2002


FLOW
SIDEWALK
HH
CURB
TYPICAL APPLICATION
PERIMETER SEDIMENT BARRIER
DRAINAGE CHAMBER (OPTIONAL)
3' MINIMUM
SAND, AGGREGATE OR SOIL FILL
LOCATE DRAINAGE CHAMBER AT LOW SPOT FOR ADEQUATE DRAINAGE OF PONDED STORM WATER
FRONT VIEW
6'
HOG RING FASTENER
8"–16"
WOVEN OR NON–WOVEN GEOSYNTHETIC FABRIC
PONDING HEIGHT
FLOW
2:1
100' MAXIMUM
APPROX. 12"
SIDE VIEW
CONTINUOUS CONTAINED BERM
ADAPTED FROM J. McCULLAH 1996

Floating Turbidity Barrier (FB)



Practice Definition

A floating turbidity barrier consists of geotextile material (curtain) with floats on the top, weights on the bottom, and an anchorage system that minimizes sediment transport from a disturbed area that is adjacent to or within a body of water. The barrier provides sedimentation and turbidity protection for a watercourse from up-slope land-disturbance activities where conventional erosion and sediment controls cannot be used or need supplemental sediment control, or from dredging or filling operations within a watercourse. The practice can be used in non-tidal and tidal watercourses where intrusion into the watercourse by construction activities has been permitted and subsequent sediment movement is unavoidable.

Planning Considerations

Soil loss into a watercourse results in long-term suspension of sediment. In time, the suspended sediment may travel long distances and affect widespread areas. A turbidity barrier is designed to deflect and contain sediment within a limited area and provide enough residence time so that soil particles will fall out of suspension and not travel to other areas.

Turbidity barrier types must be selected based on the flow conditions within the waterbody, whether it is a flowing channel, lake, pond, or a tidal watercourse. The specifications contained within this practice pertain to minimal- and moderate-flow conditions where the velocity of flow may reach 5 ft/sec (or a current of approximately 3-knots). For situations where there are greater flow velocities or currents, a qualified design professional and the product manufacturer should be consulted.

Consideration must also be given to the direction of water movement in channel-flow situations. Turbidity barriers are not designed to act as water impoundment dams and

cannot be expected to stop the flow of a significant volume of water. They are designed and installed to trap sediment; not to halt the movement of water itself. In most situations, turbidity barriers should not be installed across channel flows. There is an exception to this rule. This occurs when there is a danger of creating a sediment buildup in the middle of a watercourse, thereby blocking access or creating a sediment bar. Curtains have been used effectively in large areas of moving water by forming a very long-sided, sharp "V" to deflect clean water around a work site, confining a large part of the sediment-laden water to the work area inside the "V" and directing much of the sediment toward the shoreline. Care must be taken, however, not to install the curtain perpendicular to the water current.

In tidal or moving water conditions, provisions must be made to allow the volume of water contained within the barrier to change. Since the bottom of the barrier is weighted and external anchors are frequently added, the volume of water contained within the curtain will be much greater at high tide versus low tide, and measures must be taken to prevent the curtain from submerging. In addition to allowing slack in the curtain to rise and fall, water must be allowed to flow through the curtain if the curtain is to remain in roughly the same place and maintain the same shape. Normally, this is achieved by constructing part of the curtain from a heavy, woven filter fabric. The fabric allows the water to pass through the curtain, but retains the sediment particles. Consideration should be given to the volume of water that must pass through the fabric and the sediment particle size when specifying fabric permeability.

Sediment, which has been deflected and settled out by the curtain, may be removed if so directed by the on-site inspector or the permitting agency. However, consideration must be given to the probable outcome of the procedure, which may create more of a sediment problem by re-suspension of particles and accidental dumping of the material by the equipment involved. It is, therefore, recommended that the soil particles trapped by a turbidity curtain be removed only if there has been a significant change in the original contours of the affected area in the watercourse. Regardless of the decision made, soil particles should always be allowed to settle for a minimum of 6-12 hours before removal by equipment or before removal of a turbidity curtain.

It is imperative that all measures in the erosion-control plan be used to keep sediment out of the watercourse. However, when proximity to the watercourse makes successfully mitigating sediment loss impossible, the use of the turbidity curtain during land disturbance is essential. Under no circumstances should permitted land-disturbing activities create violations of water quality standards.

Design Criteria and Construction

Floating turbidity barriers are normally classified into three types:

- Type I (see Figure FB-1) is used in protected areas where there is no current and the area is sheltered from wind and waves.

- Type II (see Figure FB-1) is used in areas where there may be small to moderate current (up to 2 knots or 3.5 ft/sec) and/or wind and wave action can affect the curtain.

- Type III (see Figure FB-2) is used in areas where considerable current (up to 3 knots or 5 ft/sec) may be present, where tidal action may be present, and/or where the curtain is potentially subject to wind and wave action.

Turbidity curtains should extend the entire depth of the watercourse whenever the watercourse in question is not subject to tidal action and/or significant wind and wave forces. This prevents sediment-laden water from escaping under the barrier, scouring, and re-suspending additional sediments.

In tidal and/or wind- and wave-action situations, the curtain should never be so long as to touch the bottom. A minimum 1-foot gap should exist between the weighted, lower end of the skirt and the bottom at “mean” low water. Movement of the lower skirt over the bottom due to tidal reverses or wind and wave action on the flotation system may fan and stir sediments already settled out.

In tidal and/or wind- and wave-action situations, it is seldom practical to extend a turbidity curtain depth lower than 10 to 12 feet below the surface, even in deep water. Curtains that are installed deeper than this will be subjected to very large loads with consequent strain on curtain materials and the mooring system. In addition, a curtain installed in such a manner can "billow up" toward the surface under the pressure of the moving water, which will result in an effective depth that is significantly less than the skirt depth.

Turbidity curtains should be located parallel to the direction of flow of a moving body of water. Turbidity curtains should not be placed across the main flow of a significant body of moving water.

When sizing the length of the floating curtain, allow an additional 10-20% variance in the straight-line measurements. This will allow for measuring errors, make installation easier and reduce stress from potential wave action during high winds.

An attempt should be made to avoid an excessive number of joints in the curtain. A minimum continuous span of 50 feet between joints is a good “rule of thumb.”

For stability reasons, a maximum span of 100 feet between anchor or stake locations is also a good rule to follow.

The ends of the curtain, both floating upper and weighted lower, should extend well up onto the shoreline, especially if high water conditions are expected. The ends should be secured firmly to the shoreline to fully enclose the area where sediment may enter the water.

When there is a specific need to extend the curtain to the bottom of the watercourse in tidal or moving water conditions, a heavy, woven, pervious filter fabric may be substituted for the normally recommended impervious geotextile. This creates a “flow-through” medium, which significantly reduces the pressure on the curtain and will help to keep it in the same relative location and shape during the rise and fall of tidal waters.

Typical installation layouts of turbidity curtains can be seen in Figure FB-3. The number and spacing of external anchors will vary depending on current velocities and potential wind and wave action. Manufacturer’s recommendations should be followed.

In navigable waters, additional permits may be required from the U.S. Army Corps of Engineers or other regulatory agencies if the barrier creates an obstruction to navigation.

Site Preparation

If a floating turbidity barrier is specified in the erosion and sediment control plan, it should be installed before any land-disturbing activities. Shoreline anchor points should be located according to the plans.

Materials and Installation Requirements

Barriers should be a bright color (yellow or "international" orange) that will attract the attention of nearby boaters. The curtain fabric must meet the minimum requirements noted in Table FB-1.

When installing Type I barrier in the calm water of lakes or ponds, it is usually sufficient to merely set the curtain end stakes or anchor points (using anchor buoys if bottom anchors are employed); then, tow the curtain in the furled condition out and attach it to these stakes or anchor points. Following this, any additional stakes or buoyed anchors required to maintain the desired location of the curtain may be set, and these anchor points made fast to the curtain. Only then, the furling lines should be cut to let the curtain skirt drop.

When installing Type II or III barriers in rivers or in other moving water, it is important to set all the curtain anchor points. Care must be taken to ensure that anchor points are of sufficient holding power to retain the curtain under the expected current conditions, before putting the furled curtain into the water. Anchor buoys should be employed on all anchors to prevent the current from submerging the flotation at the anchor points. If the moving water into which the curtain is being installed is tidal and will subject the curtain to currents in both directions as the tide changes, it is important to provide anchors on both sides of the curtain for two reasons:

- Curtain movement will be minimized during tidal current reversals.
- The curtain will not overrun the anchors, pulling them out when the tide reverses.

When the anchors are secure, the furled curtain should be secured to the upstream anchor point and then sequentially attached to each next downstream anchor point until the entire curtain is in position. At this point, and before unfurling, the "lay" of the curtain should be assessed and any necessary adjustments made to the anchors. Finally, when the location is ascertained to be as desired, the furling lines should be cut to allow the skirt to drop.

The anchoring line attached to the flotation device on the downstream side will provide support for the curtain. Attaching the anchors to the bottom of the curtain could cause premature failure of the curtain due to the stresses imparted on the middle section of the curtain.

Seams in the fabric should be either vulcanized welded or sewn, and should develop the full strength of the fabric.

Flotation devices should be flexible, buoyant units contained in an individual flotation sleeve or collar attached to the curtain. Buoyancy provided by the flotation units should be sufficient to support the weight of the curtain and maintain a freeboard of at least 3″ above the water surface level.

Load lines must be fabricated into the bottom of all floating turbidity curtains. Type II and Type III curtains must have load lines also fabricated into the top of the fabric. The top load line should consist of woven webbing or vinyl-sheathed steel cable and should have break strength in excess of 10,000 pounds (5 t). The supplemental (bottom) load line should consist of a chain incorporated into the bottom hem of the curtain of sufficient weight to serve as ballast to hold the curtain in a vertical position. Additional anchorage should be provided as necessary. The load lines should have suitable connecting devices that develop the full breaking strength for connecting to load lines in adjacent sections. (See Figures FB-1 and FB-2 which portray this orientation.)

Table FB-1 Curtain Fabric Material Requirements for Floating Turbidity Barriers

Characteristic Test Method	16 Oz Nominal Laminated	18 Oz Laminated	22 Oz Coated	Geotextile Filter
Construction	Vinyl Laminate On 1300 Denier 9 X 9 Scrim	Vinyl Laminate On1300 Denier 9 X 9 Scrim	Vinyl Coated On Woven 6 Oz Polyester Base	Woven Polypropylene
Weight ASTM D-751-95 Sec 16	Nominal 16 Oz/Sq Yd 376 Gr/Sq M	18 Oz/Sq Yd 423 Gr/Sq M	22 Oz/Sq Yd 517 Gr/Sq M	7.5 Oz/Sq Yd 176 Gr/Sq M
Adhesion ASTM D-751-95 Sec 43.1.2	15 Lb/In 14 Dan/5 Cm	15 Lb/In 14 Dan/5 Cm	14 Lb/In 13 Dan/5 Cm	Not Applicable
Tensile Strength ASTM D-751-95 Sec 12	324 X 271 Lb/In 308 X 258 Dan/5 Cm	397 X 373 Lb/In 378 X 363 Dan/5 Cm	500 X 400 Lb/In 476 X 389 Dan / 5 Cm	350 X 250 Lb/ In 333 X 230 Dan / 5 Cm
Tear Strength ASTM D-751-95 Sec 29	76 X 104 Lb/In 72 X 99 Dan/5 Cm	96 X 86 Lb/In 91 X 82 Dan/5 CM	132 X 143 Lb/In 126 X 136 Dan / 5 Cm	95 X 55 Lb/In 90 X 52 Dan / 5 Cm
Hydrostatic ASTM D-751-95 Sec 34.2	385 Lb/Sq In 2674 kPa	385 Lb/Sq In 674 kPa	881 Lb/Sq In 6118 kPa	Not Applicable

External anchors may consist of 2″ x 4″ or 2½″ minimum-diameter wooden stakes, or 1.33 pounds/linear foot steel posts when Type I installation is used. When Type II or Type III installations are used, bottom anchors should be used.

Bottom anchors must be sufficient to hold the curtain in the same position relative to the bottom of the watercourse without interfering with the action of the curtain. The anchor may dig into the bottom (grappling hook, plow, or fluke-type) or may be weighted (mushroom type), and should be attached to a floating anchor buoy via an anchor line. The anchor line would then run from the buoy to the top load line of the curtain. When used with Type III installations, these lines must contain enough slack to allow the buoy and curtain to float freely with tidal changes without pulling the buoy or curtain down and must be checked regularly to make sure they do not become entangled with debris. As previously noted, anchor spacing will vary with current velocity and expected wind

and wave action. Manufacturer's recommendations should be followed. See orientation of external anchors and anchor buoys for tidal installation in Figure FB-2.

Installing two parallel curtains, separated at regular intervals by 10-foot-long wooden boards or lengths of pipe can increase the effectiveness of the barrier.

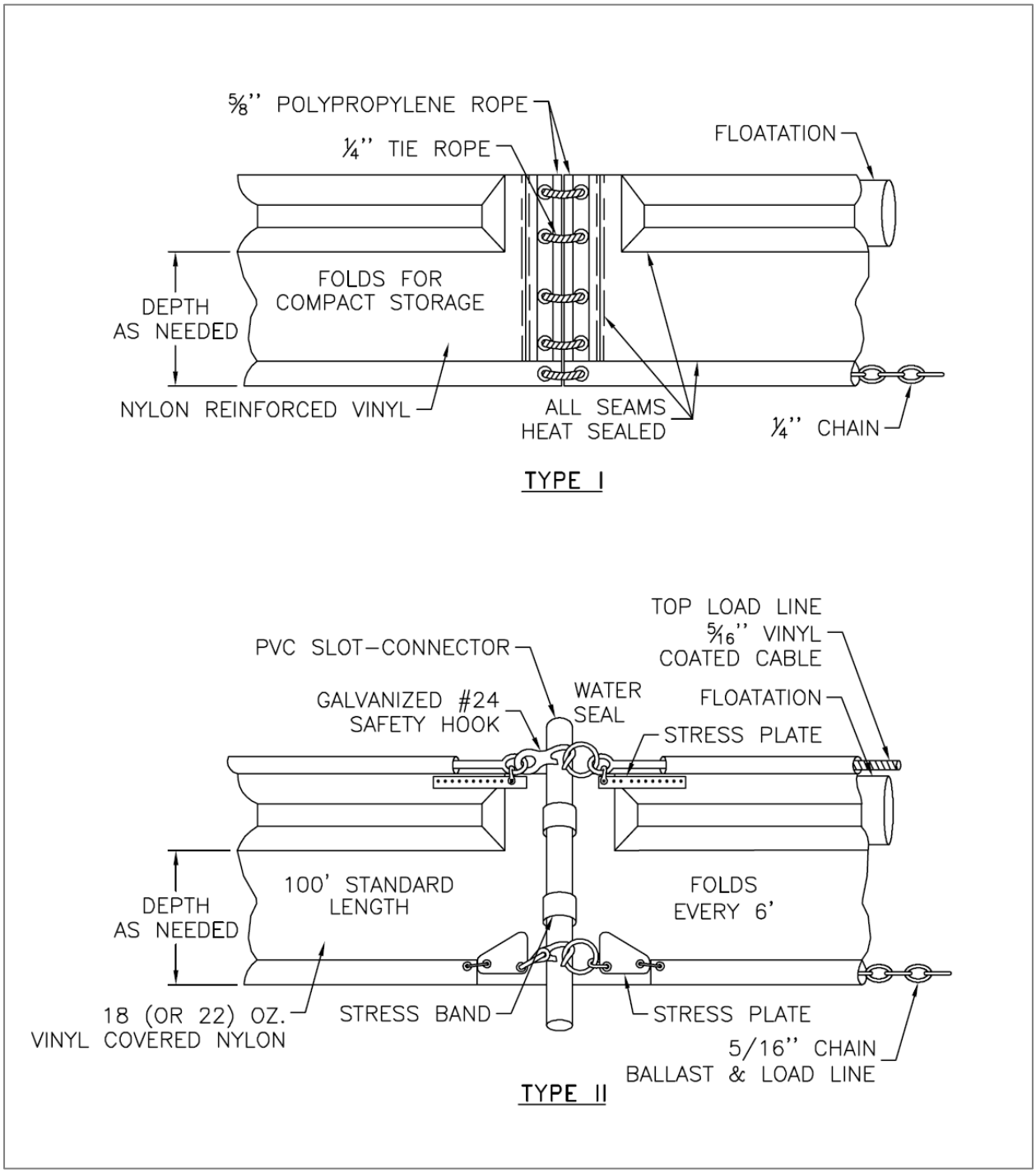


Figure FB-1 Type I and II Floating Turbidity Barriers

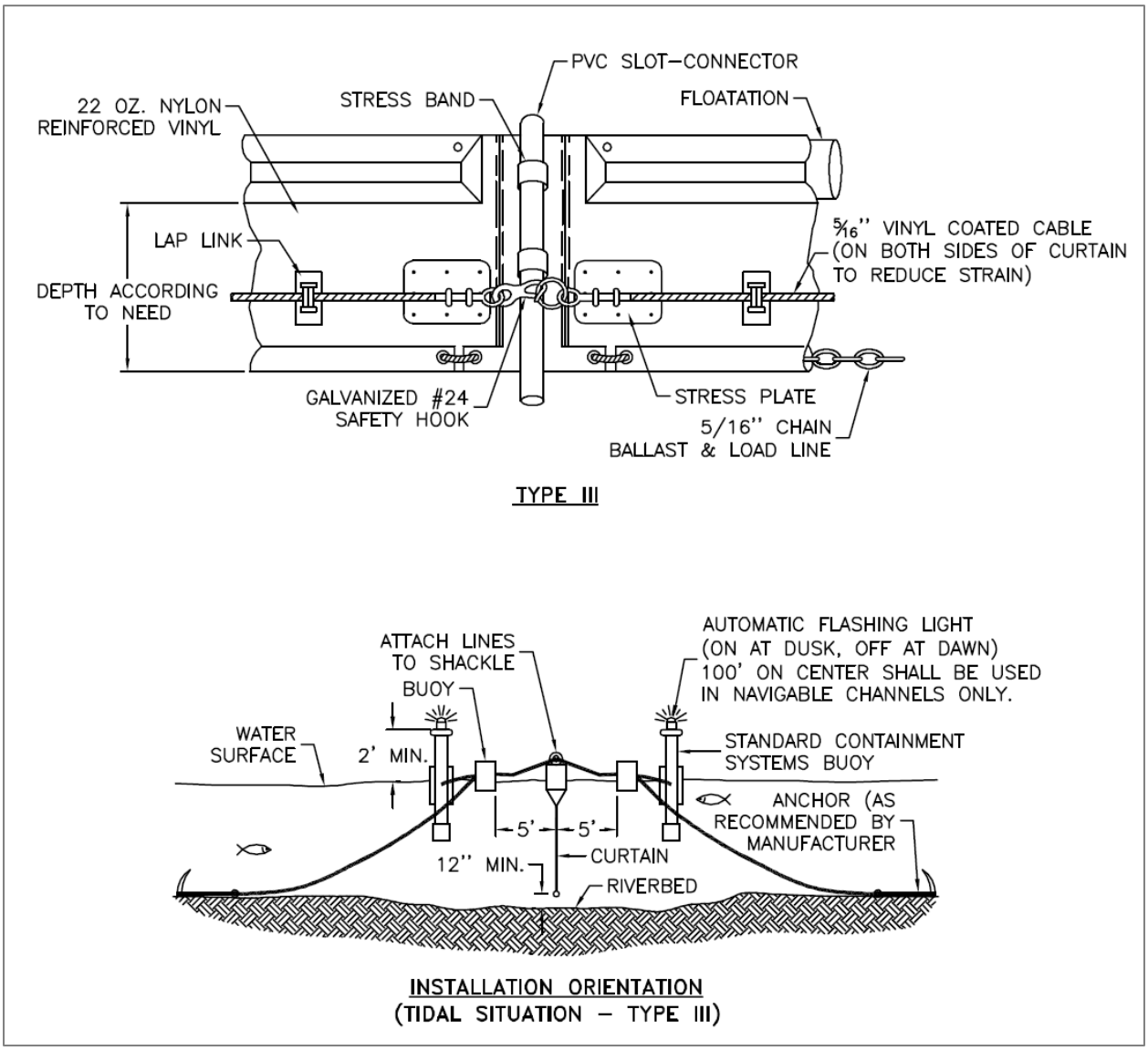


Figure FB-2 Type III Floating Turbidity Barrier

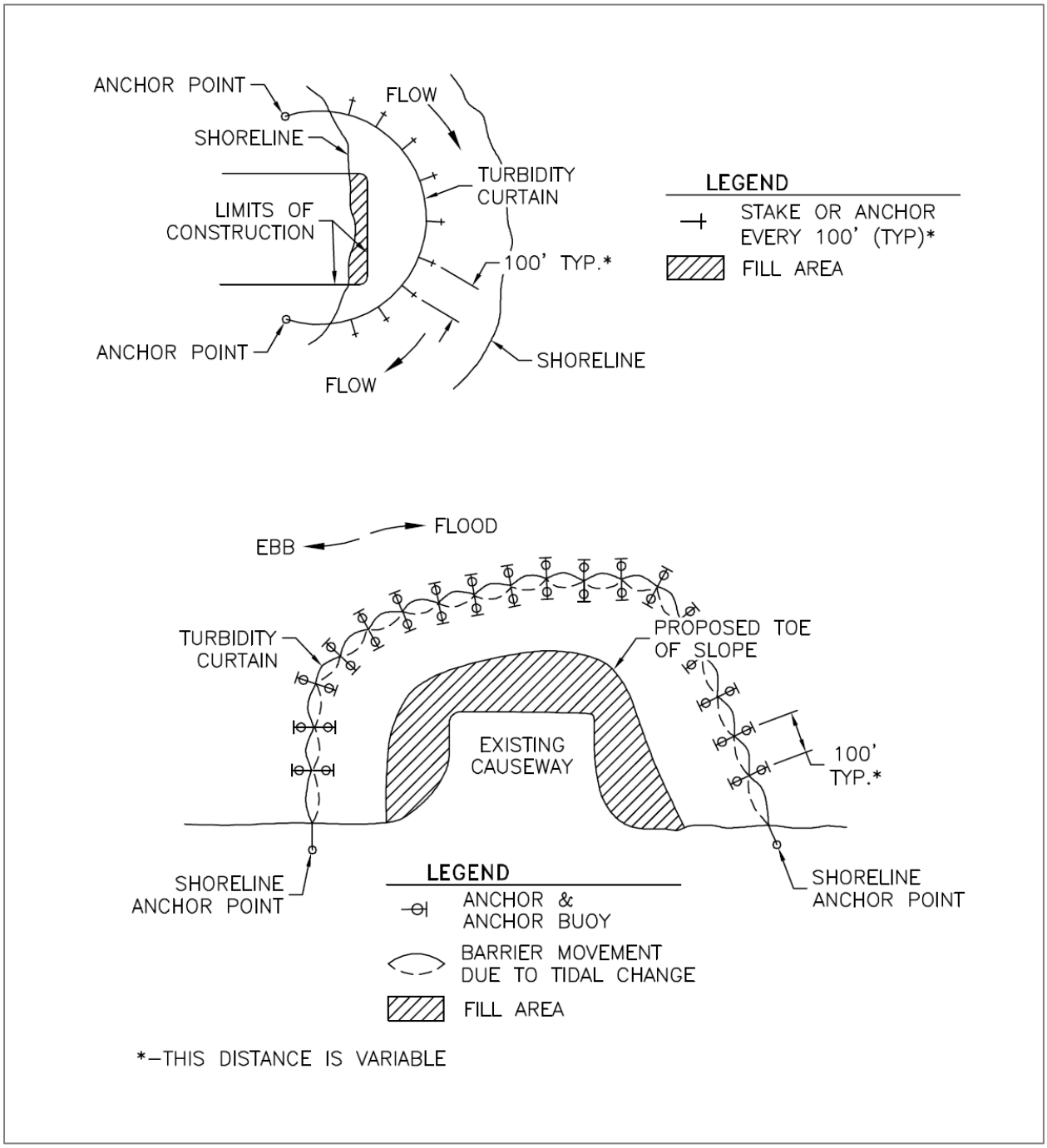


Figure FB-3 Typical Installation Layouts

Construction Verification

Check the type of floating turbidity barrier, installation location, and the installation and anchorage procedures for compliance with the standard drawings and materials list. (Check for compliance with specifications if included in contract specifications.)

Removal

Care should be taken to protect the skirt from damage as the turbidity curtain is dragged from the water.

The site selected to bring the curtain ashore should be free of sharp rocks, broken cement, debris, etc., so as to minimize damage when hauling the curtain over the area.

If the curtain has a deep skirt, it can be further protected by running a small boat along its length with a crew installing furling lines before attempting to remove the curtain from the water.

Common Problems

Consult with a qualified design professional if any of the following occurs:

Variations in topography on site indicate that a floating turbidity barrier will not function as intended. Change in plan will be needed.

The specified anchorage system will not function as planned.

Turbid water is escaping from the barrier enclosure.

Materials specified in the plan are not available.

Maintenance

The floating turbidity barrier should be maintained for the duration of the project to ensure the continuous protection of the watercourse. Anchors, anchor lines, and buoys must be regularly checked to remove debris.

If repairs to the geotextile fabric become necessary, normally, repair kits are available from the manufacturer. Follow the manufacturer's instructions to ensure the adequacy of the repair.

When the curtain is no longer required as determined by the responsible individual, the curtain and related components should be removed in such a manner as to minimize turbidity. If required by the contract or the responsible individual, sediment should be removed and the original depth (or plan elevation) restored before removing the curtain. Remaining sediment should be sufficiently settled before removing the curtain. Any spoils should be taken to an upland area and stabilized.

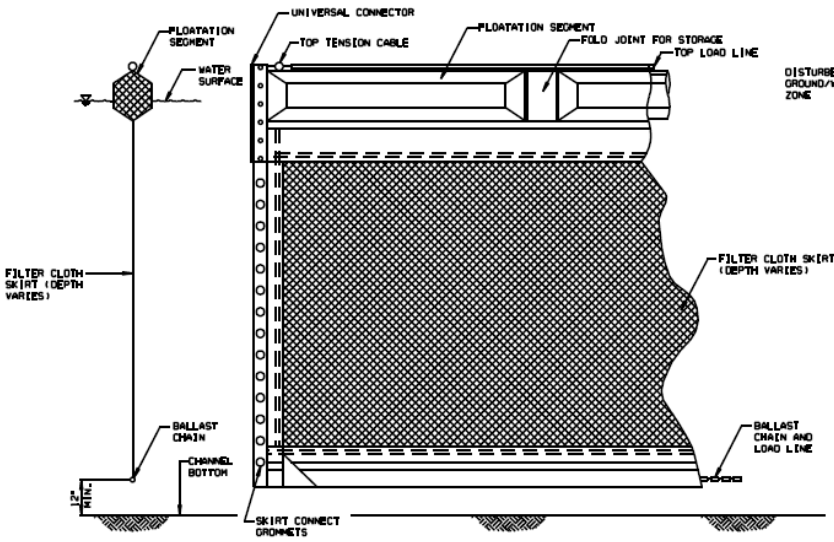
References

MDOT Drawing ECD-19

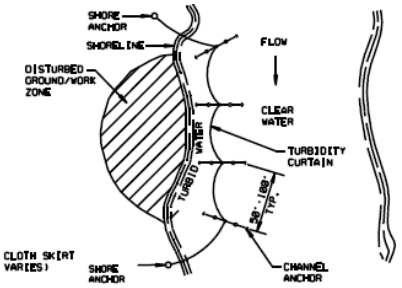
Floating Turbidity Curtain 4-277

STATE	PROJECT NO.
MISS.	

FLOATING TURBIDITY CURTAIN

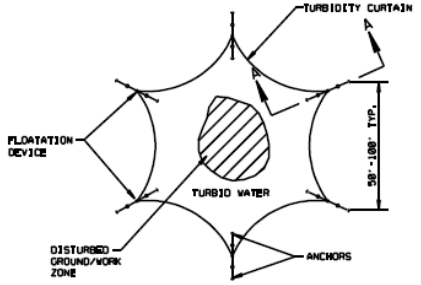


TYPICAL ANCHORING PLAN FOR SHORELINE/RIVER EDGE WORK



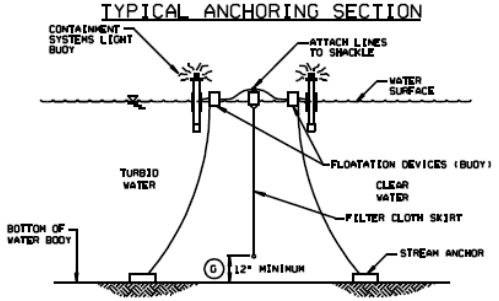
PLAN VIEW

TYPICAL ANCHORING PLAN FOR MID CHANNEL WORK (BRIDGE PIER, CAISSON, ETC.)



PLAN VIEW

TYPICAL ANCHORING SECTION



SECTION A-A

AUTOMATIC FLASHING LIGHT BUOY (ON AT DUSK-OFF AT DAWN) 100' ON CENTER SHALL BE USED IN NAVIGABLE CHANNELS ONLY

EROSION CONTROL PLAN LEGEND: FLOATING TURBIDITY CURTAIN

FLOATING TURBIDITY CURTAIN GENERAL NOTES

(A) FLOATING TURBIDITY CURTAINS (ALSO KNOWN AS TURBIDITY BARRIERS OR SILT CURTAINS) CREATE A BARRIER TO PREVENT TURBID WATER FROM ENTERING CLEAR WATER. FLOATING TURBIDITY CURTAINS SHOULD BE USED TO ISOLATE ACTIVE CONSTRUCTION AREAS WITHIN OR ADJACENT TO A BODY OF WATER TO MINIMIZE THE MIGRATION OF SILT LADEN WATER OUT OF THE CONSTRUCTION ZONE.

(B) TURBIDITY CURTAINS SHALL NOT BE INSTALLED PERPENDICULAR ACROSS THE MAIN FLOW OF A SIGNIFICANT BODY OF MOVING WATER.

(C) FLOATING TURBIDITY CURTAINS SHALL NO BE USED WHERE THE ANTICIPATED FLOW VELOCITIES WILL EXCEED 5 FT/SEC.

(D) TURBIDITY CURTAINS SHALL BE ANCHORED TO PREVENT DRIFT SHOREWARD OR DOWNSTREAM. ANCHORAGE SHALL BE INSTALLED ON BOTH SHORE AND STREAM SIDE. CURTAINS SHALL BE INSTALLED AS CLOSE TO PROJECT SITE AS POSSIBLE. BARRIERS SHOULD BE A BRIGHT COLOR (YELLOW OR "INTERNATIONAL" ORANGE ARE RECOMMENDED) THAT WILL ATTRACT THE ATTENTION OF NEARBY BOATERS.

(E) SHORE ANCHORS SHALL CONSIST OF A POST WITH DEADMAN OR APPROVED EQUAL. STREAM ANCHORS SHALL BE OF SUFFICIENT SIZE TO STABILIZE THE BARRIER WITH NUMBER AND SPACING DEPENDENT ON WATERWAY VELOCITIES AND MANUFACTURER'S RECOMMENDATIONS.

(F) IN SHALLOW WATER (2 FEET OF DEPTH OR LESS) A TURBIDITY CURTAIN MAY BE INSTALLED ON STAKES DRIVEN INTO THE BED OF THE WATER BODY.

(G) FABRIC SECTIONS SHALL BE CONNECTED END TO END WITH MINIMUM ½" DIAMETER POLYPROPYLENE ROPE. FABRIC SHALL BE SEAMED TOGETHER IN A MANNER THAT RETAINS THE OVERALL TENSILE STRENGTH.

(H) DESIGN OF CURTAIN AND ANCHORAGE SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. FILTER CLOTH SKIRT SHOULD BE ABLE TO WITHSTAND THE FORCES IMPARTED ON IT DUE TO THE EXPECTED WIND VELOCITY OR STREAM VELOCITY. FABRIC SHALL BE MADE OF A NON-DETERIORATING MATERIAL, SUCH AS PLASTIC OR NYLON, WHICH WILL ALLOW WATER TO PASS THROUGH WHILE STILL RETAINING SEDIMENT.

(I) THE TURBIDITY CURTAIN AND ADJACENT WORK AREAS SHALL NOT BE DISTURBED 12 HOURS PRIOR TO REMOVAL FROM WATER BODY. MAINTENANCE SHALL BE PERFORMED AS NEEDED. CONTRACTOR SHALL REMOVE THE CURTAIN AT COMPLETION OF WORK IN A MANNER THAT WILL PREVENT SILTATION OF THE WATERWAY. DURING REMOVAL, EXTREME CARE SHOULD BE TAKEN NOT TO DISTURB ANY SEDIMENT DEPOSITS.

(J) MAINTAIN 12" MINIMUM GAP BETWEEN SKIRT BOTTOM AND CHANNEL BOTTOM TO PREVENT ACCUMULATED SEDIMENT FROM PULLING TOP OF CURTAIN BELOW WATER SURFACE.

(K) IN WIND OR WAVE ACTION SITUATIONS, THE MAXIMUM DEPTH OF THE CURTAIN SHALL BE 12 FEET.

(L) CONCENTRATED FLOWS SHALL NOT DISCHARGE BEYOND FLOATING TURBIDITY CURTAIN. CURTAINS ARE NOT TO BE INSTALLED ACROSS FLOWING BODY OF WATER.

(M) WHEN INSTALLED IN A NAVIGABLE WATERWAY, BUOYS SHOULD BE LIT ACCORDING TO REGULATORY AGENCY STANDARDS.

(N) WHEN ESTIMATING THE LENGTH OF TURBIDITY CURTAIN, ALLOW 10 TO 20 PERCENT VARIANCE IN STRAIGHT LINE MEASUREMENT.

(O) PAYMENT FOR FLOATING TURBIDITY CURTAIN SHALL INCLUDE ALL MATERIAL AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF TURBIDITY CURTAINS

(P) ONLY FLOATING TURBIDITY CURTAINS LISTED ON THE APPROVED PRODUCTS LIST MAY BE USED.

BY	REVISION	DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

FLOATING TURBIDITY CURTAIN

WORKING NUMBER: ECD-19

SHEET NUMBER

FILENAME: EROSION CONTROL\ECD-19.DGN

DESIGN TEAM _____ CHECKED _____ DATE _____

Town of Exeter New Hampshire
Consevation Commision
Budget, Reciepts and Expenditures for the Fiscal Year Ending 12/31/2025
Tresurer Report
For The Months Ended 7/31/2025

Account 01461105-

Category Number	Category Name	Budget 2025	Expended 2025 YTD	Planned Expenses 2025	Remaining 2025 Budget	Comment
51200	Sal/Wages - PT	$602	$0.00	$0.00	$602.00	Recording secretaries @ $19.44/hr
51210	Sal/Wages - Temp	$2,530	$0.00	$0.00	$2,530.00	Interns 2@17/hr, 15 hrs/wk for 5 wks
52200	FICA	$194	$0.00	$0.00	$194.00	
52210	Medicare	$45	$0.00	$0.00	$45.00	
55051	Conservation Land Administration	$2,050	$447.46	$1,114.12	$488.42	Planned - $250 Pollinator Garden, $458 Spring Tree, $190 trail paint Expended - $447.46 no dog sign,Raynes Kiosk, alewife signs
55058	Contract Services	$1,000	$0.00	$0.00	$1,000.00	
55088	Dues	$1,200	$850.00	$300.00	$50.00	$850 NHACC, Planned $300 ESRLAC, $50 SELT
55091	Education/Training	$250	$0.00	$0.00	$250.00	
55171	Legal/Public Notices	$50	$0.00	$0.00	$50.00	
55224	Postage	$20	$0.00	$0.00	$20.00	
55247	Registry of Deeds	$30	$0.00	$0.00	$30.00	
55254	Roadside Mowing	$1,825	$0.00	$987.00	$838.00	$987 contract for mowing
	Total	**$9,796.00**	**$1,297.46**	**$2,401.12**	**$6,097.42**	

Conservation Fund (RSA 36A) Note: includes the following obligations
$60,536.41 $50k for LCHIP
$4,720 **Stewardship Fund**: Established to support enforcement of conservation deeds
Forestry Fund (RSA 31:110-114) Limited to use for Town Forest forest stand
$12,753 improvement & management

_____ _____
Andrew Koff, Treasurer Date

Exeter Conservation Commission
July 8, 2025
Nowak Room
10 Front Street
7:00 PM
Draft Minutes

Call to Order

1. Introduction of Members Present (by Roll Call)

Present at tonight's meeting were: Chair Dave Short, Andrew Koff, Trevor Mattera, Valorie Fanger, Nick Campion, Alternate Michele Crepeau, Alternate Sean Torrez and Select Board Representative Dan Chartrand

Staff Present: Kristen Murphy, Conservation and Sustainability Planner

Chair Short called the meeting to order at 7:00 PM and introduced the members.

2. Public Comment

There was no public comment.

Action Items

1. Wetland Conditional Use Permit application for impacts to the prime and poorly drained wetland buffer for the construction of a 30'x 25' addition at 18 Ashbrook Drive (Tax Map 90 Lot 30). (Sonny Iannacone, Property owner)

Sonny Iannacone presented the request for a wetland conditional use permit to put an addition on his home.

Chair Short noted there is a narrative from a wetland's scientist in the packet.

Ms. Murphy displayed the plan showing the prime wetland and buffers and wetland boundary and buffers.

Mr. Koff asked when the house was built and if a CUP was obtained. Mr. Iannacone answered that the house was built in 1982 and Ms. Murphy noted that she did not believe a CUP was obtained.

Mr. Koff asked about the existing lawn area. Mr. Iannacone indicated a tree would be taken down.

Chair Short asked about erosion control. Mr. Iannacone indicated a silt fence.

Ms. Fangor asked the size and Mr. Campion indicated 30' out.

Chair Short reviewed the criteria for granting a CUP. He noted it was permitted in the zoning district. Mr. Koff noted it would not be feasible to move it to the front or change the shape as far as no alternate design. Mr. Iannacone indicated the plumbing was to the rear of the house. Mr. Mattera noted the existing home was in the buffer. Ms. Crepeau asked if there would be a basement – no. Chair Short noted a wetland scientist provided the function and values assessment, so number three was addressed. Chair Short read criteria 4-8 and noted he would like to see the restoration addressed as a condition with seeding such as rye or fescue in the lawn area. Ms. Murphy noted that no additional permits were required.

Mr. Koff motioned after reviewing the criteria for granting a conditional use permit that the Commission has no objection to the issuance of the CUP with the condition that there be reseeding of the temporary disturbed area in the backyard as discussed. Mr. Campion seconded the motion. A vote was taken, all were in favor, the motion passed unanimously.

2. Shoreland Conditional Use Permit application for impacts to the Exeter Shoreland Protection District by J. Caley Associates, for the proposed redevelopment of the property at 97 Portsmouth Avenue. The developer is proposing to demolish the existing Blue-Ribbon Dry Cleaners building on the site and construct a multi-use building to include commercial space, amenities, and 14 residential units with parking and associated site improvements. (Tax Map Parcel #65- 125. PB Case #25-3). (Christian Smith, Beals Associates)

Chair Short read the public hearing notice out loud.

Christian Smith of Beals Associates presented the application for a shoreland conditional use permit for the construction of a mixed-use building in the MUND on Portsmouth Ave The existing building will be razed. He handed out copies of the reduced plans. He noted there would be a three-season expresso bar with 6-7 seats and a wet sink, and 1500 SF of commercial space on the first floor and the building would be four stories. He discussed the existing impervious pavement and proposed pervious pavement shown in the gray areas. He noted there were parking stalls for 14 residents, 6 for the care and commercial with overflow space. He noted there is a landscaping plan provided. He noted the disturbance within the setback to the reservoir for demolition of the existing building and noted delineation by wetland and soil scientist. Ms. Murphy noted the Exeter Reservoir has a 300' building setback and 300' shoreland protection district. Mr. Smith noted the property is ¾ covered by setback. He noted the relief to build on encroaching building setbacks and that the use is allowed by MUND zoning. Visitor parking was discussed as well as the steep drop-off. Snow storage would be in the grassed area although the back may need removal, as required by the condominium documents.

Chair Short asked about snow plowing and Mr. Smith noted the condo association would control that and use rubber blade. He believed the commercial space would be part of the condominium.

Chair Short asked about erosion control and Mr. Smith showed the area where there would be double row barrier with silt socks or berm. He noted there would be a storm water inspection permitting and pollution prevention plan as required by the Planning Board conditions of approval.

Ms. Fangor asked about the changes from impervious to pervious and Mr. Smith noted a reduction from 79% to 45.2%. Mr. Smith noted the drainage will handle the 50-year storm without overtopping. The roof has downspouts to the pervious paver patio.

Mr. Koff asked about dry-cleaning contaminants and Mr. Smith reviewed the location of the four water quality monitoring wells. Soils were tested and nothing was found. There was a spill in the 70s or 80s and concentrations have gone down, and wells will be maintained until decommissioned by NH DES.

Mr. Koff expressed concerns with soil quality with the demolition of the building which is on a slab and the noted leaking area from the flat roof runoff with regard to soil contaminant testing and moving soil around during construction. Mr. Chartrand noted he echoed those concerns. Mr. Torres questioned the state requirements and discussed grading and erosion control barriers. Mr. Koff noted it would be less expensive to deal with before than after. Mr. Chartrand noted he would like to see any contaminated soil removed from the site. Mr. Koff recommended decommissioning the well, doing the work and then recommissioning the wells so that they are not damaged during construction. Mr. Smith noted that NH DES may allow them to.

Mr. Chartrand noted it would be a big improvement over the dry cleaning that was there.

Chair Short reviewed the criteria for shoreland CUP.

Ms. Fangor noted they wouldn't like to see return of any prohibited uses such as another dry cleaner, auto repair shop, laundry, or car wash.

Mr. Mattera motioned after reviewing the criteria for granting shoreland CUP that the Commission is in support of the application with the following recommendations:

1. Soils located under and around building are tested after building removal and found to be within state regulations; and
2. Monitoring wells be decommissioned, removed and recommissioned and replaced after construction.

Mr. Campion seconded the motion. A vote was taken, all were in favor, the motion passed unanimously.

3. Great Bay Changemaker Program in the Exeter/Squamscott Watershed – seeking input on ideas for priority issues, case studies or local speakers to include in the program, and assistance with recruitment. (Katri Hillman, GB Changemaker Coordinator)

Katri Hillman gave a presentation on the Great Bay Changemaker Program. She noted they have been working in the Exeter Squamscott watershed this year and their goal is building healthy water champions for properties that drain to the Great Bay watershed. She noted the program is funded by the NH Charitable Fund. She noted there will be a fall bootcamp staring on September 11 and running for 12 weeks, meeting on Thursdays from 5-7:30. There will occasionally be visits to sites before the meeting. She explained the application process and welcomed input and feedback.

Mr. Chartrand indicated there is not a lot of non-point work such as controlling septic systems.

Mr. Koff indicated invasives along the water lead to erosion and other problems.

Mr. Mattera indicated accessibility to participating in communities and as an example referenced the failure of the Dover stormwater utility.

4. Board Empowerment Workshop Series – Re-energizing this former program and seeking to evaluate potential topics and materials for a training and get input on timing and format. (Lynn Vaccaro, GBNERR Training & Education Coordinator)

Lynn Vaccaro gave a presentation on the Board Empowerment Workshop series which would begin in 2026 and partner with conservation commissions in the seacoast area to help with their effectiveness in roles and meet to discuss issues in roundtable format and share resources, science and online materials.

5. Expense Approvals

Ms. Murphy reported the expense for the sign on the kiosk was $35.93 short and 81.49 was spent on paint for trail blazing. She got white but can use more paint but will bring a quote to the next meeting. She noted the signage for the Alewife Festival was $134.58 for the sign and small kiosk and $895 is remaining. The total expenses are $252.

Chair Short motioned to reimburse Ms. Murphy $252 from the conservation land administration fund. Mr. Koff seconded the motion. A vote was taken, all were in favor, the motion passed unanimously.

6. Committee Reports

a. Property Management

i. Raynes

Ms. Murphy noted that Keith donated time for mowing twice at Raynes and public works is understaffed. He recommended adding $2,400 to $3,000 to the budget for mowing. She reported the windows are in and two transoms remain. The budget is due late August. Ms. Crepeau recommended adding the porta potties. The Board will discuss that in August when they have more information. Mr. Campion will reach out to Recreation to see about any collaboration potential.

Mr. Campion motioned to put $3,000 in the budget for additional mowing at Raynes. Mr. Mattera seconded the motion. A vote was taken, all were in favor, the motion passed unanimously.

ii. Irving

Ms. Murphy reported that two days were spent removing oriental bittersweet, one pro bono. She recommended walking in the winter to identify and plan around downed trees.

Ms. Murphy reported that two interns were hired out of 17 applicants.

b. Outreach Events

c. Other Committee Reports (River Study, Sustainability, Energy/CPAC, Tree, CC Roundtable)

Ms. Murphy reported there will be a Styrofoam collection event on July 19th from 9-11 AM. A box truck was donated.

7. Approval of Minutes

June 10, 2025 Minutes

Mr. Koff motioned to approve the June 10, 2025 meeting minutes. Mr. Mattera seconded the motion. A vote was taken, all were in favor, the motion passed unanimously.

Next Meeting: 8/12/25, Submission Deadline: 8/1/25

8. Correspondence

Chair Short noted the letter from NH DOT concerning survey of the access on Court Street for the McDonnell Conservation areas natural and cultural resource impacts for the bridge on Court Street over the Exeter River.

9. Adjournment

Mr. Koff motioned to adjourn the meeting at 8:50 PM. Mr. Mattera seconded the motion. A vote was taken, all were in favor, the motion passed unanimously.

Respectfully submitted,

Daniel Hoijer, Recording Secretary
Via Exeter TV
Webinar ID: 875 8697 7298